

SMITHSONIAN MISCELLANEOUS COLLECTIONS  
VOLUME 115 (WHOLE VOLUME)

BIOLOGICAL INVESTIGATIONS  
IN MÉXICO

(WITH 71 PLATES)

BY  
EDWARD ALPHONSO GOLDMAN



(PUBLICATION 4017)

CITY OF WASHINGTON  
PUBLISHED BY THE SMITHSONIAN INSTITUTION  
JULY 31, 1951







Pico de Orizaba, Puebla. 1912.  
Courtesy of Hugo Brehme.

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The Lord Baltimore Press  
BALTIMORE, MD., U. S. A.

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## PREFATORY NOTE

Because of my long, close, and friendly association with Edward Alphonso Goldman—8 years as fellow research worker, 8 more as assistant and helper in administration and research under his supervision, then 10 years as a fellow administrator and researcher, and finally 10 years as his supervisor as chief of the section of biological surveys, United States Fish and Wildlife Service—it seems quite fitting that I should write a prefatory note to this his *magnum opus*.

The results of the biological explorations made by Nelson and Goldman in México from 1892 to 1906 are among the most important ever achieved by two workers for any single country. These results should be appraised not only by the valuable biological collections procured, including 17,400 mammals and 12,400 birds, but also by the vast fund of information obtained and preserved in thousands of pages of manuscript reports in regard to the physiographical features, fauna, and flora of the country, at that time so little known. Immeasurable information that was never preserved on paper vanished with the passing of these two really great field naturalists.

After the Mexican field work had been completed it was planned that Nelson would write the report on birds, Goldman that on mammals, and jointly they would compose a report on itineraries, physiography, biotic areas, and life zones. At the time of the death of Edward William Nelson, May 19, 1934, he had some years previously published an extensive monograph on Baja California (Lower California and its Natural Resources: Mem. Nat. Acad. Sci., vol. 16, first memoir, pp. 1-194, pls. 1-34, 1 folding map, July 1921) and begun to assemble his notes preparatory to writing a book on the birds of México. Goldman had from time to time identified many, perhaps most, of the Mexican mammals, and in June 1928, when he was relieved of all administrative work in the old Bureau of Biological Survey so that he could devote his entire time to research, he continued his interest in Mexican mammals. It was not until the summer of 1940 (fiscal year 1941), however, that "Mammals of México: To show distribution, life history, and status of all known species" was designated as a project in the program of work, and not until the autumn of 1942 that special attention was given to assembling the accumulated notes and reports on Mexican mammals. The work on the mammals of México as a project progressed little farther. During

the summer of 1943 as his immediate supervisor I sat in with Major Goldman for a heart-to-heart talk on his research work—a type of visit in which we frequently indulged. Among other things I told him that in spite of his vigor he was not going to live forever, and that when he went nobody would be able accurately to write a report on the Nelson and Goldman itineraries, or to describe the physiography, fauna, and flora as they saw it. I further suggested that he concentrate on this one project as the most important he could do, that others could write a report on Mexican mammals, but only he on his travels. Accordingly, in the program of work for the fiscal year 1944, the project on “Mammals of México” was deleted, and instead appeared “Biological localities of México: Itineraries, descriptions of localities, life zones, biotic areas, and fauna notes of the Nelson-Goldman field explorations in México.” He worked diligently upon the project almost to the day of his lamentable death, September 2, 1946.

In general arrangement and treatment of subject matter this report appears about as we planned it in our numerous discussions. I had suggested that there be included a list of all persons who had collected natural-history material in México, with a very brief outline of the work of each. Goldman had started this list at the time of his death, but it was incomplete, and very little pertinent data accompanied the names. I have reviewed and edited the entire manuscript, most parts of which were fairly complete. The chapter on “Biotic Provinces” I have in many places revised, and the discussions of mammals and lists of mammal species are mostly from my pen. The original manuscript was accurately and meticulously prepared by Goldman, as was characteristic of him. The only possible mistake that seemed to occur more or less persistently was an exaggeration of the number of miles as expressed in distances traveled. It is as if Goldman used “horse-back miles” or “foot miles,” instead of direct distances. Thus, for example, he says of La Salada, Michoacán, March 9-24, 1903: “La Salada is a ranch at about 2,000 feet, 40 miles south of Uruapan, Michoacán. On March 8 we left Uruapan and traveled about 28 miles in a southerly course, following a narrow valley for some distance, and then, after crossing a ridge at about 6,500 feet, wound down through the foothills to the ranch of Las Pilas in the arid country near the base of the foothills on the north side of the valley of the Río Balsas. On March 9 we continued southeasterly from Las Pilas, 12 miles across an open plain to a small canyon about 2 miles from the ranch of La Salada.” Actually La Salada is less than 25 miles from Uruapan in a direct line, and lies

slightly west of south of it, at longitude  $102^{\circ} + W.$  and latitude  $19^{\circ}07' N.$

All distances as shown on the Locality and Route Map of México (following page 34) are as accurate as can be expected.

The bird names have been checked and brought up to date by Dr. Herbert Friedmann, U. S. National Museum.

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# BIOLOGICAL INVESTIGATIONS IN MÉXICO

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## INTRODUCTION

Field investigations of mammals and birds in México were initiated by the Division of Economic Ornithology and Mammalogy (later the Bureau of Biological Survey) of the United States Department of Agriculture, as a part of general surveys designed to afford information bearing on the numbers, distribution, and habits of species in North America as a whole.

Edward W. Nelson, who was still a young man of 36, with 5 years' experience as a naturalist in Alaska, and who had been a member of the Death Valley Expedition in California, was detailed to traverse a central section of the republic, the work beginning at the port of Manzanillo on the Pacific coast in the state of Colima in January 1892. The writer, at the age of 18, accompanied him as assistant. At first it was assumed that investigations would be restricted to rather local areas, but the mammals and birds proved to be much less well known than was anticipated. A large, previously unknown, tropical woodrat (*Hodomys alleni*) was taken the second day, and the collection of other new mammals soon followed. With the discovery of new species, some of which represented new genera as well, further interest was aroused. The work in the field was extended and carried on year after year, with some seasonal interruptions in the later years, until 1906, when most of the important parts of every state and territory had been included in its scope. Most of the islands off the coasts were visited, and in the winter of 1895-96 a short trip was made through the highlands of southwestern Guatemala. The field work was concluded with a journey extending the entire length of Baja California, with a pack outfit, in 1905 and 1906.

Although attention was devoted primarily to investigations of mammals and birds, collections of reptiles, amphibians, and plants were also made, and the field reports embody much general informa-

tion concerning the physiography and climate of the country. The mammals collected number 17,400 specimens, and of birds 12,400 were taken. The mammal collections include 354 species and subspecies described as new, and a considerable number of the birds, reptiles, amphibians, and plants taken received new names. All the specimens are deposited in the United States National Museum.

Aside from the descriptions of species and subspecies new to science, the material gathered in México has been used in the revision of many groups of mammals and birds. The birds have been used especially in the preparation of the "Birds of North and Middle America" (U. S. Nat. Mus. Bull. 50) by Ridgway and Friedmann. The material has also been helpful in providing the answers to many questions concerning the distribution of species in North America as a whole. An account entitled "Lower California and its Natural Resources" (Mem. Nat. Acad. Sci., vol. 16, 194 pp., illus., 1921) was prepared for publication by Dr. Nelson; "Mexican Tailless Amphibians in the United States National Museum" (U. S. Nat. Mus. Bull. 160, 224 pp., illus., 1932) by Remington Kellogg; and "Plant Records of an Expedition to Lower California" (Contr. U. S. Nat. Herb., vol. 16, No. 14, pp. 309-371, illus., 1916) by the writer. No comprehensive reports covering the results of the Mexican expeditions as a whole have, however, been published.

In preparing the Gazetteer the very full field notes on many localities by Dr. Nelson have been used, and in the section on Baja California I have drawn freely on his narrative covering our travel through the peninsula. Dr. Nelson was in general charge of our joint operations in México, and to him, with his lively interest and enthusiasm and his driving force, is due the chief credit for the large measure of success achieved.

México, as a whole, is of outstanding biological interest, owing to peculiar configuration, varied topography, and geographic position, forming as it does the meeting ground of the teeming wildlife of the Tropics with that of more northern climes. Although our field work was planned to cover the country as thoroughly as possible, within the time and means available, it was nowhere exhaustive, and many important sections, essentially "biological islands," were only cursorily treated.

# ITINERARY OF NELSON AND GOLDMAN IN MÉXICO AND GUATEMALA, 1892 TO 1906

1892

## COLIMA

- |      |     |                                                                  |
|------|-----|------------------------------------------------------------------|
| Jan. | 24. | Arrived at Manzanillo by steamer from San Francisco.             |
| Feb. | 18. | Manzanillo to Armería (rail).                                    |
| Mar. | 5.  | Armería to Colima (rail).                                        |
| "    | 17. | Colima, 20 miles southwest, to Hacienda Magdalena (pack outfit). |
| "    | 24. | Hacienda Magdalena to Colima.                                    |
| "    | 28. | Colima, 26 miles north, to Hacienda San Antonio (pack outfit).   |
| "    | 30. | Hacienda San Antonio to Colima.                                  |

## JALISCO

- |      |     |                                                                                                         |
|------|-----|---------------------------------------------------------------------------------------------------------|
| Apr. | 2.  | Colima, Colima, 35 miles northerly, to village of Conejo on Hacienda San Marcos, Jalisco (pack outfit). |
| "    | 3.  | Conejo to Agosto (pack outfit).                                                                         |
| "    | 6.  | Agosto to Zapotlán (pack outfit).                                                                       |
| "    | 9.  | Zapotlán to Sierra Nevada de Colima (pack outfit).                                                      |
| "    | 14. | Sierra Nevada de Colima to Zapotlán.                                                                    |
| "    | 20. | Zapotlán to Sierra Nevada de Colima.                                                                    |
| "    | 23. | Sierra Nevada de Colima to Zapotlán.                                                                    |
| May  | 1.  | Zapotlán to Zacoalco (stage).                                                                           |
| "    | 4.  | Zacoalco to Guadalajara (stage).                                                                        |
| "    | 11. | Guadalajara, 7 miles north to Barranca Ibarra (pack outfit).                                            |
| "    | 16. | Barranca Ibarra, 4 miles south to Atemajac.                                                             |
| June | 1.  | Atemajac to Guadalajara (horse car).                                                                    |
| "    | 10. | Guadalajara to Teuchitlán (stage).                                                                      |
| "    | 13. | Teuchitlán to Etzatlán (stage).                                                                         |
| "    | 23. | Etzatlán to Teuchitlán (pack outfit).                                                                   |
| "    | 24. | Teuchitlán to Guadalajara (pack outfit).                                                                |

## GUANAJUATO

- |      |    |                                                             |
|------|----|-------------------------------------------------------------|
| July | 1. | Guadalajara, Jalisco, to Acámbaro, Guanajuato (via Celaya). |
|------|----|-------------------------------------------------------------|

## MICHOACÁN

- |      |     |                                                       |
|------|-----|-------------------------------------------------------|
| July | 12. | Acámbaro, Guanajuato, to Pátzcuaro, Michoacán (rail). |
| Aug. | 4.  | Pátzcuaro to Queréndaro.                              |

## SAN LUIS POTOSÍ

- |      |     |                                                             |
|------|-----|-------------------------------------------------------------|
| Aug. | 11. | Queréndaro, Michoacán, to San Luis Potosí, San Luis Potosí. |
| "    | 15. | San Luis Potosí to Hacienda La Parada.                      |
| "    | 22. | Hacienda La Parada to San Luis Potosí.                      |

1892

- Aug. 24. San Luis Potosí to Aqualulco.  
 " 28. Aqualulco to San Luis Potosí.  
 " 30. San Luis Potosí to Jesús María.  
 Sept. 1. Jesús María to camp in mountains near (pack outfit).  
 " 6. Returned from mountains to Jesús María.  
 " 8. Jesús María to San Luis Potosí and return.  
 " 17. Jesús María to San Luis Potosí.  
 " 20. San Luis Potosí to Villar.  
 " 28. Villar to San Luis Potosí.  
 " 29. San Luis Potosí to Jesús María.  
 Oct. 1. Jesús María to San Luis Potosí.

## MICHOACÁN

- Oct. 1-2. San Luis Potosí, San Luis Potosí, to Queréndaro, Michoacán.  
 " 6. Queréndaro to Pátzcuaro.  
 " 7. Pátzcuaro to Nahuatzen.  
 " 15. Nahuatzen to Pátzcuaro.

## MÉXICO

- Oct. 19. Pátzcuaro, Michoacán, to Salazar, México.  
 Nov. 8. Salazar to Lerma.

## DISTRITO FEDERAL

- Nov. 24. Lerma, México, to City of México, Distrito Federal.  
 " 28. City of México to Tlalpan.  
 Dec. 15. Tlalpan to Ajusco.  
 " 19. Ajusco to Tlalpan.

## MORELOS

- Dec. 27. Tlalpan, Distrito Federal, to Huitzilac, Morelos.

1893

- Jan. 2. Huitzilac to Cuernavaca.  
 " 10. Cuernavaca to Yautepec.

## MÉXICO

- Jan. 18. Yautepec, Morelos, to Amecameca, México.

## MORELOS

- Feb. 8. Amecameca, México, to Yecapixtla, Morelos.  
 " 10. Yecapixtla to Tetela del Volcán.

## MÉXICO

- Feb. 13. Tetela del Volcán, Morelos, to Amecameca, México.  
 " 21. Amecameca to Volcán de Popocatepetl.  
 " 26. Volcán de Popocatepetl to Amecameca.

1893

- Mar. 1. Amecameca to Cerro Ixtacihuatl.  
 " 2. Cerro Ixtacihuatl to Amecameca.

DISTRITO FEDERAL

- Mar. 5. Amecameca, México, to City of México, Distrito Federal.

HIDALGO

- Mar. 9. City of México, Distrito Federal, to Tula, Hidalgo.  
 " 13. Tula to Pachuca.  
 " 21. Pachuca to El Chico.  
 " 29. El Chico to Irolo.

TLAXCALA

- Apr. 4. Irolo, Hidalgo, to Apizaco, Tlaxcala.

PUEBLA

- Apr. 7. Apizaco, Tlaxcala, to Chalchicomula, Puebla (via Esperanza).  
 " 19. Chalchicomula to Pico de Orizaba.  
 " 28. Pico de Orizaba to Chalchicomula.  
 May 2. Chalchicomula to Tehuacán.

TLAXCALA

- May 9. Tehuacán, Puebla, to Cerro de Malinche, Tlaxcala (via Huamantla).

VERACRUZ

- May 17. Cerro de Malinche, Tlaxcala, to Perote, Veracruz.  
 " 23. Perote to Cofre de Perote.  
 June 1. Cofre de Perote to Perote.  
 " 8. Perote to Las Vigas.  
 " 20. Las Vigas to Jalapa.  
 " 21. Jalapa to Jico.

PUEBLA

- July 23. Jico, Veracruz, to Atlixco, Puebla.  
 Aug. 1. Atlixco to Tochimilco.  
 " 6. Tochimilco to Atlixco.  
 " 10. Atlixco to San Martín.

HIDALGO

- Aug. 14. San Martín, Puebla, to Irolo, Hidalgo.  
 " 15. Irolo to Tepa.  
 " 16. Tepa to Tulancingo.

1893

## DISTRITO FEDERAL

- Aug. 29. Tulancingo, Hidalgo, to City of México, Distrito Federal.

## MÉXICO

- Sept. 2. City of México, Distrito Federal, to Toluca, México.  
 " 3. Toluca to San Juan de las Huertas, at north base of Volcán de Toluca.

## DISTRITO FEDERAL

- Sept. 14. San Juan de las Huertas, México, to City of México, Distrito Federal.

## CHIHUAHUA

- Sept. 15-18. Enroute from City of México, Distrito Federal, to Santa Rosalía, Chihuahua.  
 " 26. Santa Rosalía to Chihuahua.  
 " 27. Nelson left Chihuahua, Chihuahua, for Washington, D. C., while Goldman remained in Chihuahua on vacation.  
 Oct. 15. Official work resumed by Goldman at Chihuahua on this date.  
 Nov. 18. Chihuahua to Gallego.  
 " 22. Gallego to Chihuahua.  
 " 25. Chihuahua to Escalón.  
 " 30. Escalón to Chihuahua.  
 Dec. 3. Chihuahua to Santa Eulalia.  
 " 5. Santa Eulalia to Chihuahua.  
 " 12. Chihuahua to Escalón.

## DURANGO

- Dec. 13. Escalón, Chihuahua, to Mapimí, Durango.

## COAHUILA

- Dec. 16. Mapimí, Durango, to Jimulco, Coahuila.

## ZACATECAS

- Dec. 22-23. Jimulco, Coahuila, to Cañitas, Zacatecas.  
 " 26. Cañitas to Zacatecas.  
 " 27. Zacatecas to Berriozábal.

## DISTRITO FEDERAL

- Dec. 30. Berriozábal, Zacatecas, to City of México, Distrito Federal, where Goldman rejoined Nelson, who had returned from the United States on December 27.

1894

## MÉXICO

- Jan. 3. City of México, Distrito Federal, to Amecameca, México.  
 " 5. Amecameca to Volcán de Popocatepetl.  
 " 7. Volcán de Popocatepetl to Cerro Ixtacihuatl.  
 " 8. Cerro Ixtacihuatl to Amecameca.

## DISTRITO FEDERAL

- Jan. 9. Amecameca, México, to City of México, Distrito Federal.

## VERACRUZ

- Jan. 11. City of México, Distrito Federal, to Orizaba, Veracruz.

## PUEBLA

- Jan. 13. Orizaba, Veracruz, to Chalchicomula, Puebla.

## VERACRUZ

- Jan. 15. Chalchicomula, Puebla, to Orizaba, Veracruz.  
 " 30. Orizaba to Fortín.  
 " 31. Fortín to San Juan.  
 Feb. 1. San Juan to Huatusco.  
 " 2. Huatusco to Mirador.  
 " 12. Mirador to Santa María.  
 " 13. Santa María to Chichicaxtle.  
 " 15. Chichicaxtle to Orizaba (via Veracruz).  
 " 21. Orizaba to Motzorongo (via Córdoba).  
 Mar. 6. Motzorongo to Orizaba.  
 " 12. Orizaba to Boca del Monte.  
 " 14. Boca del Monte to Chalchicomula, Puebla.

## PUEBLA

- Mar. 18. Chalchicomula to Volcán de Orizaba (camp near timber line).

## VERACRUZ

- Mar. 21. Descended to camp on east slope of Volcán de Orizaba.  
 " 22. Volcán de Orizaba to Orizaba.  
 " 24. Orizaba to Maltrata.  
 " 26. Maltrata to Orizaba.  
 " 29. Orizaba to Veracruz.  
 " 31. Veracruz to Tlacotalpan.  
 Apr. 1. Tlacotalpan to Otatitlán.

## OAXACA

- Apr. 3. Otatitlán, Veracruz, to Tuxtepec, Oaxaca.  
 " 7. Tuxtepec to camp about 10 miles north.  
 " 10. Returned from camp to Tuxtepec.

1894

## VERACRUZ

- Apr. 13. Tuxtepec, Oaxaca, to Otatitlán, Veracruz.  
 " 19. Otatitlán to Tlacotalpam.  
 " 23. Tlacotalpam to Alonzo Lazaro.  
 " 24. Alonzo Lazaro to San Andrés Tuxtla.  
 " 25. San Andrés Tuxtla to Catemaco.  
 May 6. Catemaco to San Andrés Tuxtla.  
 " 11. San Andrés Tuxtla to camp at La Vija, 6 miles south of Volcán de Tuxtla.  
 " 12. Camp at La Vija to Volcán de Tuxtla and descended to camp at 4,400 feet on southwest slope.  
 " 13. Volcán de Tuxtla to San Andrés Tuxtla.  
 " 14. San Andrés Tuxtla to Santiago Tuxtla.  
 " 16. Santiago Tuxtla to Tlacotalpam (via Alonzo Lazaro).  
 " 30. Tlacotalpam to Veracruz.  
 " 31. Veracruz to Orizaba.

## TLAXCALA

- June 2. Orizaba, Veracruz, to Tlaxcala, Tlaxcala.

## PUEBLA

- June 3. Tlaxcala to Puebla.

## OAXACA

- June 5. Puebla, Puebla, to Oaxaca, Oaxaca.  
 " 27. Oaxaca to camp 10 miles southeasterly on road to Mitla, with newly purchased pack outfit.  
 " 28. Camp on road 20 miles southeasterly to Mitla.  
 " 30. Mitla, 15 miles northeast to San Miguel Albarradas.  
 July 2. San Miguel Albarradas, 16 miles northeasterly to San Pablo Yaganiza.  
 " 3. San Pablo Yaganiza, 8 miles northerly to Yalalag.  
 " 4. Yalalag, 16 miles easterly to Yacochi on Cerro Zempoaltepec.  
 " 13. Cerro Zempoaltepec, 15 miles northeasterly to Totontepec.  
 " 20. Totontepec, 6 miles easterly to Indian ranches at lower elevation.  
 " 23. Returned to Totontepec.  
 " 26. Totontepec, 21 miles northeasterly to Choapan (via Comaltepec).  
 " 29. Choapan, 8 miles southwesterly to Comaltepec.  
 " 31. Comaltepec, 13 miles southwesterly to Totontepec.  
 Aug. 2. Totontepec, 22 miles southwesterly to Yalalag.  
 " 4. Yalalag, 18 miles southwesterly to Rancho Crisantha.  
 " 5. Rancho Crisantha, southwesterly to camp near Cuajimoloya.  
 " 6. Camp near Cuajimoloya to Oaxaca.  
 " 17. Oaxaca to camp on mountains 16 miles northeast on trail to La Parada.  
 " 18. Overnight camp, 6 miles northeast, to La Parada.  
 " 20. La Parada, 6 miles easterly, to Cerro San Felipe.

1894

- Sept. 1. Cerro San Felipe to Oaxaca.  
 " 10. Oaxaca, 8 miles southwesterly to Cuilapan.  
 " 11. Cuilapan, 14 miles westerly to camp in mountains west of Oaxaca.  
 " 19. Returned from mountains to Oaxaca.  
 Oct. 2. Oaxaca, 22 miles north to San Francisco Huitzo.  
 " 3. San Francisco Huitzo, 19 miles north to Cieneguilla.  
 " 4. Cieneguilla, 24 miles north to Dominguillo.  
 " 5. Dominguillo, 13 miles north to Cuicatlán.  
 " 15. Cuicatlán, 10 miles east to Reyes.  
 " 24. Reyes back to Cuicatlán.  
 Nov. 9. Cuicatlán, 22 miles northwest to San Miguel Huautla.  
 " 10. San Miguel Huautla, 16 miles southwesterly to Coixtlahuaca.  
 " 12. Coixtlahuaca, 22 miles westerly to Tamazulapam.  
 " 16. Tamazulapam, 26 miles northwest to Huajuapam.

PUEBLA

- Nov. 19. Huajuapam, Oaxaca, 26 miles northwesterly to Petlalcingo, Puebla.  
 " 20. Petlalcingo, 15 miles northwest to Acatlán.  
 " 22. Acatlán, 22 miles west to Piaxtla.  
 " 27. Piaxtla, 18 miles southerly to Amolac.

GUERRERO

- Nov. 28. Amolac, 18 miles southerly to Sochi, Guerrero.  
 " 29. Sochi, 18 miles southerly to Tlalquetzala.  
 " 30. Tlalquetzala, 16 miles south to Tlapa.  
 Dec. 5. Tlapa, 20 miles east to Tlalixtaquilla.

OAXACA

- Dec. 6. Tlalixtaquilla, Guerrero, 14 miles easterly to Tlapancingo, Oaxaca.

GUERRERO

- Dec. 9. Returned from Tlapancingo, Oaxaca, to Tlalixtaquilla, Guerrero.  
 " 12. Tlalixtaquilla, 20 miles westerly to Tlapa.  
 " 13. Tlapa, 16 miles westerly to Ayotzinapa.  
 " 14. Ayotzinapa, 24 miles westerly to Petatlán.  
 " 15. Petatlán, 16 miles westerly to Chilapa.  
 " 16. Chilapa, 26 miles westerly to Chilpancingo.  
 " 18. Chilpancingo, 14 miles westerly to camp in mountains.  
 " 24. Returned from camp to Chilpancingo.  
 " 28. Chilpancingo, 22 miles south to Acahuizotla.  
 " 29. Acahuizotla, 28 miles south to Tierra Colorada.  
 " 30. Tierra Colorada, 20 miles south to Alto del Camarón.  
 " 31. Alto del Camarón, 28 miles south to La Venta de Aguacatillo.

1895

- Jan. 1. La Venta de Aguacatillo, 15 miles south to Acapulco.  
 " 29. Acapulco, 23 miles southeasterly to Cerro Piedra.  
 " 30. Cerro Piedra, 17 miles southeasterly to San Marcos.  
 Feb. 8. San Marcos, 33 miles southeast to Copala.  
 " 9. Copala, 27 miles southeast to Juchitango.  
 " 10. Juchitango, 17 miles southeast to Ometepec.  
 " 12. Ometepec, 9 miles southeast to Hacienda del Capricho.

## OAXACA

- Feb. 16. Hacienda del Capricho, Guerrero, 15 miles southeast, to Llano Grande, Oaxaca.  
 " 19. Llano Grande, 24 miles southeast to Pinotepa.  
 " 23. Pinotepa, 22 miles southeast, to Jamiltepec.  
 " 24. Jamiltepec, 20 miles east, to Río Verde.  
 " 25. Río Verde, 20 miles east, to Panixtlahuaca.  
 " 26. Panixtlahuaca, 15 miles east, to Juquila.  
 Mar. 4. Juquila, 24 miles southeasterly, to Nopala.  
 " 5. Nopala, 20 miles northeast, to San Pedro Mixtepec.  
 " 6. San Pedro Mixtepec, 22 miles east, to Colotepec.  
 " 7. Colotepec, 24 miles east, to Cozoaltepec.  
 " 8. Cozoaltepec, 28 miles southeast, to Pochutla.  
 " 9. Pochutla, 8 miles south, to Puerto Angel.  
 " 14. Puerto Angel to Pochutla.  
 " 16. Pochutla, 22 miles northerly, to Pluma.  
 " 21. Pluma, 25 miles northwesterly, to San Miguel Suchixtepec.  
 " 22. San Miguel Suchixtepec, 30 miles northwesterly, to Miahuatlán.  
 " 24. Miahuatlán, 24 miles southeast, to camp in mountains near Ozolotepec.  
 " 27. Ozolotepec (mountains near), 16 miles northwesterly to Roatina.  
 " 28. Roatina, 34 miles northwesterly, to Ejutla.  
 " 29. Ejutla, 39 miles north, to Oaxaca.  
 Apr. 17. Oaxaca, 22 miles southeast, to Tlacolula.  
 " 18. Tlacolula, 26 miles southeast, to Totolapa.  
 " 19. Totolapa, 14 miles southeast, to Los Bichones.  
 " 20. Los Bichones, 17 miles southeast, to San Carlos.  
 " 21. San Carlos, 18 miles southeast, to San Bartolo.  
 " 22. San Bartolo, 18 miles southeast, to Las Vacas.  
 " 23. Las Vacas, 20 miles southeast, to Tequisistlán.  
 " 24. Tequisistlán, 35 miles southeast, to Tehuantepec.  
 May 4. Tehuantepec, 8 miles south, to Huilotepec.  
 " 14. Huilotepec, 13 miles east, to San Mateo del Mar.  
 " 18. San Mateo del Mar, 21 miles northwest, to Tehuantepec.  
 " 22. Tehuantepec, 8 miles northwest, to Cerro de Giengola.  
 " 24. Cerro de Giengola to Tehuantepec.  
 June 1. Tehuantepec, 20 miles northeast, to Juchitán.  
 " 3. Juchitán, 30 miles northerly, to Lagunas.  
 " 7. Lagunas, 5 miles northwest, to Santo Domingo.

1895

- June 14. Santo Domingo, 12 miles northwest, to La Ranchería in the mountains.  
 " 21. La Ranchería, 15 miles northeast, to San Juan Guichicovi.  
 " 27. San Juan Guichicovi, 18 miles southeast, to Lagunas.  
 " 28. Lagunas to San Gerónimo.  
 July 8. San Gerónimo to Tehuantepec.  
 " 11. Tehuantepec to San Gerónimo.  
 " 13. San Gerónimo, 22 miles east, to La Venta.  
 " 14. La Venta, 20 miles east, to Miltepec.  
 " 15. Miltepec, 22 miles east, to Zanatepec.  
 " 16. Zanatepec, 18 miles southeast, to Tapanatepec.  
 " 17. Tapanatepec, 8 miles northerly, to Santa Efigenia.

## CHIAPAS

- Aug. 1. Santa Efigenia, Oaxaca, 24 miles easterly, via Tapanatepec, to Rancho Llano Redondo, Chiapas.  
 " 2. Llano Redondo, 21 miles southeasterly, to Rancho de La Pampa.  
 " 3. Rancho de La Pampa, 16 miles southwesterly, to Tonalá.  
 " 13. Tonalá, 16 miles northwest, to La Calera.  
 " 14. La Calera, 16 miles northerly to El Ocote, in mountains north of Tonalá.  
 " 16. El Ocote, 16 miles northerly, to La Joya.  
 " 17. La Joya, 21 miles northerly, to San Ricardo.  
 " 18. San Ricardo, 18 miles easterly, to Ocozocoautla.  
 " 21. Ocozocoautla, 10 miles northwesterly to Ocuilapa.  
 " 24. Ocuilapa, 3 miles east, to Rancho Alsacia.  
 " 29. Rancho Alsacia, 23 miles east, to Tuxtla Gutiérrez.  
 Sept. 3. Tuxtla Gutiérrez, 28 miles to Chicoasén (Nelson).  
 " 4. Chicoasén to Tecpatán, via Copainala (Nelson).  
 " 7. Tecpatán to Quechula (Nelson).  
 " 8. Quechula to ranch on trail to Tuxtla Gutiérrez (Nelson).  
 " 9. Ranch to Tuxtla Gutiérrez (Nelson).  
 " 13. Tuxtla Gutiérrez, 18 miles easterly to Rancho del Calvario (via Chiapa).  
 " 14. Rancho del Calvario, 13 miles easterly, to Rancho del Burrero.  
 " 15. Rancho del Burrero, 16 miles easterly, to San Cristóbal.  
 Oct. 12. San Cristóbal, 16 miles northeasterly, to Tenejapa.  
 " 13. Tenejapa, 21 miles northeasterly, to Cancuc.  
 " 14. Cancuc, 16 miles north, to Citalá.  
 " 15. Citalá, 18 miles north to Yajalón.  
 " 20. Yajalón, 13 miles northwest to Tumbalá.  
 " 29. Tumbalá, 16 miles northerly, to La Trinidad.  
 Nov. 4. La Trinidad to Tumbalá (Goldman); La Trinidad to El Salto de Agua (Nelson).

## TABASCO

- Nov. 5-9. El Salto, Chiapas, enroute by canoe to Frontera, Tabasco (Nelson).

## CHIAPAS

1895

- Nov. 10-14. Frontera, Tabasco, enroute by canoe to El Salto, Chiapas (Nelson).  
 " 17. El Salto to La Trinidad (Nelson).  
 " 18. La Trinidad to La Sombra, near Tumbalá (Nelson).  
 " 21. Tumbalá to Yajalón.  
 " 22. Yajalón, 8 miles southwest, to Chilón.  
 " 23. Chilón, 8 miles southwesterly, to Guaquitepec.  
 " 24. Guaquitepec, 14 miles southwesterly, to Cancuc.  
 " 25. Cancuc, 20 miles southwest, to Tenejapa.  
 Dec. 1. Tenejapa, 14 miles southwest, to San Cristóbal.  
 " 4. San Cristóbal, 23 miles southeast, to near Teopisca.  
 " 5. Teopisca (near), 13 miles southeast, to camp in "Mountains near Comitán."  
 " 6. Camp in "Mountains near Comitán," 21 miles southeast, to Comitán.  
 " 8. Comitán, 22 miles southeast, to Hacienda de Juncaná ("Valley of Comitán").  
 " 12. Hacienda de Juncaná, 16 miles southeast, to San Vicente.

## GUATEMALA

- Dec. 13. San Vicente, Chiapas, 21 miles southeast, to Nentón, Guatemala.  
 " 18. Nentón, 21 miles southeast, to Jacaltenango.  
 " 24. Jacaltenango, 16 miles southeasterly, to San Martín.  
 " 25. San Martín, 11 miles southeast, to Todos Santos.

1896

- Jan. 2. Todos Santos, 22 miles easterly, to Hacienda Chancól.  
 " 10. Hacienda Chancól, 12 miles southeast, to Malacatán (via Huehuetenango).  
 " 11. Malacatán, 18 miles southeasterly, to Calel.  
 " 16. Calel, 22 miles southeasterly, to Olinstepeque.  
 " 17. Olinstepeque, 9 miles southerly, to Zunil (via Quezaltenango).  
 " 20. Zunil to Quezaltenango.  
 " 21. Quezaltenango, 8 miles southwesterly, to Volcán de Santa María.  
 " 29. Volcán de Santa María, 23 miles southwesterly, to El Suj.  
 " 30. El Suj, 28 miles southwesterly, to El Pié de la Cuesta.

## CHIAPAS

- Jan. 31. El Pié de la Cuesta, Guatemala, 26 miles westerly, to Tuxtla Chico, Chiapas.  
 Feb. 1. Tuxtla Chico, 11 miles westerly, to Tapachula.  
 " 5. Tapachula, 23 miles north, to Las Chicharras.  
 " 6. Las Chicharras, 13 miles northwesterly, to camp on road to Pinabete.  
 " 7. Camp on road, 12 miles northerly, to Pinabete.

1896

- Feb. 12. Pinabete, 15 miles southerly, to Finca México.  
 " 13. Finca México, 10 miles to Las Chicharras.  
 " 19. Las Chicharras, 17 miles southerly to ranch on road to Huehuetán.  
 " 20. Ranch on road, 11 miles southwesterly, to Huehuetán.  
 Mar. 3. Huehuetán, 22 miles southeast, to Tapachula, where we sold the horses and pack mules we had used continuously for a year and about 9 months.  
 " 11. Tapachula, 22 miles southwest to San Benito by ox cart.

## OAXACA

- Mar. 22-26. Enroute from San Benito, Chiapas, to Salina Cruz (steamer); to Tehuantepec on March 26 (rail).

## VERACRUZ

- Apr. 9. Tehuantepec, Oaxaca, to Coatzacoalcos (Puerto México), Veracruz.  
 " 17. Coatzacoalcos to Minatitlán.  
 " 26. Minatitlán to Coatzacoalcos.  
 " 27. Coatzacoalcos to Jaltipan.  
 May 4. Jaltipan to Coatzacoalcos.  
 " 15-16. Coatzacoalcos to Veracruz (enroute by steamer).  
 " 17. Veracruz to Orizaba.

## DISTRITO FEDERAL

- May 18. Orizaba, Veracruz, to City of México, Distrito Federal.

## HIDALGO

- May 22. City of México, Distrito Federal, to El Marqués, Hidalgo.

## QUERÉTARO

- May 26. El Marqués, Hidalgo, to San Juan del Río, Querétaro.

## GUANAJUATO

- May 27. San Juan del Río, Querétaro, to Celaya, Guanajuato.

## QUERÉTARO

- June 1. Celaya, Guanajuato, to Tequisquiapan, Querétaro.

## DISTRITO FEDERAL

- June 9. Tequisquiapan, Querétaro, to City of México, Distrito Federal.

## HIDALGO

- June 15. City of México, Distrito Federal, to Tula, Hidalgo.

1896

## GUANAJUATO

- June 17. Tula, Hidalgo, to Silao, Guanajuato.  
 " 22. Silao to Irapuato.

## JALISCO

- June 23. Irapuato, Guanajuato, to Lagos, Jalisco.

## AGUASCALIENTES

- July 1. Lagos, Jalisco, to Chicalote, Aguascalientes.

## ZACATECAS

- July 7. Chicalote, Aguascalientes, to Berriozábal, Zacatecas.

## AGUASCALIENTES

- July 12. Berriozábal, Zacatecas, to Aguascalientes, Aguascalientes.

## SAN LUIS POTOSÍ

- July 14. Aguascalientes, Aguascalientes, to San Luis Potosí, San Luis Potosí.

## COAHUILA

- July 17. San Luis Potosí, San Luis Potosí, to La Ventura, Coahuila.  
 " 21. La Ventura to Gómez Farías.  
 " 22. Gómez Farías, 14 miles southwest, to Hacienda Encarnación.  
 " 23. Hacienda Encarnación, 14 miles southwesterly, to Sierra Encarnación.  
 " 31. Sierra Encarnación to Gómez Farías.  
 Aug. 1. Gómez Farías to La Ventura.  
 " 11. La Ventura to Carneros.  
 " 14. Nelson left Carneros, Coahuila, to return to Washington, D. C.; Goldman continued field work.

## SAN LUIS POTOSÍ

- Aug. 17. Carneros, Coahuila, to San Luis Potosí, San Luis Potosí.  
 " 20. San Luis Potosí to San Bartolo, and 31 miles southerly to Río Verde (stage).

## QUERÉTARO

- Aug. 22. Río Verde, San Luis Potosí, 46 miles southeasterly, to Arroyo Seco, Querétaro; via San Ciro de Albergas and Hacienda San Rafael (pack outfit).  
 " 23. Arroyo Seco, 10 miles southeasterly, to Concá (pack outfit).  
 " 24. Concá, 20 miles southeasterly, to Jalpan (pack outfit).  
 " 31. Jalpan, 15 miles southwesterly, to Pinal de Amoles (pack outfit).  
 Sept. 23. Pinal de Amoles to Jalpan.

## HIDALGO

1896

- Sept. 26. Jalpan, Querétaro, 26 miles southeast to Pacula, Hidalgo (pack outfit).  
 " 27. Pacula, 25 miles southeast to Encarnación (pack outfit).  
 Oct. 10. Encarnación to Zimapán (pack outfit).  
 " 20. Zimapán, 17 miles southwesterly, to Río de Moctezuma (ox cart).  
 " 21. Río de Moctezuma, 12 miles southeasterly, to Ixmiquilpan (ox cart).  
 " 30. Ixmiquilpan, 30 miles southward to Mixquiahuala (ox cart).  
 " 31. Mixquiahuala, 15 miles south, to Tlaxcoapan (ox cart).  
 Nov. 1. Tlaxcoapan to Tula (rail).

## GUANAJUATO

- Nov. 2. Tula, Hidalgo, via Celaya, to Dolores Hidalgo, Guanajuato.  
 " 4. Dolores Hidalgo, 25 miles southwesterly, to Santa Rosa.  
 " 18. Santa Rosa to Dolores Hidalgo.

## SAN LUIS POTOSÍ

- Nov. 19. Dolores Hidalgo, Guanajuato, to San Luis Potosí, San Luis Potosí.  
 " 21. Goldman left San Luis Potosí enroute to home in California on vacation.

1897

- Jan. 5. Goldman, returning from California, arrived at Río Verde.  
 " 21. Río Verde to La Tinaja.

## JALISCO

- Feb. 5. La Tinaja, via San Luis Potosí, Irapuato, Guanajuato, and Guadalajara, to Ameca, Jalisco.  
 " 21. Nelson, returning from Washington, D. C., rejoined Goldman at Ameca.  
 Mar. 3. Ameca, 18 miles southwesterly with newly purchased pack outfit, to ranch on trail to Talpa.  
 " 4. Ranch on road 33 miles southwesterly to Atenguillo.  
 " 6. Atenguillo, 18 miles southwesterly, to Jacala.  
 " 7. Jacala, 18 miles southwesterly, to Talpa.  
 " 12. Talpa, 27 miles northerly, to Hacienda El Tajo (via Mascota).  
 " 13. Hacienda El Tajo, 20 miles northerly, to Milpillas.  
 " 19. Milpillas, 5 miles northeast, to San Sebastián.  
 " 20. San Sebastián, 5 miles southeasterly, to El Real Alto.  
 " 22. El Real Alto, 12 miles southerly, to La Laguna, Sierra de Juanacatlán.  
 " 26. La Laguna to San Sebastián.  
 " 27. San Sebastián, 3 miles west, to La Cuadrilla.  
 " 30. La Cuadrilla, 25 miles westerly, to Las Palmas.  
 " 31. Las Palmas, 16 miles southwesterly, to Ixtapa.

1897

## NAYARIT

- Apr. 4. Ixtapa, Jalisco, 20 miles northerly, to Colomo, Nayarit.  
 " 5. Colomo, 28 miles northerly, to Arroyo de Juan Sánchez.  
 " 6. Arroyo de Juan Sánchez, 45 miles northeasterly, to Compostela.  
 " 7. Compostela, 26 miles northerly, to Tepic.  
 " 15. Tepic, 25 miles northwesterly, to Navarrete.  
 " 16. Navarrete, 20 miles southwest, to San Blas.  
 " 20-22. San Blas to Isla Isabel (enroute by schooner).  
 " 23-24. Isla Isabel to San Blas (enroute by schooner).  
 " 28 to May 2. San Blas to Isla María Madre (enroute by schooner).  
 May 25. Isla María Madre to Isla María Magdalena (schooner).  
 " 29. Isla María Magdalena to Isla María Cleofas (schooner).  
 " 31 to June 1. Isla María Cleofas to San Blas (enroute by schooner).  
 June 14. San Blas, 32 miles north, to Santiago.  
 " 22. Santiago, 30 miles north, to Rosa Morada.  
 " 23. Rosa Morada, 45 miles northerly, to Acaponeta.

## SINALOA

- July 4. Acaponeta, Nayarit, 8 miles northwesterly, to Concepción, Sinaloa.  
 " 5. Concepción, 46 miles northwest, to Escuinapa.  
 " 6. Escuinapa, 14 miles northwesterly, to Rosario.  
 " 12. Rosario, 26 miles northeasterly, to Palmarito.  
 " 13. Palmarito, 20 miles northeasterly, to Colomos, near Plomosas.  
 " 20. Colomos to Palmarito.  
 " 21. Palmarito to Rosario.  
 " 27. Rosario to Escuinapa.  
 " 28. Escuinapa to Concepción.

## NAYARIT

- July 29. Concepción, Sinaloa, to Acaponeta, Nayarit.  
 Aug. 2. Acaponeta, 22 miles easterly, to Pedro Pablo, near San Diego de Alcalá.  
 " 4. Pedro Pablo, 28 miles northeasterly, to San Blasito.  
 " 5. San Blasito, 10 miles southeast, to Rancho de Aguacate.  
 " 6. Rancho de Aguacate, 15 miles easterly, to Dolores.  
 " 7. Dolores, 16 miles easterly, to Santa Gertrudis.  
 " 8. Santa Gertrudis, 18 miles northeasterly, to Santa Teresa.  
 " 13. Santa Teresa to ranch 30 miles east.

## DURANGO

- Aug. 14. Ranch 30 miles east of Santa Teresa, Nayarit, to Huazamota, Durango.

## NAYARIT

- Aug. 15. Huazamota, Durango, to camp in cave 10 miles northeast.

1897

ZACATECAS

- Aug. 16. Camp in cave 10 miles northeast of Huazamota, Durango, 25 miles easterly to summit of Sierra Madre in Zacatecas.  
 " 18. Sierra Madre, 25 miles easterly to Hacienda de San Juan Capistrano.

JALISCO

- Aug. 23. San Juan Capistrano, Zacatecas, 25 miles easterly to Huejuquilla, Jalisco.  
 " 25. Huejuquilla, 30 miles southerly, to Mexquitic.

ZACATECAS

- Aug. 26. Mexquitic, Jalisco, 18 miles easterly, to Monte Escobedo, Zacatecas.  
 " 27. Monte Escobedo to ranch 8 miles southeast.

JALISCO

- Aug. 28. Monte Escobedo (ranch 8 miles southeast), 30 miles southeasterly, to Colotlán, Jalisco.

ZACATECAS

- Aug. 31. Colotlán, Jalisco, 28 miles southeast to Plateado, Zacatecas.

JALISCO

- Sept. 5. Plateado, Zacatecas, to Colotlán, Jalisco.  
 " 7. Colotlán, 30 miles southeasterly, to Santa María, near Totatiche.  
 " 8. Santa María, 35 miles southwest, to El Romerio.  
 " 9. El Romerio, 10 miles southwest, to Bolaños.  
 " 15. Bolaños, 14 miles northwest, to camp near summit of Sierra Madre.  
 " 17. Returned from camp near summit of Sierra Madre to Bolaños.  
 " 19. Bolaños to ranch 23 miles south, on east side of Río de Bolaños.

ZACATECAS

- Sept. 20. Río de Bolaños (camp near), 37 miles southerly, to El Conejo, Zacatecas.

JALISCO

- Sept. 21. El Conejo, 46 miles southeasterly, to San Cristóbal, on Río de Santiago in Jalisco.  
 " 22. San Cristóbal, 36 miles southeasterly, to Hacienda de Copala.  
 " 23. Hacienda de Copala, 11 miles southeasterly, to Guadalajara.  
 " 25. Left Guadalajara, Jalisco; Nelson for Washington, D. C., and Goldman to home in California on vacation.

1897

## ZACATECAS

- Nov. 23. Goldman, returning from vacation, arrived at Fresnillo, Zacatecas.  
 " 24. Fresnillo, 50 miles southwesterly, to Hacienda de Saucedá (stage).  
 " 25. Hacienda de Saucedá, 20 miles southwesterly, to Valparaíso (stage).  
 " 26. Valparaíso, 13 miles west to near summit of Valparaíso Mountains (pack outfit).  
 Dec. 8. Valparaíso Mountains to Valparaíso.  
 " 20. Valparaíso to Fresnillo.

## DISTRITO FEDERAL

- Dec. 21. Fresnillo, Zacatecas, to City of México, Distrito Federal.

1898

## HIDALGO

- Jan. 1. City of México, Distrito Federal, to Tulancingo, Hidalgo.

## PUEBLA

- Jan. 3. Tulancingo, Hidalgo, 35 miles northeasterly, to Huauchinango, Puebla (stage).  
 " 16. Huauchinango, 27 miles northeasterly, to San Pedro (pack outfit).  
 " 17. San Pedro, 25 miles northeasterly, to Rancho Nuevo (pack outfit).  
 " 18. Rancho Nuevo, 6 miles northeasterly, to Metlatoyuca (pack outfit).  
 Feb. 27. Metlatoyuca, 28 miles southeasterly, to Tepesala (pack outfit).

## VERACRUZ

- Feb. 28. Tepesala, 25 miles southeasterly, to Coatzintla, Veracruz (pack outfit).  
 Mar. 1. Coatzintla, 13 miles southeasterly, to Papantla (pack outfit).  
 " 15. Papantla, 18 miles northeasterly, to Gutiérrez Zamora.  
 " 16. Gutiérrez Zamora to Veracruz (steamer).

## TAMAULIPAS

- Mar. 25. Veracruz to Tampico, Tamaulipas (steamer).  
 Apr. 2. Tampico to Altamira (rail).  
 " 24. Altamira to Tampico, where Goldman joined Nelson who had just returned from Washington, D. C.

## SAN LUIS POTOSÍ

- Apr. 27. Tampico, Tamaulipas, to Valles, San Luis Potosí (rail).  
 " 29. Valles, 25 miles southerly, to village of Santa Cruz (pack outfit).  
 " 30. Santa Cruz, 22 miles southerly through Tancahuitz, to Huehuetlán (pack outfit).

1898

- May 1. Huehuetlán, 20 miles south to Jilitla (pack outfit).  
 " 4. Jilitla to Valles (pack outfit).  
 " 8. Valles to Velasco (rail).

VERACRUZ

- May 9. Velasco, San Luis Potosí, to Chijol, Veracruz (rail).

TAMAULIPAS

- May 11. Chijol, Veracruz, to Tampico, Tamaulipas.  
 " 15. Tampico to Altamira.  
 " 20. Altamira to Victoria.  
 " 27. Victoria to Forlón.  
 " 29. Forlón to Victoria.  
 " 31. Victoria, 25 miles southwest, to ranch of La Mula (pack outfit).  
 June 1. La Mula, 25 miles southwesterly, to Jaumave (pack outfit).  
 " 6. Jaumave, 25 miles northwest, to ranch of Angelito (pack outfit).  
 " 7. Angelito, 20 miles northwest, to Miquihuana (pack outfit).

NUEVO LEÓN

- June 16. Miquihuana, Tamaulipas, 22 miles west to Hacienda del Carmen, Nuevo León (pack outfit).  
 " 17. Hacienda del Carmen, 22 miles westerly, to Doctor Arroyo (pack outfit).  
 " 18. Doctor Arroyo, 35 miles west, to ranch (pack outfit).

SAN LUIS POTOSÍ

- June 19. Ranch 35 miles west of Doctor Arroyo, Nuevo León, 10 miles west to Matchuala, San Luis Potosí (pack outfit).

DURANGO

- June 20-23. Matchuala enroute to Durango, Durango (rail); (via Monterrey, Nuevo León).  
 July 9. Durango to camp in mountains, 38 miles west, with newly purchased pack outfit.  
 " 10. Camp in mountains 28 miles southwest to Hacienda El Salto.  
 " 24. El Salto to camp enroute back to Durango.  
 " 25. Camp to Durango.  
 Aug. 5. Durango, 35 miles north, to Cacaria.  
 " 6. Cacaria, 48 miles north, to Hacienda Magdalena.  
 " 7. Hacienda Magdalena, 30 miles north, to Santiago Papasquiario.  
 " 9. Santiago Papasquiario, 16 miles northeast, to ranch of Los Sauces.  
 " 10. Los Sauces, 36 miles northeast, to Hacienda de Ramos.  
 " 11. Hacienda de Ramos, 40 miles northerly, to Indé.  
 " 14. Indé, 13 miles northwest, to El Oro.

1898

- Aug. 15. El Oro, to camp in mountains 35 miles northwest.  
 " 16. Camp 22 miles westerly to Guanaceví.  
 " 18. Guanaceví, 16 miles northerly, to camp in Sierra Madre.  
 " 19. Camp 22 miles northwesterly to Cueva Prieta.

## CHIHUAHUA

- Aug. 20. Cueva Prieta, to ranch of Piedra Larga, Chihuahua (via Arroyo del Agua and San Julián).  
 " 21. Piedra Larga, 18 miles northerly, to camp in mountains.  
 " 22. Camp 24 miles northerly to Hacienda del Tule, at east base of Mount Mohinora ("Sierra Madre near Guadalupe y Calvo").  
 Sept. 6. El Tule, 25 miles southerly, to camp on road to San Julián.  
 " 7. Camp 30 miles southerly to San Julián.  
 " 8. San Julián, 28 miles northeast, to camp in mountains.  
 " 9. Camp 30 miles northeast to Hacienda de Cerro Prieto.  
 " 10. Cerro Prieto to camp in mountains 28 miles northeast.  
 " 11. Camp 20 miles easterly to Hacienda La Providencia (Durango).  
 " 12. La Providencia to Parral.  
 " 16. Nelson left Parral for Washington, D. C., leaving Goldman to continue work in the field.  
 " 20. Parral to camp in foothills of Sierra Madre, 31 miles northwest.  
 " 22. Camp in foothills 15 miles westerly to ranch of Torreón.  
 " 23. Torreón, 20 miles westerly, to Balleza.  
 " 24. Balleza to camp 16 miles west.  
 " 25. Camp 16 miles west of Balleza to a camp 16 miles farther west.  
 " 26. Camp 31 miles west to camp near backbone of Sierra Madre.  
 " 27. Camp 21 miles westerly to ranch of Ojito.  
 " 28. Ojito 21 miles westerly to ranch of La Gualaina.  
 " 29. La Gualaina, 21 miles westerly, to high part of Sierra called Los Gentiles.  
 Oct. 2. Los Gentiles, 21 miles westerly, to ranch of Tasajera.  
 " 3. Tasajera, 25 miles westerly, to camp on mountains overlooking canyon of Río del Fuerte.  
 " 4. Camp on mountains 15 miles westerly and down into canyon to Batopilas.  
 " 8. Batopilas, 20 miles west to ranch of Las Guásimas.  
 " 12. Las Guásimas, 23 miles southwesterly, to Calabazas, a ranch on the Río del Fuerte.  
 " 13. Calabazas, 26 miles down the Río del Fuerte, to El Realito.

## SINALOA

- Oct. 14. El Realito, 26 miles westerly, to La Culebra, on east slope of Sierra de Choix, Sinaloa.  
 " 15. La Culebra, 15 miles westerly, to ranch of El Saucillo, on top of Sierra de Choix.  
 " 21. Sierra de Choix, 26 miles northwesterly, to ranch of El Palmar.  
 " 22. El Palmar, 31 miles westerly, to ranch of Jaguari.

1898

## SONORA

- Oct. 23. Jaguari, 27 miles westward to ranch of Agua Blanca, Sonora.  
 " 24. Agua Blanca, 16 miles to Alamos.  
 " 26. Alamos, 13 miles northwest to El Ranchito.  
 " 27. El Ranchito, 26 miles northwest to Camoa, on Río Mayo.  
 Nov. 9. Camoa to Hacienda de Cocoraque, enroute to Guaymas on horseback (Goldman).  
 " 10. Cocoraque to Cócorit on Yaqui River.  
 " 11. Cócorit down Yaqui River to Torín.  
 " 12. Torín, 26 miles northerly, to military post of La Pitahaya.  
 " 13. La Pitahaya about 50 miles to Guaymas.  
 " 16-28. Guaymas to Camoa, including a few days spent on a hunting trip with Yaqui Indians near Yaqui River.  
 Dec. 6. Camoa, 39 miles southeast, to Alamos.  
 " 11. Alamos, 40 miles southwest, to Tonamino.  
 " 12. Tonamino, 23 miles southwest, to port of Agiabampo.  
 " 13. Agiabampo to Tonamino.  
 " 14. Tonamino to Alamos.

1899

- Jan. 2. Alamos, 8 miles westerly, to Sierra de Alamos.  
 " 6. Sierra de Alamos to Alamos.  
 " 10. Alamos, 39 miles to Camoa.  
 " 24. Camoa to Alamos.  
 Feb. 5. Alamos, 40 miles southwest, to Tonamino.  
 " 6. Tonamino, 23 miles southwest, to Agiabampo.

## SINALOA

- Feb. 10. Agiabampo, Sonora, 45 miles southeasterly, to Mochicahue, on Río del Fuerte, Sinaloa.  
 " 11. Mochicahue, 45 miles southeasterly, to Ocoroni.  
 " 12. Ocoroni, 20 miles southeasterly, to Sinaloa.  
 " 16. Sinaloa, 40 miles southeasterly, to Mocorito.  
 " 17. Mocorito, 35 miles southeasterly, to Comanito.  
 " 18. Comanito, 35 miles southeasterly, to Culiacán.  
 " 21. Culiacán, 25 miles easterly, to hacienda of Las Flechas.  
 " 22. Las Flechas, 22 miles easterly, to La Rastra.

## DURANGO

- Feb. 23. La Rastra, 20 miles easterly, to Chacala, Durango.

## SINALOA

- Mar. 8. Chacala, Durango, to La Rastra, Sinaloa.  
 " 9. La Rastra to Las Flechas.  
 " 10. Las Flechas to Culiacán.  
 " 27. Culiacán to Altata (rail).  
 " 28-29. Altata to Mazatlán (enroute by steamer).  
 " 30. Mazatlán, 9 miles southeast, to ranch on road to Rosario.  
 Apr. 13. Returned from ranch to Mazatlán (canoe).

1899

## SONORA

- Apr. 14-18. Mazatlán, Sinaloa, to Guaymas, Sonora (via Altata, La Paz and Santa Rosalía by steamer).  
 " 20. Guaymas to Batamotal (rail).  
 " 29. Batamotal to Nogales (rail).

## CHIHUAHUA

- Apr. 30. Nogales, Sonora, to El Paso, Tex. (enroute to points in Chihuahua).  
 May 11. El Paso, Tex., to Casas Grandes, Chihuahua (rail).  
 June 9. Rejoined by Nelson who returned from Washington, D. C.  
 " 17. Casas Grandes to Colonia Juárez.  
 " 18. Colonia Juárez, 6 miles south to camp at east base of Sierra Madre, with newly purchased pack outfit.  
 " 22. Moved 25 miles southwest and camped on a branch of Pilares Canyon, 10 miles northeast of Colonia García.  
 " 29. Went on 10 miles southeasterly to Colonia García, and then turned 5 miles westerly to a meadow on Gavilán River.  
 July 5. Moved camp 9 miles southeasterly to head of a small tributary of Gavilán River.  
 " 16. Changed camp 15 miles southeasterly to a small branch of Piedras Verdes River.  
 " 19. Moved camp southward to the lower end of Meadow Valley at the head of the Piedras Verdes River.  
 Aug. 6. Moved camp 12 miles southeast to head of Alamos River, a branch of San Miguel River.  
 " 13. Moved camp 8 miles west to a fine meadow in the forest.  
 " 18. Returned from camp to Colonia García.  
 " 21. Colonia García, 15 miles northerly to Cove Valley (via Colonia Pacheco).  
 " 22. Moved camp 8 miles northeasterly into very broken country known as "The Basins."  
 " 24. Moved camp 12 miles eastward to a mountain top near a Mormon sawmill.  
 " 26. Returned from mountains to Casas Grandes.  
 Sept. 4. Left Casas Grandes and traveled 25 miles north along railroad (pack outfit).  
 " 5. Moved camp about 15 miles north along the railroad.  
 " 6. Moved camp easterly to bank of Santa María River.  
 " 7. Went 15 miles northerly down the course of the Santa María River and camped on the bank of the stream.  
 " 14. Moved camp 12 miles northerly to deserted ranch by some springs at northwest corner of Lake Santa María.  
 " 19. Lake Santa María, 10 miles west, to Guzmán on railroad.  
 " 20. Guzmán, 35 miles south of west to camp on road to Colonia Díaz.  
 " 21. Camp 6 miles to Colonia Díaz.  
 " 22. Colonia Díaz to camp on plain 8 miles west.

1899

- Sept. 23. Moved camp 40 miles westerly to east base of Sierra de las Espuelas.  
 " 24. Moved camp to north end of Sierra en Media.  
 Oct. 3. Moved camp 8 miles southwest to near base of Sierra Madre.  
 " 5. Moved camp to mudhole 10 miles south.  
 " 6. Returned to Sierra en Media camp.  
 " 8. Sierra en Media, 40 miles easterly to Colonia Díaz.  
 " 10. Colonia Díaz to Guzmán, after selling pack outfit at former place.  
 " 11. Guzmán to El Paso, Tex., enroute to United States.

## TABASCO

1900

- Mar. 4. Goldman arrived by steamer from New York, N. Y., at Frontera, Tabasco.  
 " 13-14. Frontera, up Río Grijalva to San Juan Bautista—now Villa Hermosa (river steamer).  
 " 14-18. Up Grijalva and Teapa Rivers to Teapa (canoe and pack outfit).  
 Apr. 22-24. Teapa, down river on return trip to Frontera (canoe and steamer). Goldman joined at Frontera by Nelson.  
 May 1-3. Frontera, about 140 miles up Río Usumacinta, to Monte Cristo (small river steamer).

## CHIAPAS

- May 10. Monte Cristo, Tabasco, to Palenque, Chiapas (pack outfit).

## TABASCO

- May 21. Palenque, Chiapas, to Monte Cristo, Tabasco.  
 " 26-28. Monte Cristo to Laguna (now Ciudad del Carmen) (steamer).

## CAMPECHE

- May 31. Laguna, Tabasco, to Campeche, Campeche (schooner).  
 June 14. Campeche to Hacienda de Jaina.  
 " 15-16. Arcas Keys (enroute by schooner).  
 " 17-18. Triangle Keys (enroute by schooner).  
 " 23-26. Triangle Keys to Campeche (enroute by schooner).  
 " 28. Left Campeche for New York, N. Y. (steamer).  
 Dec. 9. Goldman arrived by steamer from New York, N. Y., at Campeche, Campeche.  
 " 11. Campeche to Champotón (sailing vessel).  
 " 12. Champotón to Canasayab (canoe).  
 " 13. Canasayab to San Dimas.  
 " 14. San Dimas to Yohaltún (tram road).  
 " 17. Yohaltún to Apazote (pack outfit).

1901

- Jan. 14. Apazote to Yohaltún.  
 " 15. Yohaltún to Canasayab.  
 " 16. Canasayab to Champotón.  
 " 18-20. Campeche (enroute to, by schooner).

## YUCATÁN

1901

- Jan. 23. Campeche, Campeche, to Mérida, Yucatán. Goldman rejoined Nelson.  
 " 26. Mérida to Tunkás (rail).  
 " 27. Tunkás to Chichén-Itzá (coche-volan, or cart).  
 Feb. 11. Chichén-Itzá to Tunkás.  
 " 18. Tunkás to Mérida (rail).  
 " 23. Mérida to Progreso (rail).

## QUINTANA ROO

- Mar. 8-11. Progreso, Yucatán, to Puerto Morelos, Quintana Roo (steamer).  
 " 14. Puerto Morelos to La Vega (schooner).  
 " 23. La Vega to Mujeres Island (schooner).  
 " 27. Mujeres Island to Puerto Morelos (schooner).  
 Apr. 3-4. Puerto Morelos to Cozumel Island (schooner).  
 " 18. Cozumel Island to Puerto Morelos (schooner).  
 " 19-20. Puerto Morelos to Mujeres Island (schooner).  
 " 22. Mujeres Island to Contoy Island (schooner).

## YUCATÁN

- Apr. 23-24. Contoy Island, Quintana Roo, to Progreso, Yucatán (schooner; via San Felipe).

## VERACRUZ

- May 1-5. Progreso, Yucatán, to Veracruz, Veracruz (enroute by steamer).  
 " 6. Leaving Nelson in Veracruz, Goldman proceeded to Jalapa (rail).  
 " 7. Jalapa to Teocelo.  
 " 9. Teocelo to Jalapa.  
 " 11. Jalapa to Carrizal.  
 " 15. Carrizal to Veracruz, where Goldman rejoined Nelson.  
 " 17. Nelson and Goldman took steamer from Veracruz to New York.

## TAMAULIPAS

- Dec. 18. Goldman, returning to the field from Washington, D. C., arrived at Nuevo Laredo, Tamaulipas.

1902

- Jan. 1-3. Nuevo Laredo to Camargo (enroute by stage).  
 " 30. Camargo to San Miguel (end of railroad to Matamoros).  
 Feb. 1. San Miguel to Matamoros (rail).  
 " 4. Goldman rejoined by Nelson at Matamoros.  
 " 13. Matamoros to Bagdad.  
 " 15. Bagdad to ranch part way to Matamoros.

1902

- Feb. 16. Returned to Matamoros.  
 " 22. Matamoros to ranch about 13 miles south (wagon).  
 " 23. Ranch to another ranch 42 miles farther on road to San Fernando (wagon).  
 " 24. Ranch to another ranch 31 miles on road to San Fernando (wagon).  
 " 25. Camp at ranch to San Fernando (wagon).  
 " 26. San Fernando to Tres Palos (wagon).  
 " 27. Tres Palos to Jiménez (wagon).  
 " 28. Jiménez to Abasolo (wagon).  
 Mar. 1. Abasolo to Soto la Marina (wagon).  
 " 7. Soto la Marina to Sierra de Tamaulipas, 20 miles southwest (wagon).  
 " 8. Sierra de Tamaulipas to Soto la Marina.  
 " 10. Soto la Marina to Abasolo (wagon).  
 " 11. Abasolo to camp 16 miles beyond on road to Victoria (wagon, via Jiménez).  
 " 12. Camp on road to village of Guymis (wagon).  
 " 13. Guymis to Victoria (wagon).

## NUEVO LEÓN

- " 16. Victoria, Tamaulipas, to Monterrey, Nuevo León.  
 " 19. Monterrey to Cerro de la Silla (wagon and pack outfit).  
 " 28. Cerro de la Silla to Monterrey.  
 Apr. 1. Monterrey to Montemorelos.  
 " 6. Montemorelos to Monterrey.  
 " 8. Monterrey to Santa Catarina (wagon).

## COAHUILA

- Apr. 14. Santa Catarina, Nuevo León, to Saltillo, Coahuila.  
 " 19. Saltillo to General Cepeda.  
 " 20. General Cepeda to camp at Los Tanquitos in Sierra de Guadalupe (pack outfit).  
 " 28. Moved camp to La Concordia in Sierra de Guadalupe.  
 " 29. Moved camp to near summit of Sierra de Guadalupe.  
 May 3. Sierra de Guadalupe to Saltillo (via La Paz).  
 " 11-12. Saltillo to Monclova (enroute, via Monterrey).  
 " 20. Monclova to Sabinas.  
 " 31. Sabinas to Eagle Pass, Tex. (enroute to Washington, D. C.).

## ZACATECAS

- Dec. 19. Goldman arrived at Zacatecas, Zacatecas, to resume field work.

## JALISCO

- Dec. 22-23. Zacatecas, Zacatecas, to Ocotlán, Jalisco (rail; Goldman joined Nelson enroute).

1903

- Jan. 7. Ocotlán to La Barca (rail).

## MICHOCÁN

- Jan. 10. La Barca, Jalisco, to Zamora, Michoacán (rail).

## JALISCO

- Jan. 21. Zamora, Michoacán, to La Barca, Jalisco (rail).

## MICHOCÁN

- Jan. 23. La Barca, Jalisco, to Zamora, Michoacán.  
 " 27. Zamora to Patambán (new pack outfit).  
 Feb. 5. Patambán to Los Reyes.  
 " 20. Los Reyes to Peribán.  
 " 23. Peribán to camp on upper slope of Cerro de Tancítaro.  
 Mar. 3. Cerro de Tancítaro to Cirostó.  
 " 4. Cirostó to Uruapan.  
 " 8. Uruapan southerly to ranch of Las Pilas.  
 " 9. Las Pilas to La Salada (group of ranches).  
 " 24. La Salada, 22 miles southeasterly, to ranch of El Zapote.  
 " 27. El Zapote, 8 miles southeasterly to Hacienda de Agua Blanca, near the Volcán de Jorullo.  
 " 29. Agua Blanca, southeast 30 miles to ranch of Guadalupe.

## GUERRERO

- Mar. 30. Guadalupe, Michoacán, southward across the Río Balsas to Paso de las Vacas.  
 " 31. Paso de las Vacas, 18 miles south, to El Limón.  
 Apr. 3. El Limón, 16 miles southeast, to La Junta.  
 " 5. La Junta, 9 miles to La Unión.  
 " 6. La Unión to La Lagunilla.  
 " 7. La Lagunilla, 25 miles to Zihuatanejo.  
 " 11. Zihuatanejo, 24 miles southerly along coast, to San Jeronimito.  
 " 12. San Jeronimito, 27 miles southerly along coast, to Cayacal.  
 " 13. Cayacal, southerly along coast, to Tamarindo.  
 " 14. Tamarindo, 22 miles to Nuxco.  
 " 15. Nuxco, 28 miles to San Jerónimo.  
 " 16. San Jerónimo, 24 miles to Papayo.  
 " 23. Papayo, southeasterly along coast, to Coyuca.  
 " 24. Coyuca, 32 miles southeasterly, to Acapulco.  
 May 2. Acapulco, 18 miles north, to Ejido Nuevo.  
 " 3. Ejido Nuevo, 8 miles north, to Dos Arroyos.  
 " 5. Dos Arroyos, about 16 miles, to Coquillo (via Alto del Camarón.)  
 " 6. Nelson continued north and spent several days at Acahuizotla, enroute to Chilpancingo; Goldman turned southeast and rode about 30 miles to San Marcos near the coast.

1903

- May 7. Rode from San Marcos about 35 miles easterly to Copala (Goldman).  
 " 8. Southeasterly about 10 miles to village of Las Salinas near the coast; photographed black people and their peculiar round houses and returned to near Copala (Goldman).  
 " 9. Returned from near Copala to San Marcos (Goldman).  
 " 11. Retraced trail, San Marcos to Coquillo (Goldman).  
 " 12. Coquillo, north about 37 miles to Acahuizotla (Goldman).  
 " 13. Goldman continued from Acahuizotla north about 22 miles, and rejoined Nelson at Chilpancingo.  
 " 15. Chilpancingo, about 18 miles northerly, to ranch of Omilteme, in high mountains.  
 " 25. Omilteme to Chilpancingo.  
 " 26. Chilpancingo to Tixtla.  
 " 27. Tixtla to Chilpancingo.  
 " 28. Chilpancingo, north 19 miles to Mezquititlán.  
 " 29. Mezquititlán, about 33 miles north across Balsas River Valley to Xalitla.  
 " 30. Xalitla, about 30 miles to Iguala (pack and saddle animals sold).  
 June 2. Iguala to Río Balsas (rail).

## MORELOS

- June 4. Río Balsas, Guerrero, to Puente de Ixtla, Morelos (rail).  
 " 9. Puente de Ixtla to Tres Marías (rail).

## DISTRITO FEDERAL

- June 13. Tres Marías Morelos, to City of México, Distrito Federal.

## PUEBLA

- June 15. City of México, Distrito Federal, to Puebla, Puebla (rail).  
 " 16. Puebla to Atlixco (rail).  
 " 20. Atlixco to San Martín.

## DISTRITO FEDERAL

- June 21. San Martín, Puebla, to City of México, Distrito Federal.

## JALISCO

- June 22-23. City of México, Distrito Federal, to La Barca, Jalisco (en-route).  
 " 24. La Barca to Ocotlán.  
 " 28. Ocotlán to La Barca.

## GUANAJUATO

- June 30. La Barca, Jalisco, to Irapuato, Guanajuato.  
 July 1. Left Irapuato for Washington, D. C.

1904

## DISTRITO FEDERAL

- Jan. 17. Returned from Washington, D. C., to México City, Distrito Federal (Goldman).

## VERACRUZ

- Jan. 20. City of México, Distrito Federal, to Córdoba, Veracruz (rail).  
 " 21. Córdoba to Pérez (rail).  
 " 23. Pérez to Santa Lucrecia (rail).  
 " 26. Santa Lucrecia to Coatzacoalcos.  
 Feb. 1. Coatzacoalcos to Jaltipan.

## OAXACA

- Feb. 9. Jaltipan, Veracruz, to Tehuantepec, Oaxaca.  
 " 13. Tehuantepec to San Gerónimo.  
 " 14-15. San Gerónimo to Chicapa (saddle horse purchased; baggage on hired ox cart).  
 " 17-18. Chicapa to Ixhuatán.  
 " 19. Ixhuatán to Tapanatepec, Oaxaca; side trip to Hacienda Santa Efigenia and return.

## CHIAPAS

- Feb. 20. Tapanatepec, Oaxaca, to camp 12 miles on road to Tuxtla Gutiérrez, Chiapas.  
 " 21. Camp to ranch of El Carrizal.  
 " 22-25. El Carrizal to Tuxtla Gutiérrez (enroute by ox cart).  
 Mar. 11. Tuxtla Gutiérrez, 26 miles southeasterly, to ranch of El Faro, enroute to San Bartolomé (pack outfit).  
 " 12. El Faro, 26 miles southeasterly, to Hacienda de San Antonio (pack outfit).  
 " 13. San Antonio, 15 miles southeast, to San Bartolomé.  
 " 26. San Bartolomé, about 20 miles northeasterly, to Canjob (pack outfit).  
 " 27. Canjob, about 15 miles northeasterly, to Comitán (pack outfit).  
 Apr. 5. Comitán to ranch of El Carmen, near Teopisca (horseback).  
 " 6. El Carmen to San Cristóbal (horseback).  
 " 8. San Cristóbal to El Carmen (horseback).  
 " 9. El Carmen to Comitán.  
 " 15. Comitán to San Vicente (pack outfit).  
 " 27. San Vicente to Comitán.  
 " 30. Comitán to Canjob.  
 May 4. Canjob to Comitán.  
 " 7. Comitán to ranch of Yerba Buena, enroute to San Cristóbal.  
 " 14. Yerba Buena to El Carmen, near Teopisca.  
 " 15. El Carmen to San Cristóbal.  
 " 16. San Cristóbal, about 15 miles, to Tierra Colorada (via Zinacantan).  
 " 17. Tierra Colorada, about 35 miles to Chiapa.

1904

- May 18. Chiapa to Tuxtla Gutiérrez.  
 " 28. Tuxtla Gutiérrez, about 20 miles to El Espinal (horseback ; outfit by ox cart).  
 " 29. El Espinal to Petapa.  
 " 30. Petapa to Jiquipilas.  
 " 31. Jiquipilas to Hacienda La Razón.  
 June 1. Hacienda La Razón to Mecualapa.  
 " 2. Mecualapa to El Carrizal.  
 " 3. El Carrizal to Tonalá.  
 " 6. Tonalá to Jalisco (rail).

## OAXACA

- June 8. Jalisco, Chiapas, to San Gerónimo, Oaxaca (rail).  
 " 9. San Gerónimo to Tehuantepec (rail).  
 " 11. Tehuantepec to San Gerónimo (rail).

## CHIAPAS

- June 13. San Gerónimo, Oaxaca, to Jalisco, Chiapas.

## OAXACA

- June 18. Jalisco, Chiapas, to San Gerónimo, Oaxaca.

## VERACRUZ

- June 19. San Gerónimo, Oaxaca, to Santa Lucrecia, Veracruz (rail).  
 " 20. Santa Lucrecia to Pérez (rail).  
 " 21. Pérez to Córdoba (rail).

## DISTRITO FEDERAL

- June 22. Córdoba, Veracruz, to City of México, Distrito Federal (rail).

## MÉXICO

- July 1. City of México, Distrito Federal, to Lerma, México (rail).

## MICHOACÁN

- July 12-13. Lerma, México, to Pátzcuaro, Michoacán (enroute).  
 " 16. Pátzcuaro to Huingo.  
 " 17. Left Huingo enroute to United States (Goldman).

1905

## SONORA

- Mar. 27. Goldman, accompanied by D. T. MacDougal, Director of the Desert Laboratory, Carnegie Institution, at Tucson, Ariz., and assistants, left Yuma, Ariz., and entered México by boat on the Colorado River, camping on Sonora bank, about 10 miles south of boundary.  
 " 28. Camp on Sonora side of Colorado River, 10 miles south of boundary to camp on same side about 20 miles south of boundary.  
 " 29. Camp 20 miles south of boundary to Colonia Lerdo.

1905

## BAJA CALIFORNIA

- Mar. 30 to Apr. 4. Colonia Lerdo, Sonora, to east base Sierra de los Cocopahs, Baja California, ascending Hardy River by boat (enroute).  
 Apr. 16. East base Sierra de los Cocopahs up Hardy River to Volcano Lake.

## CALIFORNIA

- Apr. 21. Volcano Lake, Baja California, to Calexico, Calif. (wagon).  
 " 22. Calexico to San Diego (Goldman rejoined by Nelson).

## BAJA CALIFORNIA

- May 14. San Diego, Calif., to Coronados Islands, Baja California (boat).

## CALIFORNIA

- May 15. Coronados Islands, Baja California, to San Diego, Calif.

## BAJA CALIFORNIA

- May 16. San Diego, Calif., to Ensenada, Baja California.  
 " 20. Ensenada to Todos Santos Islands.  
 " 22. Todos Santos Islands to Ensenada.  
 " 23. Ensenada, 28 miles south, to Santo Tomás.  
 " 25. Santo Tomás to Ensenada.  
 " 31. Ensenada to camp in canyon 20 miles east (pack outfit).  
 June 1. Camp 20 miles east of Ensenada to La Huerta.  
 " 3. La Huerta, 18 miles northeasterly, to near ranch of El Rayo.  
 " 5. Moved camp 8 miles northeasterly to Hanson Laguna.  
 " 9. Hanson Laguna southwesterly to near village of Sangre de Cristo, and southeastern border of San Rafael Valley.  
 " 10. San Rafael Valley, 22 miles southeasterly, to camp near base of Cerro Colorado.  
 " 11. Cerro Colorado, to water hole called La Posa, 6 miles east (via Alamo).  
 " 12. La Posa, 10 miles easterly, to Rancho Viejo.  
 " 16. Rancho Viejo, 20 miles southeast, to Campbell cattle ranch, in Trinidad Valley.  
 " 17. Trinidad Valley, 16 miles east, to San Matías Pass.  
 " 18. San Matías Pass to mouth of Cañón de la Esperanza.  
 " 19. Cañón de la Esperanza, 12 miles to mouth of Cañón de la Providencia.  
 " 20. Cañón de la Providencia, 30 miles east to San Felipe, on shore of Gulf of California.  
 " 26. San Felipe to Cañón de la Providencia.  
 " 27. Cañón de la Providencia to Cañón de la Esperanza.  
 " 28. Cañón de la Esperanza to San Matías Pass.  
 " 29. San Matías Pass to Campbell Ranch, in Trinidad Valley.

1905

- July 4. Campbell Ranch, 15 miles southeast to Pozo Luciano, at north end of Sierra San Pedro Mártir.
- " 10. Pozo Luciano, 12 miles southeast, to El Piñón.
- " 11. El Piñón to camp on headwaters of Río de San Rafael.
- " 12. Río de San Rafael to Vallecitos, a cattle ranch near summit of Sierra San Pedro Mártir.
- " 18. Vallecitos, 12 miles southerly to La Grulla meadows.
- " 24. La Grulla, 12 miles southeasterly, to Rancho Santo Tomás (via Santa Rosa).
- " 28. Rancho Santo Tomás to ranch of San Antonio.
- Aug. 1. San Antonio, 26 miles southwesterly, to Cañón de Nueva York.
- " 2. Cañón de Nueva York, 20 miles southwesterly, to San Quintín.
- " 12. San Quintín to Isla San Martín (boat).
- " 14. Isla San Martín south to Isla San Gerónimo (boat).
- " 18. San Quintín north to Santo Domingo.
- " 19. Santo Domingo to San Telmo.
- " 22. San Telmo to Santo Domingo.
- " 23. Santo Domingo to San Quintín.
- " 25. San Quintín, 8 miles southeasterly, to San Simón River.
- Sept. 1. San Simón River to Rosario.
- " 2. Rosario to Las Cuevas.
- " 3. Las Cuevas, 15 miles easterly, to San Fernando.
- " 6. San Fernando, 20 miles easterly, to Pozo San Agustín.
- " 7. Pozo San Agustín, 11 miles easterly, to Onyx.
- " 8. Onyx, 8 miles southward, to Agua Dulce.
- " 9. Agua Dulce, 30 miles southeasterly, to Arroyo de Jaraguáy.
- " 10. Arroyo de Jaraguáy, 21 miles southeasterly, to San Francisquito.
- " 13. San Francisquito to near mouth of Calamahué Canyon.
- " 14. Calamahué Canyon to Calamahué.
- " 16. Calamahué, 30 miles southeasterly, to Yubay.
- " 19. Yubay, 20 miles southwest, to dry camp near Pacific coast, 10 miles north of Punta Prieta.
- " 20. Dry camp, 20 miles south, to San Andrés.
- " 24. San Andrés, 18 miles southeasterly, to Rosarito.
- " 25. Rosarito, 24 miles southeasterly, to dry camp near seashore.
- " 26. Dry camp, 13 miles, to Santo Domingo.
- " 28. Santo Domingo, 25 miles east, to dry camp near Cerro Perdido.
- " 29. Cerro Perdido about 15 miles east of Calmallí.
- Oct. 1. Calmallí to dry camp about 14 miles southward.
- " 2. Dry camp, 16 miles southeasterly, to Pozo Altamirano.
- " 3. Pozo Altamirano, 15 miles southwesterly, to San Pablo.
- " 4. San Pablo, 7 miles southerly, to Aguaje de Santa Ana.
- " 5. Aguaje de Santa Ana to La Natividad, a dry camp 5 miles south of Aguaje de San Esteban.
- " 6. La Natividad, southeasterly 20 miles, to San Ignacio.
- " 10. San Ignacio, 25 miles southwest, to San Angel.
- " 11. San Angel to dry camp 30 miles west.
- " 12. Dry camp, 20 miles to Tinaja de Santa Clara.
- " 14. Tinaja de Santa Clara to dry camp 20 miles east.

1905

- Oct. 15. Dry camp to San Angel.  
 " 16. San Angel to San Ignacio.  
 " 18. San Ignacio, 21 miles easterly, to La Cueva.  
 " 20. La Cueva, 18 miles easterly, to Santa Rosalía.  
 " 25. Santa Rosalía, 16 miles southeasterly, to San Bruno.  
 " 27. San Bruno, 15 miles southerly, to Las Delicias.  
 " 28. Las Delicias southerly to Mulegé.  
 " 29. Mulegé, 6 miles southwesterly, to Pozo San Rafael.  
 " 30. Pozo San Rafael, 15 miles southerly, to El Potrero.  
 " 31. El Potrero, about 20 miles, via Guajadomí, to Agua Grande.  
 Nov. 1. Agua Grande, 20 miles south, to Paso Colorado.  
 " 2. Paso Colorado, 13 miles southerly, to La Purísima (via La Purísima Vieja).  
 " 4. La Purísima to dry camp enroute to Comondú.  
 " 5. Dry camp, 18 miles southward, to Comondú.  
 " 10. Comondú, about 20 miles southwest, to ranch of El Batequi.  
 " 11. El Batequi, 10 miles southward, to Pozo Grande, near San Jorge.  
 " 14. Pozo Grande, to dry camp south of Rancho Santo Domingo.  
 " 15. Dry camp, 20 miles southward, to Matancita.  
 " 20-22. Matancita, 50 miles south, to Magdalena Island (sloop).  
 " 27. Magdalena Island across Magdalena Bay to Margarita Island.  
 Dec. 1. Returned to Magdalena Island.  
 " 5-8. Magdalena Island on return to Matancita.  
 " 9. Matancita, 16 miles southeasterly, to dry camp.  
 " 10. Dry camp, 7 miles south, to ranch of Servatillo.  
 " 11. Servatillo, 15 miles southeasterly, to ranch of La Cruz on Llano de Yrais.  
 " 13. La Cruz to camp 26 miles southeast.  
 " 14. Camp 35 miles southeast to ranch of Agua Colorado.  
 " 15. Agua Colorado, about 28 miles to Cerro Colorado.  
 " 16. Cerro Colorado, 35 miles southeasterly, to ranch of Rodríguez, on shore of La Paz Bay.  
 " 17. Rodríguez, around southern end of La Paz Bay, 22 miles, to La Paz.  
 " 23. La Paz, south 18 miles, to San Pedro.  
 " 24. San Pedro, 17 miles southerly, to Tres Pachitas.  
 " 25. Tres Pachitas, southerly 14 miles, to ranch of Valle Flojo.  
 " 26. Valle Flojo, 22 miles, to Pescadero (via Todos Santos).  
 " 27. Pescadero, 21 miles south, to ranch of El Cajoncito.  
 " 28. El Cajoncito, 20 miles southerly, to El Sacatón.  
 " 29. El Sacatón, southerly 15 miles, to Cape San Lucas.

1906

- Jan. 4. Cape San Lucas, 23 miles northeast, to San José del Cabo.  
 " 10. San José del Cabo, 8 miles northerly, to Santa Anita.  
 " 19. Santa Anita, 18 miles northerly, to Miraflores.  
 " 20. Miraflores, 13 miles northerly, to ranch of San Bernardo.  
 " 21. San Bernardo, 14 miles northerly, to ranch of El Sauz.

1906

- Jan. 24. El Sauz, 8 miles northerly, to La Chuparosa.  
 " 25. La Chuparosa, a few miles northerly, to La Laguna.  
 " 29. La Laguna, 14 miles northerly, to El Taraiso.  
 " 30. El Taraiso, 18 miles northerly, to El Triunfo.  
 Feb. 1. El Triunfo, 30 miles northerly, to La Paz.  
 " 6. La Paz to Espiritu Santo Island (fishing boat).  
 " 8. Espiritu Santo Island to Ceralvo Island (fishing boat).  
 " 13-15. Ceralvo Island to La Paz.  
 " 19-26. La Paz to Ensenada (enroute by steamer).  
 " 28. Nelson left Ensenada and proceeded to San Diego (gasoline launch); Goldman proceeded 55 miles north to Cañón de Cancio (stage).

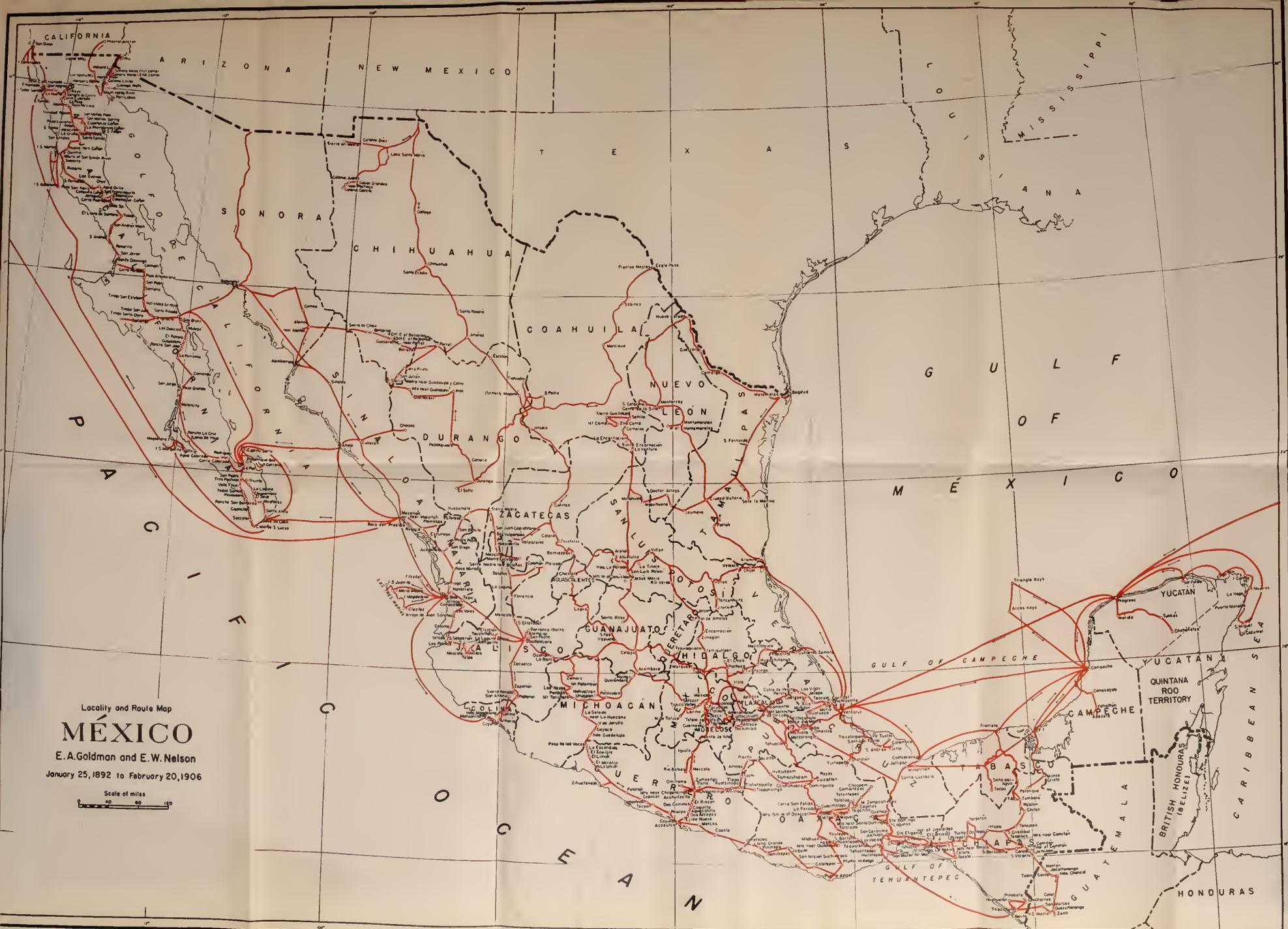
## CALIFORNIA

- Mar. 1. Cañón de Cancio, Baja California, to San Diego, Calif. (Goldman). End of joint field work by Nelson and Goldman in México.

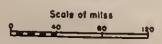








Locality and Route Map  
**MÉXICO**  
 E. A. Goldman and E. W. Nelson  
 January 25, 1892 to February 20, 1906





## LOCALITIES VISITED BY NELSON AND GOLDMAN IN MÉXICO AND GUATEMALA, 1892 TO 1906

### MÉXICO

#### AGUASCALIENTES

##### **Chicalote (6,180 feet):**

*July 1-7, 1896.*—Chicalote is a station at 6,180 feet on the railroad, about 10 miles north of the city of Aguascalientes. The locality is at about the same altitude, on an extension of the plain, on which we worked at Lagos, Jalisco, the general drainage, as there, being southward to the Río de Santiago. To the east and west the plain slopes up slightly to the bases of scattered hills and isolated ranges that, especially toward the west, rise abruptly 1,500 to 2,000 feet above the general level. The country here, and throughout the state of Aguascalientes, appears to be more arid than near Lagos. Some of the difference in aspect may, however, be due to soil conditions. Near Chicalote the surface soil is usually a dull reddish or brownish loam, overlying a heavy calcareous substratum called tepetate. Water is not so near the surface as at Lagos, and the vegetation, largely yuccas and cactuses, is more desertlike. Lower Austral Zone.

#### BAJA CALIFORNIA

##### **Agua Dulce (2,200 feet):**

*September 8-9, 1905.*—Agua Dulce is 30 miles southeast of San Fernando. On September 7 we traveled 11 miles easterly across the plain on a good wagon road to the onyx mines at Onyx, located at 2,500 feet, on the edge of the low foothills skirting the mountains, which rise abruptly a little farther eastward toward the Gulf coast. The mines were being worked by a San Diego company. On September 8 we left the wagon road at Onyx and turned southward on a trail across a low ridge and then over a gently rolling desert plain for 8 miles to a water hole known as Agua Dulce, situated in the head of a rocky canyon that begins abruptly in the limestone bedrock of a little valley on the open plain.

##### **Aguaje de San Esteban (1,200 feet):**

*October 5-6, 1905.*—The Aguaje de San Esteban, or Tinaja de San Esteban, is in the central section of the peninsula, about 25 miles

northwest of San Ignacio. On October 5 the trail continued from Aguaje de Santa Ana southeasterly over the lava plateau, crossing several canyons and gradually swinging down toward its western border. About 10 miles from Santa Ana we came to a large rock tank, the Aguaje de San Esteban, at 1,200 feet, in the bottom of a small gulch only a few miles from the eastern border of the Vizcaíno Desert. Here we collected the type specimen of *Eutamias merriami meridionalis*, the southern desert-inhabiting chipmunk, first noted near the old San Pablo Mission. Near this point also we saw the southernmost representatives along our route of the cirio (*Idria columnaris*) and the first northerly examples of the white-barked paloblanco (*Lysiloma candida*), which was abundant in the bottoms of the larger canyons and became one of the more conspicuous trees in suitable locations along our route throughout the southern part of the peninsula. A few other plants, mainly tropical or subtropical species, not noted before, were first observed along the canyons in this vicinity. Five miles beyond San Esteban, across an intervening lava mesa, we came to La Natividad, a large canyon in which water usually exists. The bottoms of the empty tanks were still damp, but no water could be found, and so we were forced to make another dry camp.

#### Aguaje de Santa Ana (3,400 feet):

October 4-5, 1905.—Santa Ana, or Santana, was a cattle ranch about 30 miles northwest of San Ignacio. When we left San Pablo, October 4, the trail turned southerly across the bench near the lower end of the water and then zigzagged directly up the steep canyon side. This brought us out on the top of a great lava plateau with a broad undulating surface rising toward the east, broken here and there by volcanic hills, and descending on the west to the Vizcaíno Desert. This plateau country is made up of horizontal beds of sandstone, capped by heavy beds of dark lava. The scanty soil supports only a thin growth of vegetation, as most of the surface is covered by an almost continuous layer, and in places deep beds, of loose fragments of lava, which give a desolate and forbidding aspect to the landscape. This exceedingly rocky plateau is cut by numerous shallow gulches and occasional deep canyons, all draining westerly into the desert. Travel through this seemingly endless bed of shattered lava blocks was very difficult for our animals. The trail wound along the top of the mesa, crossing a number of the larger canyons, one of which was about 2,000 feet deep.

Seven miles southerly from San Pablo, on top of the undulating plateau, at an elevation of 3,400 feet, we reached a small house and

corral with a large natural tank of water in the bottom of a lava-bedded gulch nearby. This place, known as Santa Ana, is occupied as a cattle ranch part of the year, but it was vacant at the time of our visit. From the crest of a small ridge here an extended view, as far as the eye could see, northwest and southeast over the top of the plateau, showed series of volcanic ridges and peaks breaking its surface irregularly. To the west was a superb view over the Vizcaíno Desert to the Sierra Pintada and Sierra Santa Clara, the salt beds at Ojo de Liebre, the old whaling location of Scammon Lagoon, and over the Pacific to the Isla de Cedros and other coastal islands.

**Alamo (3,400 feet) :**

*June 11-12, 1905.*—On June 11 we left camp near Cerro Colorado, in San Rafael Valley, and traveled about 15 miles southeasterly along the wagon road through rolling hill country and, crossing a divide at about 4,500 feet, descended to Alamo, on the western end of an open plain, at an altitude of about 3,400 feet, close to the base of some low, abrupt, and barren rocky ridges. From Alamo the plain, which has a width of 6 to 15 miles, extends easterly about 20 miles to the west base of the southern end of the Sierra Juárez. It is bordered on the northern side by a series of low hills and on the southern side by low rounded ridges and mesas, which merge into the hills bordering Trinidad Valley. Most of the plain and adjoining hills are covered with a fairly abundant growth of junipers and some pinyon pines. From Alamo we continued easterly in the afternoon along one of the several wood roads which radiate from the camp to La Posa, a muddy water hole on the plain, where we camped. The water hole was much frequented by cattle, and the stagnant water was very bad. Upper Sonoran Zone.

**Arroyo de León**—near Pozo Luciano, Baja California.

**Bahía San Felipe (= San Felipe Bay) (near sea level) :**

*June 20-25, 1905.*—San Felipe Bay is a slight indentation of the desert coast of the Gulf of California, east of the San Pedro Mártir Mountains. The bay was reached after a long, hot day's travel, covering about 30 miles across the desert from the mouth of La Providencia Canyon. There was no trail, and we had only general directions for guidance to some water holes near the beach at San Felipe Bay, as neither of our two Mexican packers had ever been there. Our course lay directly across the broad valley or plain to the west base of the Sierra San Felipe, an outlying desert range of mountains, where we found traces of an old wagon road leading through Buena Vista Pass,

evidently named from the fine view over a broad expanse of the gulf. Beyond the pass the wagon tracks disappeared, but late in the afternoon we rode through a gap in some hills and came in sight of the narrow line of green mesquites in the flat behind the sand dunes on the beach of San Felipe Bay. We saw no sign that a house had ever been built there, but a strong signal post stood on the beach just in front of two water holes, 3 or 4 feet deep, dug in the clay flat near the mesquites. No recent trace of human visitors was visible, but evidently numbers of coyotes and turkey buzzards visited the water holes regularly, and the fluid was so foul in consequence that even our exceedingly thirsty animals refused to drink it. After considerable work the holes were emptied, and the vile-smelling mud on the bottom and sides cleaned out. The new water which quickly seeped in was offensive in odor and taste, but we were glad to use it as no other was known nearer than the mountains from which we had come. Camp was made a short distance away under a fine, wide-spreading mesquite tree.

Directly offshore, in front of the bay, Consag Rock stands out like a great sail, its high cliffs whitened by the droppings of sea fowl. The bay is several miles in width but does not deeply indent the coast. The west and south shores are low and bordered by a narrow belt of sand dunes. The north side is bounded by a low, isolated, rugged mountain of dark color and probably of volcanic origin, known as Punta San Felipe, which projects as a bold headland into the Gulf.

The plains from the base of the San Pedro Mártir Mountains to San Felipe Bay have a characteristic desert flora, including such species as the giant cactus (*Pachycereus pringlei*), the ocotillo (*Fouquieria splendens*), mesquite (*Prosopis juliflora*), creosotebush (*Larrea tridentata*), and a copal (*Bursera rhoifolia*), the latter tree a northern representative of a tropical group of wide distribution. Lower Sonoran Zone.

#### Cabo de San Lucas (=Cape San Lucas) (10 feet):

December 29, 1905, to January 4, 1906.—Cape San Lucas is the village on the shore of the small bay just east of Cape San Lucas, the extreme southern tip of the peninsula. Leaving Sacatón on December 29 we crossed a high, narrow ridge immediately to the south, on the far side of which the drainage flows toward the southern end of the peninsula. Descending this south slope we followed a series of dry washes down their winding courses through the hills and finally came out on a long, open, sandy slope extending southward to the sea. This slope is bounded on the east and west by series of granite

hills, giving it the form of a valley, down which broad sandy washes lead to the shore of Cape San Lucas Bay. The slope is covered with a vigorous growth of large and small cactuses, mesquites, and numerous desert and upper arid tropical plants. The large cactuses include the two giant species, the cardón pelón (*Pachycereus calvus*) with ends of stems smooth, and the widely different cardón barbón (*Pachycereus pecten-aboriginum*) with ends of stems armed with spines.

Early in the afternoon, about 15 miles from Sacatón, we reached the village of Cape San Lucas, on the shore of the bay, the end of our long southward journey. The bay is bounded on the southwest by a low granite ridge terminating in two detached granite knobs standing boldly out of the sea and forming Cape, or Cabo, San Lucas. The village of Cape San Lucas contained about a dozen families who occupied a group of adobe houses on a flat just back of the broad sandy beach and only a few hundred yards easterly from the base of the cape. It was formerly a much more populous and prosperous place. At the time of our visit the inhabitants were making a livelihood mainly by gathering tan bark from small paloblanco trees (*Lysiloma candida*) on the sloping plain back of the town and shipping it to San Francisco. A few date palms among the houses, the tropical jungle behind, and the blue sea in front, flanked by the bold headland forming the cape, unite to make this a most picturesque spot. We obtained the use of a vacant house and spent a few days collecting specimens from a place of historic interest to American ornithologists through the work done there by John Xantus in 1859.

#### Calamahué (950 feet):

September 14-16, 1905.—Calamahué, or Misión de Calamahué, was a mission at about 950 feet, on the Gulf slope of the peninsula nearly opposite the upper end of Isla Ángel de la Guarda. At 2 a.m. on September 14 we left our dry camp, about 3 miles above the mouth of Calamahué Cañón or wash, up which we traveled in a westerly direction. At 10:30 a.m., after riding about 19 miles, we reached the upper end of the wash, where it closes into the mouth of the canyon. Just inside the mouth of the canyon we camped where several springs and pools feed a small permanent stream, which sinks a short distance below. The water in the springs is charged with soda, iron, and other minerals in varying amounts, and most of it is undrinkable. Large gas bubbles were rising in one spring about which deposits of soda had built up a broad rim several feet high. On the southern side of the mouth of the canyon are the ruined walls of the old Calamahué Mission. Owing to bad water, intense heat, high

winds, and scarcity of forage for stock, this was one of the most desolate and trying camps we made, and we marveled at the old missionary padres who would choose such a place to build a mission.

All along its upper half, Calamahué Valley was crossed from south to north by well-marked old trails, made by mountain sheep, leading from the projecting points of the Calamahué Mountains to opposite points of the lower range of hills on the north. In places the sheep traveled several miles across the flat valley bottom. A scattered growth of small trees, either pinyon pines or live oaks, was visible on the upper 500 feet or more of the Calamahué Mountains, a few miles southeasterly from the mouth of the canyon. This was the first tree growth we had noted on the mountains south of the Sierra San Pedro Mártir, and we should have investigated it if our saddle and pack animals had not been too exhausted to permit delay, owing to the scanty feed along this part of the route. The principal vegetation along Calamahué Valley and Calamahué Cañón consists of scattered mesquites, acacias, copalquín (*Pachycormus discolor*), *Fouquieria*, *Cercidium*, *Larrea*, and various cactuses.

#### Calamahué Cañón (mouth) (25 feet):

At 4 a.m. on September 13 we left San Francisquito in brilliant moonlight and traveled 10 miles easterly, following the wagon road down a low-walled canyon leading to the King Richard mine. This was a gold mine, worked by an Englishman named Dick Daggett. To our surprise the camp was deserted, every house was locked, and there were no signs of recent occupation. This left us in a serious position, for we had less than a pound of flour and no beans, rice, sugar, or bacon, and were many days' travel from any supply point. We had seen Daggett several weeks before at San Quintín, and he had agreed to sell us provisions. It was, therefore, necessary to find him or face a trip of several hundred miles to the next supply point, subsisting on such small game as we might shoot. Several used trails radiated from the camp, one leading down the canyon toward the Gulf showing the most recent tracks. We followed this for about 6 miles, through a series of small canyons and over dividing ridges in a broken granite and slate hill country, and came out into the broad, gently sloping Calamahué Valley, through which a dry rocky wash, like a broad river bed, wound its way. The trail led us on down the valley about 9 miles to the mouth of the wash on the shore known as Calamahué Landing. This was one of several places along the Gulf coast where supplies ordered from Guaymas, Sonora, were occasionally landed for mining companies. We were much relieved to find a group

of small brush shelters by a shallow well, where Daggett and his miners were camped. Daggett welcomed us hospitably and said that, through a misunderstanding, his supplies failed to arrive on time from Guaymas, and he and his men were forced to close the mine, come down to this point, and subsist for more than a month solely on sea turtles and fish caught along the shore of the Gulf, supplemented by wild honey taken from cavities among the rocks in the neighboring hills. Bees introduced by the missionaries found the habitat favorable and spread in the wild state throughout the peninsula. Fortunately, the night before our arrival the boat had come in, and the supplies were lying on the open beach at the mouth of the wash. Supplies were purchased, and as there was no feed for our stock we turned back up the valley about 3 miles and made a dry camp.

The day had been extremely hot, and as we traveled up the smooth sandy flat just after sunset we saw two "side-winder" rattlesnakes lying in the warm dust of the trail. On our approach they slid diagonally sidewise, as is their peculiar habit, and forward about 15 feet to one side of the trail. There they stopped and sounded their low warning rattles as each animal of our outfit passed. Many others were seen along our route through the central section of the peninsula. About 50 traps were set by me under bushes in the moonlight, the location of each marked by a small wisp of cotton twisted around the tip of a branch. The traps were recovered again by the same brilliant moonlight at 2 o'clock in the morning, when we wished to move on, and were found to contain 17 small mammals representing 3 species. These were labeled "Mouth of Calamahué Cañón." The mouth of the main canyon, however, is nearly 20 miles above.

#### **Calmallí (1,200 feet):**

*September 28 to October 1, 1905.*—Calmallí is a mining camp a little north of latitude 28° N., near the geographic center of the peninsula. On September 28 we took a cut-off trail easterly through the yucca forest from Santo Domingo Landing, the wagon road to Calmallí making a wide detour to the south. The trail led over a sandy plain through an unbroken forest of yuccas, intermingled with *Fouquieria peninsularis*, which had been plentiful since we entered its range near San Andrés. The yuccas all had their tops inclined toward the southeast, owing to the prevalence of northwest trade winds. Nine miles from camp we came into the wagon road again beside a deserted frame house and broken windmill over a dry well. This was the Rancho de Berrendo, situated on the border of the Llano de Berrendo, an open clayey prairie 4 or 5 miles across with a dwarf chamiso

(*Atriplex*) almost the only plant growing on it. The sandy soil and the yucca forest stopped abruptly on the border of this prairie but began again beyond it to the east. The plain rises very gradually inland, and about 20 miles from the coast the soil becomes less sandy and the yucca forest gives way to a more mixed growth of yuccas and other species, including the largest giant cactuses that we had ever seen. We traveled until long after dark, and at 9:30 p.m., at an altitude of 850 feet, reached a solitary hill known as the Cerro Perdido, about 25 miles from our camp at Santo Domingo. This was one of the regular camping places on the road, but there was no water, so we were compelled to make another dry camp, which was hard for the stock.

On September 28 we made an early start and a mile beyond camp came to another abrupt escarpment about 50 feet high, capped by a plateau extending away to the eastward into the interior. Before us to our left a range of hills approached our course diagonally from the northwest, while far away to the east low mountains, some rising to an altitude of from 3,000 to 4,000 feet, stood out boldly. About 10 miles east of this last escarpment the road led us through a range of low, detached mountains or hills, about 1 mile wide and 5 miles long. The hills rise abruptly and islandlike from the level plain, and from their relative position and formation it was evident that they represented the tops of a short, partly buried mountain range. About 4 miles beyond, the road led through another group of hills, turned to the south, and at an altitude of 1,200 feet came to Calmallí. The town is located on the foot of a group of low, bare hills and contained 25 or 30 small houses, 2 or 3 stores, and the reduction plant for the mines. Rich placer mines were long ago worked out, and we found the town nearly deserted. A quartz mine nearby was being worked in a small way by an American, Byron Hall, who received us hospitably.

Near Calmallí the country becomes more sterile and the cirio (*Idria columnaris*), which we had not seen nearer the coast, appeared again. Some of these were giants of their kind, 50 to 60 feet in height and more than 3 feet in diameter at the base. The plain extending inland from Santo Domingo reaches its eastern limit a few miles east of Calmallí, where ranges of barren, rocky mountains rise abruptly from the general level and form a barrier. Immediately about Calmallí, especially to the west and south, rise low, round-topped, barren hills or small mountains.

**Cañón de la Esperanza (=Esperanza Canyon) (1,800 feet):**

June 18-19, 27-28, 1905.—Cañón de la Esperanza descends the east slope of the San Pedro Mártir Mountains in northern Baja

California. On June 18 we crossed a low ridge of the mountain just above and to the east of our camp at San Matías Spring near San Matías Pass, and entered the head of Windy Canyon, which winds down the east slope about 8 miles to the sloping desert plain at the east base of the San Pedro Mártir Mountains. The entire bottom of Windy Canyon, which has high rocky walls, is so filled with a wash of granite, sand, and gravel from the disintegrating sides that it presents a smooth, easily traveled, gently descending slope. The canyon is dry and very barren throughout its course, but we found the desert plain at its mouth covered with a vigorous growth of cactus, yucca, mesquite, ironwood (*Olneya*), paloverde (*Cercidium*), ocotillo (*Fouquieria*), creosotebush (*Larrea*), and other desert plants. The trail turns abruptly to the right a short distance out on the plain and skirts the base of the mountain for about 12 miles to the water at the mouth of Esperanza Canyon, crossing slopes made up entirely of loose, disintegrated granite en route.

The east front of the San Pedro Mártir Mountains rises abruptly in a tremendous escarpment of bare cliffs and rocky slopes, 4,000 to 8,000 feet above the basal plain, with several canyons cutting huge, ragged gashes in its face. In cool weather small streams flow down the bottoms of the larger canyons, sometimes running a mile or so out on the plain before sinking in the sand, but in dry, hot weather commonly retreating a mile or more up the canyons. Extending out on the plain from the mouth of Esperanza Canyon is a great alluvial fan, or delta, built up of disintegrated granite with a ridge of boulders along its middle. These boulders vary from 1 to more than 6 feet in diameter and extend a mile down the slope, showing the enormous force of the occasional floods which pour down the canyon. At the time of our visit a small stream of clear, pure water flowed down the wash and disappeared in the sand just outside the mouth of the canyon. In the morning this stream flowed several hundred yards farther than in the evening, retreating during the day, owing to the evaporation caused by the sun. On June 19 we left for La Providencia Canyon and San Felipe Bay, and returned June 27, en route back to Trinidad Valley. Lower Sonoran Zone.

**Cañón de la Providencia** (=La Providencia Canyon) (2,000 feet) :

*June 19-20, 26-27, 1905.*—Cañón de la Providencia descends the east slope of the San Pedro Mártir Mountains in northern Baja California. June 19 we continued southerly about 12 miles from the mouth of Canyon Esperanza along the east base of the San Pedro

Mártir Mountains to the water at the lower end of La Providencia Canyon. As at Esperanza Canyon we found a small stream of pure cold water, clear as crystal, flowing to the mouth of La Providencia Canyon, which, with similar high walls, scores the east face of the range. The canyon descends from just south of Cerro de la Encantada, the highest peak of the range, at the most outstanding point on the desert front of the mountains. Halfway between Esperanza and La Providencia Canyons we passed the mouth of Canyon Diablo, the wildest and most rugged canyon in the east front of the mountains. It heads on the west side of Cerro de la Providencia, and descends first northerly and then easterly, thus cutting around the west and north sides of the mountain. From the mouth of La Providencia Canyon there extends for more than a mile down the middle of its great alluvial delta a stream of boulders varying in diameter up to 6 or 8 feet, and attesting to the tremendous power of flash floods that have swept the east side of the range. This great bed of boulders rendered access to the water in the mouth of the canyon difficult except by following closely the intricate course taken by the few half-wild horses and cattle which come here to drink. We left the canyon on June 20 for San Felipe Bay, and another overnight stop was made on our return on June 26. The lower part of the canyon lies in the Lower Austral Zone.

**Cape San Lucas** (see Cabo de San Lucas).

**Ceralvo Island** (= Isla Ceralvo, Ceralbo, and Cerralvo) (10 to 30 feet):

*February 11-13, 1906.*—Ceralvo Island, also spelled Ceralbo and Cerralvo (our specimens were labeled "Ceralbo Island"), is the southernmost of the islands in the Gulf of California and the nearest point lies 4 miles off the eastern coast of the peninsula, southeast of La Paz Bay. On February 8 we left Espiritu Santo Island and sailed southeasterly for Ceralvo Island. Owing to calms and head winds we did not reach the island until February 11, when we landed at a comparatively level place at the southern end and remained until February 13. The other shores of the island are abrupt and rocky. Ceralvo Island is more than 15 miles long in a northwesterly to southeasterly direction, and about 4 miles in greatest width. The southern end is within  $3\frac{3}{4}$  miles of Ventana Point, the island lying on the eastern side and partly enclosing Ventana Bay. Ceralvo is composed of a single high mountain ridge extending nearly its entire length and reaching altitudes of 2,265 and 2,477 feet near the northern and southern ends respectively.

The island is extremely arid and desert in character and has no fresh water or inhabitants. Ceralvo appears to have been connected with the mainland through the extension of the southern end of the island to Ventana Point, as indicated by the shallowness of the sea between them. That the island was once a part of the mainland is indicated by the identity of the geological formation on their adjacent shores. The vegetation is a mixture of Arid Tropical and Lower Sonoran species, mostly identical with those of the adjacent mainland. The great viznaga (*Ferocactus diguetii*), however, appears to be peculiar to this and other islands of the Gulf. The usual height of this species is 1 to 2 meters, but one of the larger plants measured 2.3 meters in height and 2 meters in circumference. February 13, we left Ceralvo and reached La Paz February 15.

**Cocopah Mountains** (see Sierra de los Cocopahs).

**Comondú (700 feet):**

*November 5-10, 1905.*—Comondú is an important town in the interior of the peninsula in latitude  $26^{\circ}$  N. From La Purísima the trail on November 4 led up about 1,000 feet to the top of the abrupt south wall of the canyon, and then southeasterly across the rolling and broken plateau. About 6 miles from La Purísima we came to a deep box canyon, in the bottom of which San Vicente Ranch is located, the house standing in the midst of a few date palm, lime, and zapote trees, near small patches of corn and sugarcane. A small stream of water rising in the bottom of the canyon supplied enough to irrigate this small oasis, which supported a single family in the midst of a gloomy waste of broken lava. From San Vicente the trail led down the canyon and then up a tributary gorge on the left to the top of the plateau, where we entered a series of lava beds descending from a conical crater a few hundred feet higher than the general level. Here for miles on all sides lie beds of bare, shattered lava with occasional small patches of soil on which were growing various species of desert bushes, and a few giant and other cactuses. With some difficulty we found a small patch of ground partly free from stones and camped at an altitude of about 1,300 feet near the base of the old crater peak. During the night a solitary huge black cloud swept over the otherwise brilliantly clear sky and gave us a hard shower.

On November 5 the trail continued about 18 miles southeasterly through the broken plateau country among scattered volcanic crater cones which rise from about 300 to 1,000 feet above the general level. Each cone is the center of a series of lava beds, which spread

over the surrounding area. The surface of the lava beds is covered with angular masses of shattered lava through which our saddle and pack animals had to pick their way with care. Canyons of varying depth gash the surface of this great volcanic plateau, which gradually rises to its greatest elevation in the district about the base of the Cerro de la Giganta, east of Comondú. The lava beds of the surface are underlaid by stratified beds of volcanic ashes and similar material, usually consolidated into soft rock. In places between La Purísima and Comondú the trail was boggy from the recent rains, and the soft mud in depressions between the rocks added to the difficulties of the road, even where the general surface was such a continuous bed of lava that we were confined to a narrow track winding among the shattered rocks. About noon we crossed a broad, rounded divide about 2,000 feet above sea level and descended the farther slope to an altitude of 1,500 feet, where we came abruptly to the edge of the canyon wall immediately opposite the town of Comondú. This we found to be a scattered settlement of about 1,000 people, located at an altitude of 700 feet along the flat bottom of a canyon varying from 200 to 800 yards in width, and with walls 500 to 800 feet high. A mile below town the walls close in and the canyon for about 12 miles is narrow and very crooked, the high basaltic cliffs forming many wild scenes. Then the canyon broadens and the walls descend gradually for 3 miles before they merge into the gently sloping coast plain, which is about 12 miles wide at this point. The lava cap of the mesa forming the south wall of the canyon below Comondú is largely columnar basalt, but the north wall is mainly of horizontal strata apparently very different in character. The water appears to have formed the canyon by following the line of contact between two distinct lava flows. A stream rising in large springs above the town flows about 8 miles down the canyon and irrigates a continuous succession of small fields. Date palms were scattered irregularly along the stream in a thin line through the small vineyards and fields of corn, sugarcane, and other crops, and other palms were grouped with the orange, fig, and pomegranate trees about the houses. The views up and down the canyon from the top of either wall are among the most beautiful in the peninsula.

For several miles along the plateau before we came to Comondú the trail followed an old wagon road from which others branched off over slopes on which there was a scattered growth of large agaves. At Comondú we learned that these roads were made some years ago by an American company that built wagon roads from the landing

on the coast to Comondú and over the adjacent hills, brought machinery up from the coast, and put up buildings with the purpose of extracting the fiber from the agaves growing there. The enterprise was foredoomed to failure, and the old roads and one or two abandoned houses in the canyon near Comondú were all that remained of it.

Bryant, Brandegee, and others who have visited Comondú speak of the kindly treatment received from the people there, and we met with the same hospitable reception. The visit of Bryant and Brandegee was still remembered, and the mayor of the town in 1905 was the man who outfitted them with saddle and pack animals for their overland trip to San Quintín in 1889. Comondú has a nearly tropical climate, although light frosts are not very uncommon in winter, and at intervals are severe enough to kill the leaves on sugarcane. Malarial fever, called morongo, is reported to occur here in summer and elsewhere about irrigated areas in Lower California as far north, at least, as Mulegé, where a number of cases occurred in 1904. These fevers were reported to be rather severe and often fatal to elderly people.

#### **El Cajoncito (1,000 feet):**

*December 27-28, 1905.*—El Cajoncito is a small cattle ranch at 1,000 feet altitude about 21 miles southerly from Pescadero and about 30 miles north of Cape San Lucas. We left Pescadero December 27 and 12 miles south came to San Jacinto ranch, consisting of a few huts located within half a mile of the sea, beside a broad sandy wash in a baylike coastal valley. The dry wash was bordered near the crossing by beautiful groups of tall fan palms, their presence giving evidence of water a short distance below the surface. Our route all day was generally parallel to the coast and within 2 or 3 miles of it, and several low ridges alternating with small coastal valleys, extending 2 to 4 miles inland, were crossed. These coastal valleys are mainly flat but are sometimes broken by low hills or ridges and crossed by sandy washes coming down from the west slope of the Sierra de la Victoria. In the afternoon the trail left one of the valleys and ascended the highest and most abrupt ridge we had yet seen along this part of the coast, bringing us to El Cajoncito on a bench just below the summit of the hills.

All along the route from north of Todos Santos the westerly front of the Sierra de la Victoria, 8 to 12 miles inland, parallels the coast, and rises with abrupt and inaccessible slopes of bare rock to a ragged line of peaks reaching 3,000 to 6,000 feet above their basal foothills.

These mountains and the foothills and ridges leading to the coast are mainly of pale gray granite resembling that in the high mountains of the northern half of the peninsula, but with their most abrupt slope facing the Pacific Ocean instead of the Gulf of Mexico.

**El Piñón**—west slope of San Pedro Mártir Mountains (5,300 feet) :

*July 5-11, 1905.*—On July 10 I traveled about 12 miles southeast from Pozo Luciano across low brush-covered hills to the mouth of a canyon in the foothills, at 5,300 feet altitude. Camp was made by a small stream that flows through the flat at the mouth of the canyon and sinks into the sand just below. The flat and adjacent hillsides are covered with pinyon trees, making it a favorite resort for Indians during the harvest of pinyon nuts. Nelson rejoined me here on July 10. Specimens collected were labeled "Piñón, W. slope San Pedro Mártir Mts." Upper Sonoran Zone.

**El Potrero**—near Mulegé (600 feet) :

*October 30-31, 1905.*—Leaving Mulegé on October 29 we traveled about 6 miles southwesterly, up the broad bottom of the Arroyo del Potrero to Pozo San Rafael, a small cattle ranch where there is a shallow well in the creek bottom. The most vigorous growth of mesquites we saw in Baja California occurs along the sides of the arroyo near this ranch, many of them being 30 or 40 feet high. October 30 the trail led southerly up the valley bottom, which gradually narrowed to a wide canyon, with a broad, dry wash, paved with water-worn boulders, winding down the course. About 10 miles from Pozo San Rafael the valley narrows for a short distance to a low box canyon and to the right rises a flat-topped mountain called Mesa de Zacatecas, where numerous mountain sheep were reported to occur. Five miles farther up the rocky and narrowing canyon we came to the ruins of El Potrero, an abandoned cattle ranch, where we camped. El Potrero is located at an altitude of 600 feet on a rocky mesa 6 or 7 miles in diameter, with mountains on three sides. On the southern side, especially, a high precipitous ridge, plainly visible from Mulegé, bars the way like a wall in that direction. The Arroyo del Potrero heads at the base of this mountain wall, and the bottom of its narrow canyon through the mesa, immediately above the old ranch, contained numerous tanks and pot holes of good water with a trickling stream here and there.

**El Rayo**—Sierra Juárez (4,500 feet) :

*June 3-5, 1905.*—El Rayo is a ranch at 4,500 feet altitude, in the Sierra Juárez, or Laguna Hanson Mountains, of northern Baja

California. On June 3 we left the wagon road at La Huerta and followed a winding trail for about 6 miles easterly to La República, an abandoned gold mine and stamp mill; then our route for about 12 miles was northerly to a small meadow in an open ravine about a mile below El Rayo ranch on the top of the mountain. The entire west slope of the Sierra Juárez in this section is interrupted only by long, rounded, undulating ridges, rising so gently that for long distances we appeared to be traversing a slightly broken plain, covered with low brush and scattered rocks. Over the slope a thin growth of small shrubs and widely scattered pines gave the landscape a rather barren appearance. The morning of June 4 a sharp frost coated with white the vegetation in the bottom of the meadow near our camp. El Rayo ranch was formerly the Hanson ranch, occupied by an American of this name with his cattle. He was murdered near there and the place at the time of our visit was one of the ranches of an American company with headquarters at Ojos Negros, in San Rafael Valley. At El Rayo ranch the trail entered a good wagon road which followed the top of the mountains from Campo, just within the California border.

**El Sacatón (=El Saccaton) (1,000 feet):**

*December 28-29, 1905.*—El Sacatón is a small cattle ranch at 1,000 feet altitude about 5 miles from the sea, 15 miles north of Cape San Lucas. December 28 the trail from El Cajoncito held in a general southerly course all day, but was extremely crooked, swinging down to the coast and then far inland, winding among the roughest and most broken hill country we had seen since leaving La Paz. About 12 miles by trail from El Cajoncito we turned inland from near the ocean and traveled about 8 miles southeasterly across foothill ridges to El Sacatón. All along this part of the route the main foothill ridges descend to the Pacific, forming bold rocky points and bluffs with broad sandy washes in deep ragged canyons between them. The vegetation along the coast from Todos Santos to El Sacatón is much like that farther back on the road from La Paz but is smaller and less abundant.

**El Sauz—Sierra de la Laguna (4,600 feet):**

*January 21-24, 1906.*—El Sauz was a ranch at about 4,600 feet on the slope of the Sierra de la Victoria in the cape region of the peninsula. On January 19, having completed our work at Santa Anita, we continued northerly on the west side of the valley. Our trail lay over a rolling and canyon-cut mesa 50 to 150 feet above the river

bottom, which had a dry and rocky bed through most of its course. About 12 miles north of Santa Anita the mesa becomes lower and the trail descends into the river bottom, where a small stream was flowing, and scattered individuals of a small but handsome live oak, 20 to 40 feet high, with narrow leaves and drooping branches, made an attractive addition to the flora. This oak proved to be a new species, which later was named *Quercus brandegei*, for T. S. Brandege, the leading authority on the botany of the region, his special field of study. Traveling on up the valley we reached Miraflores, about 18 miles north of Santa Anita. Miraflores was an attractive village of 30 or 40 houses at an altitude of about 400 feet on the west side of the San José River, just above its junction with the Arroyo San Bernardo, a small stream coming down a rocky wash from a canyon on the east face of the Sierra de la Victoria. Miraflores was the point from which Lyman Belding made his visit to the mountains about La Laguna in 1883, and we secured the services of the same guide, Francisco Amador.

On January 20 we left Miraflores and traveled northwesterly across the gently rising rocky mesa up the course of the Arroyo San Bernardo. For 4 or 5 miles the trail led across the west side of the valley, through an unusually tall and luxuriant growth of giant and other cactuses with numerous species of shrubs and small trees, mainly tropical species, which form a jungle all the way to the base of the mountains. There we entered an open canyon, the bed of the stream being very broad and covered with masses of water-worn boulders of all sizes, evidences of the floods which sometimes sweep down these slopes. The trail up the canyon was extremely rough and broken, leading repeatedly back and forth across and along the boulder-strewn bottom or up and down the densely brush-grown sides. Along the canyon we entered the range of another live oak, one with stout branches, massive trunks sometimes 2 feet in diameter, and moderately spreading rounded tops. These oaks and their distribution on the slopes reminded us of the live-oak belt of California valleys; but they proved to be of an unrecognized species later named *Quercus devia*. A few cottonwoods of a species peculiar to these mountains and locally known as the "huirigo" (*Populus monticola*), with conspicuous white bark, were scattered here and there along the canyon, and in flats along the sides were small patches of corn. About 13 miles from Miraflores we camped at an altitude of about 1,500 feet, at San Bernardo, a milk ranch, where a small amount of cheese was made.



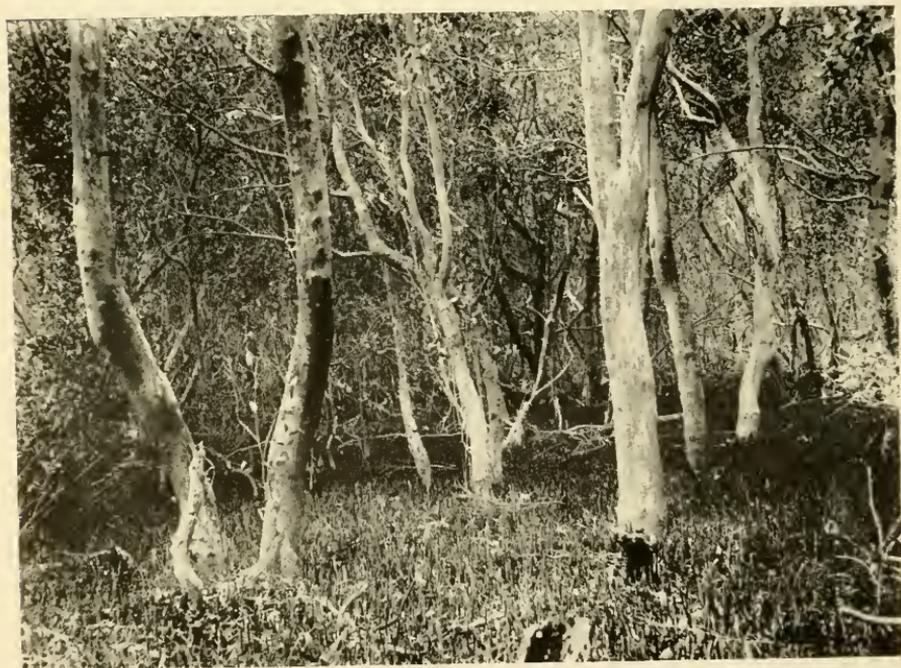
1. Desert vegetation at Arroyo Cataviña, northern Baja California. Picturesque plant life suggests that of some remote geological period. Lower Austral Zone.



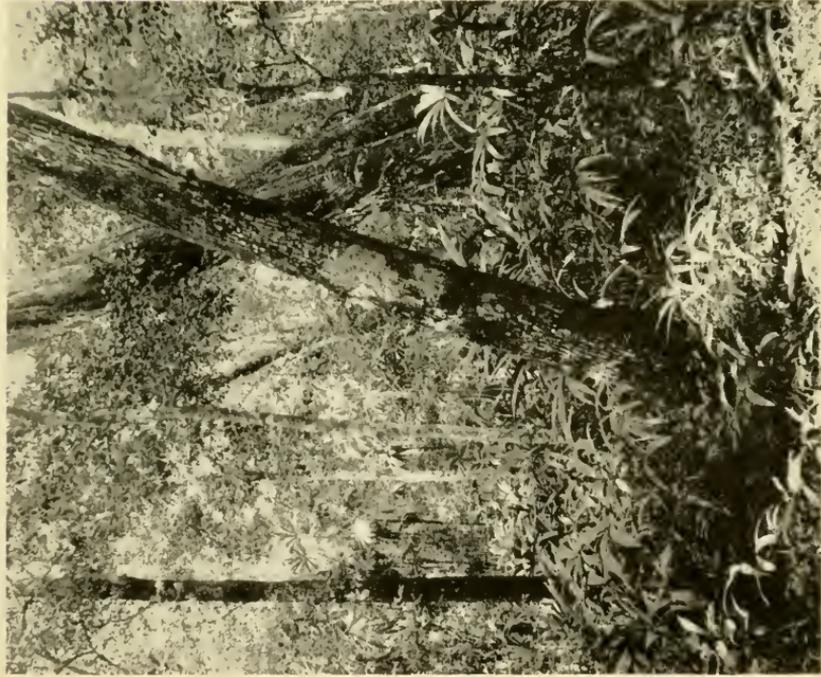
2. Cactus forest, Mexquititlán, Guerrero. Arid Lower Tropical Subzone.



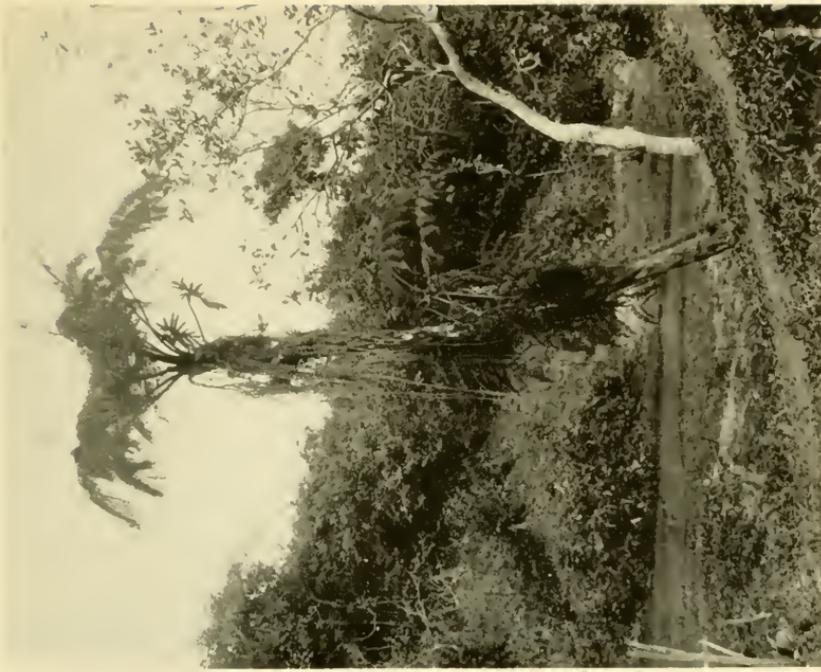
1. Humid tropical forest exterior, Santa Lucrecia, Veracruz. Humid Lower Tropical Subzone.



2. Swamp forest, Contoy Island, Quintana Roo. Humid Lower Tropical Subzone.



1. Forest interior near Apazote, Campeche. Humid Lower Tropical Subzone.



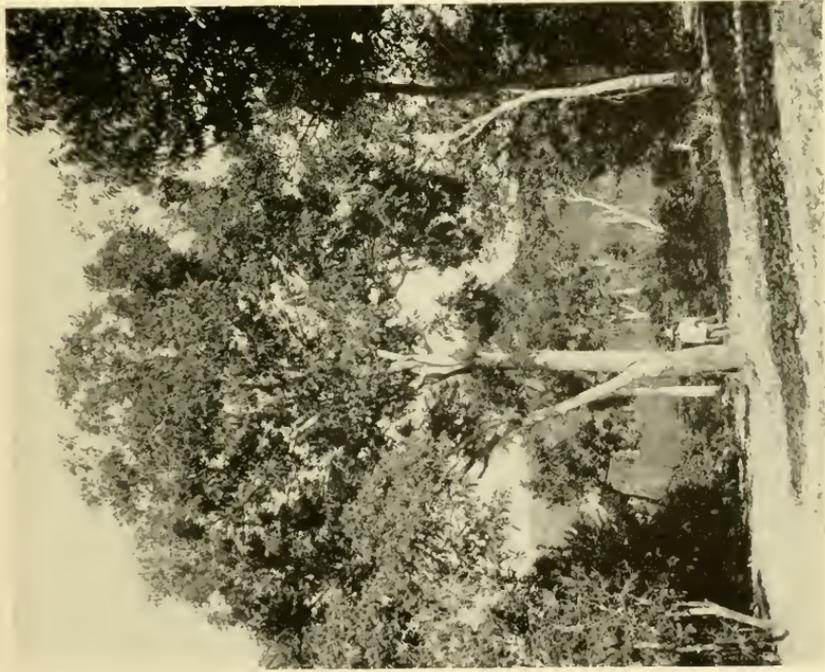
2. Tree fern in partially cleared area, Jaltipan, Veracruz. Humid Lower Tropical Subzone.



1. Interior of marsh, Altamira, southern Tamaulipas. Humid Lower Tropical Subzone.



2. Savanna area near Apazote, Campeche. Man on muleback shows size of coarse grasses. Humid Lower Tropical Zone.



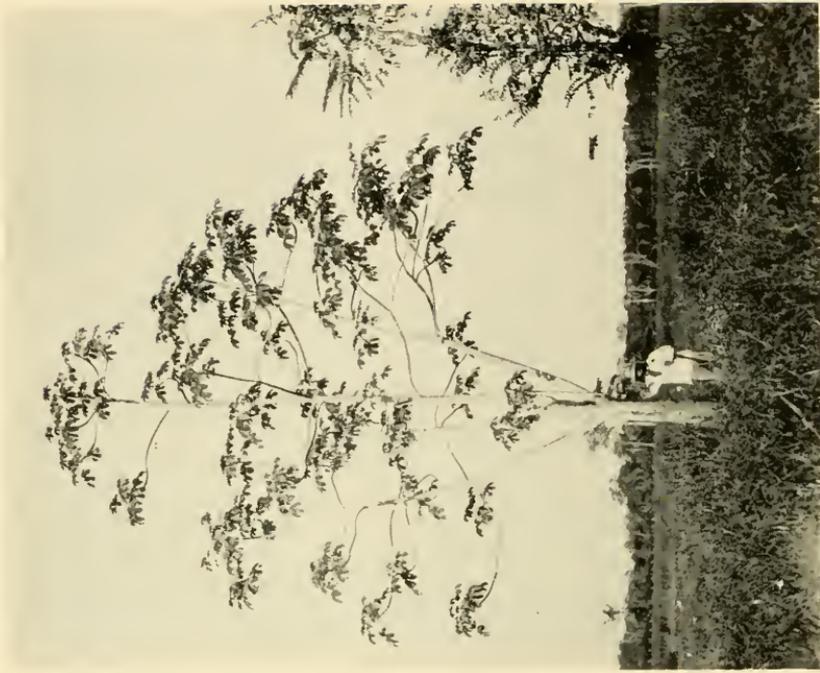
1. Spanish cedar (*Cedrela mexicana*). Extensively used for making cigar boxes. Apazote, Campeche, Humid Lower Tropical Subzone.



2. Mahogany or caoba (*Swietenia macrophylla*). Highly valued for handsome, hard wood, used in making fine furniture. Apazote, Campeche, Humid Lower Tropical Subzone.



1. Guácima (*Guazuma ulmifolia*), a tree widely distributed throughout tropical México. Yohaltún, Campeche. Here in Humid Lower Tropical Subzone.



2. Guarumo (*Cecropia mexicana*), a tree widely distributed throughout tropical México. Yohaltún, Campeche. Here in Humid Lower Tropical Subzone.



1. Typical savanna vegetation along Pacific coast near Chicapa, Oaxaca. Small trees here mainly nanche (*Byrsonima crassifolia*) and *Curatella americana*. Arid Lower Tropical Subzone.



2. Typical savanna vegetation along Gulf coast near Jaltipan, Veracruz. Bushes here mainly several small species of Melastomaceae and a scrub oak. Arid Lower Tropical Subzone.



1. An imposing forest interior where underground waters have produced a heavy growth of giant fig trees and tall palms in an arid general area near Manzanillo, Colima. Arid Lower Tropical Subzone.



2. Sand dunes encroaching on vegetation along Gulf coast near Puerto México. Arid Lower Tropical Subzone.

On January 21 we continued westerly some distance up the canyon, then turned to the right in a northerly direction and crossed two high, sharp ridges and numerous smaller and more rounded ones forming the eastern slope of this section of the main range of the Sierra de la Victoria. From San Bernardo the mountains became steeper and rougher. The more rounded ridges and depressions were covered with oaks so closely set that in some places it was difficult to find a passage. On other slopes the oaks were irregularly spaced and intermingled with open parklike grassy areas. From the tops of the highest ridges, from 4,500 to 5,000 feet altitude, we had fine views of both coasts of the peninsula and the intervening country. In the afternoon, after traveling about 14 miles in a generally northern course from San Bernardo, we came to the long-abandoned milk ranch called El Sauz. This was at an altitude of about 4,600 feet in a little flat at the bottom of a steep-sided canyon, where a small stream of clear, cold water and plenty of wood and grass completed the requirements for an ideal as well as beautiful camp. California holly (*Heteromeles arbutifolia*), bearing its scarlet fruit, and a few tall cottonwoods grew along the stream, two species of oaks and a madroño formed irregular patches on the northerly slopes, and there were open grassy areas, mainly on summits and southerly slopes, where a nolina, agaves, and yuccas, were abundant. The madroño proved to be a new species (*Arbutus peninsularis*), and the nolina (*Nolina beldingi*), a giant of its kind, is one of the striking botanical features of the region. We remained here for 2 days to do our first work in the Sierra de la Victoria. Specimens were labeled "El Sauz, Sierra de la Laguna," the latter a local name applied to the northern part of the Sierra de la Victoria.

### El Triunfo (1,800 feet):

January 30-31, 1906.—El Triunfo is a small mining town at 1,800 feet altitude, about 30 miles south of La Paz. January 30, we left our camp at El Taraiso, near the north base of the Sierra de la Laguna, and followed a good broad trail for 10 miles northeasterly through low hills and ridges to the small gold-mining camp of El Valle, where an American company was working a small stamp mill and concentrating plant. Eight miles beyond this in the same direction, along a good wagon road, through open rolling hill country, we came to El Triunfo, situated among some rounded hills. This was formerly the largest and most thriving mining camp in the peninsula, but at the time of our visit it was working on a much smaller scale. The large reduction plant and huge pile of tailings at the border of

the well-built little town gave evidence of its former prosperity. Rain began soon after our arrival and continued all night. The following day, January 31, the rain was still falling. Nelson took the stage to La Paz, but I remained with the tired pack outfit and rode the 30 miles over a good wagon road to La Paz the next day, February 1. This ended our overland work on the peninsula.

**Ensenada (50 to 100 feet) :**

*May 17-19, 22-23, 25-31, 1905.*—Ensenada is a seaport on the Pacific coast, about 65 miles south of San Diego, Calif. On May 16 we left San Diego by steamer and arrived at Ensenada the following morning. The town is situated in a small valley at the head of Todos Santos Bay. To the northeast high, grass-covered hills rise abruptly, and farther away to the east steep slopes extend up from the head of a small valley toward the mountains of the interior. Upper Sonoran Zone.

**Ensenada—canyon 20 miles east (1,800 feet) :**

*May 31-June 1, 1905.*—This place located as indicated was the first camp on our overland journey through the peninsula. It was near the upper end of the canyon, among picturesque live-oak trees with short, massive trunks, and huge, wide-spreading branches. Upper Sonoran Zone.

**Ensenada to Ojos Negros (see La Huerta).**

**Espíritu Santo Island (= Isla Espíritu Santo) (30 feet) :**

*February 6-8, 1906.*—Espíritu Santo Island walls in a part of the eastern side of the Bahía, or Bay, of La Paz, about 20 miles from the town. On February 6 we left La Paz on a small pearl-fishing boat, with a crew of three men, to visit Espíritu Santo Island. We reached this island on the following day and anchored in front of a few houses in a small bay on the west side, where a company organized at La Paz was experimenting in raising pearl oysters. They had several beds planted and claimed to be getting gratifying results.

The island is about 10 miles long north and south and 4 miles wide in its broadest part. It is irregular in outline and almost entirely covered with rocky hills and low mountains reaching an altitude of nearly 2,000 feet above the sea. The shore line is mainly rocky and precipitous, in places fronted by high cliffs. The northern quarter of the island is nearly separated from the rest by two narrow indentations formed by the sea. On the west side, near the southern end, is a small bay with a small mangrove swamp on the flat near its head. A

narrow valley extends inland from this flat and forms part of a pass across the island, extending between low, rounded hills and mesas. The southern end of the island is separated from the opposite point of the peninsula by San Lorenzo Channel, a shallow strait about  $3\frac{1}{2}$  miles broad and 5 fathoms deep. The volcanic formation of the island appears to be identical with that of the nearest point of the mainland, and the shallow water separating them indicates the existence, at no remote period, of a former land connection.

The vegetation of the island is practically identical with that of the adjacent mainland and mainly Arid Upper Tropical in zonal character with a mixture of giant and other cactuses. Among the prominent species noted were *Tapirira edulis*, *Bursera microphylla*, *Forchammeria watsoni*, *Bourreria sonora*, *Jatropha canescens*, *Pedilanthus macrocarpus*, *Pachycereus calvus*, and *Pereskioopsis brandegeei*.

This island supports a larger variety of mammal life than many of the other islands along the coast of the peninsula. On islands subject to prolonged drought, as well as to the cyclic behavior of certain species, isolation must result in the gradual elimination of species owing to competition for food. The larger variety of mammals inhabiting Espíritu Santo as compared with other islands is probably due to more recent connection with the mainland. The jack rabbit of Espíritu Santo Island, however, is derived from the *Lepus californicus* stock of the peninsula, but through isolation has developed into an extraordinary black animal, regarded as specifically distinct.

#### Guajadomí (1,300 feet):

October 31, 1905.—Guajadomí was an abandoned ranch at 1,300 feet in the interior about 30 miles south of Mulegé. Specimens were collected in that vicinity in passing through. We left El Potrero October 31 and followed the trail southwesterly about 3 miles across the mesa to the base of an abruptly rising mountain slope, which it ascends in a series of sharp zigzags and along ledges for about a mile to a pass on a sharp ridge at an altitude of about 2,400 feet. On both sides of this pass narrow mountain ridges, forming the peninsular divide, rise 1,200 feet or more and extend to the northwest and southeast. The mountain is so narrow at the pass that when the summit is reached the trail turns down immediately on the other side into the narrow cliff-bordered and extremely rocky canyon forming the head of the Arroyo de San José, in which for half a mile or more the slope is even more abrupt than on the side we ascended. This narrow divide forms the watershed of the peninsula, the drainage on the north being to the Gulf and that on the south to the Pacific. Six

miles below the summit we passed a number of stone-walled enclosures and ruins of houses marking the long-abandoned Guajadomí ranch. The extent of the ruins indicated that this must formerly have been a place of considerable importance. Four miles below this were the ruins of El Zapote, another abandoned ranch; 3 miles below another one called Los Candelitos; and 3 miles still farther down was Agua Grande, a deserted ranch, with a tank of water in the bottom of the canyon. At all the places named there were water holes in the rocks and evidence of former occupancy. The abandonment of the cattle ranches was apparently due mainly to drought conditions that were said to have prevailed throughout the central section of the peninsula during about 7 years previous to our journey, but there may have been other contributing factors. In some sections no rain at all fell during this period, according to reports. A few cattle were still ranging about Agua Grande, and the water was extremely filthy, but none of the party knew the country ahead, and, owing to the condition of our stock, we could not risk a dry camp, so we camped there and made the best of it. The next morning, only 2 miles below this camp, we found a large tank, full of good clear water. A vigorous and abundant growth of giant cactuses and other desert plants occupied all the lower slopes of the canyon and wild fig trees were growing in several places where water was close to the surface. A number of pyrrhuloxias (*Pyrrhuloxia sinuata peninsulæ*) and ground doves were seen near the water holes, and at Agua Grande the call notes of the pygmy owl (*Glaucidium gnoma hoskinsii*) were heard on all sides as we were breaking camp, the only time we heard this species during the journey. We regarded the locality as a promising one for detailed work, but feed was so scanty and our stock in such worn condition that it seemed imprudent to remain there even for a day.

**Hardy River**—near Volcano Lake (15 feet):

*March 15-16, 1905.*—Hardy River is a former channel or slough that carried overflow waters from Volcano Lake southward, along the eastern side of the Sierra de los Cocopahs, in the delta of the Colorado River. This locality was an overnight stop when en route up the slough with D. T. MacDougal.

**Isla San Gerónimo** (= San Gerónimo Island) (50 to 75 feet):

*August 14-15, 1905.*—The morning of August 14 we left San Martín Island, just north of the entrance to San Quintín Bay, and ran down the coast to San Gerónimo Island, where we arrived about 3 p.m. The island lies about 5 miles offshore near the south side of

Rosario Bay. This small island is low and barren, but several rounded eminences reach about 75 feet above sea level. The scanty vegetation is mainly herbaceous. A subspecies of white-footed mouse (*Peromyscus maniculatus geronimensis*) was excessively abundant. Every one of our traps was visited during the single night spent there, and in the morning we removed more than 60 of these mice. The condition of the vegetation also indicated that this mouse was near the top of a cycle of abundance, and that such numbers could not permanently be maintained. On August 15, in a run of about 8 hours, we returned to San Quintín.

**Isla San Martín** (= San Martín Island) (50 to 400 feet):

*August 12-14, 1905.*—San Martín is a rocky island about a mile in diameter and rounded-triangular in form, lying a few miles offshore to the northwest of the mouth of San Quintín Bay.

Early in the morning of August 12 we left San Quintín in the gasoline launch *Todos Santos*, and soon after noon landed on a sand beach on the northeastern shore of San Martín Island. San Martín Island is evidently a part of a volcanic belt including the mainland coast, the surface being made up of ragged and broken lava beds. The middle of the island is occupied by two volcanic peaks, the highest reaching an altitude of 470 feet, from which the slopes extend down on all sides to the cliffs forming the shore line. One of these peaks contains an old crater. It is a favorite nesting place for brown pelicans and cormorants, and is one of the guano islands of this coast. A few leopard seals and sea lions frequent its shores and the island was once a breeding resort for the elephant seal. The most notable plants are some cactuses and a large velvety white cotyledon with orange-red flowers (*Dudleya anthonyi*).

**Islas los Coronados** (= Coronados Islands) (50 to 300 feet):

*May 14-15, 1905.*—On May 14 we proceeded from San Diego, Calif., by gasoline launch to study the bird life of the Coronados Islands, a rocky group of islets lying about 7 miles off the extreme northwestern coast of Baja California, and in plain view about 15 miles southwest from the harbor entrance to San Diego.

A series of four small islets extends in a chain for about 5 miles, in a northwest by southeast direction. They all rise boldly from the sea, their shore lines consisting mainly of wave-washed cliffs.

The southernmost and largest of the group is about 2 miles long and half a mile broad. Its shore line is formed by high cliffs except in a small bay in the middle of its eastern shore, where boats can land.

The interior of the island consists of rounded hills rising to an altitude of 672 feet near the southern end. The second largest, the most northern of the group, about a mile long and one-quarter mile wide, is bordered by cliffs except on the southern side, where a landing can be made. This island is a narrow rocky ridge covered with sharply sloping hills rising about 460 feet above the sea. The two middle islets are steep, barren rocks, 100 to 250 feet high. The islets are treeless and have only a few shrubs, but are covered with an abundant growth of herbaceous vegetation. The northernmost has its southern slope covered with a mat of the iceplant, *Mesembryanthemum crystallinum*. We camped one night on the larger island and, after visiting the other islets and collecting some specimens, returned to San Diego on May 15. Upper Sonoran Zone.

**Islas Todos Santos (=Todos Santos Islands) (50 to 300 feet):**

*May 20-22, 1905.*—From May 21 to 22 we visited the Todos Santos Islands. This is a group of two islets and outlying rocks extending in a northwesterly and southeasterly direction, immediately in front of Todos Santos Bay, off Ensenada, and only 3 miles from, and in line with, Punta Banda, the cape at the southern side of the bay. A long line of detached rocks stretches from the point of the cape directly toward the largest islet, and a submerged connecting ridge is evidence that the islets were once a part of a long, narrow cape, of which Punta Banda is the remaining base. The southernmost and largest of the islands is about  $1\frac{1}{4}$  miles long and half a mile wide. At its northern end this islet forms a low plateau, but to the south rises into rounded hills a little more than 300 feet high. The shore line is rocky and precipitous, rising in cliffs 20 to nearly 200 feet high, and the only landing is on the northeastern side. The smaller islet lies northwest of the larger one, from which it is separated by a narrow channel. It is entirely a low platform, a continuation of that forming the northern end of the larger islet. The extreme elevation is 55 feet above the sea, and the shore line is almost continuously precipitous. Both islets are covered with an abundant growth of herbaceous vegetation and in sheltered places on the larger one are small patches of low shrubs. Cholla cactuses (*Opuntia*) are extremely abundant on the more level areas. Climatic conditions are nearly the same as along the adjacent mainland, but the islets are somewhat more fully exposed to fog and moisture-laden sea winds. Upper Sonoran Zone.

**Jaraguáy (1,800 feet):**

*September 9-10, 1905.*—September 9 we left Agua Dulce, about 30 miles southeast of San Fernando, and traveled rapidly southeasterly on an old trail leading across a gently undulating plateau, a part of the Llano de San Agustín. About 18 miles from Agua Dulce we came suddenly to the Arroyo de Cataviña, a beautiful open, shallow canyon winding through the desert. Most of the broad sandy wash in the bottom was dry, but thin patches of green grass and willows and numerous tall and graceful fan palms were scattered along its course. These showed the presence of water close to the surface, and, where the trail crosses the canyon, a small stream rises and flows on the surface a short distance. At this point the wonderfully picturesque combination of fan palms, cirios, giant cactuses, yuccas, and agaves, made a landscape suggesting the strange plant life of some remote geological period. Stopping only for water we continued southeasterly for about 12 miles to the Arroyo de Jaraguáy.

As soon as we crossed the Arroyo de Cataviña the formation of the country became more broken and was made up mainly of volcanic rock, though ridges of granite continued to outcrop here and there. The Arroyo de Jaraguáy, like that of Cataviña, is a shallow, open canyon winding across the plain, but is larger, the broad sandy wash appearing like a white river bed. Many large groups of fan palms were growing along the arroyo. We reached Arroyo de Jaraguáy at sunset and searched the sandy bed for water without success until after dark, when we discovered it in two holes 2 or 3 feet deep, dug by coyotes. The water had been visited by coyotes and buzzards until it was very foul, but we were forced to use it. A few specimens obtained were labeled "Jaraguáy."

**La Chuparosa—Sierra de la Laguna (5,000 feet):**

*January 24-25, 1906.*—La Chuparosa was the name of a camping place at 5,000 feet altitude, in the woods where a small stream came out of a side gulch at a little knoll about 8 miles north of El Sauz. January 24 we left El Sauz and followed the trail down the slope to a deserted milk ranch in a beautiful flat, in the bottom of a tributary oak-grown canyon. Here the trail turned, crossed a high ridge to the north, and descended part way on the farther side to La Chuparosa, where we camped. Many tracks of mule deer were seen, and along the route Viosca's pigeons (*Columba fasciata vioscae*) were common and nesting in the live oaks.

**La Grulla**—San Pedro Mártir Mountains (7,000 feet) :

*July 18-24, 1905.*—La Grulla is the name applied to meadows situated on a plateau at 7,000 feet on the upper part, but near the southern end, of the San Pedro Mártir Mountains. On July 18 we broke camp at Vallecitos, and, crossing the plateau southwesterly descended with some difficulty a steep and rocky trail about 12 miles to La Grulla meadows, at 7,000 feet altitude. There are three of these meadows or parks situated on a plateau more broken than that at Vallecitos, and about 1,000 feet lower. The main meadow is a narrow, winding, grassy valley several miles long and amid a beautiful open pine forest with two small ponds in the bottom, and gigantic granite boulders scattered in profusion, singly or in groups, along its sides, especially near the lower end. To the north and east high ridges topped by rounded granite boulders rise almost barren of vegetation above the belt of pine trees encircling each of the parks. A small stream flowing out of the lower end of the main La Grulla meadow by which we camped was said to form the extreme head of the Río Santo Domingo.

La Grulla has been visited by practically all naturalists who have been in these mountains, and between 1888 and 1893 A. W. Anthony was there several times. He found mallards and cinnamon teals nesting about the ponds in May, but at the time of our visit the borders of the ponds and all the valley bottom had been so closely grazed and trampled by cattle that no shelter was left for waterfowl, and not a duck was seen. Deer were common and remarkably unsuspecting near our camp. Transition Zone.

**Laguna Hanson** (=Hanson Laguna) (5,400 feet) :

*June 5-9, 1905.*—Laguna Hanson is a shallow pond at 5,400 feet altitude near the top of the Sierra Juárez, or Laguna Hanson Mountains. On June 5 we moved from camp about 8 miles northeasterly, passing El Rayo ranch, and made camp at Laguna Hanson. The pond, about half a mile across, is situated in a small mountain park surrounded by a low growth of Jeffrey pine. Two smaller ponds were located near the larger one. This locality is in the Transition Zone.

**Laguna de los Volcanes** (=Volcano Lake, head of Hardy River) (20 feet) :

*April 16-20, 1905.*—The Laguna de los Volcanes was a very shallow pond or lagoon, located near the highest part of the broad dike laid down by the Colorado River during the thousands of years required to isolate the Salton Sea from the remainder of the Gulf of California. Sloughs or side channels from the Colorado River tended

to converge to the lagoon from which some of the overflow during floods ran north through New River into the Salton Sea; but the larger part turned southward to form the slough known to Americans as Hardy River. The sluggish stream skirted the east base of the Sierra de los Cocopahs and reentered the main channel of the Colorado River a few miles farther south. The lagoon was named for the numerous geysers or mud volcanoes in the vicinity. Some of these are depressions, but many others are mud cones gradually built by small periodic eruptions. Extensive tule marshes bordered some of the sloughs in the vicinity.

**La Huerta**—west base Laguna Hanson Mountains (2,800 feet):

*June 1-3, 1905.*—La Huerta was an Indian village. On June 1 we left our camp, 20 miles east of Ensenada, and ascended the canyon a couple of miles to a divide at about 2,800 feet, beyond which we came out into San Rafael Valley. This elevated valley is 18 or 20 miles long from northwest to southeast, and from 3 to 10 miles wide. It forms the upper part of the drainage of the Arroyo de San Rafael, which at the lower end of the valley passes the old Spanish settlement, Real del Castillo, and on its way to the coast north of Ensenada passes the old Guadalupe Mission. The valley forms an open plain bordered on the west by the coast range and on the east by the higher Sierra Juárez, or Laguna Hanson Mountains.

Our road led a few miles up the San Rafael Valley past the Ojos Negros cattle ranch, and then easterly about 9 miles to the little village of La Huerta, where we camped at an altitude of 2,800 feet, just below the Indian houses. Here a small stream flows through the broad lower end of a canyon in the foothills of the Sierra Juárez. A dozen or more Indian families occupied a few huts scattered among small fields and orchards where they grew peaches, apricots, corn, beans, and other garden vegetables. The western slope of the coast mountains facing Ensenada has Upper Sonoran Zone vegetation, similar to that of the same slope near San Diego, but in the southern end of San Rafael Valley there is a mixture of mesquites, yuccas, and other Lower Sonoran species. All the way from Ensenada to La Huerta the rocks were mainly of granite, and the east side of San Rafael Valley is covered with loose granite gravel.

**La Laguna**—Sierra de la Laguna (5,500 feet):

*January 25-29, 1906.*—La Laguna is the name applied to the former bed of a shallow lake in the higher part of the Sierra de la Laguna, or northern section of the Sierra de la Victoria, in the cape region

of the peninsula. On January 25 we left camp at La Chuparosa and continued northerly, the trail leading along the summits of two high and extremely narrow ridges which form the crests of this part of the range. Between these ridges a large canyon heads close to the summit, and a small stream, the Arroyo de San Antonio, flows down the easterly slope to the Gulf, passing Santiago village. The point where the trail crosses this stream is an old camping place called San Antonio. The crest of the second ridge immediately north of San Antonio was so narrow in places that there was little more than room for the trail, the mountain dropping away precipitously several thousand feet on the west and having a very steep slope on the east. North of this ridge the mountain top broadened and the trail led down a long north slope thickly overgrown with a forest of pinyon pines and small oaks into the basinlike mountain valley of La Laguna, where we camped at the ruins of an old ranch in the extreme upper end. This open, nearly flat-bottomed valley is about a mile long and from one-fourth to one-half as wide, with several small brooklets uniting near the upper end and flowing down the middle. It is situated at about 5,500 feet altitude, and surrounded by steep mountain slopes covered with low oak and pinyon forest. Formerly the bottom of the valley is said to have been occupied by a shallow lake, the lower end of which was eroded during a season of heavy rains and the lake drained. This occurred many years before Belding's visit here in 1892, yet some people at La Paz and elsewhere in the cape region still believe the lake exists. Two or three miles by winding trail and half this distance in a direct line westerly, La Aguja, a sharp needle peak of granite, more than 6,000 feet high, stands out prominently as the northwestern end of the Sierra de la Laguna, on a precipitous front 5,000 feet high, facing the lowlands between La Paz and Todos Santos.

La Laguna Valley, from which the immediately surrounding group of mountains takes the name of Sierra de la Laguna, is a notable place from the fact that it is rich in species of plants, birds, and mammals peculiar to the cape district, and is the type locality for many of them. Frazar, Belding, and others made notable collections here. The Upper Sonoran Zone occupies the upper slopes of the Sierra de la Victoria, above about 4,500 feet altitude. Among characteristic local plant species of this zone are *Pinus cembroides*, *Nolina beldingi*, *Erythea brandegeei*, *Populus monticola*, *Salix lasiolepis*, *Quercus devia*, and *Arbutus peninsularis*. Among the mammals obtained by us far out of the previously known range of the group was a long-tailed shrew (*Sorex lagunae*).

We remained in camp at La Laguna until the morning of January 29, when we started on our return to La Paz. We crossed the northern rim of the valley and then for 3 hours descended a long, steep, and narrow ridge leading down the north end of the mountain range. The trail was an old one and apparently had not been used for years. It would have been nearly or quite impossible to ascend it, owing to wash-outs along some of the steepest slopes, down which our animals were forced to slide in a half-sitting position. In many places it was obstructed by trees and bushes which had grown in or across the trail. This abrupt and continuous descent for more than 3,000 feet brought us to a deserted ranch on the bank of a small creek in the flat bottom of a deep canyon so densely grown up with bushes and small trees that we had trouble in forcing our way across. The trail led directly across the canyon and 1,500 feet up the abrupt and rocky slope on the opposite side to the crest of a ridge. The top of this ridge is very narrow and on the farther side drops into a deep, rugged box canyon, in which there is an abundant growth of vegetation. The trail here turned abruptly to the left and followed down the crest of the ridge for several miles, finally bringing us to the bottom, where the canyon on the two sides of the ridge, both carrying small creeks, unite. Here we found two men cutting palm leaves and both left their work and went half a mile down the canyon to show us where the trail is forced up on the steep mountain side to the right by the broken character of the canyon bottom. Up on the mountain side the trail soon led into a side canyon and down it to the main canyon again, and brought us out at El Taraiso, a small ranch containing two or three families. We camped here at an elevation of 1,800 feet after traveling about 14 miles of exceedingly difficult and broken trails, which were extremely exhausting to our stock.

#### La Paz (25 feet):

*December 17-23, 1905; February 1-6, 15-19, 1906.*—La Paz on the Bahía de la Paz is the capital of the southern district of Baja California. It is the second town of the peninsula in size, with a population at the time of our visit of about 5,000 people.

On December 14 we continued in a southeasterly course about 35 miles, from El Sauz, south of the Llano de Yrais, to an old cattle ranch called Agua Colorado, on the banks of the Arroyo Colorado, in which there was a small stream. We camped at an altitude of about 75 feet in an abandoned hut at the foot of a bluff on the northern side of the creek.

On December 15 the trail led about 10 miles southeasterly across low, rolling hills to the little village of San Hilario, on top of the high northern bank of a small stream of the same name. This arroyo irrigates some small vineyards, small fields of sugarcane, and other crops. A few date palms and some fan palms were also noticed. A little wine is made here. Among the hills 3 miles beyond San Hilario we came to the junction of our trail with the one leading from the old mission of San Luis to La Paz. We had been approaching the basal slopes of the main plateau and mountains of the east side of the peninsula and were now in distinctly rolling country. Three miles easterly from the junction of the trails was an abandoned hut on top of a bluff overlooking the deep Arroyo Guadalupe, in which there was a small stream flowing over a rocky bed. Beyond this arroyo the country changes and becomes much rougher and is broken into series of low, narrow hills and ridges. Back of these toward the mountains to the east were the sharply rising fronts of low, scattered mesas made by the erosion of the plateau sloping down from the Sierra de la Giganta, to the eastward. The trail continued in a winding course about 12 miles from Guadalupe, through this broken country to Cerro Colorado. The latter is a buff-colored conical hill standing out prominently from the lower border of the high interior mesa. We made a dry camp at an altitude of about 800 feet just above the base of the hill.

December 16 the trail led southeasterly from Cerro Colorado directly up a steep escarpment to an altitude of about 1,200 feet on the top of a broad rolling plateau covered with broken lava. From the point where we first reached the top the plateau rose gradually to an altitude of 1,400 feet, which was the highest point we crossed between Cerro Colorado and the Gulf. Its surface is the roughest and most broken we had seen on any of the lava plains crossed to this point. For 20 miles we traveled the roughest trail we encountered during the entire expedition, to the crest of the abrupt escarpment on the Gulf side, at the head of a large box canyon known as the Cajón de los Reyes. Here the trail led down a sharp declivity called El Salto de los Reyes, to the bottom of the canyon. We then followed its winding course for 10 miles, between high and picturesquely sculptured walls, to its mouth near the shore of La Paz Bay. The plateau, which is of sandstone overlaid by lava beds, ends in a series of high cliffs fronting all the westerly and northerly shores of La Paz Bay, and separated from it by a sandy coast plain 2 or 3 miles broad. A vigorous growth of giant cactuses, mesquites, and other desert

species covers the sandy plain over which we traveled, about 5 miles from the mouth of the canyon to Rodríguez, a little group of huts forming a milk ranch on the shore of La Paz Bay, where we camped.

December 17 we continued in a southeasterly and then northeasterly course for about 22 miles to La Paz on the eastern side of the bay. We found La Paz a beautiful place, embowered in coconut and date palms, orange, lemon, pomegranate, avocado, banana, and other trees and shrubs. The country beyond the limits of the town, however, is an arid desert with mesquites near the bay and creosotebushes (*Larrea*) and other desert species farther back. The open plain slopes gently back from the bay, and the sharp peaks of the Cacachilas rising boldly a few miles to the southeast are the nearest mountains. Farther south, La Aguja (The Needle), a sharply pointed granite pinnacle with an altitude of 6,100 feet, projects like a buttressed spur from the main mass of the Sierra de la Victoria. This peak rises above a series of pale gray cliffs and precipitous rock slopes about 4,000 feet high, and is a conspicuous landmark from near La Paz. To the southwest the low plain forms a broad pass between the inner bay and the Pacific side of the peninsula, and thus separates the mountains and high plateaus of the north from the mountains to the south. In front of the town lies the broad sweep of La Paz Bay, bordered by cliffs along its northwestern shore and with Espíritu Santo and San José Islands lying just outside in the Gulf. La Paz is the headquarters of the pearl-fishing industry of the region, said to yield at the time of our visit about \$250,000 in pearls and \$120,000 in mother-of-pearl shell each year. We left La Paz to work at localities farther south in the cape region of the peninsula on December 23 and did not return until February 1, 1906. The port was used as a base of operations until February 19, when we took steamer for Ensenada.

#### La Purísima (300 feet):

*November 2-4, 1905.*—La Purísima is the town on the site of the old mission at 300 feet altitude, on the Arroyo de la Purísima in the interior a short distance north of latitude 26° N. It should not be confused with La Purísima Vieja, where we passed a small group of adobe houses surrounded by small sugarcane fields and a few date palms in San José Canyon about 10 miles to the northwest.

On November 2 we left our camp at Paso Colorado and continued about 3 miles down San José Canyon to the small village of La Purísima Vieja, where the trail turns to the left and climbs the

wall out of San José Canyon, and leads across the broad plateau, thickly covered with angular fragments of lava. From the top of the divide above Guajadomí down to La Purísima Vieja the trail follows the bottom of San José Canyon.

All the mountains in this district are of volcanic origin and the Pacific slope forms a continuation of the lava-covered plateau we traversed near San Ignacio. This plateau is cut in all directions by deep ragged box canyons like the upper part of the San José Canyon near Guajadomí. The rocky walls of San José Canyon rise almost vertically in a series of steplike mesas, the cliffs in some places having a talus slope, but often rising as clear vertical walls. This entire section is of black lava, overlying basal beds of sandstone and hard conglomerate, which unite to give a gloomy and savage aspect to the rugged wildness of the scenery. This volcanic plateau formation continues throughout the length of the canyon, but the walls become increasingly lower and the bottom broadens from above Paso Colorado to La Purísima Vieja and below.

At the point where our trail ascended the southerly wall of San José Canyon the plateau has an altitude of about 900 feet and slopes southwesterly toward the coast plain. After traveling in a steady rain 10 miles from La Purísima Vieja southerly and then southeasterly over the undulating and broken lava beds, varying in altitude from 1,000 to 1,300 feet above the sea, we came to the top of an escarpment nearly 1,000 feet high, overlooking the picturesque valley and town of La Purísima, the site of one of the old missions. When we arrived at La Purísima the storm, continuing all day, had increased to a cold, driving rain, and, owing to the small size and crowded condition of the houses, we found it difficult to obtain a place for ourselves and outfit. Nearly every roof in town was leaking copiously, and the room we finally obtained, in which we crowded with all our saddles and the loads of four pack mules, gave but partial shelter. The main group of houses, many of them whitewashed, was located near the old mission at an altitude of about 300 feet in the flat-bottomed valley or broad section of the Arroyo de la Purísima, nearly opposite the point where our trail approached the edge of the mesa, but other small houses were scattered among fields for 8 or 10 miles up and down the bottom. At the time of our visit this valley had 400 to 500 inhabitants.

La Purísima Valley varies from one-fourth of a mile to a mile in width, and is bordered by precipitous walls 500 to 1,000 feet high, with a lava cap on the mesas extending away on both sides. The

rocky walls are eroded into many curious forms, which add much to the picturesque interest of the surroundings. The largest stream in central Baja California rises from springs near the head of this valley and flows down its course, irrigating many small fields in which are grown numerous date palms, orange, and other trees, mission grapes, bananas, sugarcane, and corn. One of the main industries is that of making raisins from mission grapes, which are packed on burros to San Gregorio Landing on the Pacific coast, just south of the mouth of Purísima Canyon, and shipped in small sailing vessels to the mainland of México. A few miles below the town the canyon opens out on a broad coastal plain, where there was said to be much fertile land. An American company prospecting for oil some years before our visit was said to have sunk a well in the lower end of the valley, and we were informed that it has been flowing good water ever since. This indicates the possibility of obtaining water for irrigation on some of the coastal plains in this region. Owing to the light rainfall, however, the supply would probably be rather limited.

The rainstorm continued 2 days and ended in a dense fog which filled the valley. The morning of November 4 the fog had cleared away and after partly drying our outfit we continued our journey.

**La Purísima to Comondú** (see Comondú).

**Llano de Yrais** (=Rancho La Cruz) (50 feet):

*December 11-13, 1905.*—The Llano de Yrais is an open plain at about 50 feet altitude, a section of the Magdalena Plain, on the western side of the peninsula, east of Magdalena Bay. On December 9 we resumed our journey on horseback and traveled about 16 miles southeasterly from Matancita, across the slightly rolling coastal plain to a dry camp in the cactus forest. The sky was heavily clouded and we put up our tent between two giant cactuses, so we were sheltered from the rain that began during the latter part of the night. December 10 we broke camp in the rain and continued our journey in a more southerly course. A cold southeast wind drove the rain with such force that we were quickly wet through and thoroughly chilled, so we were glad to reach shelter at Servatillo ranch, 7 miles from camp. This was one of the Chartered Company's cattle ranches and consisted of two small adobe houses and a corral by a well on the plain. It rained heavily all day and most of the following night, but cleared on the morning of December 11. We then traveled about 15 miles southeasterly over a section of the plain known as the Llano de Yrais, to La Cruz, another small cattle ranch belonging to the company and occupied by a Mexican family.

The rain of the last 36 hours had flooded the coastal plain so that all depressions, including the trail, were full of water, and torrential streams ran in all the ordinarily dry channels.

La Cruz ranch is located on the nearly flat plain only a few miles immediately inland from Magdalena Bay. A belt of sand dunes along the east shore of the bay was in plain view along this part of the route, while far to the east the broad plain is limited by a high plateau sloping up to the crest of the southern end of the Sierra de la Giganta, which fronts precipitously on the Gulf coast. On December 13 we continued in a southeasterly course over the plain. About 3 miles after leaving La Cruz we came out of the cactus forest into an irregular-shaped open prairie, about 10 miles long in an easterly and westerly direction and 3 to 4 miles broad, with its western end near the sand dunes on the east shore of Magdalena Bay. This is the Llano de Yrais proper, although the name is used in a general way to cover adjoining parts of the plain as well. This open prairie appears to be a kind of shallow, nearly flat sink and was largely under water at the time we crossed it. The preceding day I had located burrows and set several traps for the long-eared desert fox inhabiting the llano, and favoring soft, slightly elevated spots among the prostrate trunks of the extraordinary creeping cactus (*Machaerocereus eruca*). The traps taken up in passing were found to contain several of these graceful creatures, which later proved to represent a previously unknown race, *Vulpes macrotis devia*.

Formerly many antelope lived on these plains but according to local information had become extinct south of the Vizcaíno Desert.

Many low places along this part of the trail were covered with broad sheets of shallow water, in which giant cactuses and other desert plants were standing, thus giving a grotesque appearance to the scenery. Late in the afternoon we entered more rising and slightly hilly country, over which small fragments of volcanic stone were scattered. About 26 miles from La Cruz we came to the first definite dry wash or creek bed since leaving Matancita. The trail crosses this wash at a point where a small clear stream of excellent water rises and flows a short distance from the bottom. Here, at an altitude of about 100 feet, is located El Sauz, a small cattle ranch, where we camped.

#### Magdalena Island (20 to 50 feet):

November 22-27, December 1-5, 1905.—Magdalena Island, the full name of which is Isla de Santa Magdalena, is the long coastal island, enclosing the northern part of Magdalena Bay of Bahía de la Magda-

lena. On November 20 we left our pack outfit at Matancita and accompanied W. J. Heney in his buckboard 10 miles west to Soledad Landing, on the lagoon leading to Magdalena Bay, where we boarded the sloop *Catarina*, belonging to the Chartered Company of Baja California. This lagoon is a riverlike channel a quarter of a mile to 2 miles wide, which extends along shore about 60 miles north from Magdalena Bay. It is bordered on both sides by a belt of mangroves and separated from the sea by a low strip of sand, which forms the northern end of Magdalena Island.

The afternoon of November 22 we arrived at the settlement of Magdalena Bay, 50 miles south of Soledad Landing. This small village, on the eastern or inland side of the mountains, near the south end of Magdalena Island, faces the bay 2 or 3 miles northwest from its entrance. It consisted mainly of a large, well-built 2-story residence, with stores and warehouses of the company and a number of smaller houses occupied by the employees, and by Mexican customs officials. During the continuance of the orchilla industry this place had a much larger population. At the time of our visit the main export was a monthly shipment of sea turtles to San Francisco on the Pacific Coast Steamship Company's boat, which called here regularly. The south end of Magdalena Island forms a narrow, rocky ridge, 10 or 12 miles long rising abruptly from the sea to about 1,250 feet at its highest point, and presenting a bold and rocky head at the entrance to the bay.

Magdalena Bay is about 15 miles across and is almost completely landlocked, with a deep entrance a little more than 3 miles wide between cliffs at the southern end of Magdalena and the northern end of Margarita Islands respectively. Owing to the broad expanse of comparatively deep water and safe anchorage it forms the finest harbor along the Pacific coast of México. For years it was the favorite winter practice resort for the American Navy. About the middle of the last century the bay was a favorite resort for the whaling fleets operating on the coast, and later, with the island, became the headquarters of the orchilla industry.

The vegetation of Magdalena Island consists mainly of some of the desert species which grow on the adjacent Magdalena Plain, but the giant cactus and some other prominent species of the plain appeared to be absent. On sheltered slopes and benches north of the village near the northern end of the high rocky ridge there is a vigorous growth of desert vegetation, including among numerous others such common genera as *Abutilon*, *Fouquieria*, *Jatropha*, *Pedilanthus*, *Elaphrium*, *Wilcoxia*, *Opuntia*, and *Lemaireocereus*.

On some of the lower, more sandy parts of the island the chiri-nola or creeping cactus (*Machaerocereus eruca*) was noted. We first saw this remarkable cactus on the coastal plain near Santo Domingo, about 30 miles north of Matancita. The stems grow 1 to 3 meters in length and are nearly prostrate, and from this habit and their long whitish recurved spines have aptly been likened to huge caterpillars. The growing ends of the branches stand up from the ground, but progressive growth leaves the main body lying prostrate. The stems become rooted along the lower sides and gradually die behind, resulting in a slow progression of the living portion along the ground. Multiplication of individuals frequently results from the decay of connecting parts. In some places disconnected plants, forming a hollow circle, can be traced by the remains of dead trunks to a common center. The plants show a preference for soft parts of the coastal plain and grow usually in groups, often topping a slight eminence formed of wind-drifted material. These cactuses, serving as a sand binder and preventing erosion, tend to favor further accumulations.

Though the climate of Magdalena Island is somewhat modified by the cool breezes of the Pacific, yet it is so far south that it receives much less fog than the coast farther north, and being extremely dry, arid tropical conditions prevail. Magdalena Island is in fact near the extreme southern limit of the influence of the oceanic current that so profoundly affects the climate of the coast region from Alaska southward.

**Margarita Island** (=Isla Santa Margarita) (20 feet):

*November 27 to December 1, 1905.*—Margarita Island, known in full as Isla Santa Margarita, is the coastal island enclosing the southern part of Magdalena Bay, or Bahía de la Magdalena, and the more southern bay, the Bahía de Almejas. On November 27 W. J. Heney, manager of the Chartered Company of Baja California, took us in his sloop across the bay from the settlement on Magdalena Island to Margarita Island. We landed on the shore of Almejas Bay, on the east side of the island, at the site of an old canning establishment, where an unsuccessful attempt was once made to can sea turtles for export. A small frame house on the beach was all that remained to mark the spot. Immediately back of the landing the shore is bordered with some small salt lagoons full of mangroves, in which a considerable colony of man-o'-war birds have their nests. The young of the year, though fully grown and on the wing, were still spending much time about the nests, and hundreds of young and adults roosted there at night.

The northwestern end of Santa Margarita Island presents a bold headland facing the southern end of Magdalena Island across a channel a little more than 3 miles broad, forming the entrance to Magdalena Bay. From this point Santa Margarita extends nearly 25 miles southeasterly nearly parallel to the trend of the mainland coast and varies from 2 to 5 miles in width. The northern and southern sections of the island are mountainous in character, the barren rocky slopes rising to peaks varying from 1,000 to 1,800 feet high. The shore line is almost entirely rocky and precipitous, except in the middle, where a low pass more than a mile broad in its narrowest place and about 100 feet above the sea separates the island into two nearly equal islandlike parts. This pass broadens to a low plain extending more than 5 miles along the southwestern side of the island between the mountain ridges and the shore. The plain is bordered along the beach by a belt of sand dunes. On the flats just inside the dunes, fresh water lies close to the surface. We found there a deserted ranch with a few date palm trees nearly buried in the encroaching sand dunes.

Almejas Bay, east of Santa Margarita Island, is nearly enclosed on the south by the long, low, narrow Cresciente Island, and it communicates on the north with Magdalena Bay through a narrow channel in which lies Mangrove Island. This is a low, sandy island, overgrown with mangroves and forming a great nesting place for cormorants and other waterfowl. Near the head of Magdalena Bay is another low, flat, and bare sandy island, only a little above tide level, which is a resort for enormous numbers of cormorants, pelicans, and gulls. Owing to the number of sea fowl which make this a roosting place, and which formerly bred there, this is a guano island.

Although climatic conditions and the vegetation are about the same as on the adjacent coast of the peninsula, Santa Margarita is somewhat more isolated than Santa Magdalena Island, and contains several forms of small mammals peculiar to it.

The hills and mountain slopes of Santa Margarita are extremely barren. The low area in the middle contains a more abundant vegetation, mainly the same species observed on Magdalena Island. Among the most notable species seen were the bald giant cactus (*Pachycereus calvus*), the pitahaya agria and pitahaya dulce (*Machaerocereus gummosus* and *Lemaireocereus thurberi*), the palo de Adán (*Fouquieria peninsularis*), *Jatropha canescens*, and *Pedilanthus macrocarpus*.

We remained on Santa Margarita until December 1, when we returned to Magdalena Island. Our accumulated specimens were

shipped on the steamer for San Francisco, and on December 5 we started with Mr. Heney on our return, by sailing vessel, to Matancita ranch, but calms delayed our arrival there until December 8.

**Matancita** (or Soledad) (50 to 100 feet):

*November 15-20, December 8-9, 1905.*—Matancita, or Soledad, was the headquarters cattle ranch of the Chartered Company of Baja California, about 10 miles inland from the coast lagoon on the Arroyo de la Soledad, a short distance north of latitude 25° N. On November 15 we left our dry camp south of Rancho Santo Domingo and traveled southerly over the coastal plain parallel to the shore, but some miles inland, and 20 miles from camp reached Matancita. We were hospitably received by W. J. Heney, the local manager of the Chartered Company, which held a concession covering a belt about 16 miles wide all along this coast from a little south of Magdalena Bay north to beyond Scammon Lagoon. Formerly this ranch was headquarters for the orchilla-gathering business, in which the original company—Flores, Hale & Co.—made large profits. The orchilla is a lichen (*Roccella*) superficially resembling Spanish moss (*Tillandsia*) in pendent habit, which grows abundantly on the branches of the palo de Adán (*Fouquieria peninsularis*) and other shrubs and trees within the fog belt along this part of the Pacific coast and was formerly used extensively in the production of dyes. The plant was, therefore, the basis of a local industry that was destroyed through the discovery of chemically produced dyes. The company in control at the time of our visit had cattle ranging from Matancita ranch south to opposite Magdalena Bay, from which visiting warships in the bay and other vessels were supplied with fresh beef.

**Miraflores to San Bernardo** (see El Sauz, Sierra de la Laguna).

**Mulegé** (40 feet):

*October 28-29, 1905.*—Mulegé is a town on the Gulf coast near the mouth of Bahía Concepción, a short distance south of latitude 27° N. From San Bruno on October 27 the trail led southerly 8 miles inland across the coast plain to a water hole at the abandoned ranch of San Marcos, a few miles from the Gulf. Seven miles beyond this place we came to a shallow well at another deserted ranch called Las Delicias, where we camped. The coastal plain here, as well as the top of the mesa along the coast near Santa Rosalía, is extremely arid, but with a plentiful growth of desert shrubs which, with the exception of *Covillea*, were mainly leafless. Near Las

Delicias we found a belt of green a few hundred yards wide, like a broad ribbon across the brown plain, showing where a heavy shower had passed over the country some weeks before and wet the ground sufficiently to bring up the grass and other herbage. Several miles west of our route the gently sloping coast plain ends abruptly at the east base of the precipitous Santa Lucía Mountains.

On October 28 the trail continued southerly for 10 miles across the coast plain, which was heavily overgrown with giant cactuses, and then southeasterly 5 miles through a range of hills 300 to 500 feet high to Mulegé. This place is situated between low hills in the valley, a few hundred yards wide, of the Arroyo del Potrero, at the head of a narrow lagoon, extending more than a mile inland from the lower end of Concepción Bay. In 1705 a mission was established there, and the town, with about 750 inhabitants at the time of our visit, was one of the most beautiful places in the peninsula. Some large springs in the creek bed just above the town yield water for irrigation, and the place is embowered among groves of date palms, bananas, oranges, lemons, pomegranates, and fig trees, with fields of sugarcane and other crops interspersed. The old mission church stands on a hill by the town overlooking the valley, and on the long peninsula forming the eastern side of Concepción Bay rises a barren rugged range of low mountains.

As at San Ignacio at this season the dates in the palm groves and other fruits here attract many gray foxes (*Urocyon*), cacomistles (*Bassariscus*), striped skunks, and raccoons, which seek the shelter of the rocky walls of the valley by day and search the orchards for fallen fruit at night. We trapped three foxes in the small palm grove at the upper end of Mulegé, the night we camped there. These were caught soon after dark and, attracting our attention by husky barks and yelps, were taken from the traps by the light of a candle.

**Onyx** (see Agua Dulce).

**Pescadero** (50 feet):

*December 26-27, 1905.*—Pescadero is a small group of huts at 50 feet altitude, a couple of miles from the Pacific about 10 miles south of Todos Santos, in the cape region of the peninsula. December 26 we passed Todos Santos and continued southward to Pescadero. Here the houses are on two low hills overlooking some small sugarcane fields in the flat bottom between the hills and the sea.

**Pozo Altamirano** (400 feet):

*October 2-3, 1905.*—Pozo Altamirano was a small cattle ranch at 400 feet altitude about 30 miles south of Calmallí. On October 1 we

left Calmallí and followed a continuation of the wagon road about 5 miles southerly through the low mountains to the still smaller mining camp of Campo Alemán, where another mine was being worked on a small scale. At both camps water was obtained from wells in the bottoms of gulches. The hills from Calmallí to beyond Campo Alemán contain much slate with some quartz and show many signs of former mining. Two or three miles beyond Campo Alemán the road led down from the hills to the low northeastern extension of the Vizcaíno Desert plain, which reaches to the base of the mountains a few miles east of our route, and west to the coast about Scammon Lagoon. We made a dry camp on the plain, at an altitude of 500 feet about 14 miles south of Calmallí.

On October 2, about 16 miles southeasterly across the plain, we came to Pozo Altamirano, on the bank of an arroyo where a shallow well in the granitic sand of the wash gave a good supply of fine water. A few miles northeasterly across the plain from this point the light-colored granite mountains, which are practically continuous from the California border to this point, end abruptly and are replaced along the backbone of the peninsula southward to La Paz by dark, lava-covered mountains and plateaus. The northern foothills of these lava-covered mountains begin about a mile south of Pozo Altamirano.

**Pozo Luciano**—northwest slope San Pedro Mártir Mountains (3,600 feet):

*July 4-5, 1905.*—Pozo Luciano is a spring near the northern end of the San Pedro Mártir Mountains, on the slope facing Trinidad Valley. On July 4 I left Campbell's Ranch in Trinidad Valley with the pack outfit, while Nelson made a trip to Ensenada, and rode 15 miles southeast across country, climbing gradually out of the valley to Pozo Luciano, at 3,600 feet altitude. Two deserted houses were evidence of former occupation of the place.

**Pozo San Agustín**—20 miles east of San Fernando (1,800 feet):

*September 6-7, 1905.*—September 6 we left San Fernando and followed the wagon road easterly up the valley, which soon broadens to an open plain called the Llano de Buenos Aires or Llano de San Agustín. After traveling about 20 miles we reached Pozo San Agustín, at an altitude of 1,800 feet, where the wagon road we followed joins the main wagon road over which onyx was hauled from the mine to Santa Catarina Landing on the Pacific coast for shipment to California. A well had been dug at San Agustín to a depth of about 50 feet beside a sandy dry wash in the open plain and contained a good supply of water.

The Llano de San Agustín is about 28 miles across in the easterly direction from near San Fernando to the onyx mines near Onyx at the edge of the foothills on its eastern border, and is more than 40 miles long from north of San Agustín southeast to Arroyo Cataviña. The plain is a part of the great central plateau lying at an altitude of from 1,800 to 2,500 feet along the middle of the peninsula southeast of the southern end of the San Pedro Mártir Mountains. On the eastern side nearly bare, abruptly rising desert mountains form a wall along the backbone of the peninsula parallel to the Gulf shore. The surface, sloping gradually toward the west, is more or less undulating, with small scattered hills and outcroppings of bare granite, often in the form of huge rounded boulders. The vegetation is a wonderful combination of desert species, among the most conspicuous of which are *Idria columnaris*, *Pachycormus discolor*, *Fouquieria splendens*, *Larrea tridentata*, *Pachycereus pringlei*, and several cactuses, yuccas, and agaves. One night's trapping at Pozo San Agustín revealed the presence of small desert mammals in large numbers.

**Rancho San Antonio**—west base of San Pedro Mártir Mountains  
(2,000 feet):

*July 28 to August 1, 1905.*—July 28 we left Rancho Santo Tomás and descended the west slope of the San Pedro Mártir Mountains by a well-worn trail. A few miles below the ranch we passed the ruins of the old San Pedro Mártir Mission on a sloping bench on the mountainside, where a small stream afforded water for irrigating some small fields. All that remained of the mission was the bases of adobe walls where the buildings stood, a little graveyard near, and the low banks of old irrigating ditches. About 16 miles below Santo Tomás we came to the bottom of the main slope of the mountain, where the streamlet we left above had increased to a swiftly flowing creek bordered by cottonwoods. From this point the trail turned northwesterly and after crossing several foothill ridges brought us to Rancho San Antonio, at an altitude of 2,000 feet on a main fork of the Río Santo Domingo, where it emerges from its canyon in the west side of the main range. The location of the ranch is in a narrow valley, with an outlying ridge about 3,400 feet high to the west and southwest. This latter mountain cuts off much of the moisture carried inland by coast winds and results in giving this valley a hot and more arid climate than is usual west of the mountains. The ranch consisted of two small houses occupied by a Mexican family. The stream at San Antonio at the time of our visit was 10 or 15 yards

across and averaged less than 1 foot deep. Willows, cottonwoods, and oaks fringe the watercourse here.

A species of rainbow trout which sometimes affords good fishing inhabits the stream from the Rancho San Antonio far up into the canyon. Our specimens proved this to be an undescribed species, which was named *Salmo nelsoni* by B. W. Evermann. The Río Santo Domingo evidently receives a large share of the drainage of the Sierra San Pedro Mártir. It is said to be the only stream containing trout in the peninsula, and is the only stream in Baja California which is reputed to maintain its flow to the sea along its entire course throughout the year. The people at San Antonio ranch reported that trout were much less numerous than usual in 1905, owing to tremendous floods which had swept down the canyon the year before carrying many boulders and killing many trout.

**Rancho Santo Domingo (50 feet):**

*November 14, 1905.*—From Pozo Grande, near San Jorge, we continued southerly on November 14 over the coast plain and about 8 miles from camp passed the deserted ranch of Santo Domingo on the bank of a deep dry wash, where some well-built adobe houses were going to ruin. Here we were able to water our stock, and a few specimens were collected. Just south of Santo Domingo on a large flat extending along the course of a dry wash we passed through a fine stand of large mesquite trees. In the afternoon we crossed a broad belt of country in which there was a good fresh growth of grasses and herbaceous vegetation 4 to 6 inches high, most of which was ripening its seeds. Some local ranchmen told us that a heavy rain fell here on August 7, which resulted in this growth. Just before nightfall we suddenly passed the border of this belt of green into the brown arid desert again and, in order to give our stock the advantage of the fine pasturage, were obliged to turn back and reenter the green belt to camp.

**Rancho Santo Tomás—San Pedro Mártir Mountains (6,000 feet):**

*July 24-28, 1905.*—Rancho Santo Tomás is situated at 6,000 feet altitude, on the west slope near the southern end of the San Pedro Mártir Mountains. The place was reached from Santa Rosa, as described under that locality. As the two localities are in close proximity and were worked together there is overlapping of dates. Transition Zone.

**Rancho Viejo (3,500 feet):**

*June 12-16, 1905.*—June 12 we left camp at the water hole at La Posa, 6 miles east of Alamo, and continued easterly about 10

miles, crossing numerous low, rounded ridges of granite boulders, to a small deserted house by a spring known as Rancho Viejo or Los Batequis, where we camped on a knoll among the pinyons and junipers. Across the plain from Rancho Viejo, close to the base of the Sierra Juárez, we saw smoke rising daily from the fires of Indians living at the old Santa Catarina Mission, but they did not come near us, and we had few contacts with Indians, which have become reduced to mere remnants of the mission groups of former times.

A band of wild horses was ranging in the vicinity of Rancho Viejo, and gave us much trouble by coming in at night and leading off our stock. A single night among the wild horses aroused such feral instincts in our well-broken stock that only their hobbles prevented their leaving us forever. When finally rounded up in the morning they gazed at us wild-eyed, as if they had never seen us before, and snorted and trembled when first touched. Once bridled and saddled, however, their usual placid demeanor was resumed, and the plodding gait showed the force of habit over instinct.

#### Rosario (200 feet):

*September 1-2, 1905.*—Rosario is a village at about 200 feet altitude on the Río del Rosario, some 5 miles above its mouth. On September 1 we traveled southward from Socorro, the coast plain giving way to rolling hill country, cut by many deep dry washes leading down to the sea from the interior, some of them broad enough to carry small rivers at flood time. About 10 miles south of Socorro the hills became so rough and broken near the coast that the road turned up a broad canyon and after crossing gently rolling hills and mesas for about 16 miles we reached Rosario. The village, containing about 30 houses, was an unusually prosperous place for this region, owing to its situation in a fertile little valley with a small permanent stream for irrigation of fields in the level river bottom. Corn, wheat, barley, beans, figs, peaches, almonds, and a few other crops were produced. At the time of our visit water rose in the bed of the Rosario a short distance above the houses, and this river is one of the very few streams of the peninsula said to reach the sea nearly throughout the year. The road ended at Rosario.

#### Rosarito (350 feet):

*September 24-25, 1905.*—An abandoned settlement at 350 feet altitude near Bahía de Santa Rosalía, near the Pacific coast in latitude 28°30' N. On September 24 we left San Andrés and continued our journey along the coast trail in an east-of-south course a short

distance inland, crossing low ranges of coast hills cut at frequent intervals by deep, rocky, dry watercourses, all nearly parallel and leading to the sea. About 18 miles from San Andrés we came to a broad, flat-bottomed valley, which narrows abruptly between hills at the lower end, bringing underground water to the surface in wet meadows and draining into Santa Rosalía Bay through a short canyon, thus almost duplicating the situation at San Andrés Valley. This is Rosarito Valley, in the lower end of which, during rainy years, there are large swampy flats, but we found water only in a single small hole. We camped on the right-hand side near the lower end of the valley, by the ruins of several large buildings about which parts of machinery were scattered. Here, years before, unsuccessful efforts had been made to extract the fiber from a large species of agave, common on the hills of this section. The hills are covered with a scattered growth of agaves, yuccas, palo de Adán (*Fouquieria peninsularis*), cirio (*Idria columnaris*), copalquín or elephantwood (*Pachycormus discolor*), creosotebush (*Larrea tridentata*), and several species of cactus. Since leaving the Sierra San Pedro Mártir at the end of July we had had unbroken sunshine all along the way, but en route here local showers from large cumulus clouds were seen to the east and south.

#### San Andrés (200 feet):

September 19-24, 1905.—San Andrés, at about 200 feet altitude, was a deserted ranch in the lower end of San Andrés Valley near the Pacific coast, a few miles inland from the Bahía de Playa María. From Yubay the trail continues southward along the middle of the peninsula by way of the old mission of San Borjas, and we had been informed that it was 50 miles to the nearest water in that direction. To attempt to travel this distance without water, with our worn-out stock, would have been extremely hazardous, and we decided to leave the trail here and strike directly across country to San Andrés, where it was reported that we could find water nearer than on the regular route. In accordance with the timing procedure we had found advantageous in hazardous desert travel we left Yubay early in the afternoon, instead of the morning, of September 19, and traveled until after dark. Our course was southwesterly down the sloping and slightly rolling plain, which is cut into mesa sections by a series of parallel dry canyons 50 to 75 feet deep. All down the slope from Yubay we traversed a jungle of giant and other cactuses, yuccas, agaves, copal trees (*Bursera*), paloverde, copalquín, cirio, ocotillo, and many other desert species. In the bottom of the valley

this growth became extraordinarily vigorous and formed a veritable forest, which over considerable areas was absolutely impenetrable. Fortunately these areas of dense growth were irregular in outline and varied by narrow open spaces, through which we were able with much difficulty to make our way. We were repeatedly forced to turn back and try a new route. Just at dark we crossed the broad dry wash in the bottom of the valley and came into a well-marked and recently traveled trail leading down the west side of the valley—the west coast trail. We were much pleased to escape from the untrodden cactus forest, and turning southward continued until it became too dark to distinguish the trail. We then made a dry camp, 20 miles from Yubay, at an altitude of about 1,000 feet, in a small open place beside the trail, the light from a group of dry yuccas we set on fire making a fine illumination for half an hour.

The darkness became less intense after midnight, and in order to make the journey as easy as possible for the stock by traveling in the cool early morning hours, we broke camp at 2 a. m. and continued down the trail. After traveling about 10 miles we reached Punta Prieta, a deserted cattle ranch. This place had been occupied within a few weeks, and we were glad to find a well about 40 feet deep with a bucket and rope, so we were able to water our stock. From Punta Prieta we continued about 10 miles farther down the trail to San Andrés Ranch, at the extreme lower end of the valley. Here the hills on both sides shut in and reduce the valley to a narrow point from which a short canyon leads through the coast hills to the shore of the Bahía de Playa María. About a mile of the lower end of the valley had been extensively worked over, and the ruins of well-built houses, machinery, good wells, irrigation ditches, and old fields, showed that a large amount of money had been spent here. We learned later that an English corporation operated here in 1887 with the object of making paper from the datilillo or tree yucca (*Yucca valida*) through veritable forests of which we had made our way across from Yubay. The project had evidently been a failure, and from the ruined condition of the improvements it was plain the place had been abandoned for many years.

At the extreme lower end of the valley water lies near enough to the surface to make some wet meadows and to fill a small pond. The green flats and large mesquites gave a welcome change from the desert country we had traversed, and forage conditions were more favorable for our stock. An ocotillo we had not seen before, a species with many finely divided branches (*Fouquieria peninsularis*), grew in the

valley near San Andrés, along with *Fouquieria splendens*, which it displaced not far to the southward. Harris's hawk, Scott's oriole, and the black-chinned sparrow (*Spizella atrogularis*) were common here. A dozen or more Harris's hawks, a species that had not been seen since we left Ensenada, gathered every evening at sunset to roost in the tall cirios (*Idria columnaris*) near the ranch.

**San Angel (100 feet):**

*October 10-11, 14-16, 1905.*—San Angel is a very small oasis on the eastern side of the Vizcaíno Desert about 25 miles southwest of San Ignacio. On October 10 I left San Ignacio with one of our camp men and a local guide on a side trip across the Vizcaíno Desert, while Nelson remained working in the vicinity of the town. Our route for the first few miles was down along the Arroyo de San Ignacio, through the lava mesa to the edge of the open desert and then across a low-lying plain covered largely with loose sand to San Angel, where water rises to near the surface over a small area in the drainage way of the Arroyo de San Angel. A shallow hole here afforded good water. A little feed, largely salt grass, was available for our saddle animals, and a few scattered date palms grew in the vicinity. We continued our journey westward October 11 and returned to San Angel on October 14. A small colony of pocket gophers was discovered near the water, and on October 15 traps were set for these animals. About 5 miles to the east sets were made for desert rodents to be picked up next day en route back to San Ignacio.

**Santa Anita (200 feet):**

*January 10-19, 1906.*—Santa Anita was a ranch at about 200 feet altitude, 8 miles north of San José del Cabo. January 10 we left San José del Cabo and traveled about 8 miles northerly up the west side of the valley to Santa Anita, a ranch where we were cordially welcomed by the proprietor, F. Pazjk. This place had been visited by various naturalists, including Dane Coolidge, Loye Miller, and J. E. McLellan, and is the type locality for various species of mammals.

San José Valley is bounded on both sides by hills and mountains and varies from a mile in width near San José to several miles at Santa Anita. The west side of the valley is walled in by foothills of the high range of the Sierra de la Victoria, and west of Santa Anita the peak of San Lázaro, in this range, rises several thousand feet and forms a bold and striking landmark. To the east the valley is limited by the gentler slopes of the Sierra de la Trinidad.

A marshy area near the San José River is inhabited by the shrew *Notiosorex craxfordi*, apparently in unusual numbers as more specimens have been taken there than anywhere else. Giant cactuses and other desert plants with a strong tropical mixture form a vigorous and abundant plant growth all along the bottom of the valley, while groups of tall fan palms at Santa Anita tower above all the other vegetation. The top of a long mesa to the north, between Santa Anita and Miraflores, is more arid than the valley bottom, and many giant cactuses and palo de Adán (*Fouquieria peninsularis*) give a resemblance to the vegetation of parts of southern Arizona. The slopes of all the mountains within sight are bare and rocky.

### San Bruno (25 feet):

October 25-27, 1905.—San Bruno was a small settlement on the Gulf coast about 16 miles south of Santa Rosalía and nearly opposite Isla San Marcos. On October 19 the trail continued easterly from our camp at La Cueva, 21 miles east of San Ignacio. For about 5 miles it led up the sloping mesa and then into the heart of the rugged Santa Lucía Mountains, which extend in a northerly and southerly direction. This is a narrow sharp-ridged range, apparently almost wholly made up of beds of black lava, many of which rest in about their original form. In the midst of the ragged peaks our trail forked, and we turned northerly on the one to the left. This led to a small ranch in the bottom of a canyon, where we learned that we had chosen the longer trail to Santa Rosalía by way of Cerro Verde instead of the more direct one to the right, which leads by the mining camp of Santa Aguada. From the ranch the trail led up a long, narrow, and extremely rough and rocky canyon to a knife-blade divide at an altitude of 2,000 feet, from which we had a fine view across the country we had traversed and ahead over lower country to the Gulf. Descending the abrupt eastern slope to the bottom of a canyon at an altitude of about 800 feet we camped about 20 miles from La Cueva under the shelter of some huge rocks just as it began to rain heavily.

On October 20 the trail continued easterly from our camp across a rolling mesa formed of deep beds of coarse rubble conglomerate traversed by deep, narrow, and sharply cut canyons leading from the Santa Lucía Mountains to the Gulf. After passing through about 15 miles of this country the trail entered a narrow canyon, along which for 3 miles were tramways and other signs of mining. At the mouth of the canyon on the shore of the Gulf we came to Santa Rosalía, the largest and most prosperous town in Baja California. Santa

Rosalía then had a population of 7,000 people and was one of the larger copper-mining camps of the world. It was the property of a French company which owned 1,000,000 acres of the surrounding country. At this place a horse that became exhausted on the trail was traded for another one, which was able to complete the journey.

We left Santa Rosalía on October 25 and followed a trail 10 miles southeasterly across the stony mesas and intersecting canyons bordering the shore of the Gulf, the mesas having an altitude of 100 feet or more and ending precipitously at the shore. The mesa country ended abruptly on the south, and we descended to an open coast plain near the little fishing village of San Lucas, on the shore of a salt lagoon at the head of a small bay. The first mangroves seen during the journey were growing in this lagoon. They were 4 or 5 feet high and apparently the northern representatives of the species on the east coast of the peninsula. Following the shore of the bay southeasterly for about 6 miles we reached another small group of houses called San Bruno. The plain all about this bay appears to be underlaid at a shallow depth with fresh water. At San Bruno there was a little cultivated land including a small vineyard and olive orchard planted by an English company about 8 years before. These plantings were unsuccessful and were being abandoned at the time of our visit. A number of little patches of sugarcane and other crops were irrigated by means of shallow wells, from which the water was raised by long sweeps. We remained one day at San Bruno and on October 27 continued the journey.

### San Fernando (1,500 feet):

*September 3-6, 1905.*—San Fernando is the village site, at about 1,500 feet altitude, of an early mission on the desert about 55 miles in a direct line southeast of San Quintín. On September 2 the trail from Rosario led in a general easterly course up a long, dry arroyo among low, barren, rolling hills, and then across hilly plateau country, which gradually rises until, about 25 miles inland, we reached a large shelter cave in the rocks on the side of a canyon where we camped. This is a regular camping place known as Las Cuevas and has an altitude of about 1,500 feet. Close by in some deep pot holes in the bottom of the dry rocky canyon are large tanks, or tinajas, of good water. A few miles from Rosario the barren clay hills change to a more rocky formation with more abundant desert vegetation. About 8 miles out on the trail we saw the first giant cactuses (*Pachycercus pringlei*) and beyond on the top of a mesa at about 2,000 feet altitude, there suddenly appeared a fine stand of the singular, polelike

trees (*Idria columnaris*), called cirio by the Mexicans. The latter species, especially, was to feature the landscape for hundreds of miles as we advanced southward through the central section of the peninsula.

On September 3 the trail led easterly from Las Cuevas through an elevated rolling and rocky plain, broken by low rounded hills and isolated mountains with occasional small valleys. All along the trail we were amid a plentiful growth of the strange cirio, giant cactus, ocotillo (*Fouquieria splendens*), and other desert plants, in striking contrast to the scanty vegetation on the barren hills a few miles nearer the coast. Fifteen miles easterly from Las Cuevas we came to San Fernando, now marked by the ruined walls of the old mission buildings, some old irrigating ditches, and a little cluster of adobe houses sheltering two or three Mexican families.

San Fernando is situated at an altitude of about 1,500 feet on the side of a narrow valley marking the course of the Río San Fernando. The bed of the stream is dry throughout most of its course except at flood times, but at San Fernando some large springs furnish permanent water for irrigating small fields. Long-abandoned canals, built by the missionaries, show that in their day several hundred acres of land must have been irrigated. More than a century ago this was a populous and well-cultivated little valley where cotton and many other crops were grown, but we found it had returned to an almost primitive condition, only a few acres being under tillage. The size and length of the ditches indicated that water must formerly have been more abundant than at the time of our visit.

#### San Francisquito (1,400 feet):

*September 10-13, 1905.*—On September 10 we continued from Jaraguáy about 9 miles southeasterly across the plateau country to a curious, high, isolated hill of granite boulders measuring 2 to 10 feet in diameter, which stands in an oval, nearly flat-bottomed basin about 2 miles in diameter. This hill, well-named Cerro Pedregoso, is a prominent landmark on this trail. Another trail, apparently the main-traveled route, came in from the west and joined ours close to Cerro Pedregoso. This is the direct trail from San Fernando by way of some small mining camps and continues down the middle of the peninsula. About 4 miles beyond Cerro Pedregoso, along the main trail, which leads through a series of basinlike flats, we stopped at midday under a group of mesquites. At this point a dim trail branched off to the left, and we followed it for about 8 miles over gently rolling hills to the crest of the slope forming the peninsular

divide at an elevation of 2,800 feet. From the top of the divide an abrupt descent on the east leads to a lower plain extending to the shore of the Gulf, which was in plain view. Owing to a change in the geological formation between Jaraguá and the crest of this ridge the abundant vegetation noted along our previous route gave way to scanty herbage and a few shrubs.

A good trail led from the divide down the east slope to a small, strongly mineralized stream flowing through a series of pools in the smooth rock bottom of a broad canyon. Then the canyon narrowed and, after leaving it and crossing some low hills, we camped on the east side of San Francisquito wash. This camp was about 8 miles from the top of the divide and at an altitude of about 1,400 feet. Here a well and some old arrastras, and many other signs marked the site of the long-deserted placer mining camp of San Francisquito. An old wagon road led away from the arrastras toward the Gulf. Conditions were extremely arid at San Francisquito and the vegetation much like that about San Felipe Bay. Small mammals, however, were very abundant. Camp was made late in the evening, and traps set by moonlight contained more than 20 specimens, representing 5 species, in the morning.

### San Ignacio (500 feet) :

*October 6-18, 1905.*—San Ignacio is an important town in latitude about  $27^{\circ}20'$  N. in the interior of the peninsula. On October 6 the trail led southeasterly from our dry camp at La Natividad, 5 miles south of Aguaje de San Esteban, about 20 miles to San Ignacio. This part of the route crossed a lower and more undulating part of the plateau and was even rockier than the section we had passed, being characterized by numerous extended beds of large angular fragments of lava, some a mile or so broad, over which the animals had to pick their way slowly and with great caution to avoid falling. Some of these lava beds were made up of rough fragments 1 to 3 feet in diameter, and it would have been impossible to cross them with animals but for the work done by the Indians under direction of the early Spanish missionaries in clearing the trail. These made trails are parts of the old Camino Real, or main road, which united some of the missions in early days. After covering about 12 miles of this exceedingly trying road we came to better traveling and 2 miles beyond reached a narrow tank more than 100 yards long full of water, called the Tinaja de San Juan, situated in the lava bottom of a small gulch. A wild fig tree grew on one side of the tank, and several coots (*Fulica*) were at home there despite the bare lava

borders of the water. Five miles beyond we rode out on the brow of the mesa overlooking the valley of San Ignacio and saw the village among the date palms a mile away on the opposite side. At this point a horse ridden by one of our camp men became too exhausted to go farther. Its saddle was placed on one of the pack mules and the animal was left to rest for a day before it was brought into camp. We continued up the valley and camped by a great spring just above the town. This is one of several springs rising in the flat bottom of the valley that supply the water used in irrigating the date palms and other cultivated crops. Below the springs are several ponds surrounded with tules and bushes.

San Ignacio Mission was established in 1728 and has been continuously occupied from that date. At the time of our visit the town contained about 800 inhabitants. Soon after 1730 three kinds of Arabian date palms were introduced, and at the time of our visit it was estimated that there were 50,000 to 60,000 trees in this valley. They stand singly and in irregular groups and form a small forest about the town and down the valley for several miles and render this one of the most beautiful oases in all the peninsula. About 50,000 pounds of dried dates were sent to Santa Rosalía on the Gulf coast each year. Ravens and Gila woodpeckers destroy the ripening dates by day and the cacomistle (*Bassariscus*) by night, thus doing considerable damage. Many gray foxes and striped skunks have their dens in the rocky walls of the canyon and come into the palm groves at night to pick up the fallen fruit. In addition to the date palms various field crops and fruits, including sugarcane, corn, beans, oranges, lemons, pomegranates, olives, figs, and grapes, are cultivated on a small scale.

The old mission church and, at the time of our visit, the adobe houses of the principal inhabitants were on the basal slope under the lava cliffs forming the south side of the valley, but most of the people lived in thatched huts scattered amid the date palms in the lowest part of the bottom among drainage channels where flood waters passed. Above the town the remains of a well-built earthen dike extended from the south side in a curve across more than half the width of the valley and then down on the north side. This was built by the Indians under the direction of the Spanish missionaries to turn flood waters out of their old channels and around the north side of town, thus protecting the fields and houses located in the original drainage way. The dike was 4 to 10 feet high with the convex curve up the valley and with the points where it crossed drainage channels

faced with stones. Long ago a heavy flood broke through the dike and drowned some of the people, since which time the survivors and their descendants, lacking the energetic direction of the missionaries, had never had sufficient energy to repair the break. Another flood was reported to have swept down the valley in the fall of 1911, washing away houses and drowning more than 20 people. We were informed that this locality sometimes suffers from prolonged droughts covering several successive years, during which the large springs continue to flow steadily but with somewhat lessened volume. The abundant water and attendant plant life at San Ignacio render it an exceptionally attractive place for birds, and a number of races ranging north from the cape region were common.

**San Ignacio—20 miles west (200 feet):**

*October 14-16, 1905.*—On October 15 I returned to San Angel from the Santa Clara Mountains, and traps were set on the desert about 5 miles to the eastward on the route to San Ignacio. On October 16 the traps were recovered, and I continued back to San Ignacio. Specimens taken at this point on the desert were labeled "20 miles west of San Ignacio."

**San Ignacio—20 miles east (750 feet):**

*October 18-19, 1905.*—We left San Ignacio on October 18 and ascended the very rocky course of the San Ignacio Arroyo easterly about 21 miles to La Cueva, a small unoccupied cattle ranch at an altitude of about 750 feet backed by a huge shelter cave in the rough lava of the northern wall of the canyon in which we camped. On the opposite side of the canyon is a fine rock tank of good water, and water comes to the surface at a few places in the creek bed. A few specimens collected near here were labeled "20 miles east of San Ignacio." Large groves of paloblanco (*Lysiloma candida*) stood here and there along the bottom of the canyon and a fine growth of large cactuses, tree yuccas, and several species of *Bursera* covered the bordering hills. The weather was cloudy with light showers in the afternoon and at night.

**San Jorge (50 feet):**

*November 11-14, 1905.*—San Jorge is a small settlement at the head of boat navigation in the long, narrow lagoon extending north along the Pacific coast from Magdalena Bay. From Comondú we resumed our way on November 10, following the wagon road about 16 miles southwesterly down the canyon. Below the mouth of the canyon we turned to the right from the wash for several miles to camp at a

small cattle ranch called El Batequi, where a shallow well furnished the only water available on that part of the plain. On November 11 we crossed the broad sandy wash where Comondú Arroyo spreads over the plain and, taking a more southerly course for 10 miles over the slightly undulating surface, came to a deserted ranch called Pozo Grande, where there was good water in a shallow hole in the sandy bed of an arroyo.

Pozo Grande is 3 miles inland from San Jorge. Specimens collected on the coast plain while camped at Pozo Grande were labeled "San Jorge." From this camp and from far up and down this coast plain the volcanic peak called Cerro de la Giganta, located on the volcanic plateau between Comondú and Loreto, stands up boldly as a striking landmark. Several showers had fallen during the past two nights, but on November 12 the sky cleared of threatening clouds for the first time since we left Mulegé, about two weeks before. It had rained at intervals throughout this time. These winter storms in the southern half of the peninsula are called equipatos, and sometimes heavy rains continue for two weeks and render the country so boggy that travel is impossible.

#### **San José (800 feet):**

*November 1, 1905.*—San José was a ranch at 800 feet altitude about 8 miles north of La Purisima Vieja. Specimens were obtained from that vicinity in passing through. Leaving our camp at Agua Grande on November 1, we traveled about 13 miles down the canyon and came to San José, one of the larger ranches, with some date palms and a small field of sugarcane. Five miles below San José was Rancho Hondo, which was occupied, and just below it a crossing of the canyon known as Paso Colorado, where we camped under a large mesquite tree. Water rises in the canyon just above Rancho Hondo and a small stream, bordered by bushes and willows, flows by Paso Colorado. During the afternoon clouds gathered and it began to rain. From Agua Grande to Rancho Hondo the canyon varies from one-fourth of a mile to a mile broad but widens below the last-named point and the walls become much lower, descending southward toward the Pacific coast.

#### **San José del Cabo (10 feet):**

*January 4-10, 1906.*—San José del Cabo is the seaport 23 miles northeast of Cabo San Lucas or Cape San Lucas. On January 4, 1906, we left Cape San Lucas and followed a trail northeasterly along the coast, part of the way on the sandy beach, but mainly a

mile or two inland. The country was broken by numerous granite ridges, 100 to 500 feet high, extending to the sea from the low southern end of the Sierra de la Victoria, a few miles inland, and separated by deep, sandy, dry washes. We arrived in the afternoon at San José del Cabo, which we found a well-built town of adobe houses, with about 1,500 inhabitants. The town is located on a low slope on the west side of the valley, and about a mile above the mouth of the Río San José, which reaches the sea here.

The San José Valley, 1 or 2 miles wide, is very fertile, and by means of irrigation from the river good-sized fields of sugarcane and other crops are cultivated on the flat between the town and the coast. Some parts of the bottom bordering the river were overgrown with willows and various bushes. About the town were many orange, lemon, pomegranate, banana, and other fruit trees, and numerous tall and graceful fan palms were scattered about the fields. The permanent supply of water in the river and the fertile valley make this one of the largest and most prosperous agricultural places on the peninsula. Steamers from and to San Francisco and the mainland of México stopped regularly twice each month, the landing place being on the open beach near the mouth of the river. We remained at San José several days to obtain topotypes of birds and mammals in a locality where Xantus, Bryant, and other naturalists had worked. The night following our arrival (January 4-5) was one of the coldest of the season, the temperature dropping close to the freezing point.

**San Matías Pass**—San Pedro Mártir Mountains (3,500 to 4,000 feet):

*June 17-18, 1905.*—San Matías Pass separates the southern end of the Sierra Juárez from the northern end of the San Pedro Mártir Mountains of northern Baja California. It is an open gap about one-fourth of a mile wide with a nearly flat bottom and gradual descent each way. On June 17 we left Campbell's ranch in Trinidad Valley and traveled 16 miles easterly up the valley to San Matías Pass, following a continuation of the wagon road by which we entered the valley. Just before entering the narrowest part of the pass we turned to the right and followed a dry wash up a little side valley and then through a rocky canyon in the west side of the northern point of the San Pedro Mártir Mountains for about 3 miles to San Matías Spring, near the head of the canyon. The spring, the only water near the pass, gives a trickling stream that runs down the canyon only a short distance before it sinks in the sand. Through this pass some Lower

Sonoran species extend across the divide from the desert region east of the mountains into Trinidad Valley, on the western slope.

**San Pablo** (1,000 feet) :

*October 3-4, 1905.*—San Pablo is the site of the former San Pablo Mission, about 45 miles southeast of Calmallí. On October 3 we traveled about 3 miles southwesterly from Pozo Altamirano and, rounding a point, entered the mouth of San Pablo Canyon. The western border of the mountain plateau rises abruptly from the Vizcaíno Desert, and the lower part of the canyon, which has its head far back in the range, is broad and gently sloping, with a dry, sandy wash which evidently at times carries great volumes of flood waters winding down its bottom and thence across the plain toward the sea. We ascended the canyon between increasingly high walls of black lava, underlaid by horizontal beds of sandstone for about 12 miles until it narrowed to a width of a few hundred yards, with a high bench along its southern side. Here we camped near the lower end of a small stream of clear water just above the point where it sinks in the sandy wash. A short distance above, close to the ruins of the San Pablo Mission, was a small ranch occupied by a Mexican family. A few acres of land are still in cultivation below the irrigating ditches built long ago by the missionaries. The old mission has an altitude of about 1,000 feet and is in an extremely hot location, the effect of the sun being intensified by the heat stored in the black lava walls of the canyon, which close in above and form a deep box canyon.

A vigorous growth of large cactuses and other desert vegetation occupied the bottom of the canyon about our camping place, and a few fan palms were growing at the ranch. The water and abundant vegetation near the old mission made an attractive place for birds, and we saw here the first representatives of such southern Baja California races as the cape cardinal and cape house finch. More surprising was the discovery among the giant and other cactuses at this camp of a previously unknown chipmunk of the genus *Eutamias*. No chipmunk had been seen since leaving the pine forests on the upper slopes of the Sierra San Pedro Mártir, and no other race of the genus is known to inhabit the Lower Sonoran Zone. This was a promising locality for more extensive work, but cattle had eaten the feed so closely that there was practically nothing for our stock, and we were forced, much to our regret, to continue our journey the next day, October 4.

**San Pedro (700 feet):**

*December 23-24, 1905.*—San Pedro is a small cluster of ranch houses at 700 feet altitude, about 18 miles south of La Paz. On December 23 we continued our journey from La Paz toward Cape San Lucas. Our route lay nearly due south along a good wagon road over a gently rolling and slightly rising plain. In the evening we camped at San Pedro, where some fields were dry-farmed with uncertain results, owing to the irregular rainfall.

**San Pedro Mártir Mountains (=Sierra San Pedro Mártir) Valley at east base (1,000 feet):**

*June 26-27, 1905.*—On June 26 I rode out on the desert plain several miles to the eastward from the mouth of La Providencia Canyon into an area with loose sandy soil inhabited by such numbers of kangaroo rats (*Dipodomys deserti deserti* and *Dipodomys merriami arenivagus*) that horse travel was impeded by breaking through into the burrows. Traps were set, and they contained a good catch when recovered the following day. Specimens were labeled "Valley at E. base San Pedro Mártir Mts."

**San Quintín (about 20 feet):**

*August 2-12, 15-17, 24-31, 1905.*—San Quintín is a small port about 100 miles south of Ensenada on the Pacific coast of Baja California. On August 1 we left San Antonio at the west base of the Sierra San Pedro Mártir. The trail crossed the valley of the Río San Domingo and led directly up the steep ridge to the west and then southwesterly down ridges and west-draining slopes for about 26 miles to our camp by a small stream at the upper end of the high-walled Cañón de Nueva York, at an altitude of about 800 feet. On August 2 we continued our southwesterly course down low ridges and over sloping mesas west-draining for about 15 miles to the head of a broad, flat-bottomed, low-walled canyon, with a small stream at its head, down which we traveled for 5 miles to where it ended on the sandy, nearly level plain of San Quintín. In the lower part of the canyon we passed a number of old fenced fields, wooden frame houses, water tanks, and wire fences, all showing evidence of having been abandoned for years. We learned later that these were relics of an elaborate and costly but unsuccessful effort made by the Baja California Development Co. to establish a large agricultural colony on the coastal plain near San Quintín.

At the time of our visit San Quintín contained a few wooden buildings, one of which was a combined hotel and store, the head-

quarters for occasional travelers and for American and English miners engaged in prospecting to the southward. The place was a port of entry with a customhouse and a total population of less than 50 people. Low volcanic hills occupy a narrow strip along the coast to the north and south of San Quintín Bay. The coastal plain of San Quintín is 2 to 6 miles broad and extends about 20 miles north and 15 or 20 miles south of the town, gradually narrowing near the extremes as the foothills approach the coast. The plain is rather sandy and overgrown with sparse vegetation consisting of small shrubs and herbs. The climate is comparatively dry, but not the extreme aridity of the region a short distance farther south. Fog is prevalent at San Quintín and the locality is subjected to humid west coastal influences due to proximity to the Sierra San Pedro Mártir, but in diminishing degree with the lessened height of the mountains near the southern end. The locality is in the Upper Sonoran Zone, but an approach to Lower Sonoran conditions is evident.

Work at and near the little port was carried on at intervals while it was used as a convenient base from which trips were made to other localities. On August 25 we finally left the town and traveled about 8 miles in a southeasterly course over the coast plain, crossing the broad dry bed of the San Simón River, near where it leaves the foothills, and camped at the Santa María Ranch, a short distance beyond and about 3 miles from the sea. Specimens collected here were labeled "San Quintín, San Simón Riv." The ranch had been abandoned, but several acres bore a heavy crop of black figs, which was being harvested as it ripened by hundreds of ravens that came down daily from the foothills. We also found the figs a delicious addition to our regular fare, which included little fruit.

#### **San Rafael Valley (3,700 feet):**

*June 10-11, 1905.*—On June 10 we traveled about 22 miles southwesterly from near the village of Sangre de Cristo on the western side of the Laguna Hanson Mountains, crossing the southern end of San Rafael Valley, and camped at 3,700 feet altitude by a small spring and marshy meadow near the base of a hill called Cerro Colorado. Upper Sonoran Zone.

#### **San Telmo (about 200 feet):**

*August 18-23, 1905.*—San Telmo is a village at 200 feet altitude near the coast about 55 miles north of San Quintín. I made a trip on horseback from San Quintín to San Telmo, August 18-23, to obtain topotypes of the antelope ground squirrel. (*Ammospermophilus leu-*

*curus peninsulæ*=*Citellus leucurus peninsulæ*). Overnight stops were made at Santo Domingo en route.

**Santa Clara Mountains** (=Sierra de Santa Clara) (1,500 feet):

*October 12-13, 1905.*—Accompanied by one of our regular camp men and a native guide I left San Angel shortly after noon on October 11, and we rode until about dark, when we made a dry camp on the desert about 30 miles west of San Angel. About 4 a. m. on the following morning we continued westward and by 10 o'clock had reached the Tinaja de Santa Clara, about 20 miles from our camp. This is a fine tank of good water well hidden by the rocky walls of a small canyon at about 1,500 feet altitude, on the western side of the Santa Clara Mountains. The weather was still hot, but by dividing the journey and by morning and evening travel the 50 miles between water supplies was covered with a minimum of discomfort for our saddle animals. For many miles our route was across the flat open desert plain to the eastern base of the Sierra de Santa Clara. These mountains form a small group of ragged volcanic peaks 2,000 to 3,600 feet high, with basal lava beds, at the southeastern end of the Vizcaíno Range, which extends northwest along the coast to Point San Eugenio, opposite Cedros Island. The highest peak is Picacho Santa Clara which is about 3,600 feet high. An outlying volcanic peak called Cerro del Tecolote, meaning "hill of the owl," owing to the form of the top, was passed a short distance south of our route.

The region is extremely arid, but on the basal slope of the Santa Clara Mountains the copalquín (*Pachycormus discolor*) appeared to reach its greatest development. This tree with contorted trunk and branches is a veritable forest monstrosity. It was first seen by us near Agua Dulce a few miles south of Onyx and was very abundant in suitable situations along the route southward to Magdalena Bay. Some of the largest trees only 12 or 15 feet high had a trunk diameter of 3 feet at the base. On October 14 we left Tinaja Santa Clara in the afternoon and returned to the dry camp where we had made an overnight stop en route, and on the following day, October 15, we reached San Angel. Tracks of antelope were seen along the way, and a mule deer was shot far out on the desert plain.

**Santa Rosa**—San Pedro Mártir Mountains (7,000 feet):

*July 24-25, 1905.*—Santa Rosa is a valleylike basin at 7,000 feet altitude near the southern end of the San Pedro Mártir Mountains.

On July 24 we completed our work at La Grulla and followed an old trail about 10 miles southeasterly along the top of the mountains

to Santa Rosa, another beautiful mountain park at about the same altitude (7,000 feet) as La Grulla. It is a waterless grassy valley, like a shallow basin in form, about 2 by 3 miles in extent, and is bordered by low pine-covered hills. This park occupies almost the entire breadth of the top of the mountain range. Santa Rosa Canyon heads on the northeastern side of the valley and leads thence directly down between high rocky walls to the desert at the east base of the range, draining to the Gulf. An old trail dating back to the days of the early missionaries leads down this canyon, and permanent water is said to be found near its mouth. Mountain sheep frequented its rocky slopes, and California condors were said to nest in holes in its high walls. The old trail from Santa Rosa Canyon crosses Santa Rosa Valley to the west side and then descends along the course of a small canyon. We left Santa Rosa by this trail, leading down to the west end, and about 2 miles below came to a benchlike valley in the canyon, with a willow-bordered stream flowing along its middle. This is a southern tributary of the Río Santo Domingo. The little valley had a house and a cattle corral at its upper end, known as Rancho Santo Tomás, near which we camped several days at an altitude of about 6,000 feet. From this camp work was extended to Santa Rosa, where, as indicated, there was no water. During our stay the carcass of a burro in Santa Rosa Valley attracted about a dozen California condors, and we were able to obtain a specimen in addition to one taken at La Grulla. Others of these great birds were seen, and they appeared to be rather common in that part of the mountains. Transition Zone.

**Santo Domingo (=San Domingo) (25 feet):**

*September 25-28, 1905.*—Santo Domingo was a little group of houses at Santo Domingo landing on Bahía de Sebastián Vizcaíno, where there was a customs inspector, and supplies for the interior mining camps of Calmallí and vicinity were landed on the beach. On September 25 our trail led from Rosarito southeasterly through the coast hills about 8 miles to San Javier Canyon, striking it a few miles from the sea. Where we entered the canyon it forms a narrow valley, soon closing in to a canyon bordered by low sandstone walls, down which the trail led for some distance. At first we found a series of fine water holes scattered along the bottom, but we soon came to a clear stream of excellent water, which flowed about a mile before it was again lost in the sand. Below this the trail passed out of the canyon for about 5 miles through the coast hills and then descended near the seashore to the northern point of the Santo

Domingo Plain. From this point southward the coast hills and low mountains swing inland, the nearly level plain extending along the coast and broadening southeasterly into the Vizcaíno Desert. Near where we entered the northern end of the plain, the shore is bordered by a broad belt of high sand dunes lying immediately back of the beach. On the inland side they are succeeded by a nearly level area 4 or 5 miles broad to the base of series of rugged scattered hills and ridges. Farther south, 2 or 3 miles back of the shore, a tree yucca forest extends over the plain for miles, sparsely intermingled with *Fouquieria* and other large desert shrubs on which a heavy growth of orchilla (*Roccella*) was hanging. This lichen superficially resembles the Spanish moss *Tillandsia* growing on trees in the Gulf coast region of the United States. Its distribution tends to delimit the fog belt along the coast. It was formerly gathered as a dye plant and exported by shiploads from Magdalena Bay to Europe, but the production of aniline dyes ended this industry. Soon after entering the plain we saw traces of a wagon road, which skirts the coast from the landing at Santa Rosalía Bay southeasterly to Santo Domingo. We followed it for about 9 miles on the flat well back of the sand dunes until sunset, when we made camp about a mile from the sea, with no water and very little grazing.

On September 26 the road led down the plain 8 miles from our camp, then crossed the dunes and skirted the shore of Santo Domingo Lagoon about 5 miles to Santo Domingo landing. We then followed a wagon road for 3 miles to a well at the foot of the escarpment of a mesa fronting the coast, where the plain rises abruptly about 50 feet. When we arrived at the well our horses and mules had been without water for 24 hours and showed such signs of exhaustion that we stopped here a day for their benefit.

The type locality of the desert thrasher (*Toxostoma lecontei arenicola*) is near where we first heard its notes in the sand dunes when we approached them north of Santo Domingo Landing. It was abundant between the landing and the well, and early in the morning and at sunset its beautiful song was heard on all sides.

#### **Santo Tomás (50 to 100 feet):**

May 24-25, 1905.—Santo Tomás is a village on the Río Santo Tomás, near the coast about 18 miles south of Ensenada. The locality was visited by me to obtain topotypes of a pocket gopher, *Thomomys aphrastus*, which proved to be inseparable from *Thomomys bottae nigricans*.

**Sierra de los Cocopahs** (=Cocopah Mountains) (10 to 3,000 feet):

*April 4-14, 1905.*—The Sierra de los Cocopahs is the range of mountains along the west side of the delta of the Colorado River. With a party including D. T. MacDougal, of the Carnegie Institution, I ascended the channel then known as Hardy River from the point where it entered the Colorado River to the east base of the mountains, where we camped. We were assisted by the tidal bore by which we were overtaken en route and carried rapidly upstream. Specimens taken at various elevations from near sea level at the base of the mountains to near the summit at about 3,000 feet were labeled "Cocopah Mountains." These mountains rise islandlike from a sandy plain only a little above sea level and extend as a narrow backbone from near the United States boundary southward about 40 miles. The highest point, the Cerro Mayor, near the southern end, reaches an altitude of more than 3,100 feet. The mountains are of much-eroded gray granite, very steep and rugged. The Sierra de los Cocopahs and the general area lying near the upper end of the Gulf of California are shielded from the humid conditions prevalent along the Pacific coast by the intervening Sierra San Pedro Mártir and as a result form one of the driest regions on the continent. Among the characteristic trees and shrubs along the base of the mountains are the mesquite (*Prosopis juliflora*), which grows to large size in moist soil along watercourses, Gregg acacia (*Acacia greggii*), ironwood (*Olneya tesota*), paloverde (*Cercidium torreyanum*), creosotebush (*Larrea tridentata*), and ocotillo (*Fouquieria splendens*). The vegetation on the mountains is very sparse owing to extreme aridity. It is limited largely to a scattered growth of *Acacia greggii*, *Fouquieria splendens*, *Encelia farinosa*, agaves, and cactuses of several species. Lower Austral Zone.

**Socorro** (about 10 feet):

*August 31 to September 1, 1905.*—On August 31 we left the Santa María near the mouth of the Río San Simón and traveled south about 8 miles along the wagon road to Socorro, where there was a small fresh-water pond in the bottom of a wash which emptied just below into a salt lagoon, winding through a marshy flat. This part of the coast is bordered by a series of sand dunes backed by a long salt flat. The low rolling foothill plateau which backs the coast plain gradually approaches the shore from the north and reduces the plain to a narrow point, ending a little south of Socorro. We found fog prevalent along that part of the coast.

**Todos Santos (100 feet):**

*December 26, 1905.*—Todos Santos is a village at 100 feet altitude near the Pacific coast nearly due south of La Paz. On Christmas Day we journeyed about 14 miles southerly along the road from Tres Pachitas and reached another small ranch called Valle Flojo, located about 3 miles from the coast beside a large dry wash at the bottom of a broad canyon about 100 feet deep. The road gradually swung around the north and west base of the Sierra de la Laguna, which rises precipitously on this front. As the mountains are approached, and a few hundred feet in altitude gained, the vegetation becomes much larger and more abundant. Huge giant and other cactuses were the most common and striking elements in a junglelike forest 15 to 40 feet high.

On December 26 we crossed a continuation of the broken country for about 12 miles southerly from Valle Flojo to Todos Santos. This was a pretty place, consisting of 30 or 40 houses at an altitude of about 100 feet on a low, bare ridge overlooking a narrow valley which is the lower end of a broad canyon leading from the west base of the Sierra de la Laguna. Below the road the valley was bright green with waving fields of sugarcane, and beyond, 2 or 3 miles away, lay the blue waters of the Pacific. A number of tall fan palms about the houses and canefields and mango trees along the irrigating ditches added to the attractiveness of the place. Water for irrigation comes from some large springs in the bottom of the valley. Formerly the springs were located high up the valley above the road from La Paz, but some years before our visit they suddenly became dry and then burst out lower down, thus necessitating the abandonment of all fields above the road. Immediately north of Todos Santos the outlying foothills of the Sierra de la Laguna reach the Pacific coast, ending in cliffs along the shore. A few specimens were collected in the vicinity of Todos Santos and we continued our journey for about 10 miles to Pescadero.

**Tres Pachitas (700 feet):**

*December 24-25, 1905.*—Tres Pachitas is a small ranch at 700 feet altitude, about 36 miles south of La Paz. December 24 we traveled southerly along the wagon road for about 17 miles from San Pedro to Tres Pachitas. Our route continued over the same rolling plain we had traversed all the way from La Paz, but approached the north end of the Sierra de la Laguna. These mountains form the northern section of the Sierra de la Victoria, which occupies so much of the cape region of the peninsula. The growth of desert vegetation was

very large and abundant along the latter part of the road, and a number of tropical shrubs, including the coral bean, *Erythrina purpusi*, were noted. The luxuriance of the vegetation near Tres Pachitas indicates a much greater rainfall than nearer La Paz, which is evidently due to the proximity to the Sierra de la Laguna, where summer rains are comparatively regular.

**Tres Pachitas to Valle Flojo** (see Todos Santos).

**Trinidad Valley** (=Trinidad Ranch)—northwest base San Pedro Mártir Mountains (2,600 feet):

*June 16-17, June 29 to July 4, 1905.*—Trinidad Valley is a basin lying between the southern end of the Sierra Juárez and the northern end of the San Pedro Mártir Mountains, on the upper part of the western slope of the peninsula. On June 16 we traveled southeast from Rancho Viejo, along a good wagon road over the rolling and gradually rising plain covered with pinyons and junipers, for about 16 miles to the top of the northern rim of Trinidad Valley, at an altitude of about 3,800 feet. From the rim a dug road descended the slope abruptly to the bottom of the valley, about 1,000 feet below. There the road forked, and we turned to the right about 4 miles down the valley and camped at Campbell's cattle ranch, or Trinidad Ranch, at 2,600 feet altitude. This ranch is near the lower end of the valley and was our headquarters while working in this vicinity. We left the locality June 17, en route to San Felipe Bay, and returned June 29. Trinidad Valley is about 18 miles long east and west and about 3 miles broad in the middle, narrowing gradually toward each end. The valley is open grassland in the lower part, with bushes on the sides and much cactus, yucca, agave, and other desert growth for miles of its upper end and in San Matías Pass through which there is a connection with the desert fauna and flora of the country east of the mountains. Several burrows of desert foxes (*Vulpes macrotis tenuirostris*) were found in the bottom of the valley and some specimens taken. The valley forms a pocket of Lower Sonoran Zone on the western slope of the peninsula in a general area that is Upper Sonoran in zonal character. It is connected across San Matías Pass with the Lower Sonoran region east of the mountains.

**Vallecitos**—San Pedro Mártir Mountains (8,000 feet):

*July 12-18, 1905.*—Vallecitos was a summer cattle ranch at 8,000 feet altitude, unoccupied at the time of our visit, near the top of the main ridge of the San Pedro Mártir Mountains. July 11 we

left El Piñón on the west slope and traversed a series of low hills and ridges covered with a vigorous growth of large bushes and scattered pinyon trees flanking the basal slopes of the main range. Our course was southerly, mainly with no signs of a trail, and travel was slow on account of the dense growth of rigid bushes, among which it was difficult to force a passage. We finally reached the bank of a small, swift stream of clear water, flowing along the base of the main slope of the mountains at an altitude of 4,800 feet, where we camped. The stream, probably the headwaters of the Río San Rafael, which enters the sea near Cape Colnett, was bordered by a dense vigorous growth of willows, and was the largest we had seen in the peninsula. Here our animals fed eagerly on the juicy grasses along the water's edge, and we found the fresh green of the willow thicket and the sound of water rushing over its rocky bed extremely refreshing after our weeks on the sun-scorched deserts.

On the morning of July 12 we climbed without any trail the steep, open, rocky slope directly above camp, and after about 10 miles came out at Vallecitos in the parklike valley or elevated shelf near the top of the main ridge of the Sierra San Pedro Mártir. The locality was named from a series of beautiful, open, flat-bottomed grassy meadows at an altitude of about 8,000 feet. These meadows have gently sloping borders overgrown with yellow pines (*Pinus jeffreyi*), mixed with a few other conifers. We camped at the lower end of Vallecitos, where in the arroyo a little water appeared on the surface. Just as we arrived the first storm of the summer or rainy season, a hard thundershower of rain and hail, enveloped the top of the mountains and continued for more than an hour. On the easterly side of Vallecitos a long, high, narrow ridge of nearly bare, eroded granite forms the main crest of the mountain and reaches an altitude of about 9,000 feet. This high ridge forms the westerly wall of Canyon Diablo, the largest of the great canyons that score the precipitous eastern front of the range.

From the crest above Vallecitos we had an impressive view to the east down the rock-walled gorge. Canyon Diablo heads southwesterly from the Cerro de la Providencia, or Cerro de la Encantada, the culminating peak of the range, and swings around the western and northern sides of the peak to open desert between Esperanza and La Providencia canyons. In front of us to the east, directly across the upper canyon, La Providencia Peak rose to an altitude of more than 10,000 feet, forming the sharp crest of a narrow cockscomb ridge of bare granite, which, cut from the main mass on two sides

by Canyon Diablo, extends northerly as a part of the eastern wall of the range, its spurlike character apparent only from the top of the range where we stood. The view was uninterrupted out through the mouth of the canyon to the desert valleys 8,000 feet below and beyond over the summits of the scattered desert ranges to the Lower Colorado River and across the northern end of the Gulf of California to the high outlying ranges of the northern Sierra Madre, far in the interior of Sonora. The view over the low desert ranges was like looking down on a gigantic relief map. Great alluvial fans or deltas extending out from the mouths of canyons were conspicuous everywhere, and several fine examples of mountain ranges 2,000 to 3,000 feet high almost completely buried in their own disintegrated material were seen.

A few stunted pinyon trees (probably *Pinus quadrifolia*, an Upper Sonoran Zone indicator) were growing in crevices in the southern faces of Canyon Diablo walls up to 9,000 feet altitude, showing an effect of peculiar local conditions, probably warm-air currents rising from the desert below. At 8,000 feet along the top at Vallecitos, however, the principal forest trees are the Jeffrey yellow pine (*Pinus jeffreyi*), sugar pine (*Pinus lambertiana*), and incense cedar (*Libocedrus decurrens*), which are indicators of the Transition Zone. In still more marked contrast with conditions typified by the pinyon was the occurrence on the colder slopes near the top of the mountains of the white fir (*Abies concolor*), lodgepole pine (*Pinus contorta*), and quaking aspen (*Populus tremuloides*), showing an infusion of Canadian Zone species.

**Windy Canyon**—north end of San Pedro Mártir Mountains (3,600 feet):

*June 28, 1905.*—A canyon on the east slope, leading down from near San Matías Pass to the desert at the east base of the mountains. Specimens collected in traversing the canyon were labeled "Windy Canyon, N. end San Pedro Mártir Mountains."

**Yubay**—30 miles southeast of Calamahué (2,000 feet):

*September 17-19, 1905.*—We left Calamahué on September 16, our route leading up the canyon, which has high rocky walls along most of its course. Mountain-sheep tracks were seen at places along the way, and one fine old ram came out on the skyline of a high rocky point about 500 yards away and gazed down as we filed by. This promising hunting ground was a great temptation, but forage was extremely scanty and our saddle and pack animals were becoming

too weak to risk the delay. Water comes to the surface at several points along the bottom, and 5 miles above its mouth near the head of the canyon we came to the last water, a spring charged with alkali and iron, but usable. Here we stopped during the middle of the day under the shade of some mesquite trees. From the spring the trail led to the head of the gently rising canyon and out on the eastern border of a part of the broad interior tableland known as the Llano de Santa Ana. The surface of the tableland is depressed at the head of Calamahué Canyon to an altitude of about 1,200 feet, thus forming one of the lowest passes between the east and west coasts in the entire peninsula.

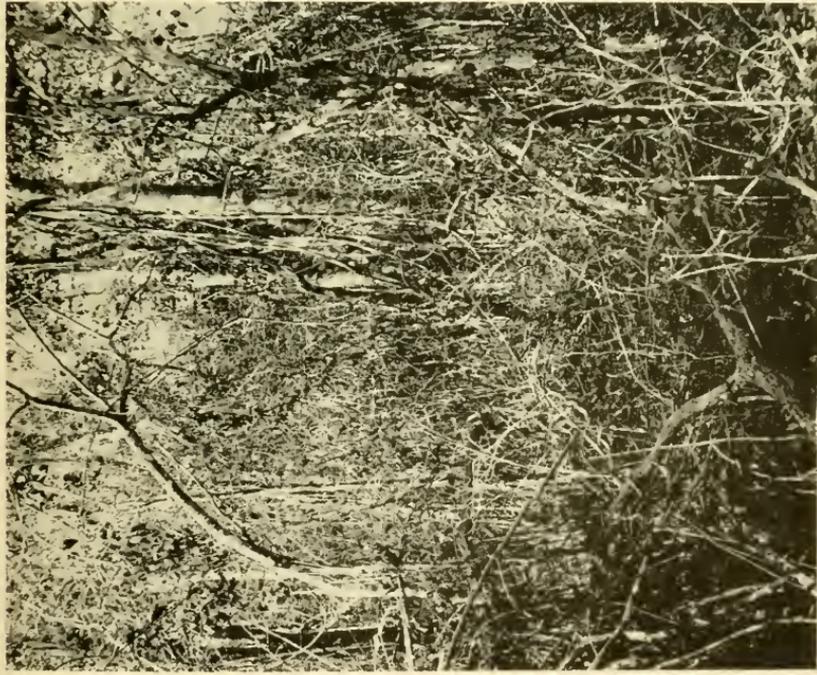
The Llano de Santa Ana is one of the more level parts of the main plateau along the middle of the peninsula, varying in elevation to 2,500 feet and sloping gently toward the southwest. Immediately after crossing the divide we came into a granitic country again and found a wonderfully vigorous growth of desert vegetation, including giant and other cactuses and heavy stands of tree yuccas, forming impenetrable jungles in many places. Soon after we reached the Llano de Santa Ana the sun set in gorgeous colors, and a little later the moonlight enabled us to continue southeasterly about 23 miles from our noon camp, through a strange forest of desert plants. About 10 o'clock the trail became too dim to follow, and we camped in an open space at 2,200 feet altitude.

On September 17 we made an early start from our dry camp and continued about 10 miles across the rolling plain to the tinaja or water hole of Yubay. This is a large pot hole of rain water 15 or 18 feet across and several feet deep in the bed rock at the mouth of a small canyon, which leads through a bare granite ridge rising about 500 feet immediately to the northeast. San Andrés Valley to the westward of our route was full of fog on the morning of September 17, and at daybreak on the 18th the fog covered the country up to at least 2,500 feet altitude, on the granite ridges back of camp. At sunrise the vegetation was dripping, and the entire surface of the ground was wet from the fog, but by 8 o'clock had become completely dry. These fogs, prevalent as far south as Magdalena Bay, must be of material aid in carrying desert vegetation through long rainless periods but do not alter its essentially arid character.

#### CAMPECHE

**Apazote**—near Yohaltún (100 to 300 feet):

*December 17, 1900, to January 14, 1901.*—Apazote is a ranch at a low elevation about 13 miles south of the hacienda of Yohaltún in



1. Forest interior during dry season when trees are nearly leafless, near Chichén Itzá, Yucatán. Arid Lower Tropical Subzone.



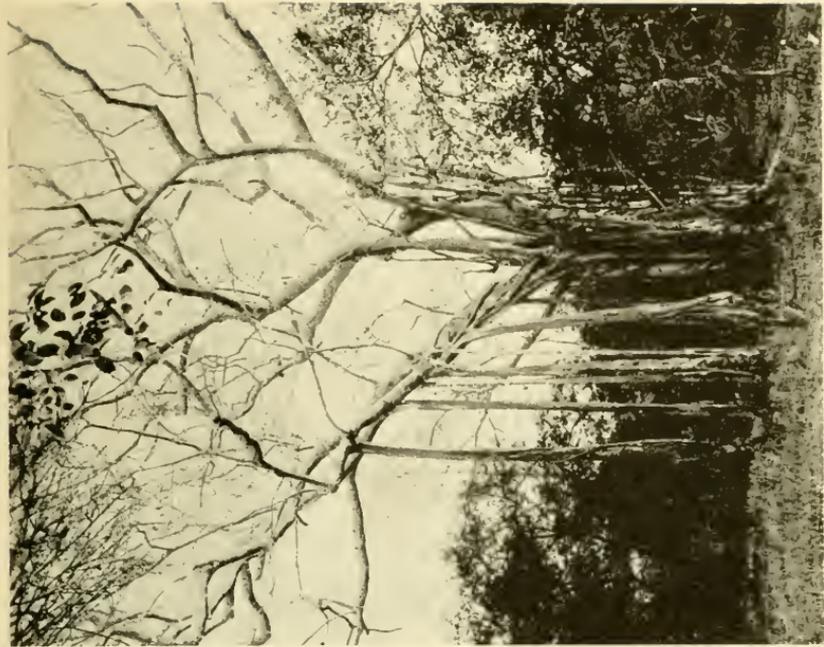
2. Wall of large natural well, or cenote, Chichén Itzá, Yucatán. This cenote appears to have afforded the water supply for the ancient Maya population of the vicinity. Arid Lower Tropical Subzone.



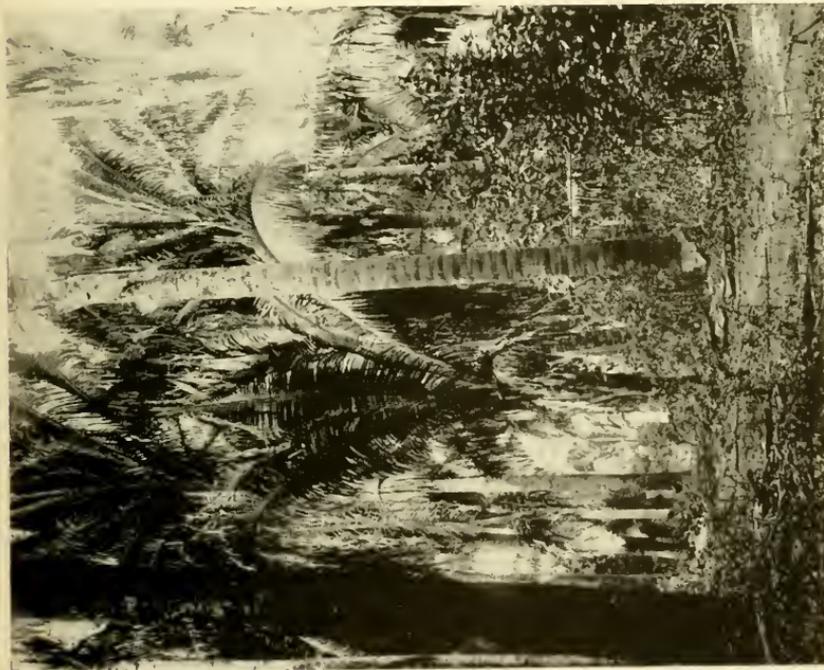
1. Vegetation along bank of stream near Carrizal, Veracruz. Arid Lower Tropical Subzone.



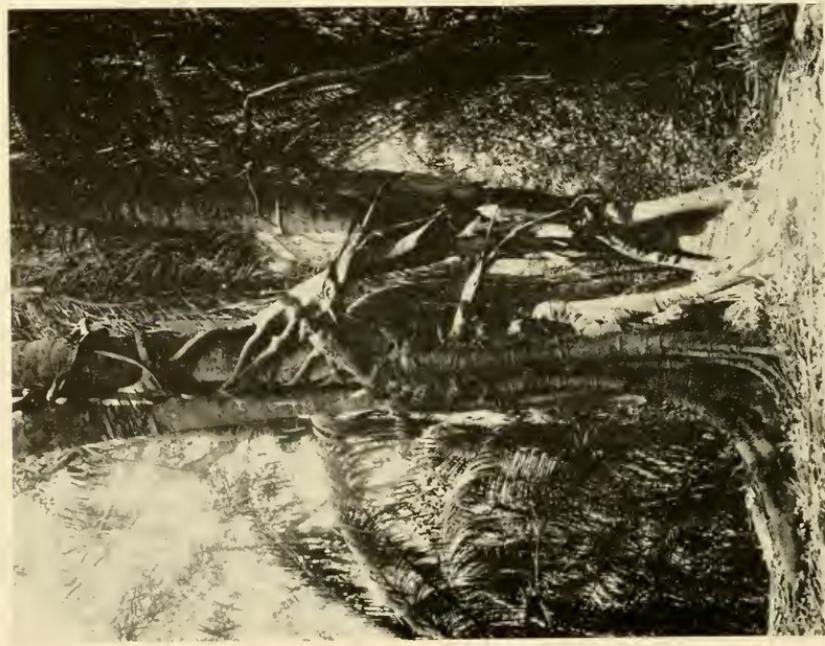
2. Vegetation on small island near Zihuatanejo, Guerrero.



2. Wild fig (*Ficus lentiginosa*), near San Jerónimo, Guerrero.



1. Palm forest (*Attalea cohune*), near Papayo, Guerrero. Grows at low levels where ground waters lie near the surface. Arid Lower Tropical Zone.



1. *Attalea* palms encircled by young wild fig (*Ficus lentiginosa*). Arid Lower Tropical Subzone.



2. Climbing cactuses, near Carrizal, Veracruz, Arid Lower Tropical Subzone.



1. Shore of Laguna de Coyuca, Guerrero. An aquatic environment—water-hyacinths in bloom. Arid Lower Tropical Subzone.



2. Low forest on broken shore line, near Acapulco, Guerrero. Arid Lower Tropical Subzone.



1. Tidal lagoon near Manzanillo, Colima. American and snowy egrets in distance. Arid Lower Tropical Subzone.



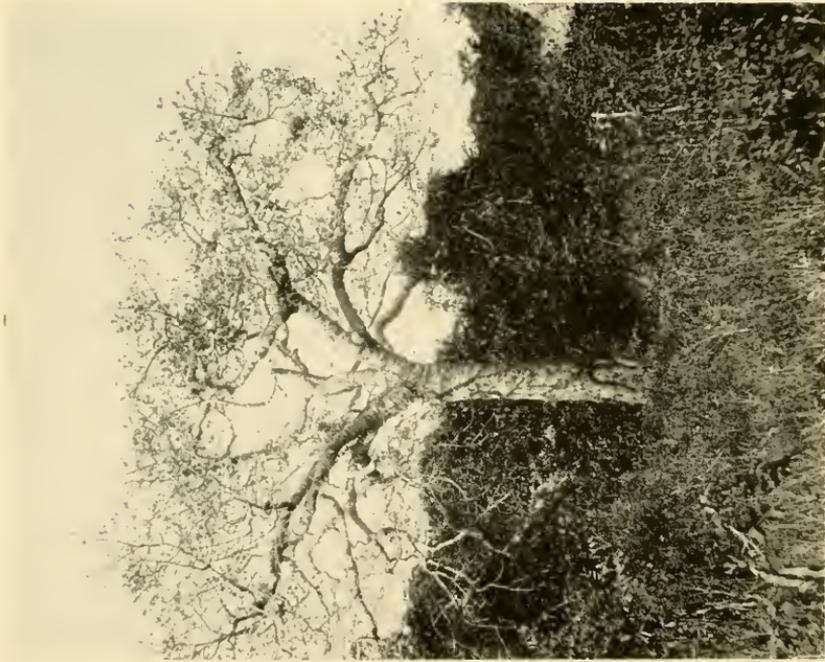
2. Nesting site of Brewster's booby (*Sula brewsteri*) on small island near Zihuatanejo, Guerrero. Arid Lower Tropical Subzone.



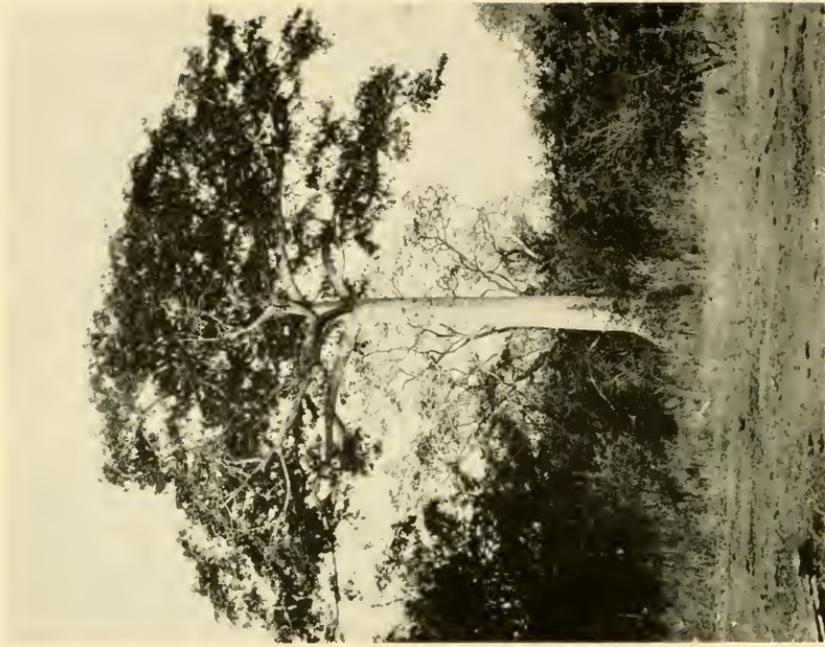
1. Mesquite (*Prosopis juliflora*), near Progreso, Yucatán. A tree of wide dispersal from Arid Lower Tropical Subzone to Lower Austral Zone.



2. Orejon tree (*Enterolobium cyclocarpum*), Mérida, Yucatán. Named in reference to large ear-shaped seed pods. One of the larger and more characteristic trees widely distributed in Arid Lower Tropical Subzone.



1. Silk-cotton tree (probably *Croton pentandra*), near Tashán, Campeche. Chiefly of Arid Lower Tropical Subzone, but ranges also into Humid Lower Tropical Subzone.



2. Silk-cotton tree (probably *Bombax ellipticum*), near Cayacal, Guerrero. Arid Lower Tropical Subzone.

the interior of central Campeche. On December 10 I left the city of Campeche on a trip into the interior of the state. A small schooner took me to the small port of Champotón, situated about 30 miles southwest of Campeche, where I landed on the morning of December 11. A canoe and two men were engaged, and in the afternoon a start was made up the Río Champotón. Traveling upriver all night, we reached Canasayab, a landing near the head of canoe navigation on the river about 20 miles above the port, early in the morning of December 12. From this point a tram road ran in a southeasterly direction about 40 miles to the hacienda of Yohaltún. In the afternoon of December 13 I was able to move to San Dimas, a ranch 6 miles on the way to Yohaltún, and on December 14 continued on by the tramway and arrived at Yohaltún late in the afternoon. December 15 and 16 were spent at Yohaltún, and on December 17 I moved by pack outfit about 13 miles south to Apazote. On January 14 I started for the coast by the same route as that followed in coming in. Most of the work was within 5 or 6 miles of the ranch, but several short trips were made to points 20 to 30 miles away. After arriving at Apazote all specimens were labeled "Apazote near Yohaltún."

The district visited is low and flat, like the peninsula of Yucatán in general, of which it forms a part. The country formation is a porous limestone that absorbs water so rapidly after rains that streams are rare and of small size. The surface is generally smooth, and outcroppings of rough, loose limestone are not numerous. Occasional ridges, however, near Campeche, Champotón, and scattered through the interior, rise rather abruptly 100 to 300 feet above sea level. Between the ridges the surface is low and gently rolling with here and there limited areas which are quite level. Some of the lowest of these become submerged during the rainy season, forming swamps called "sabanas," in which coarse grasses grow. These grassy areas usually become dry during the dry season, but in some of them water remains throughout the year. Shallow pot holes called aguadas are rather common in the forest near Apazote and Yohaltún. These fill during the rainy season, forming ponds or reservoirs that often last through the dry season and are the principal sources of supply for the people. The cenotes or great natural wells, so common in Yucatán and said to be found in northern Campeche also, do not appear to occur in central and southern Campeche. Most of the southern half of the state is covered with fairly heavy forest, and 2 or 3 feet of rich black soil commonly overlies the limestone.

In northern Campeche, at least near the coast, the country is much more arid and the covering of soil is so thin that the surface of the limestone is exposed in many places. This difference in character of the two areas appears to be due to contrasting climatic conditions. In the heavily forested part the rainfall during the wet season from May until November is very copious, and during the winter when the northers occur considerable rain falls. The northers come mainly in winter when cold northerly winds are accompanied by drizzling rain, lasting several days. One or two or none at all may occur during the driest part of the year, which is in March and April. The northers pass over the arid belt near the coast, discharging little or no moisture until they reach the taller, denser forests of the interior farther south. At Champotón, on the coast, the climate is comparatively dry, but the moisture increases toward the interior until near Apazote the climate is moderately humid, as shown by forest conditions. The degree of humidity, however, does not closely approach that of cloud forest areas along the slopes of the high mountains of adjoining states. The state of Campeche evidently includes two quite distinct ecologic areas, one quite arid and the other moderately humid. The arid section includes the extreme northern part of the state, which is like arid adjoining Yucatán and extends southward along the coast in a narrowing strip to the Laguna de Términos. The moderately humid area includes most of interior and southern Campeche and is well represented near Apazote. Though the forest is fairly heavy, there are few large trees. This is probably due to the underlying limestone which prevents deep root development. At the time of my visit a few species of trees were already dropping their leaves, and I was told that many of them do so during the dry season. I was also told, however, that the forest does not become so generally leafless as in the arid area, where few species retain their leaves.

Among the forest trees at Apazote are mahogany, Spanish cedar, palo del Brazil or palo de tinte (dyewood), chico zapote (*Achras zapota*), which produces the chicle so extensively used in the manufacture of chewing gum, and zapote mamey (*Callocarpum mammosum*). Several species of palms are abundant and at least one cactus, a climbing species, occurs. The chico zapote is common, and the extraction of chicle gum is the principal industry near Apazote. Incidentally, forests of southern Campeche and adjoining parts of Guatemala are among the most productive of this article of commerce. The chico zapote grows also in the arid belt where, however,

it is much less plentiful, and during the dry season the trees with their evergreen foliage present prominent landmarks in the scrubby, leafless forest. The zapote mamey, extensively cultivated in many parts of Mexico, and believed by some to be an introduced species, grows here under forest conditions, indicating that it is probably indigenous. Although the humidity is only moderate the forested region near Apazote seems referable to the Humid Lower Tropical Zone.

#### **Arcas Keys (10 feet) :**

*June 16-17, 1900.*—The Arcas Keys are coral islands in the Gulf about 80 miles off the coast of Campeche. We left the city of Campeche, Campeche, at 3 a. m. on June 14 in a 20-ton schooner and reached Jaina, a hacienda on the coast about 20 miles north, that afternoon. From Jaina we resumed sail the next day and anchored at the Arcas Keys on June 16. Here the sea birds received attention for a day, and we continued to the Triangle Keys, about 45 miles farther north. The Arcas Keys are of coral sand formation, the largest 40 or 50 acres in extent. The keys are near the sea route from ports of Campeche, Campeche, and Progreso, Yucatán, to Veracruz, Veracruz. Our schooner brought the monthly supply of provisions for the lighthouse keepers stationed there. The only vegetation consists of salt grass and a few herbs. Arid Lower Tropical Zone.

#### **Campeche (50 to 300 feet) :**

*May 31 to June 14, June 26-28, December 10-11, 1900, and January 20-23, 1901.*—The city of Campeche is the seaport of the state of the same name. We arrived at Campeche from points in Tabasco by boat on May 31, 1900. On June 14 we left for a trip to the Triangle Keys from which we returned on June 26. Field work for the season was brought to a close, and we took the steamer en route to the United States on June 28. The locality was revisited in December 1900 and in January 1901, but no additional field work was undertaken.

The city of Campeche is built along the shore of the Gulf of México, on a narrow level strip of land, backed by broken limestone hills 100 to 300 feet high. These hills extend southerly along the coast nearly to the Laguna de Términos. Except for such slight eminences the entire state of Campeche is flat and forms a part of the Yucatán Peninsula, in which there are no real mountains. Southern Campeche, adjoining Guatemala and Tabasco, is well watered, a fairly heavy rainfall and generally humid conditions being due to

the proximity to the high mountains of the interior and large rivers flowing from them. All the large rivers, however, enter the Laguna de Términos, and northern Campeche partakes of the arid character of Yucatán. The Río Champotón, a small, short stream, enters the Gulf about 35 miles south of the city of Campeche. There are no other streams worth mentioning in the vicinity. Wet and dry seasons are well marked, however. The rains usually begin in June and end in November. But this region is very arid owing to the length of the dry season and the absorption of moisture by the limestone that closely underlies the surface everywhere. In many places the covering of soil is only a few inches and may be so thin that the surface of the limestone is exposed. The roots of the trees, unable to penetrate the limestone, must spread laterally through the shallow soil. The result is a more or less insecure foothold and not infrequently trees blown over by the wind lift practically all the soil enmeshed in their network of roots, leaving a circular patch of bare rock.

The country is covered with a low, stunted type of forest or brushland very similar in character to that of arid tropical parts of Veracruz. Among trees that loom conspicuously above this low forest are *Enterolobium cyclocarpum* and the wild figs. Arid Lower Tropical Zone.

**Canasayab (10 feet):**

December 12-13, 1900.—See Apazote.

**Champotón (see Apazote).**

**Jaina (10 feet):**

June 14-15, 1900.—A hacienda on the coast about 20 miles north of Campeche. See Arcas Keys.

**Triangle Keys (10 feet):**

June 18-23, 1900.—The Triangle Keys are coral islands in the Gulf of México about 45 miles in a northerly direction from the Arcas Keys and about 80 or 100 miles off the coast of Campeche. We left the Arcas Keys, where we had stopped over for a day en route from Campeche, by schooner, and after sailing about 45 miles northward reached the Triangle Keys on June 18. The main object of our trip was to obtain specimens of the rare tropical seal, *Monachus tropicalis*, known to resort to sandy beaches on the keys; and in quest of these animals we were very successful. We remained on the keys seal hunting until June 23, when we started back to Campeche, where we arrived on June 26.

The largest of the Triangle Keys contains only a few acres. The little group is surrounded by coral reefs, and navigation about them is dangerous, especially as there is no fresh water and the keys are off the usual shipping routes. Arid Lower Tropical Zone.

#### CHIAPAS

##### **Canjob** (5,300 feet):

*March 26-27, April 30 to May 3, 1904.*—Canjob is a village at 5,300 feet about halfway between the towns of San Bartolomé and Comitán on the north side of the valley of the Río de Chiapas.

On March 26 I reached Canjob from San Bartolomé, about 20 miles to the southwest. The following day I continued to Comitán. I returned to Canjob on April 30 and remained there until May 4. Just north of the village a range of mountains rises to 6,500 feet altitude, and separates the valley of Comitán from the main valley of the Río de Chiapas in this vicinity. From near Canjob, mountain slopes extend up rather abruptly into the highlands of the central part of the state. Although somewhat more humid than the central part of the Chiapas valley, the climate is much drier than that of the higher mountains near San Cristóbal. Slight frosts are said to occur in the vicinity of Canjob. Oaks and pines with some admixture of tropical elements grow on the slopes of the hills near the village. The locality is in the lower part of the Lower Sonoran Zone.

##### **Chiapa** (1,800 to 2,500 feet):

*May 17-18, 1904.*—Chiapa, also appearing as Chiapa de Corzo on some maps, is a large town on the Río Grande about 10 miles southeast of Tuxtla Gutiérrez. It was an overnight stop on my route from San Cristóbal to Tuxtla Gutiérrez. Some plants were collected in the vicinity.

##### **Chicharras** (2,000 to 3,400):

*February 5-6, 13-19, 1896.*—Chicharras, or more fully Las Chicharras, is a large coffee plantation at 3,500 feet altitude, on the southern slope of the mountains, about 23 miles northeast of Tapachula, in the extreme southern part of the state. Specimens were labeled "Chicharras." This locality was reached with pack outfit from Tapachula on February 5, and we remained overnight en route to Pinabete, a place higher in the mountains. We returned to Las Chicharras on February 13.

The plantation is in an important coffee-growing district, success here being due especially to favorable climatic and soil conditions.

The geological formation is volcanic. The entire southern slope of the mountains facing the Pacific in this vicinity has a heavy rainfall and rain forest conditions are apparently due to the proximity of high mountains to the coast. The vegetation is that of the Humid Upper Tropical Zone, but the heavy forest had been largely cleared away to make room for coffee plantings. Coffee is grown in this district mainly at 2,500 to about 4,500 feet, but some plantations extend to 6,000 feet altitude. The frost line is at about 7,000 feet on this humid slope.

**Comitán (5,200 feet) :**

*March 27 to April 5, April 9 to May 7, 1904.*—Comitán is a large town at about 5,200 feet in the valley of the same name, about 30 miles from the Guatemala border. On March 26 I left San Bartolomé and proceeded about 20 miles in a northeasterly direction to the village of Canjob. On the following day Comitán was reached after traveling 16 miles farther in the same direction. In company with Nelson I had made a brief visit to the town in December 1895. Comitán is noted for a liquor called cometeco, which is distilled from a large *Agave* extensively grown in cultivation near the town. Lower Sonoran Zone.

**Comitán—mountains near (8,000 feet) :**

*December 5-6, 1895.*—A camp at 8,100 feet on the road from Teopisca and San Cristóbal, about 21 miles northwest of Comitán. From San Cristóbal southeast to near Teopisca, December 4, the road led for 21 miles across a continuation of the same mountain country, ranging 8,000 to 9,000 feet in altitude. Near the village of Teopisca we came to a steep descent from the mountains into the basinlike valley at 5,900 feet, in which are scattered numerous ranches and the village. Passing the latter we stopped at one of the ranches in the valley bottom. The next day our southeasterly course took us into the mountains on the opposite side of the valley. The trail led along narrow valleys between ridges and it was notable that, as in the mountains near San Cristóbal, water is scarce. Small springs occur here and there, but streams are absent or rare. The formation is of limestone, which evidently absorbs the water before it can run far on the surface. After traveling 13 miles we camped at 8,100 feet altitude. Specimens were labeled "Mts. near Comitán."

**La Calera (1,200 feet) :**

*August 13-14, 1895.*—La Calera is a village at 1,200 feet, near the base of the mountains, about 16 miles northwest of Tonalá. An over-

night stop on our way into the interior of the state. The route skirts the western foothills of the mountains from Tonalá to this point.

#### **El Carrizal:**

*February 21, 1904.*—El Carrizal is a ranch on the lower slope of the Sierra de la Gineta in western Chiapas. On February 20 I left Tapanatepec, Oaxaca, with my outfit in an oxcart and camped on the road after traveling east about 12 miles. Early in the morning of February 21 the outfit continued east about 12 miles to El Carrizal, near the border, but within the state of Chiapas. After a noon rest slow travel was resumed to another camp on the road.

#### **El Salto (=Salto de Agua)—near (800 feet):**

*October 29 to November 3, 1895.*—We left Tumbalá on October 29 and descended the mountains 16 miles to the village of La Trinidad, at 800 feet altitude near the north base. Heavy rainstorms made collecting practically impossible, but a few specimens taken were labeled "Near El Salto."

#### **Hacienda Juncaná to San Vicente (see Valley of Comitán and San Vicente).**

#### **Hacienda la Razón, Valle de Zintalapa (2,000 feet):**

*February 23, 1904.*—This locality was a hacienda at about 2,000 feet altitude on the rolling plain between El Carrizal and Ocozucuatla in western Chiapas. It was an overnight stop en route to the latter place. The hacienda was situated in the Valle de Zintalapa, which is a local name for a part of the larger Valley of Jiquipilas, through which we passed in the same general section in August 1895.

#### **Huehuetán (300 to 500 feet):**

*February 20 to March 3, 1896.*—Huehuetán is an Indian town at 300 feet altitude, about 22 miles northwest of Tapachula, in the extreme southern part of the state. We reached the town over the rough trail along the slope of the mountains from Las Chicharras, February 20. Huehuetán is on the low coastal plain near the base of the lower foothills of the mountains. This plain, about 20 miles wide, is nearly level except for the very gradual seaward slope. A number of small rivers cross the plain from the mountains. In the dry season these are shallow and easily forded, but become impassable torrents during storms in the rainy season. Much of the coastal plain is covered with low forest, with open grassy areas here and there near the coast. The vegetation is similar in character to that of the plain near Tonalá, but is more abundant, evidently owing

to the greater rainfall that is much more marked in effect on the neighboring mountain slopes; and even here there is more vegetation near the foothills than along the coast, except near the courses of streams where the bottoms are low and moist. Among the trees are *Enterolobium cyclocarpum*, wild figs, and the guarumo (*Cecropia mexicana*). Corn, sugar, cacao, and tropical fruits of many kinds are grown. The locality is near the boundary between the arid and humid divisions of the Lower Tropical Zone.

**Ixtapa (3,800 to 4,500 feet):**

*May 17, 1904.*—Ixtapa is a village of 4,500 feet altitude, about 10 miles northeast of Chiapa. Some plants were collected in the vicinity as I passed through en route to Tuxtla Gutiérrez.

**Jiquipilas (2,000 feet):**

*May 31, 1904.*—Jiquipilas is a village at 2,000 feet altitude, near the lower end of the Valle de Jiquipilas in western Chiapas. It was visited by me en route from Petapa to Hacienda la Razón.

**Juncaná (4,900 to 5,500 feet):**

*April 27, 1904.*—This locality is the same as "Valley of Comitán." A few specimens were collected by me in passing through en route from San Vicente to Canjob.

**La Razón (2,200 feet):**

La Razón was a hacienda at 2,200 feet on the plain in the Valley of Jiquipilas. Some plants were collected in passing through.

**La Trinidad:**

*August 14, 1895.*—La Trinidad was a hacienda on the lower part of the southern slope of the mountains, paralleling the Pacific coast north of La Calera, near Tonalá. A single specimen of bird, *Passerina rositae*, was taken along the roadside near the hacienda while on our way from La Calera, at 1,200 feet altitude near the base of the mountains to El Ocote at 2,700 feet, just beyond the summit, which was crossed at 3,500 feet altitude.

**Ocozocoautla (3,200 feet):**

*August 18-21, 1895; February 24-25, 1904.*—Ocozocoautla is a town at 3,000 feet, about 20 miles nearly west of Tuxtla Gutiérrez, the capital of the state. From Rancho San Ricardo, which we left on August 18, 1895, our direction was eastward about 18 miles to Ocozocoautla. The locality was revisited by me in February 1904. The road ascends the steep slope to the top of a tableland with low,

rounded hills scattered over its surface, much of which consists of a broad grassy plain with Ocozocoautla near the eastern border. The hills are covered with low woods that end abruptly at the bases, while the plain is nearly free of timber. At the time of our visit the plain was covered with a fine growth of grasses and flowering plants. Arid Lower Tropical Zone.

#### Ocuilapa (3,500 feet):

*August 21-29, 1895.*—Ocuilapa is a village at 3,500 feet, about 10 miles northwest of Ocozocoautla, and about 26 miles west of Tuxtla Gutiérrez. On August 21 we left Ocozocoautla and ascended an escarpment that rises near the town to an elevation of about 3,500 feet; here we found a rolling grassy plain marked here and there in low places along streams by belts of low timber. We traversed this elevated plain northwesterly for about 10 miles to Ocuilapa, near the northern side where the upper slopes of limestone ridges at about 4,000 feet are more heavily forested and show the influence of the more humid conditions along the Gulf coast. This influence is not so evident at the lower levels. We moved on August 23 from the village to Rancho Alsacia, 3 miles east, where working conditions were more favorable. Here we remained until August 29. All specimens collected were labeled "Ocuilapa." The plains as far as Ocuilapa are Arid Tropical in zonal character, but the northern slopes of the higher ridges evidently receive moisture from the Gulf and are assignable to the Humid Lower Tropical Zone.

#### Ocuilapa to Tuxtla (see Tuxtla Gutiérrez).

#### Palenque (800 feet):

*May 10-21, 1900.*—Palenque is a village at about 800 feet altitude, near the famous ruins of Palenque in northeastern Chiapas. On May 10 we left Monte Cristo, Tabasco, and traveled 28 miles in a southwesterly course to Palenque.

Palenque—the modern village—is built on a bench slightly elevated above the adjacent valley of the Río Chacamax and the adjoining plains extending to the coast. The limestone foothills of the mountains rise abruptly near the village to 2,500 feet or more and are backed by ridges reaching up to the summits of the main range at 5,000 to 6,000 feet, near Tumbalá and other places. The village is just at the dividing line between the forested foothills and the grassy plains. Between Palenque and Monte Cristo the country is an undulating plain, considerable areas of which are flooded in the rainy season.

The dense, humid, tropical forest of the mountain slopes and foothills gives place to a smaller growth on the plains, and large areas between Palenque and Monte Cristo are open savanna, interrupted by, or alternating with, irregular patches and belts of timber. A belt of heavy forest some 6 to 9 miles across lies on the road midway between Palenque and Monte Cristo. The ground in this area is lower and has more soil and moisture than other parts of the plains, and the result is the heavier vegetation. The irregular open plains extend parallel to the base of the mountains through this district and reach into Tabasco, Campeche, and Guatemala. Humid Lower Tropical Zone.

**Petapa** (2,000 to 3,000 feet) :

*May 29-30, 1904.*—Petapa is a village at about 2,500 feet altitude in the rolling plains country between Tuxtla Gutiérrez and the town of Jiquipilas. It was visited by me en route from Tuxtla Gutiérrez to San Gerónimo on the Isthmus of Tehuantepec.

**Pinabete** (7,500 to 8,800 feet) :

*February 7-12, 1896.*—Pinabete is a group of Indian ranches at 8,800 feet, about 25 miles northwest of Las Chicharras, and about 48 miles north of Tapachula, in the southern part of the state. We left Las Chicharras on February 7, traveled 13 miles northwesterly over rough trails across the front of the mountains, and camped under a shed at a small coffee and sugar plantation at 3,200 feet altitude. The next day the trail turned more directly up the mountains and in about 12 miles ascended steeply to Pinabete, on the summit. Near Pinabete the mountain slopes facing the sea are very abrupt, but toward the interior the country is rolling, the rounded hills and ridges cut by deep canyons. A very deep gorge marks a break through the range between Pinabete and the Volcán de Tacaná. This volcano is a prominent landmark, reaching to about 13,000 feet near the Guatemala boundary.

The vegetation of the mountain top near Pinabete is about like that of the high mountains in the vicinity of Quezaltenango, Guatemala, except that the large cypress, *Cupressus lindleyi*, was not seen. Two species of pines, the fir (*Abies religiosa*), an alder, madroño, and two or three species of oaks were the principal trees noted. Over the summit the woods occur as straggling lines mainly along ridges and on north slopes, leaving the greater part of the country open and covered with "sacatón" grass, with patches of bushes here and there. But on the slope facing the coast a heavy forest begins

immediately. This forest is made up of mixed pines, oaks, wild cherry, and many other trees, with a dense undergrowth. The pines reach their lower limit at about 7,000 feet, which is near the frost line. On the mountain top are grown wheat, corn, and potatoes. Frosts are frequent in winter.

#### San Bartolomé (2,500 to 4,000 feet):

*March 13-26, 1904.*—San Bartolomé is a town at 2,800 feet altitude in central Chiapas. On March 11 I left Tuxtla Gutiérrez and, after three days' travel in a southeasterly direction, reached San Bartolomé. Work in the vicinity extended to points from 2,500 to 4,000 feet. The town is built on an isolated group of hills rising above the general level in the valley a few miles north of Río de Chiapas, which flows through an arid interior basin, the high mountains of the central part of the state effectually cutting off the winter storms or northers, to which the humid climate of the north coast is largely due. The regular rainy season begins about June and ends in September or October. Although situated on the Atlantic side of the Continental Divide, the flora of the Chiapas Valley is very largely that characteristic of the Pacific coast, owing to proximity and similarity of climate. Among characteristic species are *Crescentia cujete*, *Enterolobium cyclocarpum*, *Byrsonima crassifolia*, and *Curtella americana*. Arid Lower Tropical Zone.

#### San Benito (10 feet):

*March 11-21, 1896.*—San Benito is the seaport 22 miles southwest of Tapachula. We left Tapachula in an oxcart on the evening of March 10 and arrived at daybreak next morning. The Pacific Mail Steamer, due on March 15 and expected at any moment thereafter, did not arrive until March 21, when we embarked for Salina Cruz on the Isthmus of Tehuantepec. The vegetation along the coast is less luxuriant, indicating less rainfall than near the mountains. Much of the coast plain is covered with low forest, but open grassy areas occur here and there between stream courses, where the bottoms are low, moist, and well wooded. Close along the coast line mangroves and other plants peculiar to brackish lagoons are common. Several species of cactuses abound in the sandy strip along the seashore. Sea turtles were depositing their eggs in the sand along the shore, and there were noted the tracks of jaguars that patrolled the beaches within 2 or 3 miles of the port and here and there raided caches of turtle eggs.

**San Cristóbal** (=San Cristóbal las Casas) (8,000 to 9,500 feet):

*September 15 to October 12, December 1-4, 1895.*—San Cristóbal is a large town at 8,000 feet, about 50 miles east of Tuxtla Gutiérrez, in the high mountains of the central part of the state. We left Tuxtla Gutiérrez, en route to San Cristóbal, September 13. The road at first descended about 3 miles to the Río de Chiapas. This we crossed in a canoe, with the pack and saddle animals swimming alongside. On the opposite side is the town of Chiapa, which we passed, and then began the long ascent for 15 miles to our first camp, Rancho del Calvario, at 4,300 feet. Another day's travel, covering 13 miles, brought us to Rancho del Burrero at about 5,100 feet near the base of the main range of mountains. On September 15 the road led up a long steep slope to a divide at 8,800 feet, crossed a narrow valley and climbed another ridge to 8,600 feet, from which it descended into the Valley of San Cristóbal, and on the far side 3 or 4 miles away we came to the town. The valley bottom is nearly level, or slightly sloping, and the abruptly rising hills give it a basinlike form. The trail to Comitán leads out for 2 or 3 miles across the valley in a southeasterly direction and then crosses a divide into another basinlike valley of much narrower extent and about 8,500 feet elevation. It was in the mountain ridges rising to 9,500 feet beyond this higher valley that a large share of the work in the vicinity was done.

December 1 to 4 were spent in San Cristóbal, to which we had returned from a trip to Tumbalá and other localities in the northern part of the state and adjoining state of Tabasco. Frosty nights were prevalent, in marked contrast with warm conditions at lower elevations where we had been working. On December 4 we left San Cristóbal and traveled southerly about 23 miles to a ranch at 6,700 feet just beyond the town of Teopisca. From San Cristóbal the road led through a fine mountain country at 8,000 to 9,000 feet to near Teopisca, where we came to an abrupt descent of more than 1,000 feet, leading down into the picturesque basinlike valley in which the town of Teopisca is situated. Passing the town we stopped at a ranch in the valley bottom.

En route from Tuxtla Gutiérrez to San Cristóbal there was little change in the Arid Tropical character of the flora up to about 5,000 feet near El Burrero. Near El Calvario at about 4,200 feet tropical pines begin and range up to about 5,500 feet, along with some scrubby oaks. At 4,800 to 5,000 feet two other pines begin and extend up to 7,500 or 8,000 feet. At 5,800 feet alders, sycamores, and willows were noted along a cold mountain stream. The northern slopes,

above 9,000 feet, of the mountains near San Cristóbal bear patches of cloud forest made up of large oaks with firs and other trees intermixed. Under the heavy forest canopy the ground is deeply covered with moss and ferns. These areas should probably be referred to the Transition Zone. The valley bottom at San Cristóbal is an open grassy plain. The climate there is cold and damp, with frosts and light snow or hail in winter, and still heavier snows on the mountains, according to local reports. During summer, rains are heavy and fog is prevalent.

**San Cristóbal to Teopisca** (see San Cristóbal).

**San Ricardo to Ocozocoautla** (see Ocozocoautla).

**San Vicente** (3,500 to 4,000 feet):

*December 12-13, 1895; April 15-27, 1904.*—San Vicente is a hacienda at 4,000 feet, near the Guatemala border and on the northern side of the valley of the Río de Chiapas. We made an overnight stop there in December 1895, en route to Guatemala, and the locality was revisited by me in April 1904. The country is broken and rough. The surface is of ragged, irregularly eroded limestone, in many places thinly overgrown with vegetation, and difficult to traverse. There are no high mountains very near, but in the distance toward the north the valley is bounded by the escarpments of the central highlands. A few miles southwest of San Vicente numerous streams unite to form the main trunk of the Río de Chiapas, and the upper part of the river basin is very rugged, owing to the deep canyons through which streams descend from the high mountains in Guatemala. Arid Upper Tropical Subzone.

**Tapachula** (600 feet):

*February 1-5, March 3-10, 1896.*—Tapachula is a town at 600 feet on the coast plain in extreme eastern Chiapas. We reached the town with pack outfit en route from Quezaltenango and other points in Guatemala on February 1. Tapachula is the commercial center for a large district situated near the outer foothills of the mountains which rise abruptly to form a narrow continental backbone. The most important local interest is the growing of coffee on the nearby mountain slopes. The place was used by us mainly as a base of operations for work elsewhere, and it was here that we sold the pack and saddle outfit that we had used continuously for a year and almost 9 months, and arranged to return by steamer to the Isthmus of Tehuantepec. The general conditions are about the same as at Huehuetán.

**Tecpatán (3,500 feet):**

*September 5-7, 1895.*—Tecpatán is a village at 3,000 feet on the north side of the valley of the Río Mezcalapa, about 50 miles northwest of Tuxtla Gutiérrez. It was visited by E. W. Nelson while on a reconnaissance trip. Though the river valley as far down as Quechula, at 1,200 feet, near Tecpatán, is quite arid and assignable to Arid Tropical Zone, the mountains rising to 4,000 and 5,000 feet along the northern side of the valley receive moisture from the Gulf and, as shown by large forest trees bearing an abundance of epiphytic plants, are Humid Lower Tropical in zonal character.

**Tenejapa (7,800 feet):**

*November 25 to December 1, 1895.*—Tenejapa is an Indian town at 5,600 feet, about 16 miles northeast of San Cristóbal. The town is situated in a narrow valley between high ridges reaching to 8,000 feet or more, at least on one side. Specimens were collected mainly at about 7,800 feet on the mountain slope above the town.

**Tenejapa to Yajalón (see Yajalón).****Teopisca (6,700 feet):**

Teopisca is a town at 5,900 feet, about 20 miles southeast of San Cristóbal in central Chiapas. We left San Cristóbal on December 4 and rode about 23 miles to a ranch at about 6,700 feet just beyond Teopisca, where we stopped for the night.

**Teopisca—20 miles southeast (7,200 to 8,500 feet):**

*May 7-13, 1904.*—Specimens labeled "Teopisca (20 miles southeast)" were collected by me at or near a ranch called Yerba Buena on the trail from Comitán to San Cristóbal. The trail ascends gradually from 5,300 feet at Comitán to 7,200 feet at Yerba Buena, following all the way through little valleys usually flanked by ridges that rise 1,000 to 1,500 feet higher. Work extended from Yerba Buena up to near the tops of neighboring ridges and peaks, which reach about 8,500 feet. These mountains of limestone are southern spurs of the central highlands, with slopes often rugged and steep. Beyond Yerba Buena the road descends gradually again to the valley in which are located Teopisca and several other sizable towns inhabited by various tribes of Indians.

The area, including Yerba Buena, Teopisca, and San Cristóbal, receives much more moisture than the valley of Comitán, and even here a great change is noticeable in passing from northerly to southerly slopes. The latter are dry and open, while the north slopes,

against which the northers discharge their moisture with full force often for a week at a time, are covered with a heavy humid forest, largely of oaks but including many other forest trees, heavily loaded with mosses, ferns, tillandsias, and cactuses, which grow upon the branches. Sharp frosts occur in winter in the valleys and on the more open south slopes, but the humid north slopes are less affected by them. Near Yerba Buena the mountain slopes face mainly toward the south and west and from 6,800 feet to the tops at about 8,500 feet are mainly Upper Sonoran in zonal character.

**Tila:**

*November 4, 1895.*—A village in the mountains a few miles west of Tumbalá.

**Tonalá (500 to 1,000 feet).**

*August 3-12, 1895; June 2-3, 1904.*—Tonalá is a town at 500 feet on the railroad near the Pacific coast in western Chiapas.

Three days' travel, with pack outfit as usual, over grassy savannas interrupted by strips of woodland on the coast plain took us from Santa Efigenia, Oaxaca, to Tonalá, Chiapas. The place was revisited by me June 2 and 3, 1904, when Tonalá was near the end of construction in progress on the Ferro Carril Pan-Americano. The town is situated near the base of the mountains, which rise to 4,000 and 5,000 feet in sharp peaks along the crest of the range a few miles toward the interior. There are some scattered limestone hills along this part of the mountain range, but on the first hilltops back of Tonalá are great numbers of huge weathered granite boulders, and the main formation is granite. The country here is not very unlike that farther west, on the Isthmus of Tehuantepec, in general character, but the rains are more certain and heavier. During our stay at Tonalá in the rainy season the mornings were bright and pleasant, but about midday clouds began to obscure the sky, and during the afternoon or night torrential rains fell, usually accompanied by lightning and heavy thunder. Specimens were collected near the town and up to about 1,000 feet on the slopes of the nearby hills. Arid Lower Tropical Zone.

**Tonalá—mountains near (2,700 to 3,000 feet):**

*August 14-16, 1895.*—We left La Calera, 1,200 feet altitude, on August 14, our route leading directly into the mountains and up to a divide on the crest at 3,500 feet. The trail then descended abruptly along the northwestern slope to the Rancho del Ocote at 2,700 feet,

where we camped. The day's travel covered about 16 miles. Specimens from the vicinity and up to 3,000 feet on this slope, facing the Valley of Jiquipilas, were labeled "Mts. near Tonalá." Pines and oaks cover the upper slopes of the low mountains in this section, but there is a long dry season and the general area seems assignable to Arid Lower Tropical Zone.

**Tumbalá (5,500 feet):**

*October 20-29, 1895.*—Tumbalá is an Indian village at 5,500 feet, about 13 miles northwest of Yajalón. We reached Tumbalá on October 20, the day we left Yajalón, and remained there collecting on the mountain slopes in the vicinity until October 29. Tumbalá is situated on the north slope near the top of a range of mountains extending from east to west nearly parallel with the Gulf coast, which is about 75 miles away in a straight line. The top of the range is rounded and in places very rocky and broken, or the surface may consist of a clayey soil. The descent to the lowlands is rapid, and the north slope is exposed to the full force of the prolonged rainstorms, called nortes, and the general moist conditions prevailing near the Gulf coast. The climate is, therefore, extremely humid, as, in addition to the heavy rainfall, fog and mist prevail for about nine months of the year.

The entire north slope of the mountains down to the base at 800 feet near La Trinidad is clothed with a heavy forest of trees of many species, hung with vines and epiphytes. Extensive areas of this forest have been cleared by the Indians, mainly for the growing of corn, and as it is customary to abandon a field after using it a few seasons there are considerable parts of the slopes now overgrown with matted jungle and second-growth trees representing many stages in plant succession. From 4,000 to 5,000 feet the liquidambar is one of the most common trees. Two or three towering species of oaks are among the giants of the climax forest. One of these (*Quercus cyclobalanoides*) has remarkably large acorns. The north slope near Tumbalá is favorable for the growing of coffee, and at the time of our visit Americans and Germans had recently started plantations. The cool, moist conditions extend from the north slope across the crest of the range and down to about 4,500 feet on the south slope, where a marked change to less continuously humid conditions becomes evident. Frosts are said to occur very rarely along the summit of the mountains near Tumbalá, but the general temperature, owing to cloudiness and frequent precipitation of moisture, is very cool.

**Tumbalá to El Salto** (see El Salto).

**Tuxtla** (see Tuxtla Gutiérrez).

**Tuxtla to San Cristóbal** (see San Cristóbal).

**Tuxtla Gutiérrez** (1,800 feet):

*August 29 to September 12, 1895; February 25 to March 10, May 18-27, 1904.*—Tuxtla Gutiérrez, at 1,800 feet, in the valley of the Río de Chiapas or Río Grande, is the capital of the state. On our first visit we came with pack outfit, August 29, 1895, from Rancho Alsacia near Ocuilapa, about 23 miles to the westward. We located for work at the Rancho Zapotal, 3 miles south of the town. The ranch was situated on the slope of a mountain just below a series of rocky ledges. Specimens collected here were labeled "Tuxtla."

On February 25, 1904, I revisited the locality, coming in from the west coast over a wagon road that crosses the Sierra de la Gineta through a pass at 2,800 feet near the boundary between Oaxaca and Chiapas, and on through the Valley of Jiquipilas to a final rapid descent to the town. Tuxtla Gutiérrez is situated in a small valley opening into the broad valley of the Chiapas River. The Chiapas Valley occupies a large portion of the interior of southern Chiapas, from beyond the Guatemala boundary to a point not far below Tuxtla Gutiérrez, where the Río de Chiapas turns abruptly northward and breaks through a high range of hills, the valley narrowing gradually to the tortuous and impassable gorge traversed by the river. Below the gorge the river is called the Río Mezcalapa, and lower down it joins the Río Grijalva, which enters the Gulf of México at Tabasco. Above Tuxtla Gutiérrez the Chiapas Valley broadens and slopes up on the south to the foot of the low and narrow range of mountains, usually called the Sierra Madre, which fronts on the Pacific and, although only a few miles from that ocean, forms the Continental Divide. On the north the Chiapas Valley is bounded by the escarpments of the highlands of central Chiapas, which rise abruptly and near San Cristóbal reach an altitude of 9,500 feet. The Chiapas Valley has a long dry season and is rather sterile, the high mountains of the central part of the state effectually cutting off the winter storms or northers to which the humid climate of the north coast is largely due. The rainy season usually begins about the month of June and ends in September or October. A few earlier and later rains may occur, however, and the seasons are somewhat variable. Although situated on the Atlantic side of the Continental Divide, the flora of the Chiapas Valley is very largely that of the adjoining Pacific coast

region, with which it is practically continuous through low passes in the mountain barrier. Arid Lower Tropical Zone.

**Valley of Comitán (5,700 feet):**

*December 6-12, 1895.*—The Valley of Comitán, named for the large town of Comitán, is a northern branch of the extensive drainage basin of the Río de Chiapas. The town in the valley at 6,000 feet is about 30 miles from the Guatemala border. We entered the valley and reached Comitán en route from the San Cristóbal on December 6. On December 8 we left Comitán and proceeded to the Hacienda de Juncaná, 22 miles southeast, on the road to the Guatemala border. Specimens taken at the Hacienda de Juncaná were labeled "Valley of Comitán." The broad valley, or plain, traversed from Comitán to the Hacienda de Juncaná is open and grassy for a considerable distance from town, but nearer the hacienda the route enters a thin, irregular stand of low, round-topped pine (*Pinus oocarpa*) which, added to the grass, gives the country an attractive parklike appearance. The hacienda is situated at the base of a low range of limestone hills that borders the plain in that vicinity. Oak and pine forest of a scrubby character covers the limestone ridges near Comitán and near the hacienda. Corn and wheat are grown very successfully without irrigation, as the summer rains are regular and copious, although the winters are very dry. Frost occurs at this season throughout the valley. Lower Sonoran Zone.

**Valley of Jiquipilas (=Juquipilas) (2,000 feet):**

*August 16-18, 1895.*—An extensive valley and upper drainage basin of the Río de la Venta on the northern side of the mountains near Tonalá, western Chiapas. On August 16 we left the Rancho del Ocote, in the mountains north of Tonalá, and descended to the beautiful, open, grassy Valley of Jiquipilas, down which we traveled to the Rancho La Joya, about 16 miles from our starting point. The following day we continued about 21 miles in a northerly direction down the valley to the Rancho San Ricardo, where specimens were collected and labeled "Valley of Jiquipilas." This is a long and rather narrow but basinlike valley bordered by low, rounded mountains. The altitude is about 2,400 feet at the upper end where we entered, and the bottom is slightly sloping down to about 2,000 feet at the Rancho San Ricardo near the lower end. Here and throughout the valley cattle-raising is an important industry. A small stream, one of the upper branches of the Río de la Venta, more or less forested along the banks, maintains its flow through the valley in ordinary seasons. At the time of our visit, however, the valley and neighbor-

ing regions had passed through two seasons so dry that a large share of the cattle had died from lack of food and water. At San Ricardo the country is more arid than near the head of the valley, but the general area is assignable to Arid Lower Tropical Zone.

**Yajalón** (3,000 feet) :

*October 15-20, 1895.*—Yajalón is an Indian village, at 3,000 feet, about 70 miles northeast of San Cristóbal. From San Cristóbal northeast to Tenejapa, October 12, our route crossed a series of high ridges with deep intervening canyons. The highest ridge between the two points was passed over at about 9,000 feet, and the intervening depressions extended down to about 8,000 feet until we descended a long slope to Tenejapa, in a narrow, high-walled valley, at 5,600 feet. On October 13 we reached Cancuc, 21 miles northeast of Tenejapa. Leaving the valley at Tenejapa by an extremely precipitous and dangerous trail, where our pack animals fell off repeatedly and we came very near losing them, we crossed a series of rough and rocky slopes between 4,000 and 7,000 feet until we came to the village of Cancuc, perched on a ridge at 5,600 feet. The trails, used almost entirely as Indian foot trails, proved to be so steep and dangerous that we had to hire some Indians to carry a part of the outfit from this point on in order to reduce the constant risk of losing pack animals. This was no hardship to these mountain Indians, who are accustomed to carrying everything on their backs. From Cancuc, where only one man could speak Spanish, we continued on October 14 for 16 miles across steep mountain ridges to the Indian village of Citalá, in a narrow valley at 4,100 feet. From Citalá on October 15 we traveled 18 miles north, through mountains still steep and difficult, finally arriving at Yajalón, in a setting of tropical luxuriance. The rainfall is heavy all along these northern slopes of the interior highlands, and the general area below 5,000 or 6,000 feet is in the Humid Lower Tropical Zone.

**Zinacantan** (5,000 to 6,500 feet) :

*May 16, 1904.*—Zinacantan is a village at about 6,500 feet, a few miles west of San Cristóbal, passed through by me en route to Tuxtla Gutiérrez. Plants collected in the vicinity were labeled "Zinacantan."

CHIHUAHUA

**Balleza** (also San Pablo Balleza) (5,800 feet) :

*September 23-24, 1898.*—Balleza, or San Pablo Balleza, is a settlement on the river known locally by the same name but appears on

some maps as the Río San Juan. From camp "near Parral" I made about 15 miles westerly on September 22 to the ranch of Torreón. Twenty-one miles farther in the same direction brought me to Balleza on September 23. Leaving Parral the road to Balleza follows narrow, gently rolling plains, skirting the base of the Sierra Madre and then after cutting through low outlying foothills descends gradually to the open valley at Balleza.

**Balleza**—near (6,200 feet):

*September 24-25, 1898.*—On September 24 I left Balleza and camped in the oak belt on the foothills of the main mass of the Sierra Madre, about 16 miles to the west. Specimens taken there were labeled "Near Balleza."

**Batopilas** (2,500 feet):

*October 4-8, 1898.*—Batopilas is a mining town at about 2,500 feet in the great canyon, or barranca, through which the Río del Fuerte passes on its way out through southwestern Chihuahua to the Pacific. On October 4 I left camp near the lower edge of the pines on the slope of the Sierra Madre east of Batopilas, and descended the steep zigzag trail for about 15 miles to the town. The town is situated in a side canyon on a small creek called the Río Batopilas.

The canyon is arid, as shown by the character of the vegetation. On the slope extending down from the top of the Sierra Madre the pines cease at about 5,000 feet. Scrubby oaks reach down at least a thousand feet farther. From the lower edge of the oaks on downward there is evidence of a marked change in climate. The flora is made up of tropical or subtropical species, but there are no large trees of any kind. The most conspicuous plants are cactuses, of which two large species are notable, and numerous small trees of the hot country appear. At about 3,000 feet the morning-glory tree (*Ipomoea arborescens*), the guásima (*Guazuma ulmifolia*), and the guamúchil (*Pithecollobium dulce*) begin and increase in numbers toward the bottom of the canyon. The morning-glory tree is known locally as palo santo and also batopila. From the latter the name of the town is derived. Vegetation is generally scanty, but there are in places dense thickets of small, arid tropical trees and shrubs of many kinds. Small patches of corn, beans, and sugarcane, are cultivated by the Indians.

No heavy frost occurs along the river, but frosts so slight as to be almost imperceptible are said to occur in the lower part of the canyon in winter. The life zones in the canyon are somewhat complex, owing to unusual conditions. The mammals of the lower part of the canyon

are mainly Lower Sonoran species, derived by invasion from the Lower Sonoran coastal region, but the vegetation appears to be predominantly Upper Arid Tropical in character. The Lower Sonoran Zone is more typically represented somewhat higher on the slopes, and the scrub oak belt from about 4,000 to 5,500 feet is within the Upper Sonoran Zone.

**Batopilas**—near (2,800 feet):

*October 8-12, 1898.*—As conditions for work were not very favorable in the immediate vicinity of Batopilas, I decided to move on a short distance, and on October 8, after traveling about 20 miles in a westerly course, I stopped at the ranch of Las Guásimas in the same character of country as at Batopilas, and where the conditions for work were much better. The road from Batopilas to Las Guásimas led over a ridge about 1,500 feet higher than the town and down again to the ranch at a point nearly as low as Batopilas. The little ranch of Las Guásimas is situated among some low ridges on the right bank of the Río del Fuerte, and several miles back from the stream. Specimens taken here were labeled "Near Batopilas."

**Casas Grandes** (4,300 feet):

*May 11 to June 10, 1899.*—Casas Grandes is a town at about 4,300 feet near the railroad station, Nueva Casas Grandes, in northwestern Chihuahua. On May 11 I left El Paso, Tex., and took the train at Ciudad Juárez, on the Ferro Carril Río Grande, Sierra Madre y Pacífico, for Casas Grandes, where I arrived in the afternoon. I remained in this vicinity until June 10. Work was done along the Casas Grandes River, which passes the town, and on the plains and in the low, barren hills a few miles east of the railway station.

From Ciudad Juárez at about 3,600 feet the railroad ascends gradually over a rolling plain to a point a few miles northeast of Corralitos, where a divide is crossed at about 5,300 feet, and a gentle slope, although steeper than the one ascended, leads down to the town at about 4,300 feet. Ridges and groups of hills 300 to 1,000 feet higher than the plain rise a few miles away all along the line. Most of these hills have rounded outlines, but some of them are quite rugged, and all are very barren. The town of Casas Grandes is situated on the Río Casas Grandes, a few miles north of a point where, after leaving some low hills, it enters a nearly level plain 8 or 10 miles wide. The river flows into an interior basin or sink in the bottom of which is the Laguna de Guzmán, which has no outlet. The climate of this region is exceedingly dry, although heavy rains are of frequent occur-

rence during the rainy season from June to September or October. Sharp frosts occur and occasionally light snow falls in winter.

In floral aspect the country is rather barren. The level or gently rolling plains between Ciudad Juárez and Casas Grandes are open and grass-covered for the most part, but over large areas clumps of low-growing mesquite are mixed with *Larrea tridentata* and a few other desert shrubs. Considerable cottonwood timber and a few willows and black walnut trees grow along the river. On the low barren hills vegetation is limited to grass and a few small shrubs. Lower Sonoran Zone.

**Colonia Díaz (4,000 feet):**

*September 21-22, 1899.*—Colonia Díaz is a Mormon settlement at 4,000 feet just west of the bend of the Casas Grandes River, in northwestern Chihuahua. On September 20 we left Guzmán on the railroad and traveled 35 miles south of west over the plain on the road to Colonia Díaz, and on the following day continued 6 miles to the town, en route to the antelope country to the west.

**Colonia García—near (6,400 to 7,000 feet):**

*June 22 to August 21, 1899.*—Colonia García is a small Mormon settlement in the Sierra Madre about 55 miles southeast of Casas Grandes, northwestern Chihuahua. On June 22 we left our camp 6 miles southwest of Colonia Juárez and, after traveling about 25 miles southwest over the first high ridge of the Sierra Madre, the Sierra de la Brena, camped at 6,400 feet in a broad branch of Pilares Canyon, 10 miles northeast of Colonia García. On June 29 we went on to Colonia García and from there turned west 5 miles to a meadow on the upper part of the Río Gavilán, at 6,700 feet. From this camp on July 5 we moved 9 miles southeast to the head of a small tributary of the Río Gavilán. On July 16 we changed to a small tributary of the Piedras Verdes River, distant 15 miles to the southeast. On July 19 camp was shifted 9 miles in a southerly direction to the lower end of Meadow Valley, at the head of the Piedras Verdes River, at about 7,500 feet altitude. On August 6 we moved 12 miles southeasterly to the head of the Río Alamos, a tributary of the Río San Miguel. From this place we went 8 miles west on August 13 and camped at a fine meadow in the forest. On August 18 we returned to Colonia García. Specimens from all the camps mentioned and altitudes ranging from 6,400 to 7,500 feet were labeled "Near Colonia García."

The northern part of the Sierra Madre Occidental, along the western border of Chihuahua, rises rather abruptly from the open grassy plains of the valley of the Río San Miguel, an upper affluent which skirts the eastern side in a northerly course and, as the Río Casas Grandes, flows into the Laguna de Guzmán, which has no outlet. Where we entered the mountains the bordering plains have an altitude of a little more than 5,000 feet, and the crest of the first mountain ridge reaches about 8,000 feet, with a few elevations slightly higher. The range as a whole is fairly broad in this region, as it extends over some 40 miles of western Chihuahua, and well into adjacent parts of Sonora, but is narrower than farther south. The Continental Divide is about 25 miles west of the crest of the ridge bordering the plains. The entire range is deeply scored by canyons, those of the eastern slope carrying drainage out to the Río Casas Grandes. The canyons on the eastern side, leading down to a plain at about 5,000 feet, are greatly exceeded in depth by those on the western side, which drop rapidly to low elevations on their way to the sea. The top of the mountains near the Divide is less broken, and there are areas of undulating country over which one can ride in any direction. The main Divide is 8,000 to 8,500 feet high, and there are no prominent peaks rising anywhere in the section visited by us. On the Sonoran border to the west, however, we saw the swelling bulk of Cerro Candelaria, which is more than 9,000 feet high. Far to the south the tops of two other mountains of similar height were seen. The whole area may be described in general terms as a broken mass cut with canyons in many directions, and lacking the broad plateaus found farther south in Durango and Jalisco. The main mass of the Sierra Madre narrows toward the north and decreases in altitude, ending in a descending spur known as the San Luis Mountains, which extend across the Mexican boundary in southwestern New Mexico. In northwestern Sonora, however, a series of low, parallel, outlying ranges, forming a part of the Sierra Madre system, are separated by river valleys with drainage toward the south.

The northern end of the Sierra Madre is fairly well watered with small and shallow streams, rarely over a few yards wide, except when filled by melting snow or during the summer rains. In summer small rivulets may become impassable and the larger canyons are swept by floods. The months of April, May, and June are dry and pleasant. In July, August, and September, which form the wet season when rain falls almost daily, the ground, thoroughly saturated, becomes boggy. Hailstorms are not infrequent on the higher parts of the

range, and violent rainstorms at this season are accompanied by much thunder and lightning. Frosts prevail as early as October, and snow from 6 to 20 inches deep falls at intervals during the winter but usually disappears within a few days, except on north slopes.

Pine forest made up of three or four species covers nearly all slopes of these mountains above 6,500 feet. Mixed with the pines up to 7,500 and 8,000 feet are scrubby oaks. Below the pine forest on the basal slopes of the mountains a belt of scrubby oaks extends down to about 5,500 feet. Along the courses of streams in canyons below 6,500 feet cottonwoods and black walnuts appear. In some damp places on cool north slopes small groups of aspens (*Populus tremuloides*) and Douglas firs (*Pseudotsuga mucronata*) were noted. A few maples were seen along the upper part of Pilares Canyon. On south slopes from 6,000 to 7,500 feet a dense growth of manzanita (*Arctostaphylos*) occurs. The pine forest is open, with very little undergrowth, but grasses and herbaceous plants are abundant. Beautiful parks or open meadows, some with an area of several square miles, occur here and there, and in them wild flowers in great variety abound during the rainy season. Some of these parks, as at Colonia García, were occupied by Mormon settlers who grew wheat, corn, oats, barley, and potatoes and cut wild hay for forage.

The lower slopes of the Sierra Madre, from about 5,500 to 6,500 feet on average slopes, are in the Upper Sonoran Zone. On south slopes overgrown with manzanita this zone may extend to 7,000 feet, or even higher. The upper pine-covered slopes belong mainly to the Transition Zone, with a small admixture of Canadian Life Zone elements, represented by the aspen and spruce on north slopes at the higher elevations.

#### Colonia Juárez (5,000 feet):

*June 17-22, 1899.*—Colonia Juárez is a town at about 5,000 feet near the Río Casas Grandes, about 15 miles above Casas Grandes, northwestern Chihuahua. Nelson, who had spent about 9 months in Washington, rejoined me in the field. We left Nueva Casas Grandes on June 17 with a newly acquired outfit of pack and saddle animals and rode 15 miles southwest to Colonia Juárez. On June 18 we continued about 6 miles south and camped near the east base of the Sierra Madre, where we remained working until June 22. Specimens taken at 5,000 to 5,400 feet near this camp were labeled "Colonia Juárez."

**Lake Santa María** (4,000 to 5,000 feet):

*September 8-19, 1899.*—Lake Santa María, or Laguna de Santa María, as it is called on maps, is the sink at about 4,000 feet, of the Río Santa María, in northwestern Chihuahua. On September 4 we left Casas Grandes with our pack outfit and traveled 25 miles northward along the railroad. On September 5 we continued about 15 miles in the same course, and on September 6 turned eastward about 18 miles to the Río Santa María. On September 7 we went 15 miles northward, down along the course of the Río Santa María, and camped on the bank of the stream. From September 8 to 13 we remained at this camp, hunting mountain sheep. On September 14 we moved camp about 12 miles northward to some springs at a deserted ranch at the northwest corner of Lake Santa María. Here we camped until September 19 and were successful in our quest of sheep (later to be named *Ovis mexicanus*) in the desert mountains near the lake. Lake Santa María was a saline body of water about 8 miles long and 6 miles wide at the time of our visit. Low but rugged volcanic hills and mountains rise a few miles away in three directions. The lake basin is separated from that of the Laguna de Guzmán, the saline sink of the Río Casas Grandes, a short distance to the northwest, by a divide not more than 200 feet high. The desert mountains near Lake Santa María bear grasses and a few shrubs on their slopes but are devoid of timber. Cottonwoods, willows, and mesquites grow along the Río Santa María. On the vast open grassy plains clumps of the low-growing type of mesquite here and there are mixed with acacias, the creosotebush (*Covillea tridentata*), the ocotillo (*Fouquieria splendens*), and a few cactuses. Lower Sonoran Zone.

**La Providencia** (6,500 feet):

*September 11-12, 1898.*—La Providencia was a hacienda at 6,500 feet about 28 miles west of Parral. An overnight stop was made here en route from points in the Sierra Madre to Parral.

**Pacheco**—near (8,000 feet):

*August 21-27, 1899.*—Pacheco, or more fully Colonia Pacheco, is a Mormon settlement in the Sierra Madre, 8 or 10 miles north of Colonia García, northwestern Chihuahua. On August 21 we left Colonia García and traveled 15 miles in a northerly direction to Cove Valley, passing through Colonia Pacheco en route. On August 22 we went on 8 miles in a northeasterly direction and camped in a very broken country called "The Basins" by the Mormon settlers. On August 24 we moved camp 12 miles in an easterly course and

camped near a sawmill at 8,000 feet on the top of the Sierra de la Brena. Specimens taken at both camps were labeled "Near Pacheco." On August 26 we left the mountains and returned to Nueva Casas Grandes the following day.

**Parral** (also mapped as Hidalgo del Parral) (5,700 feet):

*September 12-20, 1898.*—Parral is a town at 5,700 feet at the eastern base of the Sierra Madre in southern Chihuahua. It was the terminal point reached by Nelson and me at the end of a summer season in the Sierra Madre. Nelson returned to the United States, and I proceeded with a Tarahumare Indian helper across the Sierra Madre to Sonora. At the time of our visit to Parral a branch railroad was in course of construction, but the main line at Jiménez was still one day distant by stage. The town is nearly surrounded by low, barren hills. The vegetation is that characteristic of the interior tableland. Common plants are mesquites, acacias, and cactuses. Black walnut, cottonwood, and *Baccharis* bushes grow along the streams. The vicinity of the town is Lower Austral in zonal character. The occurrence of black walnut along streams and scrub oak and pinyon pine on the foothills of the Sierra Madre indicates Upper Austral Zone.

**Parral**—near (6,200 feet):

*September 20-22, 1898.*—On September 20 I left Parral with pack outfit and Indian helper and, after riding about 31 miles in a north-of-west direction, camped in some outlying foothills of the Sierra Madre. Specimens obtained here were labeled "Near Parral."

**San Julián** (see Sierra Madre, near San Julián).

**Santa Rosalía** (now Ciudad Camargo) (4,000 feet).

*September 17-26, 1893.*—Santa Rosalía, renamed Ciudad Camargo, is situated on the railroad near where it crosses the Río de los Conchos, a southern branch of the Río Grande. The altitude is 4,022 feet. Work here was all done within a radius of 3 miles, mainly along the sides of the river bottom and adjacent mesa above the town. The locality is on a gently rolling plain with broad stretches of nearly level mesa, or benchland. Scattered at irregular intervals over the plain are low barren groups of hills or mountains. These are usually rounded in outline, but some broken down in cliffs or rocky ledges are ragged in profile. The formation of the hills near Santa Rosalía is made up of numerous alternating strata of limestone and clay, uplifted and contorted in a remarkable manner. The climate is hot

and dry. The rainy season extends from June to October, but the rains are very irregular and often very scanty.

Conditions are very similar to those of arid sections of the southwestern United States, and the area is in the Lower Austral Zone. Among the characteristic plants are *Larrea tridentata* and *Prosopis juliflora*.

**Sierra en Media (5,000 feet):**

*September 24 to October 8, 1899.*—Sierra en Media is a low desert mountain range lying about 6 miles east of the base of the Sierra Madre, near the southern border of New Mexico. On September 22 we left Colonia Díaz, in the valley of the Río Casas Grandes, and traveled west 8 miles. On the following day we continued west about 40 miles and camped on the plain just east of the base of the Sierra de las Espuelas, a local name applied to an eastern ridge of the Sierra Madre. On September 24 we moved to a water hole at the north end of the Sierra en Media. There we remained until October 3, when the next move was 8 miles southwest to a point close to the base of the Sierra Madre. On October 5 camp was moved to a mudhole 10 miles to the south, and on October 6 we returned to camp at the north end of the Sierra en Media. There we remained until October 8, when we returned directly across country about 40 miles to Colonia Díaz. Work at the various camps was mainly for the purpose of obtaining specimens of antelope and mule deer, and all material taken was labeled "Sierra en Media." On October 9 our outfit of pack and saddle animals was sold and work for the season brought to a close.

**Sierra Madre, near Batopilas (6,000 feet):**

*October 3-4, 1898.*—From Tasajera, where material was labeled "Sierra Madre, 40 miles E. Batopilas," we continued on October 3 for about 25 miles, still in a westerly course. Our general route had been over broad, level, or gently rolling mesas, between canyons of parallel streams flowing west out of the Sierra Madre. These nearly level stretches were interrupted here and there by ridges and by very rocky and broken pieces of road, where the heads of gulches cut the surface. No deep canyons, however, were encountered until after having crossed what appeared to be the highest ridge of all this part of the mountains. We came out suddenly on the edge of the great barranca in which Batopilas is situated, and through which flows the Río del Fuerte. We descended a short distance and camped at about 6,000 feet, a little above the lower edge of the pines. From this

vicinity the views of the broken country lying in the valley of the Río del Fuerte to the westward are magnificent. In similarity of setting, titanic sculpture, and general grandeur, but not in color, the region rivals the Grand Canyon of the Colorado. Great canyons with sheer walls dropping away thousands of feet, alternating with ridges, each of which is a little lower than the preceding one, fill the area out as far as the eye can see toward the coast. High, pine-covered, level-topped spurs of the Sierra Madre extend out in long fingerlike points between the side canyons. These spurs do not slope down gradually to the river, but project on a level to a definite point where they break off sheer for hundreds of feet, below which high cliffs and narrow, sharp-crested ridges descend rapidly to the river.

Reference has been made, in remarks on other localities, to the general small size of the timber met with in crossing the Sierra Madre. The largest pines noted were on the western side, on the high ridge overlooking the valley of the Río del Fuerte, and in a dark arroyo a few coniferous trees, probably *Pseudotsuga mucronata*, were noted. Herbaceous vegetation was plentiful and many species were still in flower. Grass is fairly abundant on some of the high mesas. Corn is about the only crop cultivated and that on a small scale on scattered Indian ranches. A few peaches and apples are also grown. After leaving Balleza we met no one on the trail, and no one was seen by my Tarahumare Indian guide or me until we reached Batopilas except a few Indians at ranches. These Indians were very shy and inclined to keep out of sight. During the summer in the Sierra Madre to the southward heavy showers were of almost daily occurrence. The rainy season ended abruptly while at Parral, and during this crossing of the mountains the weather was beautifully clear, with frosts at night at the higher elevations.

Over the higher parts of the Sierra Madre Transition Zone elements prevail, but at the lower elevations the mountains are extensively invaded by Upper Sonoran Zone components.

**Sierra Madre, 40 miles east of Batopilas (6,500 feet) :**

*October 2-3, 1898.*—On October 2 I resumed my westerly direction and covered about 25 miles from the locality "Sierra Madre, 65 miles East of Batopilas," to some abandoned Indian ranches called Tasajera. Material taken here was labeled "Sierra Madre, 40 miles E. Batopilas."

**Sierra Madre, 65 miles east of Batopilas (7,000 feet) :**

*September 29 to October 2, 1898.*—On September 28 we left the camp in the vicinity of Guachochic and traveled 21 miles in a westerly

direction to the ranch of La Gualaina. On September 29 we continued about 13 miles to a high part of the Sierra Madre, locally known as Los Gentiles. The altitude of this camp was estimated at 7,000 feet. Here I remained working until October 2, and all specimens taken were labeled "Sierra Madre, 65 miles E. Batopilas." The locality is about 25 miles east of Tasajera, a group of Indian ranches marked on some maps. From the camp in the foothills west of the Río de Balleza to the top, or backbone, of the Sierra Madre, the ascent is rather gradual, the trail leading up arroyos and over ridges through comparatively barren and moderately broken country to the top at an altitude of about 6,500 feet. After crossing the main divide the ridges become higher and much better wooded than on the eastern side, considerably higher than the drainage divide at the point where we crossed, and form an elevated mountain mass between the confluence of the Río Urique and the main branch of the Río del Fuerte. On the eastern slope of the Sierra Madre and up to near the tops of the highest ridges the principal trees are rather scrubby oaks and pinyons. Near the top the pinyons cease. Oaks of somewhat larger size and perhaps different species continue, mingled with a stand of rather small pines and a few madroños, manzanita bushes, and ash trees. The ash was noted only along streams. Most of the area covered appears to be referable to Upper Sonoran Zone, with an admixture of Transition Zone elements on the top.

**Sierra Madre, near Guachochi**—(see Sierra Madre, near Guachochic).

**Sierra Madre, near Guachochic (6,500 feet):**

*September 27, 1898.*—Guachochic was a group of Indian ranches a short distance south of my route across the Sierra Madre between Parral and Batopilas. The name of the locality was misspelled, specimens taken in that vicinity being labeled "Sierra Madre, near Guachochi." On September 26 we traveled about 31 miles in a westerly direction, passed the group of Indian ranches called Guasarachic, and camped in a barren spot among the pines on the backbone of the Sierra Madre at an altitude of about 6,500 feet. On September 27 we kept on in a westerly course about 21 miles, passing a short distance north of Guachochic, to the small ranch or Ojito.

**Sierra Madre, near Guadalupe y Calvo (7,000 to 9,000 feet):**

*August 21 to September 5, 1898.*—Specimens labeled "Sierra Madre near Guadalupe y Calvo" were taken at various elevations in the vicinity of Hacienda del Tule, at the east base of Cerro Mohinora,

the highest part of the Sierra Madre. This locality is about 10 miles southwest of the mining town of Guadalupe y Calvo, in extreme southwestern Chihuahua. On August 20 we left our camp in the "Sierra Madre near Guanaceví," Durango, and traveled northwest about 21 miles to a ranch called "Piedra Larga," passing the deserted mining camps of Arroyo del Agua and San Julián en route. On August 21 we turned northerly for 18 miles and camped in the woods at 7,500 feet, and on August 22 we reached our destination at the base of Cerro Mohinora, after covering 24 miles in a northwesterly direction.

Immediately after leaving Guanaceví, Durango, we ascended the front of the high Sierra Madre and from that point to El Tule traveled through a rough mountain country lying between 7,000 and 9,000 feet. In every direction ridges and canyons cover the area, forming a broad expanse of mountains covered by pine forest. In some parts the way was extremely rocky and the canyons were walled by high cliffs, but as a rule the slopes, though steep, were not precipitous. Between the ridges here and there are beautiful basinlike valleys, and the tops of some of the elevations form gently undulating benches.

Cerro Mohinora is not a solitary peak but the culmination, at between 10,500 and 11,000 feet, of an uplifted mountain mass 10 or 15 miles in length. The mountains about 25 miles north of Guanaceví, Durango, the northern end of which we crossed later, were said by mining engineers to be about 10,000 feet high and would, therefore, approach Cerro Mohinora in elevation. A feature of Cerro Mohinora is that the eastern slope is the more gradual, with trails leading to the summit and overlooking the great mass of the Sierra Madre, while the western side skirted by the canyon of the Río Basonapa, and facing the low coast country of Sinaloa, is rugged and precipitous. The mountain is said to be snow-capped from November or December until May and to be visible from far away in the low country. At the time of our visit in the rainy season heavy showers were of almost daily occurrence, and every gulch had its small stream, but most of these would be dry during the dry season. In winter 2 to 4 feet of snow is said to fall over this mountain district.

The forest in this section of the Sierra Madre is rather open, and as a rule the trees are small and low, but in places the stand is dense and the pines may attain large size. Six or seven species of pines, including the pinyon, were noted, but only one ranges above about 9,000 or 9,500 feet. A fir (*Pseudotsuga mucronata*) and the quaking aspen

(*Populus tremuloides*) occur on cold north slopes above 8,000 feet. A few ash trees, madroño, black walnut, alder, elder, wild cherry, wild gooseberry, raspberry, willow, violets, and strawberries were familiar northern forms of vegetation noted. Most of these are indicators of Transition Zone, but some species, as the black walnut, represent invasion by Upper Sonoran elements.

**Sierra Madre, near Guasarachic (6,500 feet) :**

*September 25-26, 1898.*—On September 25 we left camp among the oaks 16 miles west of Balleza, traveled on about 16 miles in a westerly direction up the slope, and camped among the pines at about 6,000 feet. Specimens taken here were labeled "Sierra Madre near Guasarachic." Guasarachic, a group of Indian ranches, was not reached and passed, however, until the following day, September 26.

**Sierra Madre, near San Julián (8,000 feet) :**

*September 7-8, 1898.*—On September 6 we left our locality "Sierra Madre near Guadalupe y Calvo," at the base of Cerro Mohinora, extreme southwestern Chihuahua, and camped on the road halfway to San Julián, on the headwaters of the Río del Fuerte. We continued to San Julián on the following day. Material collected in this vicinity was labeled "Sierra Madre near San Julián, Chihuahua." The locality is near the Chihuahua-Durango boundary and may be shown on maps of either or both states.

COAHUILA

**Carneros (6,800 to 7,800 feet) :**

*August 11-16, 1896.*—Carneros is a station at 6,800 feet on the railroad about 20 miles south of Saltillo in southeastern Coahuila. The locality was reached by rail from La Ventura. On the evening of August 14 Nelson took the train for the United States, and I remained two days longer before moving on to localities in the state of Querétaro. The station is situated in a pass between the Sierra de Guadalupe, or a northern spur of the Sierra Encarnación, and another group of mountains forming a part of the northern end of the Sierra Madre Oriental lying to the eastward. On both sides of the gap at Carneros the mountains slope up to rounded crests from 1,000 to 1,500 feet above the level of the pass. North of the pass the railroad descends rapidly to a plain about 1,000 feet lower. This plain, similar in character to the Llano de los Perros, on which La Ventura is situated, is bounded on its farther side, about 10 miles away, by another barren range of mountains similar to those at Carneros. Near

Carneros and up the slopes to the summits of the adjacent hills the yuccas are the most conspicuous plants. Pinyon trees are scattered over the hills, and scrub oaks and junipers (*Juniperus mexicana*) occur in the canyons. In winter severe frosts occur here and several inches of snow may fall during occasional storms. The station is in the lower part of the Upper Sonoran Zone.

**Ciudad Porfirio Díaz** (now Piedras Negras) (725 feet) :

*June 2-7, 1902.*—Ciudad Porfirio Díaz was the town on the Mexican side of the Río Grande, opposite Eagle Pass, Tex. Brief visits were made to the Mexican side to collect birds while working also at Eagle Pass.

**La Ventura** (5,600 feet) :

*July 18-21, August 1-10, 1896.*—La Ventura is a railroad station at 5,600 feet, near the boundary of Zacatecas, in the extreme southeastern part of the state. We reached La Ventura by rail and found quarters at the hacienda of the same name near the station. The locality is in the southeastern part of an interior basinlike plain, about 30 miles in length. It is in an arid district with no surface water except such as is caught in artificial reservoirs. The plain mentioned is known as the "Llano de los Perros" from a large colony of prairie dogs, *Cynomys mexicanus*, a species quite restricted in distribution. Desert mountains border the plain in nearly every direction. To the east and south are low hills, backed by groups of mountains thinly overgrown with yuccas, cactuses, and small desert shrubs. To the west the Sierra Encarnación rises to an altitude of about 10,000 feet. The vegetation of the plain includes *Larrea tridentata*, an important Lower Austral Zone indicator. Lower Austral Zone.

**Monclova** (2,000 feet) :

*May 12-20, 1902.*—Monclova is an important town at 2,000 feet on the railroad in east-central Coahuila. On May 11 we left Saltillo by train and reached Monclova the morning of May 12. Monclova is situated on the northward extension of the arid tableland, where it gradually descends toward the Río Grande. The general level is broken by benches and rolling hills with ranges of low, isolated mountains rising abruptly here and there. To the south and east of Monclova these rise several thousand feet above the plain.

Between the irregularities are nearly level areas of varying size and outline, some of which appear to have been the beds of shallow lakes now dry. As elsewhere on the tableland water is generally scarce,

although a small stream, the Río de Monclova, passes through the town of Monclova and is utilized to irrigate adjacent lands.

The vegetation is that of the northern part of the tableland in general. On the neighboring plains characteristic species are the mesquite (*Prosopis juliflora*), huisache (*Acacia farnesiana*), *Larrea tridentata*, yuccas, agaves, and cactuses. On the upper slopes of hills are pinyons, junipers, and oaks. The bald cypress (*Taxodium*), willows, cottonwoods, and *Baccharis* bushes grow along the river.

#### Sabinas (1,100 feet):

May 20-31, 1902.—Sabinas is a town at 1,100 feet on the railroad in eastern Coahuila. We left Monclova by rail on May 20 and reached Sabinas the same day. Work was carried on in the immediate vicinity until brought to a close for the season on May 31. From Monclova to Sabinas the country is a gently rolling plain, descending gradually toward the Río Grande, with scattered hills, low benches, and here and there low isolated masses of desert mountains. Near Sabinas the open plains are much broader and less broken by hills and ridges than near Monclova, but are similar in general character. The Río Sabinas, rising in the mountains about 75 miles to the west, passes Sabinas where it is easily fordable except after rains which bring down flood water.

The vegetation on the plains is about the same as near Monclova. In the narrow, fertile strip of bottomland along the river large pecan, bald cypress, cottonwood, willow, ash, and sycamore trees formed a fairly dense growth, contrasting strongly with that of the adjoining desert. Recent heavy rains had brought out many wild flowers, giving the usually arid plains their seasonal appearance of floral richness. Lower Austral Life Zone.

#### Saltillo (5,000 feet):

April 14-19, May 3-11, 1902.—Saltillo is the capital of the state of Coahuila. On April 14 we left Santa Catarina, Nuevo León, by rail, and reached Saltillo, Coahuila, the same day. Work was carried on in the vicinity at intervals until May 11, when we took the train for Monclova, Coahuila. The city is situated at about 5,000 feet above sea level on the eastern border of the interior tableland. It is built on a barren plain near a northern spur of the Sierra Madre Oriental. These mountains rise steeply from the plains a few miles southwest from town to an elevation of 8,000 or 9,000 feet above the sea. In other directions numerous more or less isolated ridges and hills rise from 100 to 2,000 feet above the level of the plains. Between the

ridges are nearly level valleylike stretches of plain varying in extent. The general continuity of the Sierra Madre Oriental is lost near Saltillo. From there north many desert ranges alternate with open, nearly level plains, descending gradually toward the Río Grande Valley in a great series of terraces.

The rains in this region fall mainly from June to September or October but are irregular, and cultivated crops are very uncertain without irrigation. The mountains are scantily supplied with springs and the few streams flowing from them are small.

The arid climate of the region near Saltillo is reflected in the vegetation. On the plain the creosotebush, or gobernadora (*Larrea tridentata*), and the ocotillo (*Fouquieria splendens*), along with yuccas, agaves, and cactuses, are among the more abundant species. Some of the lower slopes of desert hills appear from a distance to be devoid of vegetation but on closer inspection show an abundance of small agaves and cactuses. Higher on the slopes of the mountains there is a scanty growth of junipers, oaks, pinyons, and some pine on the summits.

The plains near Saltillo are in the Lower Austral Zone, which gives way to the Upper Austral Zone on the slopes of the hills.

#### San Pedro:

*March 28, 1926.*—Railroad station 10 miles west of Laguna de Mayrán in an arid interior basin in the southwestern part of the state. I visited the place and took a few mammals while engaged mainly in migratory-waterfowl investigations.

#### Sierra Encarnación (7,500 to 9,500 feet):

*July 23-31, 1896.*—Sierra Encarnación is a mountain range, reaching about 10,000 feet in altitude, along the southern part of the boundary between northeastern Zacatecas and southeastern Coahuila, the northern end extending well into the latter state. From Gómez Farías, a station on the railroad in southeastern Coahuila, we proceeded southwesterly on July 22 about 13 miles by wagon to Hacienda Encarnación in the lowest part of the depressed plain known as the Llano de los Perros. On July 23 we continued in the same direction about 14 miles and camped in the foothills of the mountains. We moved camp the next day about 2 miles to a more favorable place at about 8,000 feet. Work on the adjacent slopes and up to near the top of the mountains was carried on until July 31, when we returned to Gómez Farías.

The Sierra Encarnación is about 30 or 35 miles long and reaches to about 10,000 feet in the highest parts. Like other ranges of the general region there is a single crest with a sinuous outline and the slopes drop away steeply to the plains at the base. Several deep canyons cut into the front of the range, but water is limited to a few small springs. The lower slopes up to 6,500 or 7,000 feet are overgrown with mesquites, acacias, yuccas, agaves and cactuses. The higher ridges are open and covered mainly with grass, but two species of cactus, an agave, and a yucca extend along exposed slopes and ridges to the summit. The more sheltered slopes from 7,000 or 7,500 feet to 9,500 feet bear a more or less abundant stand of pinyon pine, and above 8,000 feet cypresses, some scrubby oaks, and a few small madroños were noted. The lower slopes of these mountains up to about 7,000 feet, at least on the south slopes, are Lower Austral and those above this level are mainly Upper Austral in zonal character. A few Transition Zone elements may occur near the heads of canyons on north slopes.

**Sierra de Guadalupe (6,500 to 9,500 feet) :**

*April 20 to May 3, 1902.*—Sierra de Guadalupe, sometimes known as Sierra de Patos, and usually omitted on maps, is a range of mountains reaching 9,500 feet, about 20 miles southwest of Saltillo, Coahuila. On April 19 we proceeded by rail from Saltillo to the town of General Cepeda (formerly Patos). There we hired an outfit of men, horses, and pack animals and on April 20 rode about 12 miles south to a spring called Los Tanquitos, at 6,500 feet, on the north slope of the Sierra de Guadalupe, where we camped. On April 28 we left Los Tanquitos and rode east about 10 miles to the canyon of Las Casitas, up which we continued and passed through the range, a distance of 6 or 8 miles, and camped at about 6,500 feet, near an old sawmill on the south slope, known as La Concordia. On April 29 we ascended the south slope of the range and camped at 9,500 feet near the summit. Specimens were all labeled "Sierra Guadalupe." On May 3 we descended the mountains and returned to Saltillo.

The Sierra de Guadalupe, with an extreme summit elevation of about 10,000 feet, is the highest of a series of small, steep, narrow-crested mountain ranges with a general trend from east to west in southern Coahuila. All these ranges lie on the barren tableland west of the main chain of the Sierra Madre Oriental. The Sierra de Guadalupe, however, is connected across the low pass at Carneros with a low western spur of the Sierra Madre. To the north of the Sierra de Guadalupe the plains at about 5,000 feet continue between

irregularly scattered hills and low mountainous ridges. To the south and parallel to this range lie a series of lower mountain ridges, rising 1,000 to 3,000 feet above the surrounding plain. Between these ranges are the broad, nearly level plains or somewhat trough-shaped valleys from which the mountain slopes are thrown up with great abruptness, there being scarcely any foothills. The Sierra de Guadalupe is mainly limestone, with ledges and precipitous slopes of rock of considerable extent in many places. The summit of this range is practically devoid of springs or other permanent water, and the few springs found half-way down the slopes are small. A few larger springs occur along the base of the mountains, but water is nowhere plentiful. Several deep canyons score the range almost from summit to base, draining to the north, and the larger of these divide the range into sections. The largest of all these canyons is the Canyon of Las Casitas, which cuts entirely through the range. It heads in an elevated valley on the south side and drains north to the Arroyo de Patos, a seasonal affluent of the Río Sabinas, also known as the Río Pesquería, which turns eastward around the northern end of the Sierra Madre Oriental, and lower down joins the Río San Juan to enter the Río Grande near Ciudad Camargo. Two large springs send a small stream flowing down the lower part of Las Casitas Canyon.

Near the top of the Sierra de Guadalupe we found an irregular plateau lying like a shelf about 500 feet below and just south of a sharp ridge forming the extreme summit. This shelf varies from half a mile to a mile wide and is about 4 miles long. It is diversified by four little parklike basins, 100 to 400 feet deep and one-fourth to a mile broad, with no outlets on the surface. The bottoms are locally called *playas*. They are grass-covered and treeless, but the surrounding slopes are well wooded.

Heavy snow often falls on the top of the mountains, and frosts occur almost every month. The southern exposures of the mountains receiving the direct rays of the sun the entire year show the effects in their barren character. The vegetation on this slope consists mainly of yuccas, agaves, and desert bushes, which extend up to within 500 feet of the summit. On the north slope there are more favorable conditions for tree growth and junipers, pinyons, and scrubby oaks form a thin forest extending from about 5,500 or 6,000 feet to 7,500 feet, where the pinyons gradually give place to other pines and *madroños*. Above 9,000 feet on the north side two pines, a fir, and some aspens appear, and a cypress was noted only on the summit. On the north slope the Lower Austral Zone extends up over the foothills to

about 5,500 feet, passing into Upper Austral Zone, which reaches to about 7,500 feet. From 7,500 to 9,000 feet on this slope Transition Zone elements appear to be predominant, and near the summit the Canadian Life Zone is represented. On the south slopes the zones were less well marked.

#### COLIMA

##### **Armería** (sea level to 200 feet):

*February 19 to March 5, 1892.*—On the west bank of the Armería River, about 5 miles above its mouth, and at the upper border of the low coast belt, the hills rising close by to the north. The village is on a bench or terrace about 200 feet in altitude, representing a small descending spur of plains region extending inland to the city of Colima.

##### **Colima** (1,700 feet):

*March 5-16, 24-27, and March 30 to April 1, 1892.*—Location for work the Rancho del Ralcon, owned by Augusto Morrill, 3 miles west of the city, and close to the railroad extending to Manzanillo. The city is built on the Plain of Colima near its upper end. This plain, about 15 miles in width, is broken by low hills or ridges but has a very regular general slope down to near the coast south of the mouth of the Armería River. It is largely treeless and covered with a growth of short grass, but scattered generally over its surface is an irregular growth of mesquites, acacias, and other thorny bushes or small trees 10 to 20 feet high, with an abundance of cactuses of at least half a dozen large and conspicuous species. Arid Lower Tropical Zone.

##### **Cuyutlán** (10 feet):

*February 27, 1892.*—A station on the railroad along the sandy strip between the Laguna de Cuyutlán and the sea. Visited while working from Armería as a base of operations.

##### **Hacienda Magdalena** (1,500 feet):

*March 17-24, 1892.*—A large sugar, corn, and cattle ranch about 9 miles west of the Armería River and about 20 miles southwest of Colima. Work limited to the valley about 3 miles wide, arid in general character, but with a stream affording water for irrigation. Bottom lands along the stream are covered with heavy forest growth. The valley is bordered by steep-sided hills, rising to mountains from 5,000 to 6,000 feet, with small pines on their tops a few miles away. Arid Lower Tropical Zone.

**Hacienda San Antonio** (3,800 feet):

*March 28-30, 1892.*—Coffee plantation about 26 miles north of the city of Colima, near the base of the Volcano of Colima. Locality in a canyon formed by a tributary of the Armería River. Up this canyon some 10 miles a magnificent view of the Volcano of Colima is presented, the volcano appearing to rise at the head of the canyon. Irrigation is required for coffee, sugarcane, or corn, during the dry season, although almost daily rains, often heavy, occur during the wet season and occasional rains during the dry season. Somewhat mixed faunal relations are shown by the occurrence of the tropical ring-tailed ground squirrel (*Citellus annulatus annulatus*) and the Mexican rock squirrel (*Citellus variegatus variegatus*) of the Lower Austral parts of the tableland among the same boulders at 3,800 feet. A heavy forest clothes northerly slopes above the hacienda. Trailing vines and many species of epiphytic plants grow along the wide-spreading branches of the trees, and general conditions indicate the occurrence of small areas assignable to Humid Upper Tropical Zone not examined by us owing to lack of suitable facilities at the time of our visit.

**Manzanillo** (sea level to 200 feet):

*January 25 to February 17, 1892.*—Seaport on the south side of Manzanillo Bay, where field work in México was begun. A gap between two low hills leads from the town of Manzanillo to the shore of the Laguna de Cuyutlán. The lagoon extends along the coast from Manzanillo southeastward about 25 miles to near the mouth of the Armería River. Between the mangrove-bordered lagoon and the coast a low, sandy strip varies from a few hundred yards to a couple of miles in width. From the lowlands near the coast more or less isolated hills or low ridges rise to 100 or 200 feet, gradually increasing to 1,200 or 1,500 feet in elevation within a few miles, and to much higher elevations toward the mountains of the interior. The low, dense forest embraces many species but consists largely of thorny growth, including mesquites, acacias, and cactuses, with palm groves near the coast, and giant wild fig and a few other large trees towering conspicuously above the general level. Arid Lower Tropical Zone. We worked in the vicinity of the town from January 25 to February 4, when we moved to Tepalcates, a rancho about 8 miles away on the south shore of the lagoon. Specimens taken at the rancho are labeled "Manzanillo." On February 14 we returned to Manzanillo.

## DISTRITO FEDERAL

**Ajusco (10,000 to 11,500 feet):**

December 16-19, 1892.—From Tlalpan in the Valley of México we took a southerly course on December 16, up the mountain slope to the village of Ajusco at an altitude of about 9,800 feet. The village is 2 miles east of the base of the main peak of the same name. From the vicinity of the village work was extended up to near the summit of the Cerro de Ajusco, which has an altitude of about 12,600 feet. The Sierra de Ajusco forms the high mountain rim extending in an easterly and westerly direction along the southern border of the Valley of México. The western end of the range, marked by the Cerro de Ajusco, is continuous with the Sierra de las Cruces, which has a more northerly trend, and the eastern end abuts against the western slope of the Volcán de Popocatepetl. The Cerro de Ajusco is a steeply eroded, scantily wooded volcanic peak, rising prominently above the general crest of the range.

Much of the timber had been cut at the time of our visit. The fir (*Abies religiosa*) was noted as ranging from 8,500 to 10,500 feet, a cypress (*Cupressus lindleyi*) from 8,500 to 9,300 feet. Oaks of several species, probably including *Quercus reticulata*, are present, one at least ranging up to 11,000 feet. The large species of grass, commonly called sacatón, so abundant in open meadows in the Canadian Zone on all the mountains of this region, grows in great luxuriance almost everywhere above 8,500 feet on the Sierra de Ajusco.

**Ixtacalco (7,400 feet):**

June 25, 1904.—A suburb at 7,400 feet, about 5 miles south of the City of México. Visited by horse-drawn street car. The valley bottom is marshy in that vicinity.

**Ixtapalapa (7,500 feet):**

November 13, 1892.—A village several miles south of the City of México. Near the village are extensive caves inhabited by a large colony of free-tailed bats (*Tadarida mexicana*).

**San Nicolás (7,400 feet):**

June 26, 1904.—A station at 7,400 feet near the base of the mountains 8 or 10 miles southwest of the City of México on the railroad to Cuernavaca. Visited from the City of México to collect birds on the valley bottom.

**Tacubaya (7,500 feet):**

*November 16, 1892.*—A suburb in the southwestern environs of the City of México.

**Tlalpan (7,600 feet):**

*November 28 to December 14; December 19-27, 1892.*—The field work for the Valley of México was centered mainly at this locality, extending for several miles in all directions. Tlalpan is a town in the Federal District 9 miles south of the City of México. It is located at the extreme southern border of the bottom of the Valley of México, where the slope begins to rise abruptly toward the Sierra de Ajusco. The slopes to the south and west of Tlalpan are covered with a great lava bed, which is exceedingly rough and broken. This lava came from the Volcano of Ajusco, some 6 miles southwest of Tlalpan, near the base of the Cerro de Ajusco, an older and higher volcanic peak. Lying just east of Tlalpan and extending out into the valley for about 2 miles was a bed of fine volcanic sand or ashes, more or less mixed with humus, and nearby the marshy border of Lake Xochimilco was partly confined at the time of our visit by dikes. Convenient for our purpose was the varied character of terrain and environmental conditions thus presented. For many miles to the north from Tlalpan extends the nearly level valley floor, sloping up slightly from 7,400 feet at the City of México to a low divide. The general basinlike surface is broken by numerous abruptly rising and barren volcanic cones or rounded hills. On the west, south, and east the valley is walled in by high mountain ridges, the Sierra de las Cruces, the Sierra de Ajusco, and farther to the east the great mountain mass formed by the Volcán de Popocatepetl and Cerro Ixtacihuatl. Both of the latter are more than 17,000 feet in altitude, with a pass at about 12,000 feet between them. Several lakes at slightly differing levels formerly formed a notable feature of the Valley of México, and have had an important bearing on its history. The principal ones were Lake Xochimilco, Lake Chalco, and Lake Texcoco. The water that formerly filled these rather large lakes had one of its main sources in giant springs in Lake Xochimilco, from which the water passed to a lower level in Lake Chalco and on to the larger Lake Texcoco, which occupies the lowest part of the valley and had no outlet. The water of Lake Texcoco is heavily charged with mineral salts, commonly referred to by the people as "tequisquite." In the fresh waters of Lake Xochimilco considerable peat formed and luxuriant aquatic vegetation made floating islands or partly floating masses of more or less decomposed vegetation. In places a layer of

peat from the bottom was laid on partially buoyant platforms by native gardeners, and luxuriant crops of vegetables and flowers were produced under these unusual conditions. Owing to the striking floral display thus produced the so-called floating gardens, or, to use the native name, "chinampas," attracted a great deal of attention from tourists. Under changed conditions due to drainage, however, the chinampas have been greatly reduced in extent.

At the time of the Conquest and for many years thereafter the City of México was frequently threatened with inundation from Lake Texcoco, and there was no satisfactory way of disposing of the sewage of the city. In order to relieve this constant menace the cutting of the Grand Canal was begun in 1879. The canal leads from near the City of México northward out of the valley and through a long tunnel to the watershed of the Río de Tula, an affluent of the Río Pánuco, which enters the Gulf of México at Tampico. The canal was finally completed in 1900 and was regarded as one of the engineering triumphs of the Díaz administration. The Grand Canal served its purpose admirably in carrying away the city sewage and has drained an estimated area of 600 square miles of former lake bed, but like many other drainage projects this one has not proved to be an un-mixed blessing.

Lake Chalco has been almost entirely drained, and much of the former bed of Lake Texcoco is now a nearly bare plain with a whitish soil and friable surface. When the wind blows, great clouds of dust are carried into the city to the great discomfort of the people. Much of the bottom of Lake Chalco was planted to corn for a time, but the limited fertility of the soil is soon exhausted. On much of the bed of Lake Texcoco mineral salts in the soil are so concentrated that no field crops can be grown. Shallow water still remains on the lowest part of the bottom in the southeastern part of the lake basin.

The lake and marsh areas in the Valley of México formerly afforded extensive and very favorable wintering grounds for migratory waterfowl, especially ducks, that visited the valley in hundreds of thousands. The Valley of México, and the adjacent Valley of Toluca, at the southern end of the central plateau of México, are near the southern limit of the winter distribution of various species that reach the region in considerable numbers. Comparatively few species of ducks pass on to the southward of the plateau. The drainage of some 600 square miles of marsh and water area in the Valley of México has, therefore, had an adverse effect on the wintering of North American waterfowl.

## DURANGO

**Cacaria (6,000 feet):**

*August 5-6, 1898.*—Cacaria is now a station on the railroad, about 30 miles north of Durango. It was an overnight stop on our route with pack outfit from Durango to points farther north.

**Cerro Prieto (8,000 to 9,000 feet):**

*September 9-10, 1898.*—Cerro Prieto is a hacienda at 6,000 feet on the headwaters of the Río Balleza, a branch of the Río Conchos in extreme northwestern Durango. On September 8 we left San Julián in extreme southwestern Chihuahua, and after traveling 28 miles in a northeasterly course camped in a mountain park at 8,000 feet near the Chihuahua-Durango boundary. On September 9 we continued northeast and reached the Hacienda Cerro Prieto. From San Julián to the Hacienda Cerro Prieto we were in the high mountains, but at that point we descended into the deep narrow valley of the Río San Juan, which has the climate of the interior tableland. On September 10 we traveled 28 miles northeasterly and camped in pine woods at 7,500 feet. On September 11 we made about 28 miles easterly to Hacienda La Providencia, Durango, and 35 miles on September 12 brought us to Parral, Chihuahua.

**Chacala (3,000 feet):**

*February 23 to March 8, 1899.*—Chacala is a small town at 3,000 feet in the foothills of the Sierra Madre across the state line in Durango, and a little north of east of Culiacán, Sinaloa. On February 21 I left Culiacán, Sinaloa, with a pack outfit and traveled about 23 miles in an easterly direction, ascending very gradually to the ranch of Las Flechas, lying between low ridges and foothills of the Sierra Madre. From Las Flechas the road continues a gradual ascent through broken country to Chacala, which was reached after crossing the state line on February 23. I remained at Chacala until March 8, working in the valley and on the adjacent slopes for several miles in all directions. The town is situated in a circular valley 2 or 3 miles in diameter, bordered on nearly all sides by hills which rise several hundred feet above it. To the east rugged ridges and narrow canyons lead up rapidly to the base of the main slope, which extends to the top of the Sierra Madre. A small stream, a branch of the Río San Lorenzo, is used for irrigation in the valley.

Owing to the location on the flank of the higher part of the Sierra Madre the climate of the valley at Chacala is slightly more humid than that of the nearly or quite tropical foothills just below. Heavy rains

are said to fall nearly every day from about the first of June to the end of September, and occasional rainstorms lasting two or three days occur during the two following months. These latter rains are called equipatos. During the remainder of the year the soil becomes so dry that scarcely any crops can be grown without irrigation. The mean temperature for the year is probably lower at Chacala than on the coast plains, but in winter, regardless of the difference in altitude, temperatures in a thermal foothill belt are higher than on the plains below. At the time of my visit frosts that had occurred at Chacala were so slight that the vivid green of the sugarcane was unmarred. At the same time light frosts at Culiacán had a scorching effect but did not seriously injure the sugarcane. Above Chacala, however, the general evidence indicates that with increasing altitude the climate becomes markedly colder.

Many of the conspicuous plants found on the plains close to Culiacán range up to Chacala, but a considerable number not found on the plains occur in the hills, particularly the higher hills just below Chacala. The flora of the slope from Culiacán up to Chacala is similar to that of the foothill region near Alamos, Sonora, but is more tropical in character. Among the more conspicuous plants that range up the slope to very near to Chacala are the guamúchil, guásima, several species of wild fig, paloblanco or morning-glory tree, ceiba or silk-cotton tree, palo del Brazil or common dyewood, largely cut for exportation, an agave, and cactuses. The valley of Chacala is near the lower limit of oaks and pines and close to the upper limit of the ranges of many of the hot country plants. The flora of the hot country ranges up through the valley of Chacala and follows the stream as far as the lower edge of the pines, where it ends abruptly. In the valley crops of corn, sugarcane, and such fruits as the mango, aguacate, papaya, and orange are raised by irrigation. The thermal foothill region near Chacala belongs to the Arid Upper Tropical Zone, which seems to be interposed between a Lower Sonoran coastal strip and oak-pine forested mountain slopes, on which the life zone boundaries have not been delimited in detail.

#### Durango (6,200 feet) :

*June 23 to July 8, July 25 to August 5, 1898.*—The city of Durango, at 6,200 feet, is the capital in the south-central part of the state of the same name. We arrived in Durango on June 23 and left on July 9 for a trip to the Hacienda El Salto, in the Sierra Madre to the west. We returned to Durango on July 25 and remained working

there until August 5. From Torreón, at 3,700 feet, in Coahuila, our route to Durango was by the railroad that traverses the interior tableland basin, gradually increasing in altitude toward the eastern base of the Sierra Madre Occidental. Much of the route was across the wide-spreading drainage area of the Río Nazas, which discharges in a large sink, the Laguna de Mayrán, in Coahuila. Smaller drainage basins without outlets are common in the region. It is mainly a plains region, but rising islandlike within the basin are many hills and mountainous ridges reaching 100 to 2,500 feet above the surrounding level.

The plains of Durango are grassy prairies with scattered patches of low-growing mesquites, acacias, agaves, cactuses, and many herbaceous plants. The hills and low mountains, as well as the plains, are arid, and vegetation is scanty. Some of the highest hills have a few scrubby oaks on their tops, but as a rule they are bare and nearly sterile masses of earth and rock. Winter wheat, corn, and beans are the main crops. Some grapes, peaches, and other fruits are grown. The summer rains from June to September are often heavy, and then the country takes on a brilliant green with wildflowers in profusion but is brown and dry the rest of the year. Lower Austral Zone.

#### **El Oro to Guanaceví** (see Guanaceví).

#### **El Salto** (7,600 to 8,400 feet):

*July 11-24, 1898.*—El Salto is a hacienda in the Sierra Madre about 82 miles southwest of the city of Durango, Durango. On July 9 we left Durango with a newly purchased outfit of pack and saddle animals and proceeded about 38 miles in a westerly course into the mountains, where we camped. The next day we rode about 28 miles southwesterly, and about 16 miles farther in the same direction on July 11 brought us to our destination. We remained at El Salto making collections in the surrounding country for several miles in various directions until July 24. On the latter date we started back to Durango, where we arrived on July 25. Since the time of our visit a railroad covering our general route to El Salto has been built.

Soon after leaving Durango (about 6 miles west) the road led up for about 1,000 feet to the top of a gently rolling tableland, which extends to the westward for about 100 miles, with a slight upward slope to the western border, where it breaks down abruptly, and in places precipitously, to the coast plains of Sinaloa. The western edge of this mountain plateau reaches in places to a little over 9,000 feet. Except along its extreme eastern border this great tableland country is covered with pines and oaks and forms a cross section of the Sierra

Madre Occidental, which, with little change in character, extends for hundreds of miles from north to south. Nowhere in the broad expanse west of the city of Durango is there a single mountainous elevation rising as much as 500 feet above the general level of the surrounding country. Here and there, however, the surface is scored by great canyons, some of which are 2,000 to 4,000 feet deep and carry drainage out to the Pacific coast. Cut into level or nearly level surfaces, one sees these canyons only when almost at the brink of their precipitous side walls. During the summer rains water is plentiful, but at other seasons permanent water is scarce and limited to a few small creeks. Sharp frosts are reported to be common during the winter months, and snow falls at intervals to a depth of from a few inches near 7,000 feet to 2 or 3 feet at 9,000 feet.

The mountain plateau of this section, lying mainly on the gradual slope from 7,000 to 8,500 feet, bears a more or less continuous forest made up of pines of about 4 species mixed with madroño (*Arbutus*) and oaks of several kinds. This area belongs mainly in the Transition Zone but is invaded by Upper Austral Zone elements. The pinyon pines range upward from about 6,500 feet, and manzanita bushes (*Arctostaphylos*) that grow along canyon walls are indicators of Upper Austral Zone. The forest is generally open, with open parks and small valleys here and there. There is little underbrush and the ground is covered with grasses and many small herbaceous plants. Except in a few spots the trees are small and the forest unimpressive.

#### Guanaceví—mountains near (7,800 feet) :

August 15-17, 1898.—On August 15 we left El Oro, also called Santa María del Oro, about 13 miles northwest of Indé, and after traveling 35 miles in a course a little north of west camped in an outlying range of mountains known as the Sierra de la Candela. On August 16 we continued about 22 miles west to Guanaceví. Specimens taken at our camp were labeled "Mountains near Guanaceví." The road from El Oro to Guanaceví was through hilly country until we crossed the Río del Oro, an upper branch of the Río Nazas. It followed up the narrow level valley of the river for a few miles and then ascended and crossed the northern part of the Sierra de la Candela to descend on the farther side to Guanaceví, lying in a rocky canyon against the base of the main Sierra Madre. The top of the Sierra de la Candela is covered with scrub oak, pinyon and other pines. In zonal character the range is a mixture of Upper Austral and Transition.

**Huazamota** (1,700 feet):

*August 13-16, 1897.*—Huazamota is a village at 1,700 feet in the bottom of the canyon of the river draining south from extreme southern Durango to the Río Grande de Santiago. Huazamota was reached by us from Santa Teresa, en route across the Sierra Madre August 13. On August 15 we proceeded about 10 miles in a northeasterly direction to a large rock shelter on the mountainside at an altitude of 5,100 feet. Here we camped for the night, and a few specimens collected were labeled "Huazamota."

**Indé** (6,000 feet):

*August 11-14, 1898.*—Indé is a mining town at about 6,000 feet in northern Durango. We left Durango on August 5 and rode 33 miles north to Cacaria. On August 6 we covered 48 miles in a northerly course to Hacienda Magdalena. On August 7 about 33 miles brought us to Santiago Papasquiario. We remained at Papasquiario over August 8 to rest the stock and on the following day made 15 miles in a northeasterly course to a ranch called Los Sauces. On August 10 we continued 36 miles to Hacienda de Ramos, and about 40 miles north on August 11 brought us to the town of Indé.

From Durango to within 8 or 10 miles of Papasquiario the road led over level or gently rolling grassy plains, with the scattered ridges and hills of the interior tableland to the east, and the outlying foothills of the Sierra Madre on the west. Just before reaching Papasquiario we entered and crossed an outlying spur of foothills beyond which we came to the narrow valley of the Santiago River, with the town on the west bank of the stream and the main Sierra Madre rising to the westward. From Papasquiario we descended the valley a few miles and entered a broken and hilly country until within 5 or 6 miles of Ramos, where we came out on the tableland plain again. The vegetation along the route from Durango to Indé is that of the arid Lower Austral plains and hills of the tableland. A few oaks and junipers on the hills are indicators of Upper Austral Zone; willows, cottonwoods, and a few black walnuts and cypresses grow along streams.

**Papasquiario** (see Indé and Santiago Paspasquiario).

**Ramos** (6,000 feet):

*August 10-11, 1898.*—Ramos was a hacienda on the Río de Ramos about 40 miles south of Indé. An overnight stop was made en route with pack outfit from Santiago Papasquiario to Indé.

**Santiago Papasquiario** (=Papasquiario) (6,000 feet):

*August 7-9, 1898.*—Santiago Papasquiario is a town at 6,000 feet near the railroad in central western Durango. Specimens were labeled "Papasquiario." The town was visited while en route with pack outfit from Durango to Indé. The town is located in the narrow valley of the Río de Ramos near where it emerges from the foothills of the Sierra Madre, curving thence to the northward and eastward as one of the principal branches of the Río Nazas. Upper Austral Zone.

**Sierra Madre, near Guanaceví** (8,500 feet):

*August 19-20, 1898.*—On August 18 we left Guanaceví and, entering the mountains to the north, traveled about 16 miles to a camp in the pine forest at about 8,000 feet. August 19 we made about 22 miles northwesterly to a large cave (Cueva Prieta) at about 8,000 feet. Specimens taken near this camp were labeled "Sierra Madre near Guanaceví."

**Sierra Madre and Sierra Barbara, near La Providencia** (see Cerro Prieto).**Tlahualilo, or Tlahualilo de Zaragoza:**

*March 17, 1926.*—Terminus of branch railroad in interior basin near Coahuila boundary in northeastern part of the state. I visited here on my 1926 trip. Lower Austral Zone.

## GUANAJUATO

**Acámbaro** (5,000 feet).

*July 7-11, 1892.*—Railroad junction on the tableland in extreme southern Guanajuato, so near the border of Michoacán that specimens collected were erroneously labeled as from that state.

**Celaya** (5,700 feet):

*May 28-31, 1896.*—Celaya is a railroad junction at 5,700 feet on the tableland in the southwestern part of the state. We reached Celaya by rail from Marqués, Hidalgo. The town is situated on the plain in the broad valley of the Río Leonia, which flows southwest into the Río de Lerma. To the southeast the Sierra de Agustinos and, in other directions, other high, rounded hills and mountains in isolated groups or singly vary in elevation from 100 to 2,000 feet above the level of the plain. All our work here was done in a limited area of uncultivated land just north of the town. Elsewhere for several miles in every direction the plain was intensively cultivated. The water level is near the surface, and water raised by hand is used

for irrigation. The hills are largely of volcanic origin as indicated by scattered rock fragments. The valleys are covered with a clay-like soil washed in from the hills. The country showed evidence of prolonged drought. The vegetation is scanty. The mesquite, acacias, mimosas, cassias, and a few cactuses grow where left undisturbed. Wheat, corn, potatoes, alfalfa, and a great variety of garden vegetables are grown under irrigation. The climate is hot and dry. Lower Austral Zone.

**Irapuato** (5,600 feet):

*June 22-23, 1896.*—Irapuato is a large railroad junction at 5,600 feet, in the south-central part of the state. One day was spent here between trains, and a small number of specimens collected. The town is an important agricultural section, a part of the same valley in which Silao, about 20 miles away, is located. The vicinity is noted for the fine strawberries grown, which are said to be in production throughout the year. Frosts occur in winter but are not very severe as a rule. Lower Austral Zone.

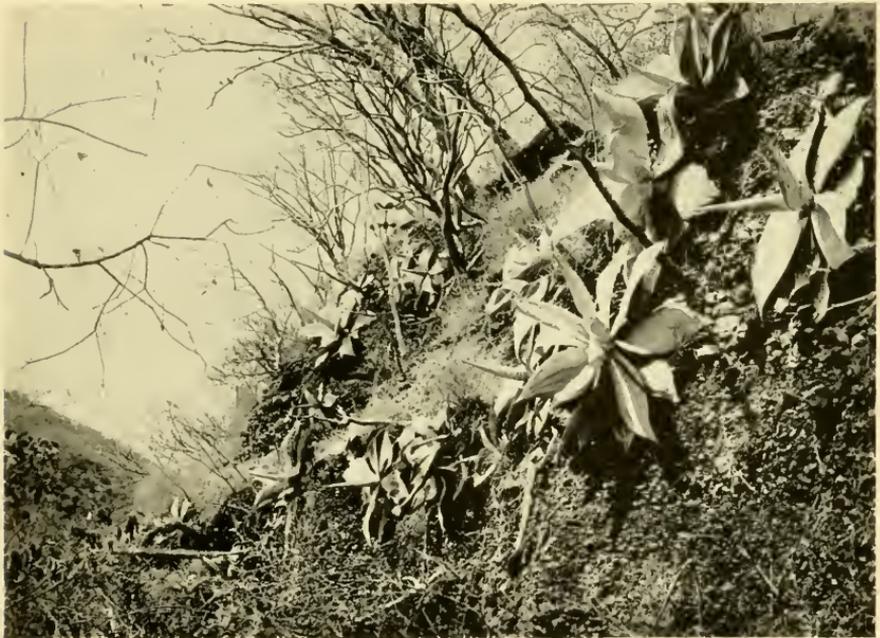
**Santa Rosa** (8,500 to 10,000 feet):

*November 4-17, 1896.*—Santa Rosa is a small mining town at 9,500 feet in the Sierra de Guanajuato about 7 miles northeast of the city of Guanajuato. From Dolores Hidalgo, Guanajuato, my route to Santa Rosa November 4 was southwest across a nearly level plain past San Antonio de las Minas and on to a point where it led up the steep eastern slope of the Sierra de Guanajuato to Santa Rosa, a distance of about 28 miles. The town is situated near the summit of the range, which here consists of a main backbone with many spurs and short, lower parallel ridges, the whole 10 to 15 miles in cross section. The range extends from near the northwestern corner of Guanajuato southeast to the south-central part of the state. The highest point in this vicinity is the Cerro San Miguel, also called Cerro de los Llanitos, about 9 miles north of Santa Rosa. This mountain is at least 10,500 feet in height. The range is everywhere very rocky with few deep canyons, but especially along the eastern side there are very high cliffs. The rainfall is light, as shown by the character of the vegetation.

The principal plants up to 8,000 feet on the eastern basal slopes are the mesquite (*Prosopis*), huisache (*Acacia farnesiana*), agaves, cactuses, and other species of the dry tableland. At about 8,000 feet the vegetation changes abruptly. Small oaks and manzanita bushes begin at that point and gradually increase in size up to the top. Above



1. Vegetation along Río Balsas, near village of Río Balsas. Arid Lower Tropical Subzone.



2. An unidentified centuryplant (*Agave*), near La Salada, Michocán. Note peculiar pendent habit and habitat restricted to rocky face of cliff. Arid Tropical Subzone.



1. Mangrove-bordered tidal lagoon near Tonalá, Chiapas. Arid Lower Tropical Subzone.



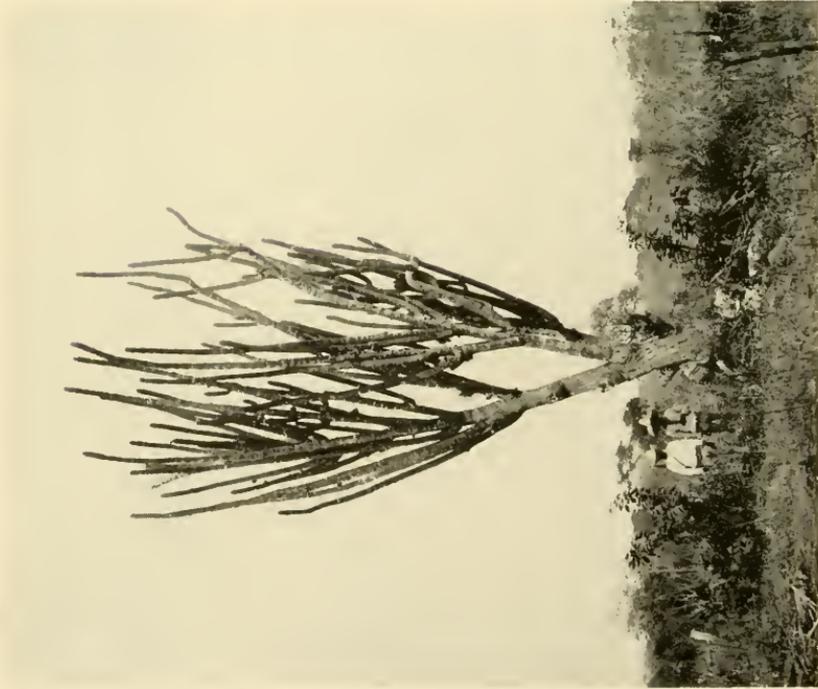
2. Mangrove-swamp interior near Progreso, Yucatán. Arid Lower Tropical Subzone.



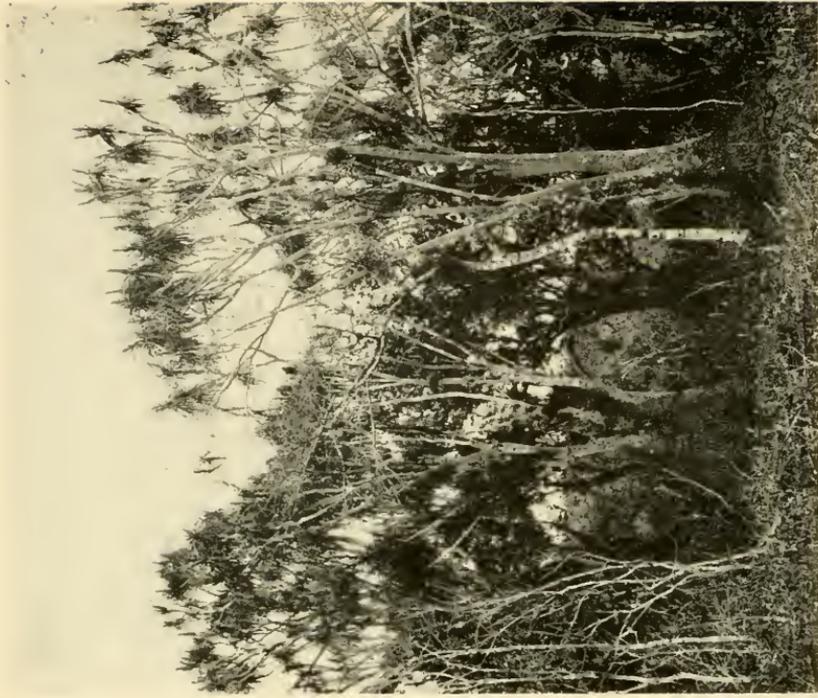
1. Jicara tree (*Crescentia alata*), near La Salada, Michoacán. Mainly Pacific side. Arid Lower Tropical Subzone.



2. Jicara tree (*Crescentia cujete*), near Progreso, Yucatán. Mainly Gulf side. Arid Lower Tropical Subzone.



1. Unidentified cactus of giant size, near Carrizal, Veracruz, Arid Lower Tropical Subzone.



2. Tree-like plant (*Beaucarua incrimis*) with trunk enormously expanded at base, near Carrizal, Veracruz, Arid Lower Tropical Subzone.



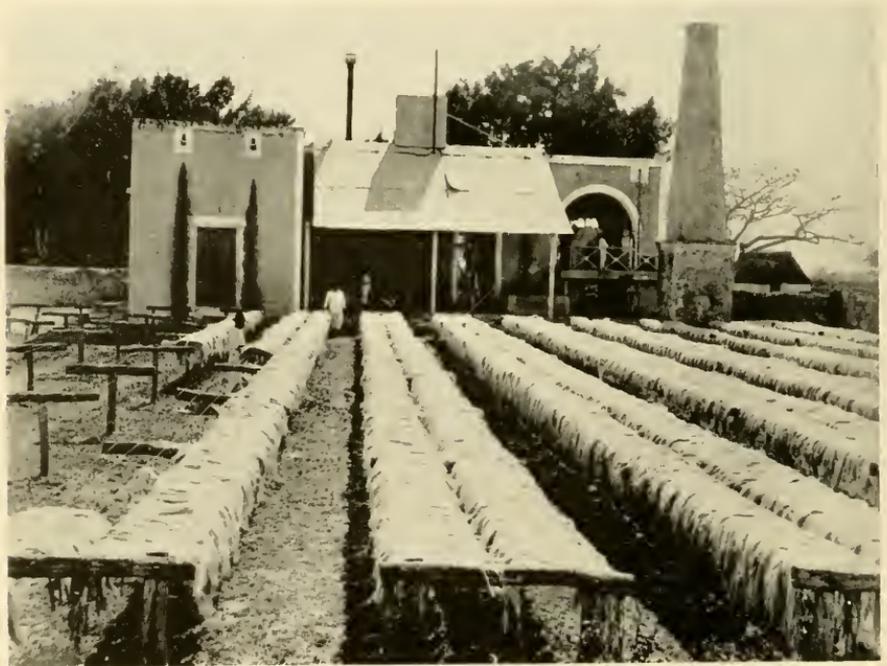
1. Maya Indian ruin at Chichén Itzá, Yucatán, as it appeared before excavation, February 5, 1901. Surrounding forest little disturbed in recent times. Arid Lower Tropical Subzone.



2. Maya Indian structures, ancient and modern, Chichén Itzá, Yucatán. February 5, 1901. Arid Lower Tropical Subzone.



1. Hennequen or sisal (probably *Agave sisalana*), extensively grown for the fiber, near Mérida, Yucatán. Arid Lower Tropical Subzone.



2. Stripping plant for agave leaves, and sisal-fiber drying, near Mérida, Yucatán. Arid Lower Tropical Subzone.



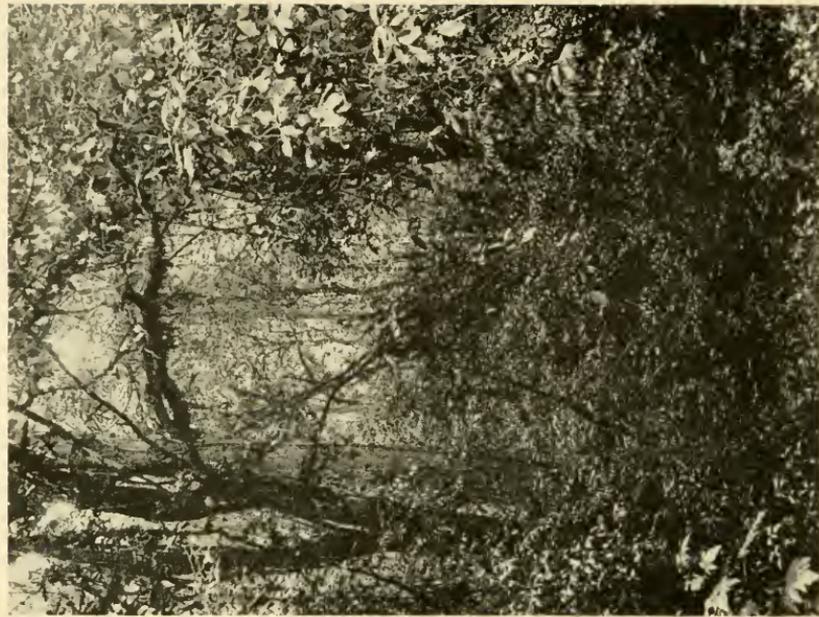
1. Pack outfit, E. W. Nelson leading, on coastal trail near Cayacal, Guerrero. Arid Lower Tropical Subzone.



2. Hacienda of Santa Efigenia, southeastern Oaxaca. Francis Sumichrast, the French naturalist, married a daughter of the owner and lived here 3 years. Arid Lower Tropical Subzone.



1. Forest interior at 7,500 feet, near Omilteme, northwest slope of Sierra Madre del Sur, Guerrero, Humid Upper Tropical Subzone.



2. Forest interior, liquidambar and oaks among dominant species, at about 5,500 feet, near Jalapa, Veracruz, Humid Upper Tropical Zone.

9,000 feet on both slopes grow alder, madroño, thornapple (*Crataegus*), and wild cherry. The upper slopes of these mountains were once covered with a tolerably heavy forest of oak timber, but it had been cut until at the time of my visit none of the original stand was left. There was a dense second growth of young oaks which did not exceed 6 inches in diameter and were already being cut extensively for firewood and the making of charcoal. Owing to the high base level the life zones are pushed upward. The Lower Austral Zone apparently extends to 7,000 or 8,000 feet, and the Upper Austral Zone includes the upper slopes with the possible exception of some areas near the tops of the highest peaks, where Transition Zone elements may occur.

#### Silao (5,830 feet):

*June 18-22, 1896.*—Silao is a large town at 5,830 feet on the railroad at the junction with the line extending to Querétaro, the capital of the state of the same name. It is situated on the broad and nearly level plain that extends as an open valley from there southeastward nearly across the state to Celaya, as a large interior basin draining southwest to the Río de Lerma. The plain is bordered by hills and mountains that rise irregularly in groups or single elevations. A few miles directly east of Silao the plain is bounded by a high isolated range of mountains extending northward through the central part of the state. To the west only a few rounded hills and low mountains break the level surface, which reaches away for many miles.

Water is found near the surface, and on much of the plain are grown crops of corn, garbanso, and peppers. The hills and mountains, however, are poorly supplied with water and are extremely barren. The watercourses were mainly dry at the time of our visit, but they often carry rushing floods during the heavy summer rains. In uncultivated sections a growth of mesquite and other small shrubs, agaves, and cactuses is so thin and scanty that it is scarcely distinguishable at a short distance during the dry season. Under these conditions the dull browns and yellows of the soil make the land appear even less productive. During this period Nelson visited the Museum of the State College, and the naturalist Dr. Alfred Dugès, in Guanaajuato. Lower Austral Zone.

#### Tequisquiapan (6,500 feet):

*June 1-8, 1896.*—Tequisquiapan is a large town at 6,500 feet in the valley of the Río San Juan del Río, near the border of Hidalgo, in the southwestern part of the state. On June 1 we left Celaya, Guana-

juato, by rail for San Juan del Río, Querétaro. There we took the stage to Tequisquiapan, 13 miles northeast, where we arrived the same evening. The town is situated on an arid, rolling plain, typical of the general region. The irregular surface is broken by scattered hills, ridges, and mountainous elevations, some of which reach 1,500 to 2,500 feet above the general level. Scattered fragments of lava show the general character of the geological formation. The plains and mountains have very thin vegetation made up of mesquite, *Schinus molle*, acacias, mimosas, cassias, and cactuses, and along the streams willows, ashes, and cypress (*Taxodium*). Crops of wheat and corn are grown by irrigation with flood water from summer rains stored in reservoirs. Lower Austral Zone.

## GUERRERO

**Acahuizotla** (erroneously spelled Aguahuizotla on first visit) (3,100 feet) :

*December 28-29, 1894; May 12-13, 1903.*—A village at 3,100 feet, about 22 miles by trail south of Chilpancingo. We made an overnight stop here on our way to Acapulco in 1894 and revisited the place in May 1903. Near Acahuizotla a pine not noted on the Chilpancingo side of the divide is abundant, along with a scrubby species of oak. Arid Tropical Zone.

**Acapulco** (near sea level to 2,000 feet) :

*January 1-27, 1895; April 24 to May 2, 1903; January 2-6, 1935; February 1-5, 1936.*—On January 1, 1895, we reached Acapulco after 4½ days by trail from Chilpancingo. Work was limited to the vicinity until January 9, when we moved to the Hacienda del Potrero at El Márquez, near the coast and about 5 miles southeast of Acapulco. Specimens from that place were labeled "Acapulco," as it is so near and there is no change in the character of the country. On January 14 we returned to Acapulco, where work was continued from sea level up to 2,000 feet on the slopes of the mountains near the coast. From the summit of the pass at about 5,500 feet, just south of Chilpancingo, we entered the drainage basin of the Río Papagayo, the river flowing into a large coastal lagoon just east of Acapulco. The route goes through mountains decreasing gradually in height toward the coast, until near La Venta de Aguacatillo they are only 500 or 600 feet high. A high granite spur, however, just back of Acapulco, around the eastern end of which the road passes, rises steeply to about 3,000 feet. A good automobile road from Acapulco

to the City of México now facilitates travel over routes laboriously traversed by Nelson and me with a pack outfit.

In 1935, I returned to Acapulco with my brother, Luther J. Goldman, to observe winter conditions affecting migratory waterfowl, and again in 1936 for the same purpose, this time with my son Luther C. Goldman.

Near Acapulco are the two largest of the series of lagoons that extend along much of the coast line of Guerrero. The Laguna Coyuca, beginning a few miles northwest of Acapulco, is about 10 miles long and a mile wide. It is connected at times, through the delta of the Río Coyuca, with the Laguna Carrizal, farther west. The lagoon is isolated from the sea at most seasons, and the water is fresh enough to permit the growth of considerable aquatic vegetation, including waterhyacinths and waterlilies. Near the northern end a dense growth of cattail flags covers many acres. Parts of the lagoon are bordered by mangroves 50 to 60 feet high, and in other places there are canebreaks. The lagoon is a winter resort for large numbers of migratory waterfowl, especially ducks.

The Laguna de Tres Palos, or Laguna de Papagayo, one of the larger coastal lagoons, begins a few miles southeast of the Bay of Acapulco and extends for an undetermined distance across the mouth of the Río Papagayo. This lagoon is about 2 miles in width. The water is fairly fresh, and along the shores, especially the inlets, there is considerable aquatic vegetation. Thousands of migratory waterfowl, especially ducks, congregate here in winter.

From the vicinity of Acahuizotla down to the coast the entire country is covered with a dense but scrubby growth, mainly of small trees and bushes, including palms, species of *Cassia*, *Acacia*, *Pithecollobium*, and many others. Arid Lower Tropical Zone.

**Aguacatillo, La Venta de (150 feet):**

*December 31, 1894; January 1, 1895.*—La Venta de Aguacatillo is a village about 15 miles north of Acapulco, on the trail to Chilpancingo. The place is located on the coastal plain at the base of foothills 500 to 600 feet high. Arid Lower Tropical Zone.

**Alto del Camarón (=Camarón) (700 feet):**

*December 30-31, 1894.*—A village at 700 feet about 40 miles by trail northeast of Acapulco. An overnight stop on our route from Chilpancingo to Acapulco.

**Ayotzinapa (5,800 feet):**

*December 13-14, 1894.*—Ayotzinapa, erroneously spelled "Ayusi-napa" on our specimen labels, is a village about 16 miles west of

Tlapa, northwestern Guerrero. Leaving Tlapa on the trail toward Chilpancingo, the capital of the state, on December 13, we ascended the valley several miles, crossed one of the bare grass-grown ridges that occur here, and descended to the village of Aquilpa, at 4,600 feet, on a tributary of the same stream we had left. From Aquilpa we continued up along the course of the stream through a series of nearly bare hills to Ayotzinapa, at 5,800 feet, on a hillside in an open canyon. The mountains near reach 6,000 to 7,000 feet in altitude. Much of our route was nearly bare of trees and bushes except close along watercourses, but at about 5,500 feet scrubby oak, black walnuts, and cypresses appeared and were plentiful up to the town at 5,800 feet.

**Ayotzinapa to Petatlán** (see Chilpancingo).

**Cayacal** (20 feet):

*April 12-13, 1903.*—Cayacal is a village situated on a flat in a nook among the hills that extend down to the coast about 50 miles southeast of Zihuatanejo. There we spent the night of the second day out from Zihuatanejo en route to Acapulco. Along this part of the coast the hills reach the sea in places and then recede, distances varying from a few hundred yards to several miles, where level plains extend to the coast. Here and there the coast is bordered by sand dunes with lagoons or mangrove swamps lying between them and the land farther back. The general section is Arid Tropical, with the characteristic jungle of bushes and low trees, except on the north slopes of hills and canyons and along watercourses, where trees of larger growth are found. Wild figs, nut palms, and large silk-cotton trees occur on the level parts of the coast plain and coconut palms are plentiful about the towns. Cayacal is situated on the border of a beautiful forest of nut palms. The principal crops in this section are corn, beans, cotton, and tobacco. (See Papayo.)

**Chilapa to Tixtla** (see Chilpancingo).

**Chilpancingo** (4,600 feet):

*December 16-18, 24-28, 1894; May 13-15, 25-28, 1903.*—Chilpancingo, the capital of the state of Guerrero, is situated at 4,600 feet in a valley forming a narrow gap extending across the Sierra Madre del Sur. Very little work was done here, but on several visits the city was used mainly as an outfitting point for field operations in the nearby mountains. We returned to the locality in 1903, more than eight years after our first visit.

En route to Chilpancingo on our first visit we left Ayotzinapa in northeastern Guerrero on December 14, 1894. From the creek near the town we ascended a long, steep mountain slope to a divide at 7,500 feet at the village of Tlatlanque. From the top of this divide the hills could be seen descending in regularly diminishing height to the valley of Tlapa, while to the south the ridge we were on connected with a still higher series, probably reaching 9,000 feet. These are spurs of the main range lying still farther to the south. Leaving the divide, we descended steep-sided canyons and traversed broken country past Atlixnac, on a mountain bench at 6,200 feet. Continuing through rough country, we descended to the town of Petatlán at 5,000 feet, in a narrow valley draining north toward the Río Balsas. We stayed overnight at Petatlán, about 24 miles from our starting point in the morning. On December 15 we continued through mountainous country from Petatlán, crossing a deep canyon en route and then ascending a ridge beyond to 7,800 feet. From this ridge a long slope led down to the large town of Chilapa in a broad valley at 5,200 feet. The distance traveled was about 16 miles. December 16 was another day through the mountains, past Tixtla, the former capital of the state, in a broad, nearly level valley at the same altitude as Chilapa. From the crest of the last ridge at 7,000 feet we descended directly to Chilpancingo at its base and about 26 miles from Chilapa. The valley at Chilpancingo is 2 to 4 miles wide and about 15 miles long, with mountains rising steeply on both sides. From the head of the narrow, basinlike valley a few miles south of Chilpancingo the drainage is northward to the Río Balsas.

Our route all the way from Tlapa was across northern spurs of the Sierra Madre del Sur, which extends from Guerrero into Oaxaca, with the northern flank drained by the Río Balsas and its tributaries. All this section up to about 6,500 feet has an arid climate, the south and east slopes being largely bare of woody vegetation. Northern and western exposures, on the other hand, are covered with bushes and low trees, mainly of the Lower Austral Zone from the valleys up to between 5,500 and 6,500 feet. Most of the moisture is here evidently derived from the Pacific side. Above the altitudes mentioned oaks and other bushes form a narrow belt extending to about 7,000 feet, where pines become dominant. In the valley at Chilpancingo were mesquite, acacia, wild guava, wild fig, the tree *Ipomoea* with woolly calyx, many agaves, and a few large cactuses, mainly plants of the Lower Austral zone. This zone extends up on south slopes to about 6,500 or 7,000 feet.

Chilpancingo—mountains near (9,500 to 9,800 feet):

*December 18-24, 1894; May 15-25, 1903.*—High range of mountains, the Sierra Madre del Sur, lying west and northwest of the valley in which Chilpancingo is situated. On December 18, 1894, we left Chilpancingo, crossed the narrow valley in a westerly course, and, turning to the north, in a distance of about 14 miles ascended to the summit of the mountains at about 10,200 feet. No water was found, and we were obliged to make a dry camp. In a search for water the next morning we found a small spring in a meadow at 9,500 feet, where we camped under shelter of a large oak. Specimens were labeled "Mts. near Chilpancingo."

The Sierra Madre del Sur extends in a southeast by northwest course between the valley of the Río Balsas and the Pacific coast, with a high crest that seems to be continuous except for the narrow gap or low pass at the head of the valley near Chilpancingo, eastward into Oaxaca. From the highest peak in our vicinity we could look along the crest extending away in massive ridges to the northwest and southeast, until lost in the distance in both directions. We were later informed by American miners that a mountain known locally as Teotepec, on the coast side of the range north of San Jerónimo, is more than 11,000 feet high with occasional light snow in winter. The section of the range visited by us consists entirely of massive limestone. The summit is strangely sculptured by water into fantastic hollows, pits, and ragged spurs, presenting in many places the wild roughness of a great lava bed. This resemblance to lava is due to rough exposed surfaces blackened by the weather. In many places pit or cauldronlike hollows are 100 to 500 feet deep, with an outlet in the bottom through which the drainage water escapes. The climate is cold, and the summer rains are undoubtedly heavy. During the time of this visit hard frosts occurred every night. We returned to Chilpancingo on December 24.

In 1903 we again visited these mountains. Leaving Chilpancingo on May 15 we traveled about 18 miles diagonally across the valley and directly over the summit to Omilteme, a small cattle ranch at 7,200 feet on the western side. Specimens collected at various elevations from about 1,500 feet above to 1,500 feet below the ranch were labeled "Omilteme." This is the locality where Herbert Smith and his wife had worked some 15 or more years previously and collected the types of three new birds. Living here were several families who had charge of cattle ranging in a narrow valley a mile or so long and closed at each end by rocky walls. A small stream that flows down the length of the valley is lost in the canyon below the houses.

Across a divide at about 8,000 feet on the southwestern side of the valley the western flank of the mountains drops away rapidly into the hot country, and on this slope, in striking contrast with corresponding exposures facing the arid valley at Chilpancingo and with the colder upper levels, we were surprised to find the luxuriance of a tropical rain forest. Northern exposures and sheltered canyons are especially rich in vegetation. A heavy forest is made up largely of towering oaks, but many other species are intermingled, and tree ferns were plentiful in the moist bottoms of canyons at about 7,500 feet. This area of abundant rainfall representing the Humid Upper Tropical Zone, extends from about 6,000 to 8,500 feet. Above about 8,500 feet the forest becomes thinner, and pines and firs (*Abies religiosa*) appear. The latter species, confined to north-slope canyons at 8,500 feet, is more or less generally distributed along with pines from 9,000 feet up to the summit of the range. The humid area about Omilteme is noteworthy for the peculiarity of the bird fauna, and several of the mammals are not known to occur elsewhere.

On the arid Chilpancingo valley exposure of the mountains, open grassy country with scattered bushes and trees extends up to about 6,200 feet. Fan palms, possibly of more than one species, begin at 5,500 feet and range up south slopes to 9,500 feet, the highest point we had ever noted them, and *Juniperus mexicana* occurs from 8,000 to 9,000 feet. Several species of oaks are found on this slope. At about 7,500 feet small oaks and a madroño were noted. From 8,000 to 9,000 feet an oak with notched leaves is present, and larger oaks are mixed with the pines and firs near the summit. In cool, moist spots on the upper slopes dense stands of lupines, 6 or 7 feet high, grow along with thistles 8 or 10 feet tall, and a variety of other herbaceous species. We returned to Chilpancingo from our second trip into the mountains on May 25, 1903.

#### Copala (200 feet) :

*February 8-9, 1895.*—A village at 200 feet altitude, near the coast and about 50 miles in a direct line southeasterly from Acapulco. An overnight stop on our route from Acapulco to Ometepe.

#### Copala to Juchitango (See Ometepe—near).

#### Coquillo (1,500 feet) :

*May 5-6, 1903.*—Coquillo is a small village at 1,500 feet about 42 miles north of Acapulco on the trail to Chilpancingo. On May 5 we moved about 16 miles from Dos Arroyos to Coquillo. The village, well down in the Arid Lower Tropical Zone, is located close against

the base of an irregular mountain mass, rising 5,000 or 6,000 feet with very abrupt slopes. On May 6 I left Nelson at Coquillo and took the trail directly to San Marcos on the coast, and thence east to Copala. I rejoined him at Chilpancingo about a week later.

**Coyuca** (also mapped as Coyuca de Benítez) (100 feet) :

*April 23-24, 1903.*—Coyuca is a town on the lagoon of the same name about 32 miles northwest of Acapulco. An overnight stop on our route along the coast to Acapulco. Arid Lower Tropical Zone.

**Dos Arroyos:**

*May 3-5, 1903.*—Dos Arroyos is a town about 26 miles from Acapulco on the trail to Chilpancingo. On May 3 we traveled from Ejido Nuevo, 8 miles north to Dos Arroyos, where we remained until May 5. Near Dos Arroyos the country is broken and hilly, rising here and there into low mountains, the general elevation increasing toward the interior. Beyond Dos Arroyos, on May 5, we entered the narrow valley of the Río Papagayo and followed the winding course upstream for several miles.

**Dos Caminos:**

*May 7-8, 1903.*—A town on the road a little more than halfway from Acapulco to Chilpancingo. An overnight stop by Nelson.

**Ejido Nuevo** (500 feet) :

*May 2-3, 1903.*—A village at 500 feet, 18 miles from Acapulco, on the trail toward the interior. An overnight stop was made by us en route to Chilpancingo.

**El Limón** (about 2,500 feet) :

*March 31 to April 3, 1903.*—El Limón is a small village at about 2,500 feet some 35 miles northwest of La Unión, which is near the coast in western Guerrero. On March 29 we left the ranch of Agua Blanca near the Volcán de Jorullo, Michoacán, and rode southward about 30 miles to the ranch of Guadalupe, passing the village of Cayaco en route. The following day, March 30, our course was southwesterly to Paso de las Vacas, a collection of huts on the banks of a dry sandy watercourse in Guerrero. About halfway we crossed the Río Balsas at the village called Balsas, situated at the point where the river turns southward in a direct course to the sea. The Río Balsas flows through an arid interior basin, but it has an extensive watershed and its many affluents drain high mountain areas in various states. It is the largest river in Mexico, and, although at a low stage when we crossed, it was a quarter or a third of a mile wide with a swift cur-

rent. The hill country extends back from near the river on both sides at Balsas, and along the route to El Limón. In places as at El Limón, the hills are low and rounded, and here and there they rise into mountains 4,000 to 6,000 feet high. The general region is very arid, with only occasional streams in small valleys where there is a little tillable land for the scattered population. Arid Lower Tropical Zone.

**El Naranjo** (about 1,800 feet):

*April 3-4, 1903.*—El Naranjo is a village at about 1,800 feet about 21 miles northwest of La Unión, which is a larger town near the coast in western Guerrero. On April 3 we reached El Naranjo for an overnight stop from El Limón, about 16 miles to the northwest. The village is in a deep canyon among rugged mountains with folded stratification. Arid Lower Tropical Zone.

**El Rincón:**

*May 8-9, 1903.*—A village about halfway between Dos Caminos and Acahuizotla on the road from Acapulco to Chilpancingo. An overnight stop by Nelson.

**El Zopilote** (about 1,000 feet):

*March 31, 1903.*—El Zopilote is the name of a ranch at about 1,000 feet near the Río Balsas in extreme western Guerrero. It was passed en route from Paso de las Vacas to El Limón, Guerrero. Arid Lower Tropical Zone.

**Hacienda del Capricho to Llano Grande, Oaxaca** (see Llano Grande, Oaxaca).

**Iguala** (2,400 feet).

*May 30 to June 2, 1903.*—Iguala is a railroad station at 2,400 feet in northern Guerrero. From Xalitla we rode north on May 30 about 32 miles to Iguala, where we sold our horses and mules and resumed travel by rail. The trail from Xalitla led out from the hills over a series of open, slightly rolling plains, valleylike in form, with ranges of low hills and small rounded mountains along their borders. Approaching Iguala the land surface gradually ascended over plains and through rolling hills to the summit of a broken escarpment overlooking a broad valley set among hills and low mountains, with a small lake on its farther side. The town lies in the bottom of this valley.

**Juchitango to Ometepepec** (see Ometepepec—near).

**La Escondida** (about 1,000 feet):

*March 31, 1903.*—La Escondida is a ranch at about 1,000 feet near the Río Balsas in extreme western Guerrero. It was passed en route

from Paso de las Vacas to El Limón, Guerrero. Arid Lower Tropical Zone.

**La Lagunilla:**

*April 6-7, 1903.*—On April 6 we left La Unión and traveled about 20 miles in a southeasterly course near the coast to a small collection of huts called La Lagunilla or Lagunillas. The locality was an overnight stop en route to Zihuatanejo.

**La Unión (about 500 feet):**

*April 5-6, 1903.*—La Unión is a small town at about 500 feet near the coast in western Guerrero. It was an overnight stop on our route southeastward along the coast. En route from El Naranjo to La Unión we passed the village of La Junta or Las Juntas, near which some plants were collected. Near La Unión we collected a specimen of the ring-tailed ground squirrel (*Citellus annulatus annulatus*), a tropical species not noted farther south. Arid Lower Tropical Zone.

**Mexcala (1,350 feet):**

*May 29, 1903.*—Mexcala is a town at 1,350 feet on the Río Balsas. On May 29 we left Mezquititlán, 19 miles north of Chilpancingo, and rode north about 33 miles to Xalitla, crossing the Río Balsas at Mexcala en route.

**Ometepec—near (200 feet):**

*February 10-15, 1895.*—Ometepec is a town at about 1,000 feet on the Río Ometepec, about 20 miles from the coast, and very near the boundary of the state of Oaxaca. On February 8 we were able to leave San Marcos, where we had been detained owing to illness, and rode about 33 miles southeast over the rolling plain closely bordering the coast to the village of Copala at 300 feet. Continuing southeast on February 9 about 27 miles we reached the village of Juchitango at 400 feet, and 17 miles farther on February 10 brought us to Ometepec. As we approached Ometepec the route swung inland and the altitude increased until at about 1,000 feet we reached the highest point visited along this part of the general route. On February 12 we left Ometepec and traveled about 9 miles southeast to the Hacienda del Capricho at 200 feet, on the bank of the Río Santa Catarina, a large tributary of the Río Ometepec. Specimens taken here were labeled "Near Ometepec." On our route near the coast from Acapulco to Ometepec there are no mountains, but the surface of the country consists mainly of low rolling hills of the same white granite formation as near the port. Toward the interior the hills gradually increase

in altitude until, at 12 to 25 miles from the coast, ridges and isolated hills begin to assume the proportions of mountains 1,000 to 2,000 feet high. Behind these, higher ridges and mountains form outlying spurs of the Sierra Madre, concealing from view the main chain rising to 6,000 and up to 10,000 feet 50 to 75 miles away. From San Marcos to Ometepe we crossed several small rivers, each with a broad sandy bed and shallow water but showing evidence of rising many feet during summer rains.

Owing to the prevalence of mosquitoes and malaria on the narrow strips of lowland along streams, most of the native villages along the coast are built on the tops of low hills or ridges, where they get the benefit of the sea breezes. In some places all the water for domestic uses is brought for 1 or 2 miles in earthen jars carried by the women on their heads.

We found the town of Ometepe in a half-ruined condition from recurrent earthquakes of moderate severity during the previous few months. From Ometepe to the Hacienda del Capricho our route was across a stretch of rolling hills until we reached the bottomlands along the Río Santa Catarina. Crossing the river we followed down the flats along the eastern bank for a few miles to the hacienda located a short distance back from the stream at the base of a low granite hill. Summer rains are ordinarily plentiful, but from November to May or June an almost cloudless sky affords the sun full sway in its torrid energy. The result is that the character of the vegetation is determined more by the length of the dry season than by the copious rainfall during the wet season. Water is scarce almost everywhere during the dry season, and the numerous sandy courses of the summer drainage become dry or have a scanty flow in all but the larger streams before the rains again supply their sources.

On the low, flat areas where the soil contains more or less moisture the forest is often dense and rather heavy but nowhere attains the size and luxuriance found in humid tropical areas. The hills are very arid and have usually a thin forest or small trees and bushes, mainly leafless at this season, interspersed with irregular open areas of thin grassy growth. Arid Lower Tropical Zone.

**Omiteme** (see Chilpancingo—mountains near).

**Papayo** (about 200 feet):

*April 16-23, 1903.*—Papayo is a village on our route along the coast about 47 miles northwest of Acapulco. On April 13 we left Cayacal and rode 18 miles to Tamarindo; on April 14 we made 22 miles to the

village of Nuxco; on April 15 we went on 28 miles to San Jerónimo; and on April 16 we continued 24 miles to Papayo. All this travel was in a southeasterly direction. Papayo is the principal locality at which work was done in the coastal region north of Acapulco. From Cayacal, reached April 12, to Papayo, where we arrived on April 16, and on to near Acapulco, low coastal plains vary in width but usually extend back for several miles to low hills. Here and there, however, the plain is interrupted by ranges of hills that reach to the shore. Toward the interior the hills rise irregularly into mountain masses forming the outlying front of the Sierra Madre del Sur. These mountains lie in the somewhat isolated area between the valley of the Río Balsas and the sea. Several small rivers drain the southern slopes of the Sierra Madre. Among the larger streams are the Río de Tecpan, Río Atoyac, and Río Coyuca. The coast is bordered by a series of long, more or less brackish lagoons, which are separated from the sea by sand dunes.

Near Papayo the low coastal plain extending from the lagoon to the base of the foothills is about 2 miles wide. The rainy season extends from the end of May or early June to October or November. The remainder of the year is dry. During some seasons the rains are very scanty and infrequent, and crops cannot successfully be grown except on low and permanently moist areas. Scrubby jungle covers the northern slopes of the hills, but southern exposures are often open and grassy. Occasional natural openings also occur in the form of savannas here and there on the more level areas.

On the level bottomlands along streams or in moist situations occur areas of heavier forest, and here and there are patches of nut palm forest unmingled with any other trees except a wild fig (*Ficus lentiginosa*), which maintains a curious association with the palm. This remarkable fig tree climbs the palm, which is encircled and affords support. The palm is slowly throttled and may finally be killed by the enveloping stems of the fig, many of which become confluent and form a net with a viselike grip on the trunk. When the palm has been killed the fig may remain standing without further support. Cayacal, one of the villages passed, was a picturesque place situated on the border of a beautiful forest of nut palms. Near Papayo the low coastal plain is overgrown with nut palms mixed with other forest trees, including the Brazilwood and silk-cotton trees of several species.

Arid Lower Tropical Zone.

**Paso de las Vacas** (see El Limón).

**Petatlán** (about 300 feet) :

*April 12, 1903.*—Petatlán is a village at about 300 feet that we passed about 35 miles southeast of Zihuatanejo. Not to be confused with Petatlán, which is shown on some maps on the coast 8 or 10 miles southeast of Zihuatanejo. Arid Lower Tropical Zone.

**Petatlán to Chilapa** (see Chilpancingo).**Río Balsas** (1,200 feet) :

*June 2-4, 1903.*—Río Balsas was the station at the end of the railroad line on the river of the same name. The locality was reached by us by rail from Iguala, where we had just sold the pack and saddle animals used in our field work for nearly 6 months. The Balsas Valley near Río Balsas is an extremely arid region. The river flows among hills and low mountains, in some places forming a narrow canyon, and in other sections small, nearly level open valleys extend back for several miles from the edge of the water. The hills and mountains are rather steep, with cliffs and broken slopes facing the river.

The vegetation is scanty, a scrubby growth of trees and bushes forming dense low jungle here and there, especially on north slopes. South slopes and many of the more level areas are more or less free from trees and bushes and covered with grass. The bald cypress (*Taxodium*) grows along the banks of the river. Among the characteristic trees, especially in the bottoms of canyons and lower parts of valleys, are the guásima (*Guazuma ulmifolia*) and the mesquite.

**San Marcos** (300 feet) :

*January 30 to February 7, 1895.*—San Marcos is a village on the coastal plain about 40 miles by trail east of Acapulco. On January 29 we left Acapulco on our return trip to the City of Oaxaca, skirting the coast as far as Puerto Angel, Oaxaca, en route. The first night out we stopped at a rancho called Cerro Piedra and continued 17 miles to San Marcos the following morning. On the way, on January 29, I had an attack of malarial fever, which continued the next day. Nelson was suffering from an extremely sore throat and bronchitis, and we were detained about a week at San Marcos to recuperate.

**San Marcos to Copala** (see Ometepec—near).**Sierra Madre, near Chilpancingo** (see Chilpancingo—mountains near).**Sihuatanejo** (see Zihuatanejo).

**Sochi (=Xochihuehuetlán) (3,800 feet):**

*November 28-29, 1894.*—Sochi, apparently an abbreviation for Xochihuehuetlán, is a town at 3,800 feet on a small tributary of the Río Mixteco, or Río Tlapaneco, near the boundary of Puebla in northeastern Guerrero. From Amolac, Puebla, on November 28, we followed the trail southward about 18 miles across the state line to Sochi. The route was through broken hilly country with no point over 4,800 feet in altitude, and none of the neighboring mountains exceeding 7,000 feet in height.

**Sochi to Tlalquetzala (see Tlapa).****Tamarindo:**

*April 13-14, 1903.*—A village at low elevation near the coast on our route from Zihuatanejo to Acapulco. On April 13 we left Cayacal and rode 18 miles southeasterly to Tamarindo, where we spent the night.

**Tecpán (also mapped as Tecpán de Galeana) (300 feet):**

*April 15, 1903.*—Tecpán is a town at about 300 feet on the Río de Tecpán about 50 miles northwest of Acapulco. It was passed during the day's ride of about 28 miles from the village of Nuxco to a place called San Jerónimo. Arid Lower Tropical Zone.

**Tierra Colorada:**

*May 6-7, 1903.*—In my absence on a side trip, Nelson moved with the pack outfit 11 miles from Coquillo north to Tierra Colorada, where he stopped overnight en route to Chilpancingo, May 6.

**Tixtla (about 4,500 feet):**

*May 26-27, 1903.*—Tixtla, the former capital of the state, is a city at about 4,500 feet in a broad, nearly level valley, a few miles northeast of that in which Chilpancingo is situated. The two valleys are separated by a mountain ridge about 7,000 feet in altitude. On May 26 I rode over to Tixtla to collect some birds, especially a series of meadowlarks, in the valley, and returned on the following day to Chilpancingo.

**Tixtla to Chilpancingo (see Chilpancingo).****Tlalixtaquilla (4,200 feet):**

*December 5-6, 9-12, 1894.*—Tlalixtaquilla is a village at 4,200 feet about 20 miles east of Tlapa and near the Oaxaca boundary in northeastern Guerrero. This locality was reached from Tlapa on December 5. Our route from Tlapa led about 2 miles down the valley to

the confluence of the Río Tlapaneco with another stream of about equal size coming in from the southeast. We followed up the valley of Tlapaneco for about a mile and then turned abruptly up the steep mountain slope on the east side. A zigzag trail led to the top of the divide at about 7,000 feet and then down to the bed of a parallel stream, also a tributary from this part of the Río Balsas basin. At this point the river flows through a narrow canyon, up which we traveled until near Tlalixtaquilla, crossing the stream many times. On December 12 we returned to Tlapa. The mountains near Tlalixtaquilla, like those about Tlapa, are of limestone and reach to from 6,000 to 8,500 feet. They are especially steep and rugged along the route from Tlapa. Tlalixtaquilla is near the upper border of the Arid Upper Tropical Zone. Bananas grown here are near their extreme upper limit. On the hill slopes above 5,000 feet are two species of oak, juniper, and other plants, apparently referable to Lower Austral Zone.

**Tlalixtaquilla to Tlapa** (see Tlalixtaquilla).

**Tlalixtaquilla to Tlapancingo, Oaxaca** (see Tlapancingo, Oaxaca).

**Tlalquetzala** (misspelled "Tlalkisala" on specimen labels) (3,600 feet):

*November 29-30, 1894.*—Tlalquetzala is a village at 3,600 feet in the valley of the Río Tlapaneco, northeastern Guerrero. An overnight stop en route from Xochihuehuetlán to Tlapa. The name of the locality was misspelled "Tlalkisala" on the labels of the specimens collected.

**Tlalquetzala to Tlapa** (see Tlapa).

**Tlapa** (3,900 feet):

*November 30 to December 5, 1894.*—Tlapa is a town at 3,900 feet on a large upper tributary of the Río Balsas in northeastern Guerrero. From Xochihuehuetlán our trail on November 29 led southward across numerous ridges, which reach about 5,000 feet, and down to Huemuxtítlán in the valley of the Río Tlapaneco, one of the larger upper tributaries of the Río Balsas. The valley is 1 to 3 miles broad, with a nearly level bottom at 3,400 feet where we entered. Mountains on each side of the valley rise abruptly to from 1,500 to 3,000 feet above the bottom, with many cliffs and sharp slopes to rounded ridgelike summits. We continued up the valley about 8 miles to Tlalquetzala (misspelled "Tlalkisala") at 3,600 feet, where we spent the night. Distance covered during the day

was about 18 miles. The following morning our route followed the narrow valley a few miles southerly and then turned up the steep slope of a high ridge over which the trail passed in a zigzag course, crossing the highest point at about 7,000 feet and then descended through a series of minor ridges and foothills to Tlapa in a canyon or narrow valley of a branch of the Río Tlapaneco. The distance from Tlalquetzala was about 16 miles, but the entire day was spent in slow progress over steep trails.

Toward the east, south, and west from the high ridge east of Tlapa the sharp peaks and ridges of the Sierra Madre del Sur, covered with pines, were clearly outlined against the sky, 15 to 30 miles away. The general section is arid. The hills are covered as a rule with a thicket of low scrubby trees and brush, in many places difficult to penetrate on foot. In this dense stand trees that reach a height of 25 to 40 feet are conspicuous above the general mass of lower growth. The vegetation cover is heaviest in canyons or on north slopes. On south exposures the tops of hills are frequently bare of trees and bushes. Scattered openings of irregular form and sometimes of large extent occur among wooded hills. Along the bottoms of the valleys where the water-courses afford more moisture occur large fig trees and other vegetation peculiar to the more favorable conditions. The openings free from bushes on hills or in valleys, or wherever the trees or bushes are scattered, are covered with an abundant growth of grasses and small herbaceous plants. During the summer rains these are vivid green, but in winter when no rain falls these areas are yellowish brown and give the distant landscape an intricately patched or flecked appearance.

Much of this general region is along the border between the Arid Upper Tropical and Lower Sonoran Zones, local areas assignable to these zones being interwoven, depending on altitude and other local modifying conditions. Below 4,000 to 4,200 feet on average slopes Arid Tropical faunal and floral elements are predominant, although there is some intermingling of Lower Sonoran species. From about 4,200 feet upward Lower Sonoran conditions are more prevalent. In the vegetation this is shown in part by the abundance of fan palms and oaks above about 4,800 feet.

**Tlapa to Ayotzinapa** (see Ayotzinapa).

**Tlapa to Tlalixtaquilla** (see Tlalixtaquilla).

**Zihuatanejo** (20 feet):

*April 7-11, 1903.*—Zihuatanejo on the labels and map we used is a small village or port on a bay of the same name in western Guerrero.

Here we remained until April 11, working mainly on the sea birds of some rocky islets a few miles off the coast. From La Unión, which we left on April 6, the trail led southerly through a rolling hill country to the small village of La Lagunilla. On April 7 we continued over higher ridges here and there, with occasional more or less level stretches in between to the port. In one place the trail crosses a flat plain bordering the coast, and then strikes inland and over a sharply defined mountain ridge between 2,000 and 3,000 feet high, which reaches the coast just north of Zihuatanejo. The little port of Zihuatanejo is on the level plain at the head of a bay, which is enclosed on both sides by rocky hills and low mountains. The small islets offshore are barren, precipitous rocks inhabited by sea birds and 25 or 30 pairs of military macaws (*Ara militaris*) that were nesting on inaccessible cliffs. Arid Lower Tropical Zone.

#### Zumpango (3,300 feet):

May 28, 1903.—Zumpango is a town at 3,300 feet about 10 miles north of Chilpancingo. It was the first town we passed after leaving Chilpancingo en route to Mexcala on the Río Balsas.

#### HIDALGO

#### El Chico (7,600 to 9,800 feet):

March 21-29, 1893.—From Pachuca our route was northerly, directly across the Sierra de Pachuca, and then descended abruptly to El Chico at about 8,000 feet on the northern slope. From this point work was carried on up to about 9,800 feet, near the top of the Sierra de Pachuca, the highest pinnacles of which reach to nearly 11,000 feet. These mountains form an irregularly oval islandlike mass, rising abruptly on all sides from the lower surrounding country. The summit is broken by low ridges, and projecting knobs and huge pinnacles of bare porphyry. Here and there are small valleylike areas. Several small streams flow down from near the summit in various directions to the adjacent plain. To the north and east the descent is abrupt to the general level of the plateau at about 6,000 feet, cut by numerous great canyons carrying the headwaters of the Río San Andrés and other streams northward to the Río San Juan and the Río Pánuco. The Sierra de Pachuca constitutes one of the richest silver-mining districts in all México. Real del Monte, a mining town dating back many years, and the type locality for certain birds, is situated at more than 9,000 feet near the top of the range, about 3 miles in an airline east of the city of Pachuca.

High on the road to Real del Monte small cypresses (*Cupressus lindleyi*) and oak bushes skirt the lower border of the fir timber, which extends up irregularly from about 8,500 feet on north slopes, and 9,000 feet on south slopes, to the summit. On the upper slopes the dwarf juniper (*Juniperus mexicana*) forms almost impenetrable thickets over considerable areas. From 8,000 feet to nearly 9,000 feet on some northerly exposures a fine stand of large oaks covers considerable areas to the almost total exclusion of pines or firs. From 8,000 feet down to 7,000 feet, where the timber ends, there is a forest of two species of pines which, with a few oaks and madroños, form a lower forest belt.

**Encarnación** (also mapped as Ferrería de la Encarnación) (8,200 to 9,500 feet):

September 28 to October 9, 1896.—Encarnación is an iron-mining town at 8,000 feet near the summit of the Sierra Madre Oriental in northwestern Hidalgo. On September 26 I left Jalpan, Querétaro, and traveled 26 miles southeast to Pacula, Hidalgo, en route to Encarnación. From Jalpan the road soon descended rapidly to the Río Moctezuma, which it crossed by a suspension bridge. The river here forming the boundary between Querétaro and Hidalgo flows through a narrow gorge, bordered by cliffs and steep rocky slopes at about 2,000 feet. From the river the road ascended the steep river bluff to about 3,500 feet, and then climbed on up more gradually among the hills to Pacula. I left Pacula the following day, the trail continuing up along the ridges through very rocky country to Encarnación, a distance of 26 miles. The town is located in the same range of mountains as Pinal de Amoles, Querétaro. This range begins in San Luis Potosí and extends southeast across northeastern Guanajuato, and northern Querétaro, into Hidalgo. The mountains here are very rugged and rocky, with the higher peaks reaching to a little above 9,500 feet. The vegetation and its distribution are much the same as on the mountains near Pinal de Amoles, Querétaro. On the east slope from the bottom of the canyon of the Río Moctezuma, at 2,000 feet, up to 4,500 feet, near Pacula, arid conditions prevail.

At 5,000 feet the first small oaks were noted, and they increased in size from that point up to near the top at Encarnación. The cypress (*Cupressus lindleyi*) begins at about 5,500 feet and was seen up to 6,500 feet on the east slope and between 7,000 and 7,800 feet on the west slope. The first pines begin at about 6,500 feet and increase in size upward to the top. A pine (*Pinus montezumae*) extends down

the west slope to a lower limit at about 7,000 feet and is the only species, with the exception of the pinyon, that is found far beyond the summit on the western slope. On the eastern slope at least three species occur. Alders and thornapple (*Crataegus*) occur at 8,000 feet near Encarnación. Black walnut and basswood trees grow on the west slope between 7,500 and 7,800 feet. Below 7,500 feet on the west side the cedars become scarcer and give way to the pinyons, which extend down to 6,500 feet, where they are most numerous on north-facing sides of canyons. At 6,500 feet the vegetation of the arid interior plains begins. Oaks range down to 5,000 feet on the east side but do not grow much below 7,000 feet on the west slope. The life zones are of about the same altitudinal extent as near Pinal de Amoles, Querétaro. The lower limit of the oaks seems approximately to mark the lower limit of the Upper Sonoran Life Zone at 5,000 feet on the northeastern side, and at 7,000 feet on the southwestern side of the range.

#### Irolo (7,500 feet):

*March 29 to April 3, 1893.*—Irolo is a railroad station near the southeastern border of Hidalgo and about 30 miles southeast of Pachuca. Work here was carried on within a radius of about 3 miles of the station, mainly to the south and southwest. This locality is just east of the Valley of México, on the east side of the low divide separating the valley from the plains of Tlaxcala and Puebla, and in the broad gap between the Sierra de Pachuca and the Cerro Ixtacihuatl. Through this low gap the tableland biota of the country to the west and northwest is connected with that of the states of Tlaxcala, Puebla, and parts of the extreme western border of Veracruz.

Irolo is on the rolling Plain of Apam, which is 8 or 10 miles long from east to west, and somewhat narrower in width, forming a shallow basin. The plain rises to low mountains to the north and east. There are no streams near, and the general drainage is into two small lakes. One of these lakes, the Laguna de Apam, contains much marsh vegetation and is an important winter resort for migratory waterfowl. It was not visited by us, however, at this time. The hills near Irolo are mainly volcanic, and the bottom of the basin has a clayey soil. Between the foothills and the bottom are scattered areas with sandy surface which may be distinguished at a long distance by the pale yellowish-white color in contrast with the darker color of the adjacent hills and plains. These areas afford the more favorable burrowing ground for various rodents.

The district is arid and the vegetation that of other barren portions of the southern end of the Mexican tableland. The general flora is a continuation of that of the plains about Pachuca and adjacent parts of the Valley of México. Agaves, yuccas, cactuses, acacias, the introduced *Schinus molle*, and various other desert species are characteristic. Upper Austral Zone.

**Ixmiquilpan** (6,000 feet).

*October 21, 1896.*—Ixmiquilpan is a large town at 6,050 feet on the Río de Tula, in western Hidalgo. On October 20 I left Zimapán at 3 a.m., with my outfit, in a train of freight oxcarts that made regular weekly trips to Tlaxcoapan on the railroad. A stop for the night was made at the point where the road crossed the Río de Tula, about 21 miles southeast of Zimapán. On October 21 the carts started early, and I reached Ixmiquilpan, distant about 13 miles, before noon. The route from Zimapán to Ixmiquilpan is through an undulating plains region of the same general character as the valley of Zimapán. The town is situated on a sandy plain that probably formed the bed of an ancient lake. The plain is circular in outline and some 5 or 6 miles in diameter. The Río de Tula enters the plain through a narrow gorge, and after crossing to the farther side passes out through a box canyon cut in the hills. The vegetation is about the same as at Zimapán. Lower Austral Zone.

**Marqués** (8,000 feet):

*May 22-26, 1896.*—Marqués is a station at 8,132 feet on the railroad about 26 miles northwest of Tula, and just north of the boundary of the state of México. We reached Marqués by rail from the City of México on May 22. From Tula, where we worked several years previously, the railroad winds in and out among rounded volcanic hills and along valleylike slopes to the highest point just south of Marqués. Near Marqués the country is a high, rolling, irregular plain with scattered hills within a few miles and rounded mountains in the distance in all directions. Just north of Marqués is a broad valley with a dry stream bed along the middle. During the rainy season the stream is one of the affluents of the Río de Tula, the course of which is northward toward the Gulf of México. Our visit here was at the end of the dry season, and the aspect of the country was extremely arid, typifying that of much of the tableland region in general. The hills near Marqués are volcanic, and in many places the ground is thickly covered with small boulders and fragments of broken lava. The high windswept plain about Marqués is covered with short grass. The sides

of a rocky canyon leading down from a neighboring hill and the north slopes from 8,200 feet to the summit at 8,600 feet had a scanty covering of stunted pines and oaks. Wheat and corn are grown extensively on the plains and lower hill slopes when the rains are sufficient to supply the needed moisture. The crops failed in 1895. Sharp frosts occur in winter. Upper Austral Zone.

**Pachuca** (7,824 feet) :

*March 14-21, 1893.*—Pachuca, the capital of Hidalgo, is the well-known mining center of that part of the state. It is situated at 7,824 feet altitude at the southern base of the Sierra de Pachuca, which is a small group of mountains rising to about 10,000 feet and forming the northeastern limit of the Valley of México. Real del Monte, the type locality for certain birds, is a mining town at an altitude of more than 9,000 feet near the summit of the Sierra de Pachuca, about 3 miles in an airline from Pachuca. The general section is arid and rather barren, forming a part of the high arid interior tableland. Prominent among the plants are agaves, yuccas, acacias, and the introduced peppertree, *Schinus molle*. Upper Austral Zone.

**San Agustín** (7,500 feet) :

*March 18, 1893.*—The village of San Agustín, which was visited from Pachuca, is on the railroad about 18 miles south of Pachuca. It is situated at the base of an isolated hill within the northeastern border of the Valley of México.

**Tula** (6,800 feet) :

*March 9-13, 1893.*—Tula is a station on the railroad in southern Hidalgo about 50 miles north of the City of México. It is situated on a small stream, the Río de Tula, which heads near the northern border of the Valley of México, as an affluent of the Río Pánuco, draining to the Gulf of México at Tampico. Much of the country about Tula is a great lava bed, worn and broken so as to form low, scattered hills with rounded outlines. The fauna and flora are similar to those of the general tableland region.

**Tulancingo** (7,200 feet) :

*August 16-29, 1893.*—The town of Tulancingo is about 35 miles a little north of east of Pachuca. The altitude is about 7,200 feet. The town is situated in the bottom of a long and rather narrow valley that heads a few miles to the southeast and extends north along a stream leading to the Río San Andrés, an affluent of the Río San Juan. Work was done in the valley and bordering hills and also at the

Hacienda Santa Ana, about 15 miles south, and up to 9,000 feet on the mountains to the west.

The valley of Tulancingo is open, grassy country bordered by low cactus-overgrown hills that rise to higher ridges and mountains. The country is volcanic throughout, and to the south between Tulancingo and the southern border of the state the surface is made up of low mountain groups interspersed with open, prairielike basins, often of considerable size but with no outlets. Some of these basins have shallow lakes in their lowest parts. This mountainous plateau country has an elevation of between 7,000 and 7,500 feet in its valley basins, and some of the surrounding mountains reach 8,000 and 10,000 feet. To the west across the dividing ridge lies the Valley of México, while a broken, lava-strewn, mountainous country more than 20 miles broad on the east separates it from the slope leading down into the hot country. To the north deep canyons extend up along the streams as long tongues of lowland, which penetrate the high plateau and bring the climate and tropical elements to within a few miles of the town. Summer rains in this district are abundant, and winter frosts are common.

Along the streams flowing down the valley grow willows, alders, and cottonwoods, and on adjacent dry hills are several species of *Opuntia*, agaves, and other plants of dry hillsides in this region. On the slopes of the mountains the distribution of belts of timber is about as follows: Oaks and madroños, 7,800 to 8,500 feet; pines, 8,500 to 9,000 feet; and firs (*Abies religiosa*), 9,000 feet to summits at about 10,000 feet. The belt extending from the bottom of the valley up to about 7,800 feet on the slopes may be assigned to Upper Austral Zone.

The area from 7,800 to 9,000 feet is less well marked but may be regarded as Transition in zonal character. The fir belt above about 9,000 feet seems clearly assignable to Canadian Zone.

#### Zimapán (6,200 feet):

October 11-20, 1896,—Zimapán is a mining town at 6,200 feet in western Hidalgo. On October 10 I left Encarnación and descended the southwestern slope of the Sierra Madre Oriental by a good wagon road 31 miles southwest to Zimapán. The town is situated in a very dry, barren valley several miles across, bordered by barren hills rising 1,500 to 2,000 feet above the general level. A small stream comes down from a spur of the Sierra Madre to the east and flows out through the valley into the Río Moctezuma, to the west of Zimapán. The vegetation is that of the arid interior plateau region and extends

up to about 6,500 feet on the slope of the mountains. The principal plants are mesquite, acacia, agave, juniper, the introduced pepper-tree (*Schinus molle*), yucca, and cactuses of various species. Yuccas of large size are notably abundant. Lower Austral Zone.

#### JALISCO

**Ameca** (4,000 to 6,500 feet):

*February 5 to March 3, 1897.*—Ameca is a large town at 4,000 feet on the railroad, about 50 miles west of Guadalajara. On February 5 I arrived in Ameca from Guadalajara and remained until March 3, working on the plain for several miles in all directions and up to 6,500 feet on the slopes of neighboring hills. From Guadalajara to Ameca the country is rolling and partly hilly, the general surface descending gradually about 1,000 feet en route.

The town is situated on a level plain in one of the finest agricultural districts in the republic. The summer rains are usually ample for the maturing of corn, wheat, and other crops, and the Río de Ameca, heading near Guadalajara and flowing westward to the Pacific, is extensively used for irrigation along this part of its course. A few miles to the south, west, and north, isolated groups of hills rise to from 6,000 to 7,000 feet.

The vegetation is similar to that of the warmer parts of the tableland in general. Among the principal plants on the plain are several species of wild fig (*Ficus*), a morning-glory tree (*Ipomoea*), acacias, the mesquite, *Pithecolobium dulce*, the wild guava (*Psidium guajava*), and several species of cactuses. On the hills oaks and pines are the most important trees. Crops raised are corn, wheat, beans, sugarcane, and bananas, and oranges are grown to a limited extent. Lower Austral Zone.

**Atemajac** (4,000 to 4,500 feet):

*May 16-31, 1892.*—A village at about 4,500 feet altitude 3 miles north of Guadalajara on the rim of a short side canyon leading down into the main canyon of the Río Grande de Santiago. The fauna and flora are the same as those of the neighboring tableland region in general.

**Atenguillo** (4,200 feet):

*March 5, 1897.*—Atenguillo is a small town at 4,200 feet, about 40 miles southwest of Ameca. An overnight stop en route to Talpa. Lower Austral Zone.

**Barranca Ibarra (3,000 feet) :**

*May 12-15, 1892.*—On May 11 we left Guadalajara with pack and saddle animals and traveled about 4 miles northeast to the edge of the great barranca, also known as the Cañon de Oblatos, of the Río Grande de Santiago. The trail then led down in a zigzag course for about 3 miles to a ford near which we found quarters at the Hacienda Ibarra. This great canyon, one of the tourist attractions of the region, is here about 1,500 feet in depth and quite narrow. The walls rising as cliffs hundreds of feet high, composed of igneous rock, form imposing escarpments often jutting out over the river as bold headlands and knobs. On some very narrow strips of comparatively level land along the river a vigorous growth of bananas, mangoes, and a few coffee trees gave a tropical luxuriance to the scene, in marked contrast to the generally arid aspect of the surroundings at that season. This tropical character is reflected also in the mammals and birds found along the bottom of the canyon.

The Río Grande de Santiago is the longest river of México. From its source in giant springs near Lerma in the Valley of Toluca it takes a northwesterly course as the Río de Lerma to Lake Chapala. Leaving the lake near the point of entry the river becomes the Río Grande de Santiago and traverses the tableland region to the Falls of Juanacatlán, about 20 miles above Guadalajara, where the great gorge begins. Continuing northwesterly the river flows through the tropical coastal region and enters the sea in Nayarit. From the coastal region to the Falls of Juanacatlán the bottom of the river canyon has a much more tropical climate than the tableland region through which the stream has so deeply cut its way. Along this narrow course, therefore, many species of mammals, birds, and doubtless other animals and plants have penetrated far into the interior of the plateau from their main distribution area along the coast. The contrast in conditions between the plateau at 5,000 feet along the canyon near Guadalajara and in the bottom of the canyon at 3,000 to 3,500 feet is quite remarkable. Arid Upper Tropical Zone.

**Bolaños (2,800 feet) :**

*September 9-15, 17-19, 1897.*—Bolaños is a town at 2,800 feet in the bottom of the deep rocky canyon of the Río Bolaños in the northwestern extension of Jalisco. On September 7 we left Colotlán and covered 30 miles in a southwesterly course to a ranch near the village of Totatiche. Thirty-five miles of travel on the following day in the same direction brought us to El Romerio. Continuing our journey

10 miles southwesterly on September 9 we reached Bolaños. There we remained until September 15, when a trip was made into the Sierra Madre. We returned to Bolaños on September 17. The Río Bolaños, which passes the town, drains the southern spurs of the section of the Sierra Madre north of the broad gap across the continental backbone through which the Río Grande de Santiago makes its way. Bolaños was the place where the collector Flores lived. Specimens of birds taken by him were sent to the British Museum. The canyon at Bolaños is very arid and the vegetation is Arid Upper Tropical in character up to an altitude of about 4,000 feet on general slopes.

**Colotlán (5,600 feet):**

*August 28-31, September 5-7, 1897.*—Colotlán is a town at 5,600 feet in an extreme northern prolongation of the state of Jalisco. From the mesa at Monte Escobedo, Zacatecas, we descended to the adjoining plain on the east at 6,200 feet, and our course was in a southeasterly direction for nearly 40 miles across a rolling country with the edges of deep canyons showing to the south. Beyond these could be seen a great area of mountainous country forming a part of the Sierra Madre. Near Colotlán we came to the eastern edge of the plain where an abrupt descent led down to the town in the valley of the Río de Colotlán, which is an affluent of the Río Bolaños. On August 31 we made a side trip across the Sierra Moroni to Plateado, Zacatecas, and returned to Colotlán on September 5.

The vegetation in the valley at Colotlán is largely Arid Upper Tropical, the canyon carrying tropical elements far north in this region. Copal trees (*Elaphrium*), acacias, mimosas, and morning-glory trees occur along with the mesquite and *Pithecollobium*. Crops grown include sugarcane, bananas, and other tropical fruits.

**Etzatlán (3,500 feet):**

*June 14-23, 1892.*—Etzatlán is located at the southern end of the Laguna de la Magdalena, which is a body of water several miles wide and about 20 miles long, occupying a basin without outlet. The Cerro Tequila, east of Etzatlán, reputed to be over 9,000 feet high, was not visited owing to torrential rains that prevailed. Near the lagoon wild fig trees (*Ficus*), mesquites, and large cactuses are abundant. Mangoes, oranges, and grapes were grown to a limited extent, and a small coffee plantation, apparently in good condition, was said to yield coffee of excellent quality. A few sickly, stunted banana plants were seen growing in the patios of houses—as was noted up even as high

as Guadalajara. The locality is evidently near the boundary between the Arid Upper Tropical and Lower Austral Zones.

**Huejuquilla (5,400 feet):**

*August 23-25, 1897.*—Huejuquilla is a town at 5,400 feet near a branch of the Río Bolaños, in northeastern Jalisco. From the Hacienda San Juan Capistrano, Zacatecas, our trail on August 23 led over the ridge to the east and down to the narrow valley of the Río Atenco beyond. We crossed the river and climbed a steeply rising slope with many cliffs facing west to a rolling plain at 5,000 to 6,000 feet. This part of the tableland region is somewhat broken or hilly, with broad, gently swelling areas between the hills. We reached Huejuquilla on the open plain after traveling about 25 miles in an easterly direction from our starting point. Lower Austral Zone.

**Ixtapa (300 feet):**

*March 31 to April 4, 1897.*—Ixtapa is a hacienda at 300 feet near the head of the Bahía de Banderas. From Las Palmas, where we spent the night of March 30 en route from near San Sebastián, we continued westerly 16 miles across the coast plain to the Hacienda de Ixtapa. The plain near Ixtapa is bounded by mountainous ridges toward the interior, and a ridge 3,000 feet or more in height extends out to Cape Corrientes, south of the bay. A lower ridge reaches to Punta de Mita to the north of the bay. Toward the north, however, level country extends across the Río de Ameca, to the Valle de Banderas, in Nayarit. The coastal region is arid, most of the vegetation being small and the trees stunted except along streams. Arid Lower Tropical Zone.

**Jacala (5,000 feet):**

*March 6, 1897.*—Jacala is a ranch about midway between Atenguillo and Talpa. An overnight stop en route. Lower Austral Zone.

**La Barca (5,000 feet):**

*January 7-10, 1903; February 22-25, 1926; January 16-18, 1935; and February 27-29, 1936.*—La Barca is a town at about 5,000 feet on the Río de Lerma, a few miles above the outlet, in the east end of the Lago de Chapala. On January 7, 1903, we moved from Ocotlán to La Barca, where we spent 3 days in the great marshes then existing near that place. I revisited the locality during three separate periods in connection with winter investigations of migratory waterfowl in México. On the first of these, February 22-25, 1926, I was accompanied by Señor Valentin Santiago, representing the Mexican Gov-

ernment. On the second, January 16-18, 1935, I was accompanied by my brother, Luther J. Goldman, and by Señor Manuel Guerrero, representing the Game Section of the Mexican Forestry, Game, and Fish Department. On the third, February 27-29, 1936, I was accompanied by my son Luther C. Goldman. The three visits enabled me to record changes in local conditions of critical importance on the wintering of waterfowl in general, but particularly of geese, which were attracted in greater numbers than anywhere else in México.

These areas in the delta of the Río de Lerma were, when first visited by Nelson and me, probably the largest and most important freshwater marshes in all México. There were two main divisions; the *Ciénega de Guaracha*, which extended from near La Barca to the lake, and another large marsh, the *Ciénega de Cumuato*, to the southward, near the southeast corner of the lake. The two marshes covered a number of square miles and formed the wintering ground for hundreds of thousands of geese and an equal if not greater number of ducks, coots, and many other kinds of waterfowl. The marshes contained a rank growth of aquatic vegetation of many kinds, of which perhaps the most important was an aquatic grass or grasslike plant, locally known as *camalote*, that had a tender succulent base much sought by the geese. Along the borders of the marshes were extensive areas over which cattail flags, called *tules*, grew to a height of 10 or 12 feet and furnished material for an extensive local industry in the making of mats. These *tules* were also used in the construction of picturesque habitation by fishermen.

During the period from 1909 to 1912 advantage was taken of a low stage in water level to build a dike as a government project across the lake, thus reclaiming 49,991 hectares of delta land, including the marshes described. At the same time the channel of the Río de Lerma was diked on the southern side, confining the stream against the north bank to prevent the water from spreading into the delta. The length of the two sections of dikes is said to be a little over 30 miles. The dike when built was 30 meters wide at the base, 4 meters wide at the top, and had a height of 4 meters. Twenty thousand men, mainly Indian laborers, were employed, and all the material in the great earth fill was carried and dumped in place by men using baskets.

As the water evaporated much good agricultural land was exposed and, at the time of my second visit in 1926, was cultivated to corn, wheat, garbanso, and various other crops. The exclusion of water had obliterated the great marshes I knew in 1903. The *camelote*, the favorite goose food, appeared to be entirely gone, and the *tules* were

reduced to insignificant patches. In the vicinity of springs within the diked-off area, however, spreading water maintained marshes of varying sizes up to 100 acres or more, affording considerable open water and feeding and resting places for waterfowl, while the neighboring grainfields supplied additional food. As a result many ducks and some geese were present, but it was significant that the geese in the former great numbers were gone. The reduction in geese especially was probably due to the apparent extirpation of the camelote.

At the time of our visit in 1935 most of the small marshy areas had disappeared. Thousands of acres in the diked-off area had been planted to corn, but the soil appeared to have lost much of its fertility. The land had been extensively invaded by Bermuda grass and was being used mainly for grazing purposes. On revisiting the locality in February 1936 we learned that about September 1935 a break in the dike led to the flooding of the entire area under it. Thousands of acres of corn were already in the ear, and the flooding resulted in a total loss. There was a very decided temporary gain for waterfowl, mainly ducks, however, of which we estimated the number at 500,000, where we had estimated 100,000 the year before.

When first visited in 1903 the Lerma delta near La Barca was undoubtedly the greatest winter waterfowl concentration area in México and was especially favorable for geese, owing to the abundant growth of the aquatic plant camelote. The construction of the dike, affording water-level control, would have further increased its value for waterfowl if it had been administered for that purpose; and it still is of outstanding potential value for waterfowl. The suggestion of the desirability of creating here a great federal refuge was made to the game department, but although the land in 1935 appeared to have lessened fertility its value for agricultural and grazing use will probably always preclude the carrying out of any such plan for the creation of a refuge. The land was originally reclaimed under government auspices but we understood was subdivided and parceled out to agrarians under the new land system in vogue in the country. We were informed that plans were being made to close the breach in the dike and thus again provide for the recovery of land through evaporation.

**Lagos (6,150 feet):**

*June 23-30, 1896.*—Lagos, on some maps Lagos de Moreno, is a large town at 6,134 feet above the sea, on the railroad, in the southeastern part of the state. Lagos is on a part of an elevated plain that extends without a break to Silao, Guanajuato. The drainage, how-

ever, is by way of another tributary system, the Río de Lagos, which unites with other tableland streams converging from the interior basin embracing the northwestern arm of the state and flows into the Río de Santiago. As near Silao, this plain has water near the surface and is part of a famous agricultural region. Summer rains are somewhat uncertain but are apt to be heavy and sometimes cause destructive floods. In general the region is warm, dry, and desertlike.

The vegetation indicates that the rainfall is greater than at Silao, and a small river was here used for irrigation. Mesquites, acacias, agaves, cactuses, and other desert plants are more abundant and appear more thrifty than at Silao. The low mountains to the north and east bear a thin growth of scrubby oaks at 1,000 to 1,500 feet above the plain. About the same crops are produced at Silao, but with more apples, pears, peaches, quinces, and pomegranates in evidence. The plain is in the Lower Austral Zone, but the slopes of the mountains above about 7,500 feet are assignable to Upper Austral Zone.

**Lake Chapala** (see Ocotlán) :

**La Laguna** (5,000 to 6,500 feet) :

*March 22-26, 1897.*—La Laguna is a small lake at 6,500 feet in the Sierra de Juanacatlán, about 10 miles northeast of Mascota, northwestern Jalisco. On March 22 we left El Real Alto, near San Sebastián, and crossing a deep canyon ascended to the highest part of the mountain range lying between San Sebastián and the valley of Mascota. There, about 12 miles southeast of Real Alto, we reached a deep and narrow basinlike mountain valley containing the small lake from which the name of a small settlement is derived. To the east the mountains include a considerable area of broken or rolling mountain tableland, with knobs and ridges some of which reach 8,000 feet in altitude.

The predominant vegetation is made up of pines, firs, alders, madroños, thornapples (*Crataegus*) and several species of oaks. The curious drooping-leaf pine is abundant here and attains large size. The long-leaved large-coned pines from a lower level range up into the firs here, where with a species of long-leaved small-coned pine, the drooping-leaf species, and firs they make a varied coniferous forest. In the valley at La Laguna and on level parts of the higher uplands small areas are cultivated to wheat. The climate is cool, and at the time of our visit there was frost every night. The upper slopes of the Sierra de Juanacatlán bear a mixture of Upper Austral and Transition Zone elements.

**La Laguna and Florencia [Zacatecas]—between:**

*September 20, 1897.*—Localities astride the boundary between Jalisco and southwestern Zacatecas. On September 19 we left Bolaños, en route to Guadalajara. We descended the Río Bolaños Canyon about 23 miles to a group of ranches at 4,300 feet on the eastern side of the river valley. On September 20 we traveled on 37 miles in a southerly course. Near La Laguna we crossed a mountain range 7,200 feet high, paralleling the course of the river. Our route was then southeasterly over a broken tableland and across the line into Zacatecas, past Florencia, and on to El Conejo, a ranch at 6,600 feet. September 21 we traveled about 46 miles, passed through Estanzuela, Zacatecas, reentered Jalisco, and, after passing the village of Malacate at 5,400 feet, descended to the village of San Cristóbal or San Cristóbal de la Barranca, at 2,500 feet on the Río de Santiago.

**Las Palmas (1,000 feet):**

*March 31, 1897.*—Las Palmas is a village at 1,000 feet about 31 miles northwest of San Sebastián, extreme northwestern Jalisco. An overnight stop was made at the extreme lower edge of the foothills en route to Ixtapa, a hacienda near the Bay of Banderas. Arid Lower Tropical Zone.

**Las Palmas to Ixtapa (see Ixtapa).****Malacate (5,400 feet):**

*September 21, 1897.*—Malacate is a village at 5,400 feet near the southern boundary of Zacatecas, north of the town of San Cristóbal de la Barranca, on the Río de Santiago. Locality passed through en route from Bolaños to Guadalajara.

**Mascota (3,900 feet):**

*March 12, 1897.*—Mascota is a town at 3,900 feet in the valley of the Río Mascota, about 10 miles north of Talpa, in western Jalisco. On March 12 we left Talpa and traveled 27 miles in a northerly course, passing through the town of Mascota and stopping for the night at the small hacienda of El Tajo, at the extreme northwestern end of the valley in which the town is situated. Specimens were labeled "Mascota." Lower Austral Zone.

**Mascota to San Sebastián (see San Sebastián).****Mesquitic (see Mexquitic).**

**Mexquitíc** (= Mesquitíc) (4,100 feet) :

*August 25-26, 1897.*—Mexquitíc is a town at 4,100 feet in extreme northern Jalisco. Specimens were labeled "Mesquitíc" This locality should not be confused with Mezquitic, a town in the same valley about 10 miles north of Bolaños. On August 25 we proceeded about 30 miles in a southeasterly direction from Huejuquilla to Mexquitíc, crossing a narrow northern extension of the state of Zacatecas en route. From Huejuquilla at 5,400 feet the rolling plain continues to the south and rises gradually to altitudes of 5,800 to 6,200 feet. About 18 miles south of Huejuquilla we began the descent into the broad deep canyon, or high-walled valley, of the Río Bolaños, in which Mexquitíc is situated.

**Ocotlán** (5,000 feet) :

*December 23, 1902, to January 7, 1903; February 25-26, 1926; and January 18-19, 1935.*—Ocotlán is a town at about 5,000 feet on the Río de Santiago near the point where it leaves the Lago de Chapala, the largest lake in México. Nelson and I arrived at Ocotlán by rail on December 23, 1902, and worked along the river and lake shore in the vicinity until January 7, 1903, when we left for La Barca. Lake Chapala is about 50 miles long from east to west and about 10 miles wide. The locality was revisited by me on February 25 and 26, 1926, and again on January 18 and 19, 1935, when I was accompanied by my brother, Luther J. Goldman. The lake lies in a basin at the lower end of an extensive valley in the form of a nearly level or gently sloping plain. This plain as a whole includes western Guanajuato and Querétaro, part of eastern Jalisco, and northern Michoacán. It has an altitude of about 5,000 feet in the lowest part and rises a few hundred feet at the upper end. On the borders are low hills and mountains that encroach here and there, giving the valley an irregular outline but nowhere breaking its continuity. Lake Chapala, however, is closely bordered, especially toward the western end, by hills and low mountains, which, like most of those about the great valley, are of volcanic origin. The valley forms the southwestern part of the Mexican tableland. It is traversed by the longest river of México. This river, with sources in giant springs at more than 8,000 feet altitude in the interior valley of Toluca, takes a northwesterly course as the Río de Lerma, to the eastern end of Lake Chapala. At Ocotlán, only a few miles away, it leaves the lake again as the Río Grande de Santiago, which enters the Pacific a short distance north of San Blas, Nayarit.

The upper part of the valley includes some of the more arid interior

sections of the country where irrigation is necessary to produce crops. Rains are more frequent near Lake Chapala, but even there irrigation is utilized, especially below reservoirs to supplement the usual summer rains from the first of June to the last of September. Heavy winter rains sometimes occur during January and February. These are known as the cabanuelas, said to endure for about 40 days. We experienced one of these storms during which rain fell for a period of seven days in January. For the most part, however, the winter season is dry. Immediately along the shore of the lake and the adjacent slopes of hills frosts are almost unknown, but elsewhere they occur every winter, although not very severe.

The vegetation near the shore of Lake Chapala and on the southern slopes of hills where frost is absent or rare includes a silk-cotton tree, wild fig, guava, tree morning-glory, *Bursera*, *Erythrina*, *Lantana*, and a large organ cactus. More generally distributed are the mesquite (*Prosopis juliflora*), huisache (*Acacia farnesiana*), and the guamúchil (*Pithecollobium dulce*). Bald cypresses, willows, a species of ash and *Baccharis* grow along streams. Although the warmer areas are nearly frostless and there is some invasion of Arid Upper Tropical elements the general region is mainly Lower Austral in zonal character.

**Platanar** (=Plantinar) (4,000 feet):

*April 3-6, 1892.*—A village 10 or 15 miles north of the Colima state boundary on the trail we followed, and now on the railroad from Colima to Zapotlán (also called Ciudad Guzmán). The name of this locality was erroneously spelled "Plantinar" on the labels of specimens collected. Quarters were in one of a group of huts at a place called Agosto, which is located above Platanar on the edge of the high tableland overlooking the latter place from a point about 2 miles to the northward. The Río de Tuxpan passes a little over a mile to the eastward. The locality is in a region of open rolling plains and irregular benchlike surfaces, deeply scored by many box canyons, carrying drainage from the mountain mass formed by the Volcán de Colima and the Sierra Nevada de Colima to the Río de Tuxpan, which lower down becomes the Río Coahuayana, and forms the eastern boundary of the state of Colima.

**San Cristóbal** (2,500 feet):

*September 21-22, 1897.*—San Cristóbal, or San Cristóbal de la Barranca, is a town at 2,500 feet on the Río de Santiago, where a northerly bend closely approaches the southern boundary of Zacatecas. The locality was an overnight stop on our route from Bolaños, Jalisco, across southwestern Zacatecas, to Guadalajara, Jalisco.

**San Pedro (4,500 feet):**

*May 10, 1892.*—Also called San Pedro Tlaquepaque. A village about 5 miles southeast of Guadalajara.

**San Sebastián (3,800 to 7,000 feet):**

*March 13-21, 27-30, 1897.*—San Sebastián is a small mining town at 3,900 feet in northwestern Jalisco. On March 13 we left the hacienda of El Tajo in the valley near Mascota and traveled about 20 miles northwest, along a route mainly across a series of closely set mountain ridges rising to from 5,000 to more than 6,500 feet. About 14 miles from our starting point we came to the head of a long canyon with steeply sloping sides, down which we traveled to its mouth at about 3,850 feet. Here is a little collection of Indian huts, known as Milpillas, where we stopped and remained, working in the vicinity, mainly up the canyon, until the morning of March 19. On the latter date we went on about 5 miles to San Sebastián. On March 20 we moved about 5 miles southeast to a little mining camp called El Real Alto, at about 7,200 feet, near the summit of a prominent mountain known as La Bufa, where we remained until March 22, when we left the vicinity for a few days work at La Laguna, in the Sierra de Juana-catlán. The highest point of this mountain reaches to more than 8,000 feet. On March 27, having returned from La Laguna, we moved to a ranch known as La Cuadrilla, at 3,000 feet, about 6 miles below San Sebastián, where we worked until March 30. As San Sebastián is a central point, and the only one in the vicinity regularly appearing on maps, the name of the town was used in labeling all specimens from the three localities mentioned.

San Sebastián lies just beyond a knife-like ridge from Milpillas and is reached by crossing a deep gorge and then the ridge. The town is in the lower end of an open depression in the mountainside. The drainage is to the Río de San Sebastián, a small branch of the Río de Ameca. Above the town towers La Bufa. A trail leads in a zigzag course up the slope above the town along one flank and over a shoulder of La Bufa to the little half-deserted camp of El Real Alto. The camp is perched high on the brow of the mountain, facing away from San Sebastián and looking over a succession of mountain ridges and peaks extending to the far horizon. The ranch of La Cuadrilla is on a second irregular mesa below San Sebastián, and overlooks the low country. The canyon and general slope at Milpillas face the northwest and receive precipitation from cloud formations brought in by sea winds before they have passed over other high ranges of hills. As a result the vegetation is very luxuriant in this vicinity, especially

on the lower slopes, in the bottoms, and along the courses of streams. Both sides of the deep canyon above Milpillas are clothed with a heavy oak forest, in which other trees and many shrubs also occur. The forest is a mixture of tropical and extratropical species, as might be expected from the location near the frost line at about 4,000 feet. The slopes of La Bufa, above 5,000 feet, are much drier and the vegetation is that of a colder climate. Several oaks, pines, firs, madroños, thornapples (*Crataegus*), and wild cherry occur toward the top. At Milpillas and La Cuadrilla coffee, sugarcane, bananas, mangoes, and oranges are grown. In the gardens at El Real Alto were apple, pear, peach, and quince trees. No very exact life-zone limits were established, but northwestern slopes at about 4,000 feet above Milpillas appear to be Humid Upper Tropical. Areas just below about 4,000 feet on most slopes are assignable to the Arid Upper Tropical Zone, and the upper slopes of the mountains appeared to belong mainly in the Upper Austral Zone. The firs, however, represent a higher zone near the top.

**San Sebastián to La Bufa de Mascota** (see San Sebastián).

**San Sebastián to Las Palmas** (see Las Palmas).

**Sierra Madre, near Bolaños** (7,500 to 8,500 feet):

*September 15-17, 1897.*—From Bolaños we crossed the Bolaños River on September 15 and proceeded about 14 miles up the steep rocky canyon side in a northwesterly course to some caves beside the trail near the summit of the Sierra Madre, here known as the Sierra de Nayarit. We returned to Bolaños on September 17. The general character of the mountains here is about as where we crossed farther north near Santa Teresa, Nayarit. The top is a rolling tableland 7,500 to 8,500 feet high and 3 or 4 miles broad, descending steeply into another canyon on the western side. These mountains, therefore, form a spur projecting southward from the main backbone of the Sierra Madre.

The top of the range is covered with about the same type of vegetation as near Santa Teresa, mainly several species of pines, oaks, and madroños. Zonal character a mixture of Upper Sonoran and Transition.

**Sierra Nevada de Colima** (6,500 to 13,500 feet):

*April 9-13, 20-23, 1892.*—Leaving Zapotlán on the morning of April 9 with a pack outfit, we crossed the plain in a westerly direction for about 10 miles to the lower border of the pine timber at the foot

of the mountains. Entering the timber we ascended for about 5 miles to the foot of the main slope where at an altitude of about 6,500 feet was located the highest ranch on that side of the mountain. There we remained two nights and then ascended the mountain by a steep mule trail and made camp at about 12,000 feet. From this point the mountain was worked up to an altitude of about 13,500 feet at the foot of the sharp rocky pinnacle forming the summit at about 14,118 feet. Our men insisted on returning to Zapotlán on April 14 to attend "Semana Santa" festivals. On April 20 we returned to the mountain, stopping two nights on the lower slopes at 5,000 and 6,500 feet, respectively. We then ascended the mountain farther to the west than on our first trip and camped the night of April 22 at a spring at 10,000 feet. On the following day we descended part way and camped at a small spring in a canyon at about 7,500 feet.

The Sierra Nevada de Colima and Volcán de Colima, or Volcán de Fuego, are isolated twin volcanic peaks rising boldly as a mountain mass on the western border of the interior plateau in Jalisco, near the boundary of northern Colima. The altitudes given on our map, 14,118 feet for the Sierra Nevada and 12,758 for the Volcán de Colima, may not be exact but probably approximate the true elevations. The Volcán de Colima, which is much the better known, owing to its frequent eruptions of smoke, cinders, and ashes, rises from the southern base of the Sierra Nevada. It appeared as a perfect volcanic cone and was said to be inaccessible as the ashes extending down from the rim of the crater for thousands of feet lie at the angle of repose. We were able to ride on horseback, however, to near the summit of the Sierra Nevada, and from that vantage point looking down obtained excellent views, including the farther inner wall of the crater. The Volcán de Colima thus appears as an excrescence built up on the south side of the main mountain mass.

The Sierra Nevada de Colima, in about the same latitude as the lofty volcanoes of eastern México, with its western and southern flanks sloping down into the tropical belt along the Pacific coast, thus affords an excellent example of the zonal distribution of animal and plant life at the various elevations. Limited observations indicated that the principal timber belts on the north slope are a lower pine belt from about 5,000 feet to 6,500 feet, an oak belt from 6,500 feet to between 8,500 and 9,000 feet, and an upper pine and fir belt from about 9,000 to 12,500 feet. Above 12,500 feet an alpine belt was characterized by a dense stand of grass 2 to 4 feet high.

**Talpa** (3,700 to 5,000 feet) :

*March 7-12, 1897.*—Talpa is a town at 3,700 feet about 10 miles south of Mascota, western Jalisco. We left Ameca with a newly acquired pack outfit on March 3 and reached Talpa on March 7. Our route between these places was across a series of narrow mountain ridges rising 1,000 to 2,000 feet above the level of the narrow intervening valleys. The latter form the base level of the country and range from 3,700 to 5,000 feet in altitude. Through the valleys in this area flow small streams uniting to form small rivers which, through the largest, the Río de Ameca, reach the Pacific at the Bay of Banderas. Much of the geological structure is volcanic but there are no prominent peaks along our route, and an approach to uniformity in valley levels is paralleled in the heights of the mountain ridges rising 5,500 feet to 6,500 feet with a flowing outline along the crests. The sides of the mountains are steep, but there are few cliffs or other rugged features. Many of the slopes are covered with loose boulders, which render the trails hard traveling, especially on steep grades. A few miles beyond the ridge west of the valley at Talpa a more rapid descent leads down into the hot country. The valley at Talpa is drained by a branch of the Río Mascota, which flows northwest into the Río de Ameca. The valleys lie near the lower limit of frosts, yet are hot enough to permit invasion by some tropical species. A long dry season, extending from November to June, prohibits any luxuriance of plant growth, and the landscapes in the dry season show a general aridity, although not so extreme as that of the more central parts of the tablelands region. The vegetation of the valley bottoms is about the same as at Ameca. From 4,300 feet to 6,000 feet there is a thin stand of *Pinus oocarpa*, perhaps the most characteristic tree of these mountains. Scrubby oaks occur and madroño ranges in places above 5,500 feet. The valleys are mainly Lower Austral in zonal character, although proximity to the hot country along the west coast favors the invasion of some tropical species such as the long-tailed jay (*Calocitta formosa colliei*), at least during the warm season. The northern slopes of the mountains above about 5,500 feet belong to the Upper Austral Zone.

**Talpa to Mascota** (see Mascota).**Teuchitlán** (3,500 feet) :

*June 10-13, 1892.*—From Guadalajara we traveled west by stage about 49 miles to Teuchitlán, a town on the road to Etzatlán.

**Zacoalco** (3,000 feet):

May 2-3, 1892.—A town at southern end of Lago Zacoalco. We traveled by stage from Zapotlán to Guadalajara, and Zacoalco was a stage stop en route. The locality is in one of the deeper basinlike depressions with no outlet. The lake has low, flat shores, and the water is alkaline. A border of salt grass (*Distichlis*) near the water gives way to a rather heavy stand of mesquite (*Prosopis*) farther back.

**Zapotlán** (Ciudad Guzmán) (4,000 feet):

April 6-9, 15-19, 24-30, 1892.—The town, generally known as Zapotlán, but officially styled Ciudad Guzmán, is on the eastern side of an open basin or depression lying at the northeastern base of the Sierra Nevada de Colima. The sink is 18 or 20 miles long from north to south and about 10 miles across from east to west. In the lowest part of the basin near the northern extremity is the Lago Zapotlán, about 4 miles across, formed by the drainage of the adjacent mountain slopes during the rainy season. The lake is a permanent but shallow body of water with no outlet. It is one of a number occupying the bottoms of similar depressions in the region extending north over the tableland to northern Jalisco. A larger example to the north is the Lago de Sayula, which is several miles wide and about 20 miles in length, from north to south. Near the southern end of the basin is a volcanic crater several hundred feet high, and from it a belt of broken lava extends across the plain from east to west. On the lava bed there is a mixed stand of small trees, cactuses, and agaves, but with this exception the basin is practically treeless, with a rather sandy soil. On the southwest the open plain rises to the border of the pine timber on the lower slopes of the Sierra Nevada de Colima at an elevation of about 5,000 feet. Lower Austral Zone.

## MÉXICO

**Amecameca** (8,200 feet):

January 30 to February 6, February 13-21, 1893; January 5, 1894.—A town near the southeastern corner of the Valley of México on the lower part of the general slope extending up toward the northeast to the top of the Cerro Ixtacihuatl, and toward the southeast to the Volcán de Popocatepetl. The adjacent mountain slopes are covered mainly with pines, but a hill known as Sacromonte, rising prominently 300 to 400 feet above the neighboring level, is covered with a dense growth of oaks of several species, a madroño, and cypress (*Cupressus lusitanica*) on its northern base. A few miles to the south a pass at

about 9,000 feet separates the Volcán de Popocatepetl from the eastern end of the Sierra de Ajusco. The soil near Amecameca is loose and sandy, being made up of finely divided volcanic material. The kangaroo rat (*Dipodomys phillipsii*) occurs here at 8,200 feet, near the upper limit of its altitudinal range.

**Cerro Ixtacihuatl (13,800 feet):**

*March 1-3, 1893; January 8, 1894.*—We left Amecameca on March 1, our route leading to the mountain in a northeasterly direction for some 10 or 12 miles by trail, but not over 6 miles in a direct line. We made camp in a cave at timber line close to the base of the main peak. In the evening we set mammal traps in the vicinity. Before daybreak on March 2 we started on the ascent of the mountain. The entire day was spent in a difficult climb up over the glacier to the top, cutting precarious footholds in the ice and taking a devious course in order to avoid crevasses that could not be crossed. One wide crevasse was crossed where the ice in opening had splintered and left a slippery diagonal bridge about 2 feet wide. It was after dark when we returned to camp. The next day we and our Indian guides were suffering from snow-blindness. Traps neglected the previous day were recovered with difficulty, and we returned to Amecameca.

Cerro Ixtacihuatl is the high mountain mass forming the main part of the wall along the eastern side of the Valley of México. On the south it abuts against the Volcán de Popocatepetl, the other high segment of the wall. Above timber line, at about 13,000 feet, the mountain is a narrow ridge of porphyry extending in undulating profile for 5 or 6 miles in a north and south direction. The altitude of the highest part of the ridge is about 17,300 feet. Though not quite so high, Ixtacihuatl is a larger mountain mass than Popocatepetl. The slopes are generally steep but a small glacier forms in a basin near the top and descends the southwest side to about 14,500 feet. This glacier is receding as a terminal moraine showing that it once extended down to about 12,000 feet.

Owing to geological structure and glaciation more soil has accumulated, running streams are more numerous, and conditions are, therefore, more favorable for plant and animal life on the slopes of Ixtacihuatl than on Popocatepetl. Brief observations indicated that the zonal distribution of species is about the same. There is a definite fir belt from 9,500 feet to 11,500 feet in which the fir (*Abies religiosa*) is characteristic, along with large alders (*Alnus*). The dwarf juniper (*Juniperus mexicana*) ranges from within the fir belt up to about 13,500 feet. An upper pine belt extends from about 11,500 feet to

timber line at about 13,000 feet, as marked by the disappearance of pines, the dwarf juniper, as indicated, reaching somewhat farther.

**Lerma (8,200 feet):**

*November 10, 23, 1892; July 1-11, 1904; February 17-19, 1926.*—Lerma is a town on the railroad near the eastern border of the Valley of Toluca, and near the western base of the Sierra de las Cruces, about 10 miles east of the city of the same name. The Valley of Toluca is an interior basin, a broad expanse of open, prairielike country nearly surrounded by high mountains. It is the highest valley in México. Near Almoloya del Río, at the upper end, giant springs flowing into extensive marshes form the sources of the Río de Lerma. This stream flows northwestward to Lake Chapala, Jalisco. From the lake it continues in a northwesterly course as the Río Grande de Santiago and enters the Pacific Ocean near San Blas, Nayarit. The stream under the combined names is the longest river with headwaters in México. The marshes of the Valley of Toluca, traversed by a sluggish current from the springs, extends 8 or 10 miles from the headwaters to near Lerma, where there is a bridge and causeway. Below Lerma the marsh continues for several miles, varying in extent according to season. The marsh is filled with a varied assortment of aquatic vegetation, including tules, sedges, and many submerged species. The water-hyacinth, introduced here, has multiplied so rapidly as seriously to interfere with canoe navigation. The marsh is an important wintering place for migratory waterfowl, and a breeding area for resident waterfowl, especially the Mexican black duck (*Anas diazi*).

**Salazár (10,000 feet):**

*October 21 to November 8, 1892.*—Salazár is a small village and station on the Mexican National Railway at the summit of the Sierra de las Cruces, which separates the Valley of México from the Valley of Toluca, about 25 miles west of the City of México. While located here we worked down the west slope of the mountains to points as low as 8,800 feet near the eastern border of the Valley of Toluca. From a small, open, grassy plain about the station at Salazár the hills on all sides are covered with an abundant growth of pines and firs. A short distance to the southeast the heavily wooded hills reach about 11,000 feet in altitude. Springs near the upper end of the plain or large meadow carry drainage to the Valley of Toluca. The locality is in the Canadian zone, as indicated by the occurrence of *Abies religiosa* from about 9,500 feet on the slopes up to the summit of the mountains. A pine, perhaps *Pinus leiophylla*, appears to be an indi-

cator of Transition Zone between 9,000 and 9,500 feet on the west slope. From June to October heavy rains occur nearly every day, often accompanied by dense fogs. The winters are mainly dry but snow sometimes falls. Sharp nightly frosts were the rule at the time of our visit.

**Volcán de Popocatepetl** (11,500 to 13,500 feet):

*February 21-26, 1893; January 5-7, 1894.*—From Amecameca our route with pack animals was southeasterly for some 6 or 8 miles, up a long, open, sandy slope to the base of the main mountain. There we entered the pine forest and wound up the steep side of the mountain along a woodcutter's trail. At an altitude of 11,500 feet we left the trail and worked down into the bottom of a steep, narrow canyon, and camped for three nights under shelter of a small overhanging cliff. We then moved up to an old camp of a sulfur gatherer, Rancho Tlamacas near timber line, and camped for one night. On the following day, February 26, we ascended the volcano and returned some 15 miles to Amecameca. Specimens were labeled "Mount Popocatepetl."

The Volcán de Popocatepetl rises prominently on the continental backbone about 40 miles southeast of the City of México. With the Cerro Ixtacihuatl it forms a high mountain wall along the eastern side of the Valley of México. Toward the east it overlooks the plains of Puebla, which also form a part of the high southern end of the tableland region of central México. The southern slopes descend rapidly to the "tierra caliente" of Morelos and southern Puebla. The Volcán de Popocatepetl is a single giant cone among numerous small craters that mark this region as having been the one of greatest volcanic activity in all México. The volcano was quiescent for many years, except for the escape of fumes that left deposits of nearly pure sulfur in crevices in the bottom of the crater. More recently, however, great clouds of smoke mushrooming from the crater are evidence of renewed activity. From near timber line, at about 13,000 feet, the volcano rises in steep, unbroken ascent to the crater at about 17,800 feet. Among the mountains of México it is surpassed in height only by the Volcán de Orizaba.

Pines, with some oaks, cypress, and madroño extend up over the lower slopes to about 9,000 feet. Beginning at about this level is a rather dense stand of firs (*Abies religiosa*) mixed with cypress (*Cupressus lindleyi*). The trees are all rather small and there is evidence of crowding. The cypresses end at about 9,500 feet. From about 9,500 feet up to 11,000 feet firs form the bulk of the forest, mixed

with scattered pines and large alders. Above 11,000 feet the fir belt gives way to pines, which extend up to timber line at about 13,000 feet. From about 9,000 feet an abundant growth of "sacatón" grass extends up on the more open slopes past timber line to about 13,700 feet. Some shrubs and many herbaceous species range up for several hundred feet beyond timber line. Heavy frosts and summer snows are said to be of frequent occurrence above the fir belt.

**Volcán de Toluca** (Nevado de Toluca on some maps)—north slope (9,500 to 11,500 feet):

*September 4-12, 1893.*—The Volcán de Toluca is on the southwestern side of the Valley of Toluca, southwest of the city of Toluca, the capital of the state. From the latter place we proceeded southwest about 10 miles to the village of San Juan de las Huertas, at the lower border of the pine timber on the northern side of the mountain. Little work was done in the open valley of Toluca below San Juan but was extended from this point up the north slope of the volcano to 11,500 feet. We spent three days at a small ranch at about 11,000 feet and from there made an ascent of the mountain.

The Volcán de Toluca raises its bare, rocky summit to about 15,000 feet on the southwestern border of the high Valley of Toluca. It is a somewhat isolated mountain mass, sloping up abruptly from 11,500 feet as one of the more prominent topographic features near the southern end of the tableland. The southern and western sides of the mountain face the low, hot country along the Pacific coast. At the summit there is a large double crater with high rugged walls, highest on the northwest side, broken down on the southeast side. In the bottom of the crater are two small lakes, one of which appears dark blue and is said to be very deep. Traces of glacial action may be noted near the summit, but they are much less distinct than on the high volcanoes farther east, probably owing to the greater distance from the Gulf coast and the high intervening mountains.

At the northeast base of the Volcán de Toluca the open plain of the Valley of Toluca slopes up gradually to about 9,000 feet. From this point the forest is continuous to timber line at about 13,000 feet. A few oaks and alders occur along the lower border of the forest, which is mainly of pines of several species. Firs were noted in surprisingly small numbers on the north side of this mountain. Only a few were seen along a rocky canyon at about 11,500 feet. A few herbaceous plants were found ranging up among the rocks to within 200 feet of the summit. The Valley of Toluca is Upper Austral in zonal character.

Owing to the high base level and the comparatively dry climate of the Valley of Toluca the boreal life zones on the adjacent north slope of the Volcán de Toluca are pushed upward to higher elevations than would otherwise be the case. During our brief visit they were not clearly differentiated and can be only approximated. The Transition Zone probably includes the belt of mixed oaks, madroño, and pines, from about 9,000 to 10,500 feet. The Canadian Zone appears to be less clearly marked by a fir belt than on the high mountains farther east, but may extend from about 10,500 to 12,500 feet. Firs, as already indicated, were noted only near the 11,500-foot level. A narrow belt from 12,500 to 13,000 feet may be assignable to Hudsonian Zone, but was not critically examined by us.

#### MICHOACÁN

##### **Cayaco:**

*March 29, 1903.*—A village passed on March 29 on our route southwestward from the ranch of Agua Blanca, near the Volcán de Jorullo, to Guadalupe, a hacienda 30 miles from our starting point. (See El Limón, Guerrero.)

##### **Cerro de Tancítaro (7,500 to 12,000 feet):**

*February 20 to March 3, 1903.*—Cerro de Tancítaro is a larger mountain mass south of Cerro Patambán, and southwest of Uruapan in western Michoacán. On February 20 we left Los Reyes and traveled about 8 miles in a southerly course to the village of Peribán, situated at about 5,000 feet at the extreme lower border of the pines on the northwest slope extending up to Cerro de Tancítaro. On February 23 we rode up to about 9,000 feet on the northwest slope of the mountain and camped in a small opening in the heavy forest. From February 23 to March 3 we worked out from this camp on the slopes of the mountain up to near the summit at more than 12,000 feet. Specimens were labeled "Mount Tancítaro."

Cerro de Tancítaro is a high mountain mass, rising to a little more than 12,000 feet from a spur 15 or 20 miles long that extends southward from the main range of the Sierra Madre. The highest point of this spur is 6 or 8 miles long, with a rather broad top except along the extreme summit, which is a narrow backbone. A gap at about 7,000 feet separates the mountain from the main range to the northward. Toward the west and northwest the descent is rapid to the low hot country. The northwest slope of Cerro de Tancítaro really begins near Los Reyes. It extends gradually upward at an easy grade across a hot, treeless llano to Peribán. From Peribán the easy

upgrade continues for about 7 miles farther in a southeasterly course to the base of the main mountain at about 7,500 feet. From there to the summit the trail leads up steep slopes following a small stream that has cut a canyon down this face of the mountain. The northwesterly slopes are made up of a series of canyons of varying depth separated by flanking buttresslike ridges, some sharp and others rounded. One very deep and extremely rugged canyon cleaves this flank of the mountain, and two or three less rugged had trails leading up to the summit; at the time of our visit the natives used these trails in bringing down snow and ice to sell in Peribán, Los Reyes, and other towns.

Our first sight of Cerro de Tancítaro from the summit of Cerro Patambán late in January was not long after a heavy storm, and the top on the northwest side was covered with snow down to about 11,000 feet near the lower border of the Hudsonian Zone. At the time of our work on the mountain, however, all this had gone except on the upper 500 or 600 feet, where from 1 to 2 feet of snow remained. The Indians living about the base of the mountain told us that snow sometimes covers the slopes down to about the 7,000-foot level. From high on Cerro de Tancítaro the view toward the southeast, south, and southwest was of small, valleylike plains among mountain ridges that rise one after another as far as the eye can see. The areas lying in the hot, arid country below about 3,000 or 3,500 feet were recognizable by a yellowish color, as they are mainly treeless and overgrown with grass, dead and bleached at that season, in marked contrast with the darker color of the wooded mountains.

The distribution of vegetation on Cerro de Tancítaro is much the same as on Cerro Patambán. From 6,500 feet to 8,500 feet on the western and northwestern sides of the mountain several species of oaks intermingled with pines, alders, and large dogwoods (*Cornus*) formed a heavy forest with a profusion of shrubs and herbs as undergrowth. Along streams from 6,500 to 8,500 feet were scattered basswood (*Tilia occidentalis*) and hophornbeam (*Ostrya guatemalensis*) trees. This belt, dominated by the oaks, belongs mainly to the Transition Zone but appears to be overlapped in the lower part by Upper Sonoran Zone. From about 9,000 feet to 10,500 or 11,000 feet, firs (*Abies religiosa*), willows, and a narrow-leaved oak were abundant, and along with one or two pines and a gooseberry (*Ribes ciliatum*), were representative of the Canadian Zone. A timber-line belt above about 11,000 feet is distinguished by the same somewhat dwarfed type of pine (*Pinus montezumae* var. *lindleyi*) found on the upper parts

of other high mountains in México. This species forms a scattered forest with alders intermingled, the open stand favoring an abundant growth of bunch grass, and seems to represent the Hudsonian Zone.

#### Hacienda Guadalupe:

*March 29-30, 1903.*—A hacienda about 16 miles north of Balsas, on the Río Balsas. An overnight stop on our route from the Volcán de Jorullo. The hacienda is situated in the valley of the stream that drains the western slopes of the volcano. This stream flows into the Río Manquez, a short distance above the point where the latter enters the Río Balsas.

#### Huingo (6,000 feet):

*July 16-17, 1904.*—A railroad station at about 6,000 feet near the eastern end of the Lago de Quitzeo. It was reached by rail en route from Pátzcuaro, Michoacán, to Acámbaro, Guanajuato.

#### La Huacana (misspelled "Ahuacana" on specimen labels)—near (2,000 feet):

*March 24-27, 1903.*—La Huacana is a village at about 2,000 feet, some 60 miles south of Uruapan, in western Michoacán. On March 24 we left camp near the ranch of La Salada and, crossing the river, traveled about 22 miles southeasterly to the ranch of El Zapote, near La Huacana, where we remained until March 27. The name of this locality was misspelled, and specimens were originally labeled "Near Ahuacana." The locality was correctly given, however, in field reports. From La Salada to La Huacana our trail wound through a series of hills and long valleys. The country at the height of the dry season was very arid, with an occasional small stream, usually sinking at intervals and leaving long stretches of dry bed. La Huacana, however, is in a somewhat broader valley with a clear swift stream flowing through it.

The vegetation is about the same as at La Salada. Arid Tropical Zone.

#### La Salada (about 2,000 feet):

*March 9-24, 1903.*—La Salada is a ranch at about 2,000 feet, 40 miles south of Uruapan, Michoacán. On March 8 we left Uruapan and traveled about 28 miles in a southerly course, following a narrow valley for some distance, and then, after crossing a ridge at about 6,500 feet, wound down through the foothills to the ranch of Las Pilas in the arid country near the base of the foothills on the north side of the valley of the Río Balsas. On March 9 we continued southeasterly from Las Pilas, 12 miles across an open plain to a small

canyon about 2 miles from the ranch of La Salada. We camped in the bottom of this canyon during our two weeks' stay while collecting specimens for several miles in various directions. To the east and south the plain near our camp extends to a canyon several hundred feet deep with a small river at the bottom. Beyond the canyon the country becomes a succession of hills and low mountains in irregular formation, separated by canyons with here and there a long valley gently sloping with the drainage toward the Río Balsas. The general section is a part of the arid sloping valley of the Río Balsas, with water limited mainly to a few rivers in the bottoms of deep canyons.

The country is mainly open. The grassy plain, except where recently burned over, was covered with dry and partly fallen and matted grass, which evidently stands from 18 to 36 inches high at the end of the rainy season, and at the time of our visit in the dry season was bleached to a dull yellow. The hills and canyon slopes bear an abundant growth of shrubs and small trees, but the grassy plain is marked here and there mainly by gourd trees (*Crescentia alata*) and a few cactuses. In the canyon where we camped were mahogany trees (*Swietenia cirrhata*) and Brazilwood (*Haematoxylon brasiletto*). Arid Lower Tropical Zone.

#### Los Reyes (4,800 feet):

February 5-19, 1903.—Los Reyes is a town at 4,800 feet near the eastern border of Jalisco, in extreme western Michoacán. From Patambán, on February 5, our route led in a westerly course for a few miles, crossing a saddle between Cerro Patambán and the hills to the north, and then took a southerly direction through the small town of Tingüindín, on an almost continuous downgrade until close to Los Reyes. At Los Reyes we worked in the valley and along the base of the hills north of the town, which is situated on the nearly level valley bottom close to the outlying foothills of Cerro Patambán. It is now reached by a branch railroad from Yurécuaro that had not been built at the time of our visit. To the southeast across the open valley begin the basal slopes of the western side of Cerro de Tancítaro, whose snow-capped summit was visible 18 or 20 miles away in a direct line. Nearly due west and plainly seen across low intervening hills and ridges was the snow-capped summit of the Sierra Nevada de Colima, and close by was the Volcán de Colima, which was seen to send up a column of smoke several times during our stay at Los Reyes. The basal south and west slopes of Cerro Patambán are drained by several small streams, which unite in the valley to form the Río Grande, an affluent of the Río Balsas.

Los Reyes is near the boundary between the Lower Austral and Arid Upper Tropical Zones but is preponderantly tropical in zonal character. Among the more conspicuous and characteristic vegetation species are the guásima tree (*Guazuma ulmifolia*), guava (*Psidium guajava*), wild fig (*Ficus*), tree morning-glory (*Ipomoea*), "jinicuile" tree (*Inga spuria*), a *Lantana*, an *Erythrina*, and a large *Calliandra* (*C. houstoniana*). The regular crops are mainly sugarcane, rice, and corn. Coffee, bananas, mangoes, oranges, avocados, and other warm-country fruits seem to thrive in a small way in gardens. Most of these were also noted in gardens in passing through Tingüindín.

**Nahuatzen** (8,500 feet):

*October 8-15, 1892.*—At this locality we worked in the eastern part of a high mountain mass reaching greater elevations farther west on Cerro Patambán. We left Pátzcuaro with a pack outfit on October 7 and after skirting the southwestern shore of Lake Pátzcuaro for 12 or 15 miles struck almost due west into the mountains for about 15 miles to the Tarasco Indian village of Nahuatzen. From the village we moved about 5 miles south into the higher mountains and camped by a spring at the border of an open grassy meadow, at about 8,500 feet above sea level.

From the top of the first ridge back from the lake shore our course was through a succession of basinlike mountain valleys, in some of which were cultivated corn and other crops near well-built Indian villages; others were still in a state of nature. In the latter cases the middle of the basins were usually open, nearly level, and covered with a luxuriant growth of "sacatón" grass. The pine forests (*Pinus montezumae*) along the valleys and lower slopes of the bordering hills are very open, with long vistas among tree trunks as straight and regular as the masts of a ship and commonly 50 to 60 feet to the first branches. At somewhat higher elevations the pines, especially on the north slopes, become mixed with oaks and a more or less abundant undergrowth, which in places above about 8,000 feet becomes almost impenetrable. On the north slopes above about 8,500 feet firs (*Abies religiosa*) of fair size occur, becoming larger and more abundant above 9,000 feet. Associated with this species is an alder (*Alnus*) and a profuse stand of a very large lupine, apparently like one noted on the Sierra Nevada de Colima in similar situations. In the valleys at about 7,500 feet corn and wheat do well, and apples, pears, peaches, quinces, and other fruits are successfully grown. The corn is a variety with small grains very different from that cultivated on the main plateau to the east.

Our camp was evidently near the border between two life zones: (1) a lower zone indicated by the occurrence of the pines and absence of firs, probably assignable to the Transition Zone, and (2) a higher zone indicated by the firs and alders and probably representing the Canadian Zone. A notable resident of the pine forest was the imperial ivory-billed woodpecker (*Campephilus imperialis*), which appeared to be common. Frosts were prevalent at the time of our visit. Snow is said to fall with the rare occurrence of winter storms. From June to October heavy rains occur and the climate is damp, cloudy, and cool. Fog is not infrequent and as a result short green lichens may be seen growing on trees and the walls of old houses.

**Patambán** (7,500 to 12,000 feet):

*January 27 to February 5, 1903.*—Patambán is an Indian village at 7,500 feet at the northern base of Cerro Patambán in northwestern Michoacán. We left Zamora on January 27 and proceeded about 18 miles in a southerly direction to Patambán. From quarters at the village we worked at various levels on the north slope up to about 12,000 feet, mainly along a large canyon heading near the summit of the mountain. All specimens were labeled "Patambán."

From Zamora the country rises to the south and a low-pine-covered mountain shuts off the view of Cerro Patambán. Rounding the left flank of this and another mountain of the same character the trail descends into a narrow valley heading against the north base of Cerro Patambán. In the valley is the village. Below the village the valley extends away to the northeast, broadening to the main valley of the Río de Lerma.

Cerro Patambán is a solitary high mountain culminating in a narrow ridge about half a mile in length and a little more than 12,000 feet high, somewhat curved in outline and descending in a long slope at each end to a saddle at 7,500 or 8,000 feet. Beyond the saddle to the east extends a wooded ridge connecting with the main range near Pátzcuaro. To the westward the mountain slopes down to an irregular series of undulating ridges and hills, which extend away to the horizon with no elevation reaching above about 9,000 feet until the Sierra Nevada de Colima looms on the far-away skyline. At the time the Sierra Nevada de Colima well deserved its name for the slopes above about 11,000 feet were gleaming white owing to the heavy cap of snow. To the south a ridge extending from Cerro Patambán broadens into a mountainous area, connecting with Cerro de Tancítaro, another high mountain about 30 miles away. Between the two, however, is a gap at about 7,000 feet. Cerro de Tancítaro appeared as a larger mountain

mass with snow on the summit, while Cerro Patambán was bare. The north slope of Cerro Patambán is so nearly destitute of springs and streams that it was necessary to carry drinking water with us for all our work on the mountain.

For a thousand feet above Zamora there was no striking change in the vegetation, the grassy hillsides bearing a scattered growth of *Acacia farnesiana* and tree morning-glories as notable species. The lower border of the oaks was reached at about 6,000 feet and formed a narrow belt of thin scrubby growth, which merged with the lower edge of the pines at about 6,500 to 7,000 feet. Two species of pines (*Pinus leiophylla* and *P. montezumae*) make up the lower coniferous forest of the north slope and extend from 6,500 or 7,000 feet up to about 8,000 feet. Along with these pines were two small scrubby oaks, a wild cherry (*Prunus salicifolia*), and *Crataegus mexicana* var. *microsperma*. A madroño (*Arbutus xalapensis*) begins almost with the lower pines and ranges up nearly to the summit of the mountain. The lower pine belt, extending from 6,500 or 7,000 feet to 8,000 or 8,500 feet, apparently forms the Transition Zone. Along a small stream we crossed on the west slope on leaving the mountain were many hornbeam trees (*Carpinus caroliniana* var. *tropicalis*) 30 to 60 feet high. On this mountain the Canadian Zone begins between 8,200 and 8,500 feet and extends up to 11,000 feet and is characterized by a number of species, including *Abies religiosa*, *Pinus pseudostrobus*, *Cornus disciflora*, *Salvia fulgens*, and a small alder. At about 11,000 feet on the north slope the Canadian Zone gives way to the Hudsonian Zone, which includes the upper 1,200 feet on that side of the mountain. This zone is marked by the comparative poverty of the fauna and flora. The firs and many other trees, shrubs, and herbs that form a dense cover, especially in undergrowth lower down, give way abruptly to an open forest of stunted pines, thinly scattered over grassy slopes. This pine (*Pinus hartwegii*) appeared to be the same species found on all the mountains of México reaching an altitude of more than 11,000 feet. The change is so marked that the heavily forested Canadian Zone area and the thinly wooded Hudsonian Zone may be distinguished at a long distance from the mountain. The distribution of vegetation and general conditions indicate that while temperatures are lower and snow lies longer in the Hudsonian Zone, precipitation is greater in the Canadian Zone below. Frosts occurred at the village of Patambán several nights during our stay, and harder freezing was evident near the top of the mountain. We were told that snow commonly lies during the winter months on the north slope above



2. Nest of warbler (*Basileuterus belli clarus*), near Omilteme, northwest slope of Sierra Madre del Sur, Guerrero, Humid Upper Tropical Zone.



1. Nest of solitaire (*Myadestes obscurus*), near Omilteme, northwest slope of Sierra Madre del Sur, Guerrero, Humid Upper Tropical Zone.



Typical landscape aspects near San Vicente, in upper part of valley of Río de Chiapas, Chiapas. Arid Upper Tropical Subzone.



1. Mixed vegetation near head of Cañón de los Reyes, southern Baja California. Arid Upper Tropical Subzone.



2. Valley of Anita, southern Baja California. Arid Upper Tropical Subzone.



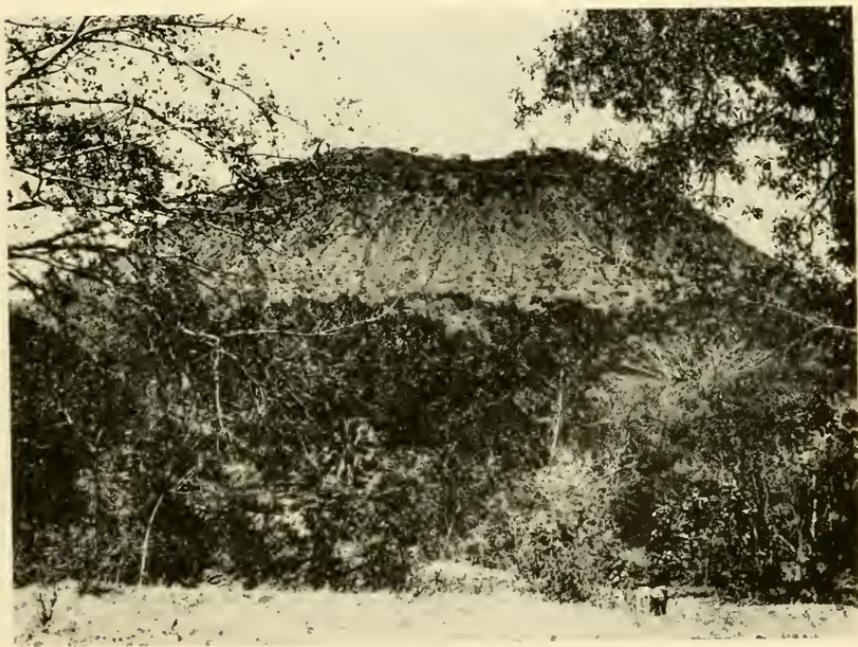
1. Desert vegetation near Bahía de Concepción, Baja California. Arid Upper Tropical Subzone.



2. East front of Sierra de la Giganta, Baja California. Arid Upper Tropical Subzone.



1. Cabo San Lucas, Baja California. Arid Upper Tropical Subzone.



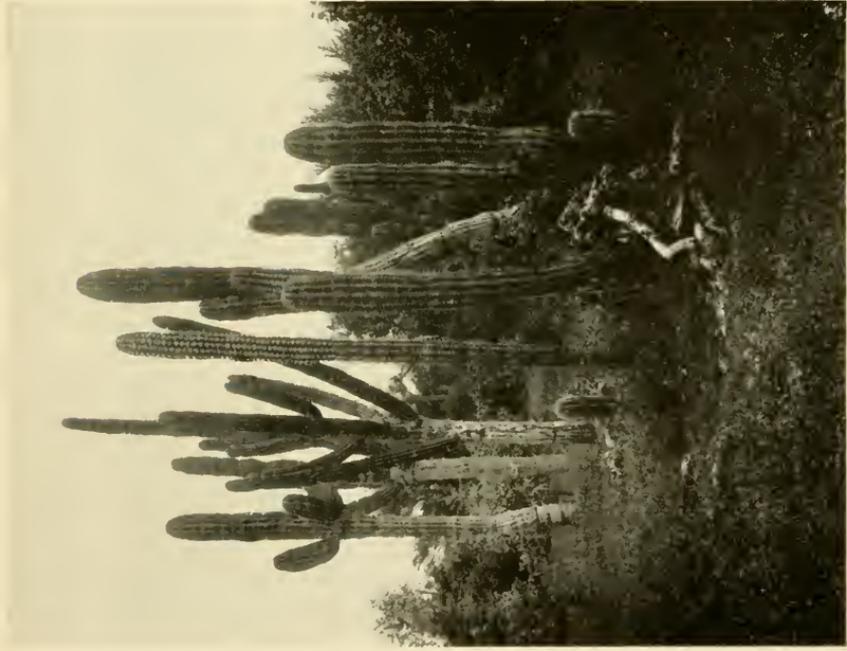
2. Volcán de Jorullo, Michoacán. Arid Upper Tropical Subzone.



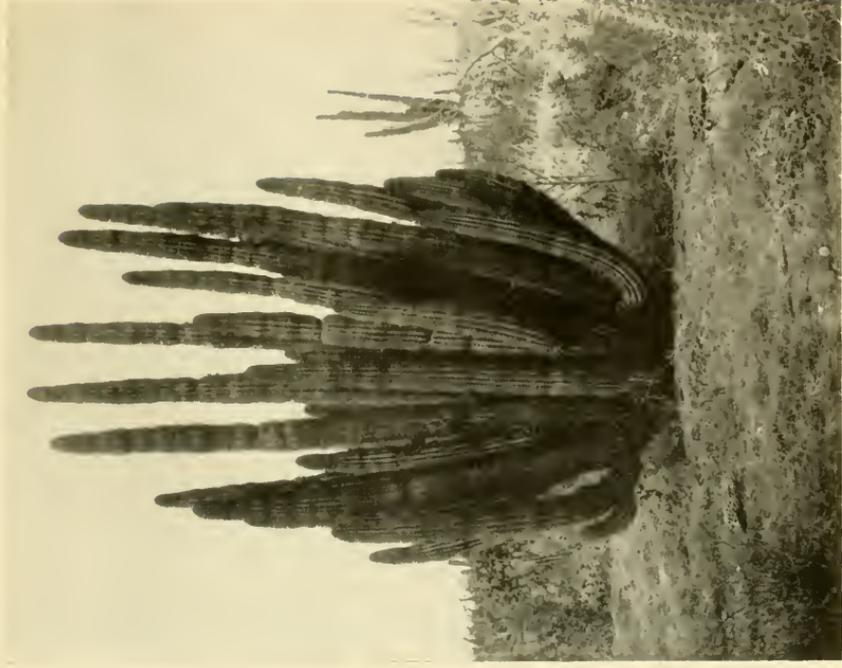
1. Wild fig (*Ficus palmeri*), near Cabo San Lucas, Baja California.  
Arid Upper Tropical Subzone.



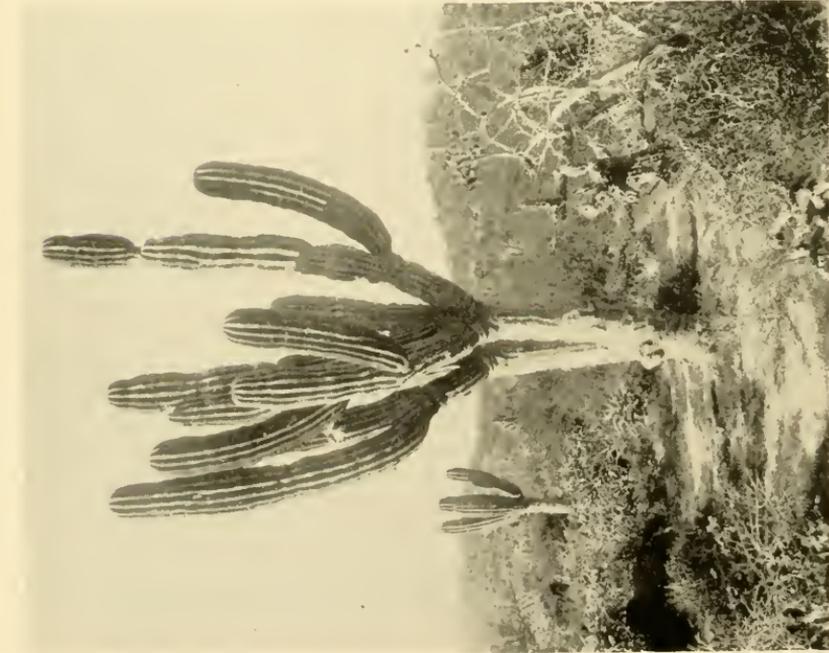
2. Creeping cactus or chirinola (*Machaerocercus crucea*), near Santo Domingo, southern Baja California. A remarkable prostrate species that, by growing at the forward end and dying behind, actually progresses over the surface of the ground. Arid Upper Tropical Subzone.



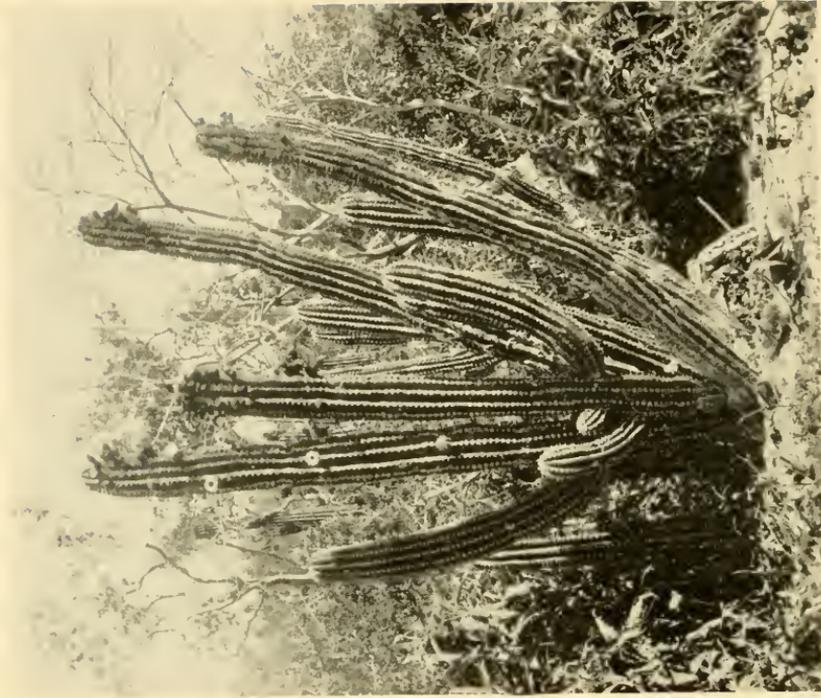
1. Giant cactuses (*Pachycercus pruigleyi* and *P. pecten-aboriginum*). Tres Pachitas, southern Baja California. Arid Upper Tropical Subzone.



2. Pitahaya dulce (*Leunairocercus thurberi*), near Matancita, southern Baja California.



1. Giant cactus (*Pachycereus pringlei*), San José del Cabo, Baja California. Arid Upper Tropical Subzone.



2. Giant cactus (*Pachycereus pecten-aboriginum*), near Cabo San Lucas, Baja California. Arid Upper Tropical Subzone.

about 10,000 feet. The mountain was free of snow at the time of our visit.

**Pátzcuaro** (7,200 to 8,000 feet) :

*July 12 to August 4, October 15-19, 1892; July 14-16, 1904.*—A town near the railroad and south shore of the Lago de Pátzcuaro. We stayed a few days at the Hacienda Ibarra on the shore of the lake and later moved into the town about 2 miles to the south. Work within a radius of 6 or 7 miles included the hills south and east of town up to an altitude of about 8,000 feet. According to the latest information the altitude of the lake is about 7,100 feet and the town is about 200 feet higher. Most of the specimens were labeled as collected at 7,000 feet but were obtained at nearer 7,500 feet. Lake Pátzcuaro, perhaps the most beautiful in México, is crescent-shaped, about 15 miles long and 2 to 3 miles wide. A very irregular outline is due to its setting in an amphitheater of high hills with spurs and buttresses that break the shore line and form deep bays. Small tule marshes occur, however, along the south shore. Small rocky islands rise in the middle of the lake, and on one is a village inhabited by Tarasco Indian fishermen. There is no outlet at present, but low elevation of the southeastern shore indicates former drainage toward the Lago de Cuitzeo.

To the south of the lake the country rises in a broken slope for a couple of miles to the town of Pátzcuaro. Beyond this is an exceedingly rough lava bed locally known as the pedregal covered with a forest of small pines and oaks and extending some miles toward the crest of the main range 6 or 7 miles away. The main divide in this vicinity is about 8,500 feet high, with isolated hills and peaks rising to from 9,000 to perhaps 12,000 feet. These higher elevations are usually abrupt, but as a rule the contour of the broad summit of the range is that of rolling hills interspersed with beautiful grassy mountain parks in the form of shallow basins. To the east the range slopes down gently to the level of the high central plateau. To the south and west the descent is more abrupt into the hot lowlands of the coast region. A mixed forest of pines, oaks, and madroño (*Arbutus*) covers the hills up to about 8,000 feet. Some species of pine and oak range well above that level, and firs (*Abies religiosa*) and large alders (*Alnus*) occur on north slopes at about 9,500 feet.

**Peribán** (see Cerro de Tancítaro).

**Queréndaro** (5,900 feet) :

*August 4-10, October 2, 1892.*—Queréndaro is a railroad station on the southeastern shore of the Lago de Cuitzeo. To the southward

extends a fertile valley some miles in width with the town of Queréndaro on its farther side. Beyond the town to the south rise the pine-covered summits of the main range of the Sierra Madre, extending toward the alpine region near the Valley of México. Scattered about the lake are rounded hills and mountains rising from low elevations up to 1,500 or 2,000 feet above its shores, with fertile valleys and cultivated slopes about their bases. Lying close to the base of the Sierra Madre the vicinity of Queréndaro has as a rule an abundant rainfall during the wet season, from May until October. This is shown in the abundant but not luxuriant growth of the vegetation. Being near the border of the open tableland district of the interior plateau the influence of the more arid climate of that region can be seen in the tendency of the vegetation to grow most abundantly in the flats and on northerly slopes, while the lower hills are comparatively barren on their southern slopes. The higher hills and mountains show a steadily increasing size in tree growth from a bushy character near the level of the lake up to the large oaks and madroños of the higher levels.

The Lago de Cuitzeo is a body of brackish water about 40 by 15 miles in extent. It is very shallow and irregular in outline, with alkaline flats and saline deposits along parts of its shores; in other places rounded hills closely overlook the water. The Río de Morelia, a small stream, enters the southern side, but there is no outlet. Conditions are favorable for migratory waterfowl, especially ducks which winter here in large numbers. Among many species of plants of the tableland are the peppertree (*Schinus molle*), mesquite (*Prosopis*), tree yucca, and various species of cactuses.

**Tingüindín** (see Los Reyes).

**Uruapan** (5,000 feet):

*March 4-8, 1903.*—Uruapan is a town at about 5,249 feet on the railroad in western Michoacán. On March 3 we left camp on Cerro de Tancítaro and descended the northern slope leading out on the high broken plateau lying between the mountain and Cerro Patambán to the village of Cirostó, about 15 miles from our starting point. Cirostó is in a valley between the two mountain masses. From Cirostó we continued on March 4 about 20 miles along a series of narrow valleys separated by low divides and then began a long winding descent of some 15 miles through very broken country to Uruapan. Uruapan is in a narrow valley through which a fine stream flows south to the Río Balsas. The vicinity of the town is subject to frequent

frosts in winter, but they are not severe enough to prevent some production of coffee and bananas under cover of massed vegetation in gardens. About the fields and on open hillsides near Uruapan grew a large maguey (*Agave*) 12 to 15 feet high, which was used as a hedge. The general section is, however, rather arid. The locality is within the Lower Austral Zone, just above the upper limit of the Arid Upper Tropical Zone.

**Volcán de Jorullo** (2,000 to 4,000 feet) :

*March 27-29, 1903.*—The Volcán de Jorullo is an extinct volcano in south-central Michoacán. On March 27 we left the ranch of El Zapote near La Huacana and moved about 8 miles southeast to the ranch of Agua Blanca, near the Volcán de Jorullo. The mountain was ascended on horseback by a trail leading up on the northern side to the summit, but little collecting of specimens was undertaken. Material gathered was labeled "Volcán Jorullo."

The Volcán de Jorullo is a solitary volcanic cone rising from a base level at about 2,000 feet to about 4,000 feet on the summit. It is surrounded by lava beds for a distance of 2 or 3 miles, with a line of smaller and apparently older cones in slight relief along a ridge extending from the southern side of the volcano. The main cone is somewhat rounded in outline and is covered from base to summit with ashes and scoriae into which summer rains have cut a series of narrow washes down the southern side. The top forms a narrow rim enclosing a deep crater of ragged lava, black and forbidding. The northwest wall is broken down and through the gap lava flowed out at the last eruption, forming a bed half or three-quarters of a mile long and several hundred feet deep, the lava cooling and leaving a high, abrupt front. There was no evidence of recent volcanic activity. Directly to the north is the high, pine-covered front of the Sierra Madre, rising several thousand feet above the intervening country. To the south the country is a succession of hills and low mountains, irregularly grouped and gradually descending to the bottom of the valley of the Río Balsas.

A thin stand of vegetation covers the slopes of the Volcán de Jorullo to the summit. At about 3,000 feet on the northern slope a pine, evidently tropical in distribution (*Pinus montezumae*), was collected. Among other plants taken in the vicinity were the Brazilwood (*Haematoxylon brasiletto*), nanche (*Byrsonima crassifolia*), wild fig (*Ficus padifolia*), and *Enterolobium cyclocarpum*. Many of the hills and slopes near the volcano are covered with fan palms 8

to 30 feet high. Immediately about the volcano was a forest of low, leguminous trees of many kinds. Arid Lower Tropical Zone.

**Zamora (5,200 feet):**

*January 10-27, 1903.*—Zamora is a town at 5,200 feet on the railroad in northwestern Michoacán. We reached Zamora by rail from La Barca, Jalisco, on January 10. Work here was centered on the rocky hill slopes near town and along the Río de Zamora, which flows out in a northwesterly direction over a plain dotted with small marshes and joins the Río de Lerma near La Barca. Zamora is situated among outlying hills of the Sierra Madre about 15 miles north of Cerro Patambán. Owing to location at low elevation at the base of the foothills the place is in a thermal belt and appears to have less frost than the bottom of the valley of the Río de Lerma.

The vegetation is similar to that found on the southern slopes of hills near Ocotlán, including the silk-cotton tree and the large, many-branched organ cactus. Willow, ash, and bald cypress grow along the river. Various plants noted in the plaza at Zamora cannot endure very severe frost, but light frosts occur every year. Mainly Lower Austral Zone but invaded by Arid Upper Tropical elements.

MORELOS

**Cuernavaca (5,000 feet):**

*January 2-10, 1893.*—Cuernavaca, the capital of the state of Morelos, is situated on a nearly open, southerly sloping plain, at 5,000 feet. The plain is a bed of conglomerate, cut by numerous deep, nearly perpendicularly walled canyons down which flow small streams. These streams, taking at first nearly parallel courses, unite farther south and, traversing more broken territory, the drainage is into the Río Yautepec, an affluent of the Río Balsas. Five or six miles to the north the foothills of the Sierra de Ajusco begin abruptly. A few miles east of the city a broad lava bed extends from an old crater down for 10 or 12 miles over the sloping plain.

The region about Cuernavaca is quite arid and in tropical character contrasts strongly with the closely adjoining high mountains and Valley of México. The scanty vegetation consists largely of mesquites, acacias, and cactuses. Wild fig trees, exhibiting the climbing habit, are common along the steep walls of the canyons, and wild guava bushes are generally distributed. In the gardens of Cuernavaca bananas and mangoes are grown and coffee on a very limited scale is produced. Arid Upper Tropical Zone.

**Huitzilac (7,500 to 10,000 feet) :**

*December 27, 1892, to January 2, 1893; June 8-12, 1903.*—From Tlalpan, in the Valley of México, our route was along the old wagon road, crossing the Sierra de Ajusco at about 9,800 feet. It descended the southern slope a few miles to the village of Huitzilac, at about 8,000 feet, in Morelos. The work here extended from 7,500 feet up to about 10,000 feet on the Peak of Huitzilac. I revisited the locality alone on June 8-12, 1903.

Pines, probably largely *Pinus montezumae*, are the prevailing timber of the slope, but a spurlike ridge that projects as a huge buttress at right angles to the trend of the range just to the west of Huitzilac has a surprisingly different vegetation. The northern slopes, from about 7,500 feet to 8,500 feet, are covered with a luxuriant growth of oaks, madroños, and other deciduous trees and bushes. The oaks, heavily festooned with moss and ferns, indicate a more humid climate and the prevalence of fog on that slope. Among the birds here were *Buarremon virenticeps*, *Diglossa baritula*, *Heleodytes megalopterus*, *Ptilogonys cinereus*, *Myadestes obscurus*, and *Turdus assimilis*.

**Puente de Ixtla (3,500 feet) :**

*June 4-8, 1903.*—Puente de Ixtla is a station at about 3,500 feet on the railroad in southeastern Morelos. We reached Puente de Ixtla by rail from Río Balsas on June 4. Our work until June 8 was limited to the vicinity of the town. Puente de Ixtla is on the sloping plain that occupies the southern part of the state of Morelos. To the north a series of hills and ridges rise irregularly, one behind and somewhat higher than the other, to the base of the great volcanic range walling the Valley of México. A small stream, the Río Tembembe, flowing from the mountains to the north provides water for rice and sugarcane plantations. The region is arid, with a distinct dry season lasting from November or December until June.

The plains are mainly open and grassy, with woody vegetation limited in extent. Among the most notable trees are the morning-glory, mesquite, and several species of *Acacia*. Arid Upper Tropical Zone.

**Tetela del Volcán (7,800 to 9,500 feet) :**

*February 10-13, 1893.*—Tetela del Volcán is a small Indian town at about 8,000 feet on the south slope of the Volcán de Popocateptl, some 10 miles below the base of the main peak. The town is located

near the upper border of the lower pine belt. In this vicinity the soil is so dry and sun-baked during a large part of the year that the pines and deciduous trees are small and few in number. A thousand feet higher, however, conditions are more favorable and the pines become good-sized trees with numerous fine oaks and madroños scattered among them, or covering considerable areas by themselves.

**Yautepec (4,000 feet):**

*January 10-17, 1893.*—Yautepec is a town in the valley of the Río Yautepec about 16 miles southeast of Cuernavaca. Conditions here are much the same as at Cuernavaca but more definitely tropical in character. On rich bottomlands sugarcane and corn are grown extensively; also such fruits as oranges, bananas, chirimoyas, anonas, guavas, and mangoes. Yautepec is noted for the fine quality of the oranges grown there.

**Yecapixtla (5,000 feet):**

*February 8-10, 1893.*—Yecapixtla is a town and railroad station about 15 miles east of Yautepec, in the northeastern part of the state. The town is in the valley of the Río Cuautla, which drains the western slopes of the Volcán de Popocatepetl.

NAYARIT (TEPIC)

**Acaponeta (200 to 300 feet):**

*June 23 to July 4, July 29 to August 2, 1897.*—Acaponeta is a large town at about 200 feet on the railroad where it now crosses the Río de Acaponeta, in northwestern Nayarit. No railroad had been built at the time of our visit. From Santiago our route on June 22 was north 30 miles to Rosa Morada, and on the following day we rode northwesterly about 45 miles to Acaponeta. The town is situated on the coast plain not far from the outlying foothills of the Sierra Madre. The general features of the vegetation along our route were areas of scrubby forest, alternating with open, grassy prairies, except where it traversed lowlands bordering streams where the soil is subirrigated at all seasons and thus produces a mixed stand of huge wild figs, Spanish cedar, mahogany, *Enterolobium*, and other trees of large size. The general forest growth is made up of a great variety of trees and shrubs, prominent among which are several species of *Bursera*, two species of silk-cotton trees, acacias, mimosas, cassias, *Pithecollobium dulce*, *Crescentia*, *Erythrina*, and *Randia*. Heavy rains were frequent at the time of our visit. Arid Lower Tropical Zone.

**Arroyo de Juan Sánchez (1,000 feet):**

*April 5-6, 1897.*—Arroyo de Juan Sánchez is a small settlement at 1,000 feet in a palm forest about 28 miles northeast of Colomo, southern Nayarit. An overnight stop on our route north to San Blas. Arid Tropical Zone.

**Colomo (600 feet):**

*April 4-5, 1897.*—Colomo is a small group of ranches at 600 feet near the Río de Ameca and within the southern boundary of Nayarit. An overnight stop on our route about 20 miles north of Ixtapa, Jalisco. Arid Lower Tropical Zone.

**Colomo to Arroyo de Juan Sánchez (see Arroyo de Juan Sánchez).****Compostela—near (2,000 feet):**

*April 6-7, 1897.*—Compostela is a town about 25 miles south of Tepic, southern Nayarit. It was an overnight stop on our route north to Tepic. The town is in a valley flanked by mountains reaching to about 6,500 feet along the extreme western border of the great interior tableland. Arid Lower Tropical Zone.

**Isla Isabel (10 feet):**

*April 22-24, 1897.*—Isla Isabel is a small island about 35 miles northwest of the port of San Blas. It is a barren, rocky island inhabited by many sea birds. Specimens were labeled "Isabel Island."

**Jalisco (5,000 feet):**

*April 10, 1897.*—Jalisco is a village at about 5,000 feet on the slope of a ridge about 5 miles south of Tepic. This ridge reaches an elevation of about 7,500 feet. Work here was carried on from headquarters in Tepic.

**Las Varas (800 feet):**

*April 6, 1897.*—Las Varas is a hacienda at 800 feet in the low coastal strip about 20 miles southwest of Compostela, in southern Nayarit. On April 6 we traveled about 45 miles in a general northerly course from Arroyo de Juan Sánchez to Compostela. About noon we passed Las Varas and leaving the coast country behind climbed the bordering mountains to Compostela. Arid Lower Tropical Zone.

**Navarrete (800 feet):**

*April 16, June 17, 1897.*—Navarrete is a village at 800 feet about 24 miles northwest of Tepic and was an overnight stop on our route to San Blas. Revisited on June 17, 1897. Arid Lower Tropical Zone.

**Pedro Pablo (3,500 feet) :**

*August 2-4, 1897.*—Pedro Pablo is a village at 3,500 feet about 22 miles east of Acaponeta, northern Nayarit. From Acaponeta our route was eastward among scattered, outlying foothills for some miles, the road keeping on the nearly level country until we reached the base of the Sierra de Teponahuasta. Up the west slope of this range of mountains we continued to Pedro Pablo at 3,500 feet, just below the summit, which is at about 4,000 feet. Pedro Pablo is on the north end of the narrow range that extends parallel to the main mountain mass of the Sierra Madre to the east. This outlying mountain range is separated from the Sierra del Nayarit by the valley of the Río de San Pedro, which takes a southerly course and then curving westward around the southern end of the Sierra de Teponahuasta turns northward and discharges into a lagoon near the coast. Pedro Pablo is near the boundary between the Arid Upper Tropical and Lower Austral Zones.

**Santa Teresa (6,800 feet) :**

*August 8-13, 1897.*—Santa Teresa is a Cora Indian village at 6,800 feet near the summit of the Sierra del Nayarit, in the northeastern part of the state of the same name. From Pedro Pablo our trail led east on August 4 for 28 miles to a group of Indian ranches known as San Blasito, on the Río de San Pedro. On August 5 we crossed the San Pedro, a deep, turbulent stream at that season, flowing through a narrow canyon at an elevation of only 800 feet, and began at once the long ascent of the higher mountain range. We camped about 10 miles to the east at an Indian ranch called Aguacate. On August 6 we covered about 15 miles to the Indian village of Dolores, just below the summit at 7,500 feet, and on August 7 made about 16 miles to the Indian ranch of Santa Gertrudis near the top to the northeast of Dolores. The top proved to be a rolling tableland, or plateau, with small streams crossing it here and there. On August 8 we traveled about 28 miles in a northeasterly direction along the top, descending gradually to Santa Teresa at 6,800 feet. The Sierra del Nayarit is a western spur of the Sierra Madre Occidental. It extends southward from the main backbone between the valley of the Río de San Pedro, which breaks across the Sierra Madre from the interior plateau, and a valley to the east carries tropical elements north into southern Durango.

Santa Teresa is on a gently rolling plateau near deep canyons that cut the eastern slope. To the west the summit of the range presents

a series of rocky escarpments 500 to 1,000 feet high. At the time of our visit heavy rains were of almost daily occurrence, but little soil overlies the bed rock, and during the dry months these mountains are evidently rather arid. Sharp frosts occur on the upper slopes during winter. The vegetation of the mountain slopes up to 3,600 or 4,000 feet is Arid Upper Tropical in zonal character. Above 4,000 feet the pines and oaks are the dominant trees and increase in abundance on the upper slopes. Over the broad undulating top there is an abundant stand of pines, but few are of large size, owing to the thin soil which is washed away in many places, exposing the underlying "tepetate." Madroños and manzanitas are common, but there is little underbrush such as that found on other wooded mountains farther south. The upper slopes near Santa Teresa are a mixture of Upper Austral and Transition in zonal character.

#### **Rosa Morada (200 feet):**

*June 22-23, 1897.*—Rosa Morada is a village at 200 feet on the coast plain about 30 miles north of Santiago and 45 miles southeast of Acaponeta. It was our overnight stopping place en route between the two towns mentioned. See also Acaponeta.

#### **San Blas (50 to 150 feet):**

*April 17-20, 24-27, June 1-14, 1897.*—San Blas is the principal seaport in Nayarit. It is situated at the mouth of a long narrow lagoon opening into the sea. Just back of the town a rocky hill rises abruptly for about 100 feet, with a precipitous face toward the sea. On the top of this hill was located the old town of San Blas during the days of the Spanish viceroys. The tide rises and covers extensive flats, which extend irregularly along the shore. These flats are largely overgrown with mangroves and other vegetation. Back of these the level country reaches eastward for 8 or 10 miles to the outlying foothills. To the north the country is very flat for many miles. A mile south of San Blas a small river enters the sea. Beyond this river low hills descend from the interior to the coast. The vegetation of the tide flats and bordering lagoons near the coast consists mainly of mangroves (*Rhizophora mangle*) and *Conocarpus erecta*, with a few other salt-loving species. Back of this belt in sandy upland soil grow mesquites, acacias, wild figs, Spanish cedar, palo mulato (probably *Bursera grandifolia*), wild guava (*Psidium guajava*), *Castilla elastica*, silk-cotton trees, and many other species. Along parts of the road between San Blas and Navarrete, palms, probably including both *Attalea cohume*

and *Acrocomia mexicana*, form forests in many places almost to the exclusion of other trees. Corn, beans, tobacco, cotton, bananas, pineapples, coconuts, mangoes, and a few other tropical fruits are grown. Arid Lower Tropical Zone.

**San Blasito (800 feet) :**

*August 4-5, 1897.*—San Blasito is a group of Indian ranches on the western side of the Río de San Pedro in northern Nayarit. From Pedro Pablo, a village about 22 miles easterly from Acaponeta, our trail led on August 4 for 28 miles farther toward the east, or a little to the northeast, to San Blasito. Here the Río de San Pedro flows through a rugged canyon at only 800 feet altitude in Arid Lower Tropical Zone. Continuing our journey on the following day we crossed the San Pedro, a deep turbulent stream at this season, on a round raft fashioned by the Indians and made buoyant by lashing together in a fiber net 7 large hollow gourds. One was placed in the center, with the other six around it, firmly bound side by side and open at the top. On this a platform was tied and we were taken across one at a time, with our outfit, the raft being pulled by two Indian swimmers, one on each side. A number of trips were required to pass over all our outfit, including riding and pack saddles, while our horses and mules swam across.

**San Diego (2,300 feet) :**

*August 2, 1897.*—San Diego, or San Diego de Alcalá, is a village at 2,300 feet, about 15 miles east of Acaponeta. We passed through it en route to Pedro Pablo on August 2, 1897.

**Santiago Ixcuintla (200 to 300 feet) :**

*June 14-21, 1897.*—Santiago Ixcuintla is a town at 250 feet on the north bank of the Río Grande de Santiago, western Nayarit. The town is usually referred to as "Santiago," and our specimens from the general vicinity were so labeled. On June 14 we rode 32 miles north from San Blas to Santiago. The Río de Santiago flowing by the town is the longest river of México. Its head waters are giant springs at about 8,200 feet a few miles south of Lerma, in the valley of Toluca, and along its upper course, above Lake Chapala, the river is known as the Río de Lerma. It drains a large tableland area, including parts of the states of México, Michoacán, Querétaro, Guanajuato, Aguascalientes, Zacatecas, and Jalisco. In the dry season the river is only about 100 yards wide and 2 or 3 feet deep at Santiago, but during

the summer rains it becomes very greatly increased in size. A nearly level plain extends from around the town out to the coast. A few scattered, isolated hills rise here and there, and to the east 5 or 6 miles take form as the outlying foothills of the Sierra Madre. At the time of our visit the rainy season was just beginning and is said to last until about the first of December. A part of the country between Santiago and San Blas, with water near the surface, is overgrown with many wild figs, Spanish cedar (*Cedrela mexicana*), palo mulato (*Bursera simaruba*), and nut palms. Extensive areas are also covered with almost impenetrable thickets of a pineapple-like plant, widely distributed in tropical Mexico. Arid Lower Tropical Zone.

### **Tepic** (3,000 feet):

*April 7-15, 1897.*—Tepic is the capital of the state of Nayarit, which at the time of our visit had the status of Territory of Tepic. On April 7 we left Compostela and rode north 26 miles to Tepic. Our route was across a mountain ridge at an elevation of about 7,500 feet from which we descended to the long, narrow plain that forms the valley of Tepic. This plain or valley, which varies from 5 to 10 miles in width, slopes down gradually toward the hot lowlands of the coast. The Río de Tepic carries the drainage of the valley northwest to the Río Santiago. Near Tepic the Cerro San Juan rises to nearly 8,000 feet as an isolated peak overlooking the lowlands and is visible far out to sea. The general region is arid. The valley at Tepic and the neighboring foothills are covered mainly with grass, with very limited areas of bushes and rarely any arboreal growth until the slopes are ascended for some distance. There oak bushes begin, which become larger until at 4,500 to 5,000 feet they appear as a scattered stand of small tree size. At about 5,000 feet on northerly slopes scattered areas are covered with pines. Life-zone limits were not definitely fixed, and near Tepic considerable overlapping of Arid Upper Tropical and Lower Austral Zone elements is evident.

### **Tres Mariás Islands** (50 to 800 feet):

*April 28-June 1, 1897.*—The Tres Mariás Islands form a group consisting of three large islands and several small ones about 65 miles west of the port of San Blas. Accounts of our work on these islands have been published in "The Natural History of the Tres Mariás Islands, Mexico," North American Fauna, No. 14, p. 94, April 29, 1899.

## NUEVO LEÓN

**Cerro de la Silla** (2,000 to 3,500 feet) :

*March 19-28, 1902.*—Cerro de la Silla, translated as Saddle Mountain owing to the saddle-shaped outline of the top, is a conspicuous landmark about 6 miles east of the city of Monterrey. On March 19 we drove about 15 miles from Monterrey to the mouth of a canyon on the opposite side of the mountain. There we hired some natives with burros to pack our outfit about 4 miles up the canyon, where we camped. On March 28 we returned to Monterrey. Cerro de la Silla is an isolated mountain mass. It rises steeply several thousand feet above the plain, which has an altitude of about 1,700 feet. The mountain is mainly of limestone with several small streams flowing from springs in the larger canyons.

The vegetation on the arid plains about the base of the Cerro de la Silla is of the widely distributed mesquite-huisache type. Within the canyon, where we did our work, the presence of water and the higher altitude combined to make a decided change in plant life. Sycamores, oaks, mesquites, and ebony trees, with some smaller species, formed a heavy growth along the narrow bottom of the canyon. On north-facing slopes the oaks formed a moderately dense but low forest. South slopes were covered with a mixture of mesquite, acacias, mimosas, agaves, and cactuses. The plains and lower slopes and the southern exposures to near the top of the mountain are assignable to the Lower Austral Zone, but the north slopes at the higher levels appear to be Upper Austral in zonal character.

**Doctor Arroyo** (4,000 feet) :

*June 17-18, 1898.*—Doctor Arroyo is on the interior tableland in southern Nuevo León. A stop-over point en route from Miquihuana, Tamaulipas, to the railroad at Matchuala, San Luis Potosí. Lower Austral Zone.

**Montemorelos** (2,500 feet) :

*April 2-5, 1902.*—Montemorelos is a town on the railroad in central Nuevo León. On April 2 we moved by wagon about 15 miles west from the town and camped among low rolling foothills about 6 miles from the main base of the Sierra Madre Oriental. Specimens were labeled "Montemorelos." On April 5 we returned to town. Montemorelos is on a nearly level part of the vast plain that slopes down very gradually to the Gulf coast. Toward the west the country rises in a series of hills and low ridges to the base of the mountains, which, rising abruptly for several thousand feet, present the same bold sea-

ward front as farther south. At intervals of a few miles the front of the range is cleft by deep gorges through which small streams find their way to the coastal plain; the low hills and ridges forming what might be called the foothills of this range are only 100 to 300 feet higher than the plain, and the transition from them to the elevated mountain mass is very striking. Between Morelos and the Gulf islandlike groups of limestone mountains stand out prominently with altitudes of several thousand feet above the general level.

On the foothills near the mountains, where we camped, the mesquites and huisaches of the plains were still abundant on south slopes with areas of oak brush on north slopes. In the narrow bottoms along the small streams were some large oaks, walnuts, and mesquites. Our camp at about 2,500 feet was near the dividing line, depending on slope exposure, of Upper and Lower Austral Zones.

**Monterrey (1,700 feet):**

*March 16-19, March 28-April 1, April 6-8, 1902.*—Monterrey is the capital of the state of Nuevo León. Stop-over point en route to other localities.

**Santa Catarina (2,200 feet):**

*April 8-14, 1902.*—Santa Catarina is a town at about 2,000 feet on the railroad, 14 miles west of Monterrey. From Monterrey, which we left on April 8, we drove 14 miles up the valley of the Río de Monterrey to Santa Catarina, the type locality of *Spermophilus couchi* (= *Citellus variegatus couchi*), where we located for a few days' work in the vicinity and on the slopes of adjacent hills. Santa Catarina, only 200 to 300 feet higher than Monterrey, is situated in a long, flat-bottomed valley 2 or 3 miles wide, walled in by mountains that rise abruptly for 2,500 to 3,000 feet. The slopes are precipitous in many places up to serrated knifebladelike summit ridges. The mountains are of pale-colored limestone made up of strata standing vertically or bent and twisted into many fantastic curves. As the slopes are almost devoid of vegetation the strata are left much exposed. The mountain wall on the right side of the valley as one ascends separates the valley from the coast plain, while the mountains on the left side are the front of a series of similar sharply defined ridges and peaks that extend back toward Saltillo and form the main mass of the Sierra Madre in this district. A deep canyon cuts through this range and opens into the valley at Santa Catarina, bringing a fine stream of clear water from the interior of the mountains. This water is the head of the Río de Monterrey. It flows

down the valley, irrigating many fields on the way, and passes through the city of Monterrey to the plains beyond. Aside from this stream, water is extremely scarce in this section.

Except along the river, which is bordered by walnut and sycamore trees, the vegetation indicates more arid conditions than at Monterrey and partakes of the character of the interior tableland. A number of stunted representatives of the Tamaulipas lowland flora extend up to Santa Catarina, but a short distance higher up the valley they are gone. On the rocky slopes of the canyon several species of small agaves and *Dasyilirion* grow in abundance, and the tops of some of the ridges are fringed with small fan palms. Santa Catarina is near the boundary between Upper Austral and Lower Austral Sonoran Zones.

#### OAXACA

##### Cerro San Felipe (10,000 to 10,300 feet):

*August 20 to September 1, 1894.*—On August 20 we left La Parada, a small Indian ranch on the road through the mountains about 20 miles northeast of the City of Oaxaca, and proceeded in a northwesterly course to the summit of the group of mountains just north of the city known as the Cerro San Felipe. Camp was made on an exposed hill-top near a spring that rises in the middle of a trail leading down a small canyon. The altitude was 10,300 feet at this point. Here we remained until August 22, when we moved camp to a fine spring in a beautiful little meadow at about 10,000 feet on the south slope of Cerro San Felipe. This camp was located about 10 miles north of the City of Oaxaca, on top of the first summit reached in ascending the mountain from that direction. About 3 miles north of our camp the Cerro San Felipe, the highest mountain of the group, reaches an altitude of 11,000 feet.

The name of the peak, Cerro San Felipe, is applied to the high mountain mass lying in an angle formed by the meeting of two arms of the Valley of Oaxaca near the city of the same name. From this mountain group a general range extends southeasterly along the continental backbone toward the Isthmus of Tehuantepec. The slopes of the Cerro San Felipe are steep on all sides, but a broad, rolling area above 9,500 feet forms the general top. This area is cut by the heads of numerous canyons, and from it rise several culminating peaks. It is forested, except for small open meadows here and there. Two of these high meadows, lying at about 9,800 feet, were termed "neverías" from the fact that they were utilized for ice making to supply the city nearby. In a series of wooden troughs water was frozen on cold

nights and then stored in grass-thatched pits until needed. Winter freezing is said to be severe. Frosts occurred at our camps every clear night during our stay in the latter part of August.

From about 8,000 to 10,000 feet on the slope of these mountains fronting the City of Oaxaca a fine oak forest is made up largely of *Quercus reticulata*. Along with these oaks are many madroños (*Arbutus*), small tree alders (*Alnus*), *Sambucus mexicanus*, scattered pines of two species, *Ceanothus coeruleus*, and one or more kinds of *Arctostaphylos*. In this forest are many herbaceous plants that are conspicuous for the beauty of the flowers. Among genera represented are *Castilleja*, *Pentstemon*, *Lupinus*, *Eryngium*, *Commelina*, *Tradescantia*, *Lamoureauxia*, *Dahlia*, and *Salvia*. The great majority of trees and shrubs show a marked decrease above about 10,000 feet. Between this level and the summit the forest consists mainly of a single species of pine. The belt from about 7,800 to 10,000 feet may be assigned to the Transition Zone, and the higher peaks from 10,000 feet to the summits may represent Canadian Zone.

#### Cerro Zempoaltepec (8,000 to 10,500 feet):

July 4-13, 1894.—Cerro Zempoaltepec is the highest peak of a rugged mountain group forming a part of the continental backbone nearly due east of the City of Oaxaca. Specimens taken at this locality were labeled "Mount Zempoaltepec." We left the large Indian village of Yalalag, renamed Villa Hidalgo, early in the morning of July 4, and after a hard day's travel of only about 16 miles in an easterly direction reached Yacochi at 7,700 feet on the west side of Mount Zempoaltepec. This point, where we were among unfriendly but not actively antagonistic Mije Indians, was our headquarters for work on the mountain. Collecting was done at various levels up to 10,500 feet. The main peak of Zempoaltepec is a rocky, pine-covered ridge 11,400 feet high, according to our aneroid. It is one of the culminating points of a mountain range that extends northwesterly for many miles and separates the broken eastern watershed from the interior plateau. Another high-mountain group, about 25 miles to the southeast, given on local maps as Santa Margarita, appeared from the summit of Zempoaltepec to be as high, if not higher, and still more rugged than Zempoaltepec. Like Zempoaltepec it appears to rise from an eastward projecting spur of the range along the Continental Divide, with deep, steep-sided canyons heading far around the flanks and carrying all or nearly all the drainage toward the Gulf. Santa Margarita is on a ridge separating the San Juan and the Coatzacoalcos River Basins. Mount Zempoaltepec rises from the watershed between the San Juan

and Playa Vicente Rivers. No signs of volcanic activity were noted in the vicinity of the mountain. The general region is rather arid, except on the highest ridges that are exposed to northerly or easterly winds from the Gulf. Our visit was during the rainy season, and heavy showers were of frequent occurrence along eastern slopes near the tops of ridges to the east, which appeared to intercept most of the moisture before it could reach Mount Zempoaltepec. Mists were not uncommon, however, and some scattered showers fell while we were at Yacochi. Farther west and about Yalalag, as we could observe from our vantage point, high drifting clouds were abundant, but no rain fell for several days at a time.

Ascending the slope from Yalalag to the top of Mount Zempoaltepec the vegetation changes rapidly through several zones, the limits of which can only be approximated. At Yalalag, at 3,800 feet, Arid Upper Tropical conditions prevail and extend up through a nearly treeless belt to 4,500 feet. The generally treeless character, however, is interrupted here and there by scattered pines, evidently tropical in range. From 4,500 or 5,000 feet to 6,500 or 7,000 feet other pines appear and on southern exposures fan palms reach 7,000 feet. This belt seems to be mainly Lower Austral in character. At about 7,000 feet on the west slope of the mountain the pines give way to a zone of oaks, with alders and madroños intermingled, and at 8,000 feet the oaks are large and grow so densely that other tree vegetation is choked out. The branches and trunks of the trees are heavily draped with epiphytic plants. The ground below is covered with an almost impenetrable tangle of huge ferns, a species of long-trailing cane, and a variety of other undergrowth. This belt extends up to about 9,000 feet on the west slope and may begin at a lower level on the east slope. It is evidently the area that receives the greatest amount of moisture, and owing to complex conditions the life zones are not readily delimited. It seems, however, to be mainly Upper Austral in character. The oaks become smaller and cease altogether at 10,000 feet. With equal abruptness a species of small pine appears and forms a scattered forest over all the grassy slopes on up to the summit at 11,400 feet. From the upper limit of the oaks to a little over 11,000 feet a few alders and madroños were noted among the pines. The upper pine belt to the summit on the west slope is probably assignable to Transition Zone. No firs were noted by us in the course of our work, which was limited to the west slope. In Totontepec, however, we saw fir timber that had been brought down from high on the northeast slope, and which seemed to be an indication that there may be a small patch of Canadian Zone on that side.

**Chicapa (100 feet):**

*February 14-17, 1904.*—Chicapa is a village at about 100 feet, near the upper end of the Laguna Superior, east of the city of Tehuantepec. I left San Gerónimo, on the railroad, on the evening of February 14 and reached Chicapa the next morning, having traveled slowly by oxcart all night. Arid Lower Tropical Zone.

**Choapan (2,800 to 3,000 feet):**

*July 26-29, 1894.*—Leaving Totontepec on July 26 we proceeded northeast about 15 miles to Comaltepec, at 1,900 feet in the bottom of a canyon, and then continued 6 miles farther over rugged mountain trails in the same direction to Choapan at 2,800 feet. The entire country extending about 15 miles to the eastward is made up of a series of steep mountain ridges, alternating with deep canyons descending from the main range along the eastern border of the interior plateau. At about 3,500 feet above Choapan a dense oak forest begins and covers the eastern slopes up to the summits of the hills at 4,500 to 5,000 feet, but the south and west slopes at the same levels bear only scattered oaks or are open and grass-covered. The banks of the numerous small clear streams are luxuriantly overgrown with a great variety of small trees, bushes, and herbaceous plants.

**Coixtlahuaca (7,000 feet):**

*November 10-12, 1894.*—Coixtlahuaca is a town in the high plateau region of northwestern Oaxaca. Leaving Cuicatlán November 9 with pack outfit we traveled northwest 22 miles to the village of San Miguel Huautla at 6,300 feet, crossing en route a divide at 8,000 feet. Next morning our course was southwest for 16 miles over a ridge at 8,500 feet and across hilly plateau country to Coixtlahuaca at 7,000 feet. The geological formation in this general section is a soft limestone, which on disintegration forms a lime subsoil known as "tepetate." The soil is very thin, and every trail is visible for miles as a winding white line across country. The vegetation is scanty, and a parched appearance at this season is evidence that little rain fell during the summer. Pines and oaks grow along the ridges. In the open country near town the birds and mammals were similar to those found in the Valley of Oaxaca.

**Colotepec (300 feet):**

*March 6-7, 1895.*—Colotepec is a village at 250 feet about 15 miles from the coast, on the Río Colotepec, southern Oaxaca. An overnight stop en route along the coast. Arid Lower Tropical Zone.

**Colotepec to Cozoaltepec** (see Puerto Angel).

**Comaltepec** (1,900 to 3,500 feet):

*July 30-31, 1894.*—Comaltepec is an Indian town at 1,900 feet about 6 miles southwest of Choapan. It is in the bottom of one of the numerous deep canyons carved by upper tributaries of the Río San Juan and Río Playa Vicente, which enter the Gulf at Alvarado, Veracruz. It has a humid tropical climate but receives less moisture than the tops of neighboring ridges.

**Cozoaltepec to Pochutla** (see Puerto Angel).

**Cuajimoloya** (10,000 feet):

*August 5-6, 1894.*—On August 5 we continued from near San Pedro Cajones across the mountains over a divide 10,500 feet high and camped at 9,500 feet just west of the village of Cuajimoloya. Material collected was labeled "Guahamaloya." On August 6 we descended the west slope of the mountain and reached the City of Oaxaca in the afternoon.

**Cuicatlán** (1,800 feet):

*October 5-15, October 24 to November 9, 1894.*—Cuicatlán is a town on the railroad at 1,800 feet in the deep and narrow valley or broad canyon drained by an interior tributary of the Río San Domingo or Río Cosamaloapam, which flows to the Gulf at Alvarado, Veracruz. The town was reached by pack outfit from Oaxaca over the divide at 8,000 feet, between the Valley of Oaxaca and the valley at Cuicatlán. The climate is extremely hot and dry, owing to the interception of moisture from the Gulf by a high range of mountains along the east side. The bordering hill slopes, largely of limestone or of sandstone and conglomerate, bear a thin growth including shrubs, small trees, several species of cactus, a *Jatropha*, and several species of *Cassia*. Over much of the valley bottom a heavy stand of giant cactuses is a prominent feature. The locality is somewhat isolated in the Arid Lower Tropical Zone, but owing to invasion much of the fauna is the same or very similar to that of adjoining Lower Austral areas.

**Dominguillo** (2,400 feet):

*October 4-5, 1894.*—Dominguillo, also called Dondominguillo, is a village at 2,400 feet about 13 miles south of Cuicatlán in northern Oaxaca. From Oaxaca our route on October 2 was north with our pack outfit along the bottom of the Valley of Oaxaca to Huitzo, a distance of 22 miles. The altitude at the latter place is 5,600 feet. Leaving Huitzo on October 3 we continued 19 miles in the same direction,

ascending gradually through a series of rounded hills along a good wagon road, over the summit of a divide at 8,000 feet, and down a short distance on the farther side to a group of Indian ranches known as Cieneguilla at 7,500 feet, where we camped. From this point the road on October 4 wound down between high steep hills for 24 miles past the village of Salomé at 6,600 feet, to Dominguillo at 2,400 feet. At Dominguillo we came to the banks of a small river which we followed next day to Cuicatlán at 1,800 feet. Dominguillo is in arid tropical country, but the hill slopes to the south extend up into Lower Austral, and on the top of the divide into Upper Austral Zone. Plants were collected along the road on the slopes south of Dominguillo.

**Guichicovi** (also known as San Juan Guichicovi) (900 feet) :

*June 21-27, 1895.*—Guichicovi is a town at 900 feet about 8 miles southwest of the railroad station of Mogoñé, on the northern slope of the Isthmus of Tehuantepec.

On June 21 we proceeded from the Indian village of La Ranchería near Santo Domingo across the low mountains in a northerly direction for about 15 miles to the town situated among low hills on the west side of the Isthmus of Tehuantepec. The locality is nearer the Gulf coast and the vegetation somewhat more luxuriant than at localities visited farther south. Humid Lower Tropical Zone.

**Guichicovi to Lagunas** (see Lagunas).

**Huajuapan** (5,500 feet) :

*November 16-19, 1894.*—Huajuapan (Huajuapan de León on some maps) is a town at 5,500 feet in an open valley of a small tributary of the Río Mixteco, one of the upper branches of the Río Balsas, in northwestern Oaxaca. The town was reached by us after traveling about 26 miles northeast over the plateau from Tamazulapan. Crossing a range of hills en route we obtained a fine view over a great expanse of round-topped limestone hills lying in every direction at an altitude of from 7,500 to 8,500 feet. To the south about 18 miles were the rugged summits of a high, pine-covered range, with very steep, broken slopes. This range forms a link in an interrupted chain of high mountains along parts of the western side of the interior plateau. A long descent led us out of the hills and into the valley near the town, where the transition to warmer conditions was shown by the vegetation. Fan palms were abundant on south slopes at the lower elevations all along our route. In the valley at Huajuapan a tree morning-glory with smooth calyx (*Ipomoea intrapilosa*) is a characteristic species, instead of the one with woolly calyx (*Ipomoea muru-*

*coides*), common at Tamazulapan. Other common species are *Prosopis juliflora*, *Pithecollobium dulce*, several species of *Cassia*, *Acacia*, and other thorny shrubs. Lower Austral Zone.

**Huajuapán to Petlalcingo, Puebla** (see Acatlán, Puebla).

**Huilotepéc (100 feet):**

*May 4-14, 1895; April 2-4, 1896.*—Huilotepéc is a Zapoteco Indian village on the Río Tehuantepec, 8 miles below the city of Tehuantepec. Here we found working conditions more favorable than in the immediate vicinity of the city. Arid Lower Tropical Zone.

**Ixhuatán (100 feet):**

*February 18-19, 1904.*—Ixhuatán is a village at about 100 feet on the low, nearly level plain, extending down to the Pacific coast between the two large lagoons, Laguna Inferior and Mar Muerto. I left Chicapa by oxcart the evening of February 17 and reached Ixhuatán, about 25 miles distant, the next morning. Arid Lower Tropical Zone.

**Jamiltepec** (see Juquila).

**Jamiltepec to Río Verde** (see Juquila).

**Juchitán to Chivela** (see Lagunas).

**Juquila (5,000 feet):**

*February 26 to March 4, 1895.*—Juquila is a town at 5,000 feet in the range of mountains lying in an angle formed by the course of the Río Verde in southwestern Oaxaca. We left Pinotepa on February 23 and reached Juquila on February 26, stopping overnight at Jamiltepec, Río Verde, and Panixtlahuaca en route. From Pinotepa to Jamiltepec, at 1,200 feet, and for some miles farther east our trail was through hills and across a continuous series of low ridges along the front of the high mountains of the interior. It then descended abruptly about 800 feet to the level bottomlands along the Río Verde, which are about 5 miles wide at that point. We turned up the valley for 18 or 20 miles and crossed the stream at about 400 feet altitude, near where it emerges from the hills. The river was about 75 yards wide and from 2 to 3 feet deep at the time of our crossing, but it has an extensive interior watershed, including the Valley of Oaxaca, and the banks afford evidence of great floods during the summer rains. From the river the trail ascended into the hills to the village of Panixtlahuaca, at 1,500 feet, and then entered the mountains, crossing a series of steep-sided ridges with canyons between. These ridges be-

come successively higher, until, just before reaching Juquila, a divide is crossed at about 6,500 feet.

Juquila, on the slope of a hill at 5,000 feet, is surrounded by pine-covered hills or mountains from 6,500 feet to 9,000 feet high. Juquila is near the frost line and just above the limit of coffee culture. The climate is cool and damp. Much fog and mist prevail, as shown by the moss on the trees on the north slopes of the adjacent hills and by the abundance of vegetation belonging to the temperate mountain flora. On a ridge at nearly 7,000 feet just east of the town were oaks of two or three species, two pines, a madroño, an *Eryngium*, *Lobelia*, *Sambucus*, *Datura*, *Salvia*, and a slender species of *Yucca*. The slopes below about the 5,000-foot level near Juquila are Arid Lower Tropical and Arid Upper Tropical, while those extending up to 7,000 feet are mainly Lower Austral in zonal character.

**Juquila to Nopala** (see Puerto Angel).

**Lagunas** (800 feet):

*June 3-7, 27-28, 1895.*—Lagunas is a station at 800 feet on the railroad about 50 miles north of the city of Tehuantepec. Traveling from the city of Tehuantepec I reached Lagunas with a pack outfit via Juchitán, about 20 miles northeast. Nelson, meanwhile, made a trip by rail to Coatzacoalcos to ship specimens. From Tehuantepec the arid plain ascends gradually to near San Gerónimo, also given as San Jerónimo Ixtepec, where limestone hills appear and a more broken surface extends on up to the top of the Continental Divide at about 900 feet near the station of Chivela, 8 miles south of Lagunas. On June 27 we returned to Lagunas from a side trip to Guichicovi, about 18 miles across rolling grassy plains to the northeast. Stretches of open, grassy plain, however, continue near Chivela and Lagunas. The station of Lagunas is across the watershed on the long, gentle slope extending north to the Gulf, but owing to distance and low altitude is little affected by the more humid conditions nearer the Gulf coast. Arid Lower Tropical Zone.

**La Parada** (7,900 feet):

*August 18-20, 1894.*—On August 17 we proceeded from Oaxaca about 15 miles northeast, climbing up to 9,200 feet on the summit of the mountains, which extend in an east-west direction, west of the Cerro San Felipe, on the north border of the Valley of Oaxaca, in this vicinity. On the following day we descended the north slope of the range to the ranch known as La Parada, at an altitude of a little less than 8,000 feet. We found this an Indian rancho where those who

pass may sleep, and nearby were the quarters for a few soldiers to guard the road. It is an old stopping place for travelers going to Oaxaca from Orizaba and other eastern points. Various naturalists, among whom were Boucard, Sumichrast, and Liebmann, have stopped there to work in the surrounding districts. The local setting is a broad, dry canyon among scattered oaks and pines 6 or 8 miles north-east of the Cerro San Felipe. Springs and streams are scarce and the aspect is one of general aridity. Above 8,500 feet, however, there is evidently more rainfall as the forest is much more vigorous.

**Las Vacas** (2,600 feet):

*April 22-23, 1895.*—Las Vacas is a rancho at 2,600 feet about 29 miles west of the town of Tequisistlán. It was an overnight stop on our route from Oaxaca to Tehuantepec. Arid Lower Tropical Zone.

**La Venta** (200 feet):

*July 13-14, 1895.*—La Venta is a small village at 200 feet on the coast plain about 22 miles east of San Gerónimo. An overnight stop on our route to Santa Efigenia.

**Llano Grande** (200 feet):

*February 16-19, 1895.*—Llano Grande is a village at 200 feet about 25 miles from the coast between the affluents of the river flowing from southwestern Oaxaca into Guerrero. Not to be confused with another Llano Grande, shown on some maps nearer the coast in the same general region. On February 16 we left the Hacienda del Capricho, near Ometepec, Guerrero, and rode about 15 miles southeast to Llano Grande. The village, as the name implies, is on a broad, nearly level plain that extends from the vicinity of the Hacienda del Capricho out to the coast. The plain is dry and slightly rolling and is made up largely of open savanna overgrown with short grass, irregular patches of low woods, and thickets. Arid Lower Tropical Zone.

**Llano Grande to Pinotepa** (see Pinotepa Nacional).

**Miltepec** (250 feet):

*July 14-15, 1895.*—Miltepec is a village at 250 feet on the river of the same name about 20 miles east of La Venta. It was an overnight stop on our route from San Gerónimo to Santa Efigenia.

**Miltepec to Zanatepec** (see Santa Efigenia).

**Mitla** (5,600 feet):

*June 28-30, 1894.*—On June 27 we left Oaxaca late and traveled with pack outfit up the open valley for about 10 miles in a south-

easterly direction. On the following day we continued to the town of Mitla, in an arm of the main valley about 28 miles from Oaxaca. Near Mitla we visited the ancient ruins of the same name, which are among the most remarkable in all México.

**Nopala to San Pedro Mixtepec** (see Puereo Angel).

**Oaxaca** (5,000 to 7,500 feet):

*June 5-30, August 6-17, September 2-10, September 19 to October 2, 1894.*—On June 5 we arrived by rail in the City of Oaxaca. Using this as a base for field operations at distant points during the summer, we worked in the vicinity and up to 7,500 feet on the neighboring slopes of the Cerro San Felipe. The work in the vicinity included the top of the hill known as Monte Albán, the exact site of the excavation in recent years of a mound found to contain an ancient tomb and fabulous riches in pure gold ornaments.

The City of Oaxaca, capital of the state of the same name, is situated at 5,000 feet in a broad interior valley known as the Valle de Oaxaca. The general drainage of the Valley of Oaxaca is toward the south and southwest. The extreme northern end of the valley lies about 30 miles north of the city, where the Continental Divide, at about 6,400 feet, separates it from drainage which flows north and soon forms a deep canyon, breaking through the mountains and out to the Gulf coast at Alvarado, Veracruz. From Las Sedas, a railroad station near the top of the divide, the valley descends gently to the south, first filled with a series of rounded hills and then as a plain 10 or 12 miles across, bounded on the east and west by ranges of mountains rising to from 9,000 feet to 11,000 feet. On the west side of the valley the mountains continue at varying elevations far to the south and southwest. On the east side of the valley the mountains extend south to near the city and then turn abruptly to an easterly or southeasterly course and continue past the eastern end of an arm of the valley which heads at the town of Mitla. The nearly level plain forming a large part of the valley is broken in places by rolling hills, rising 500 to 1,000 feet above the general level. The Monte Albán, near Oaxaca, is a hill of this character.

The climate in the valley is arid, with summer rains hardly sufficient to grow crops of corn and wheat without irrigation in ordinary seasons. The streams are, therefore, of small size. The united drainage flows south through the Río Atoyac to the Río Verde and enters the Pacific near the boundary of the state of Guerrero. Owing to the arid climate much of the valley is treeless, the arid belt extending up

to about 6,500 feet on the slopes of the bordering mountains, where more vegetation is evidence of an increase in precipitation.

The bottom of the Valley of Oaxaca is an open plain with trees or bushes scattered or irregularly distributed. The mesquite (*Prosopis juliflora*), *Fouquieria formosa*, *Acacia farnesiana*, a *Jatropha*, several species of *Cassia*, *Baccharis*, and two large tree species of *Ipomoea*, one of these with twining ends of branches, are a few of the many common plants. Bald cypresses (*Taxodium mucronatum*) appear here and there along streams. One of these is the famous tree at Santa María del Tule, near the city of Oaxaca, with a trunk circumference of 51.8 meters. *Schinus molle* and a large pecan tree have been introduced and grow abundantly about towns. A few cactuses occur.

The mountains on the east side of the valley, south of Oaxaca, and near Mitla and Las Sedas are largely of limestone. Elsewhere in the general region they are made up of metamorphic rock with no evidence of volcanic action. The summer season is the time for rains, which occur as showers and rarely as continuous storms. The winters are dry with rather severe frosts.

The general appearance of the valley bottom is that of the arid Lower Austral Zone to which it belongs. The bordering mountain slopes from 6,500 feet up to about 7,500 feet, however, bear oaks and manzanita bushes (*Arctostaphylos*) and are assignable to Upper Austral Zone.

**Oaxaca**—mountains 15 miles west (8,800 to 9,500 feet):

*September 10-19, 1894.*—Leaving Oaxaca on September 10 we traveled southwest down the open valley about 8 miles to the town of Cuilapan. On the following day our direction was west into the mountains that extend along the west side of the Valley of Oaxaca. We passed the town of Santa Inéz and, crossing the summit of the range at 9,500 feet, descended into a wet meadow at 9,300 feet on the west slope known as Nevería Herrera.

These high mountains, which appeared to have no distinctive name, are somewhat isolated, the only connection with the high mountains to the east being through low hills north of Oaxaca. The upper slopes are well watered, and general conditions much as on Cerro San Felipe. Specimens were labeled "Mountains 15 miles west of Oaxaca," but as we later learned the direction was more nearly southwest.

**Panixtlahuaca to Juquila** (see Juquila).

**Pinotepa Nacional (300 feet):**

*February 19-23, 1895.*—A large town variously known as Pinotepa, Pinotepa del Estado, and Pinotepa Nacional, 15 or 20 miles from the coast in southwestern Oaxaca. Specimens were labeled "Pinotepa." From Llano Grande we traveled east about 24 miles to Pinotepa February 19. The route was at first a continuation of the plain at the former locality and then again entered the low rolling hills and dry sterile ridges of white granite rock that we had seen nearly all along the way from Acapulco. Arid Lower Tropical Zone.

**Pinotepa to Jamiltepec (see Juquila).****Pluma (3,000 to 4,700 feet):**

*March 16-21, 1895.*—Pluma, or Pluma Hidalgo, is a town at 4,600 feet about 20 miles from the coast, southern Oaxaca. Most of our work here was in the woods adjoining the coffee plantations at about 3,000 feet, below the town. The town is located on the crest of a ridge known as the Sierra de Pluma, a southern projection between the valleys of the Río Tonameca and the Río Copalita from the high Sierra Madre del Sur of the interior. The Sierra de Pluma is thus set out prominently in front of the main higher mountain mass of ridges and rounded summits lying behind it to the north. Near Pluma the end of the spurlike ridge rises prominently to a high, rounded summit reaching to between 5,000 and 6,000 feet, affording a fine view toward the sea about 20 miles away. It falls away behind to about 4,000 feet and then rises rapidly again toward the main range to another rounded summit back of Pluma, higher than the first. The Arid Lower Tropical coast belt ends at about 2,500 feet on the mountain slope facing the sea. A Humid Upper Tropical area extends from 2,500 feet up to about 5,000 feet, which appears to be near the frost line near Pluma. Most of the coffee, for which this vicinity is noted, is grown between 2,500 and 4,000 feet. The humid climate is evidently due to local topography, involving exposure to moisture-laden air currents from over the Pacific.

**Puerto Angel (100 to 300 feet):**

*March 9-14, 1895.*—Puerto Angel is a village on the Pacific coast at the very southern extremity of the state of Oaxaca. From Juquila our trail on March 4 crossed a high ridge lying to the east of the town, at an altitude of 7,000 feet. This ridge is a southern spur of the main range, which has a trend from east to west and reaches elevations of 8,000 to 9,000 feet. Descending the steep slope on the southeast side of the divide a series of ridges led down to about 1,700 feet in a nar-

row valley at Nopala, 23 miles from Juquila. The next day we left Nopala, keeping the same course and, crossing a high ridge, again descended toward the coast to the village of San Pedro Mixtepec at an altitude of 750 feet about 20 miles from our starting point. On March 6 we made 22 miles in an easterly course to the village of Colotepec at an altitude of 250 feet. On March 7 we reached Cozotaltepec, 24 miles beyond at an altitude of 500 feet. On March 8 we continued 28 miles southeasterly to Pochutla, which is 500 feet above the sea. On March 9 we left Pochutla and proceeded 8 miles to Puerto Angel. Work here was in the vicinity of the port and along the road toward Pochutla. We found Puerto Angel a collection of huts on a small open bay. The general section is arid, but low, thinly forested hills extend down to near the coast. A large forest, however, is said to cover an extensive area of bottomland near the mouth of the Río Copalita, to the eastward. Arid Lower Tropical Zone.

**Reyes** (also known as Reyes Pápalo) (6,700 to 10,200 feet):

*October 15-24, 1894.*—Reyes, or Reyes Pápalo, is a village at 6,700 feet on the west slope of the high mountains about 10 miles northeast of Cuicatlán. From 1,800 feet at Cuicatlán the trail leads in a long series of sharp ascents to Reyes and then continues on up an equally steep course to the top of the divide at 9,400 feet. There it turns down the east slope and descends abruptly into the humid forest that clothes the eastern side down to the hot lowlands of Veracruz. To the north of the trail crossing the summit is the culminating peak, known, locally as Volcán Negro, although there are no traces of volcanic action near the mountain. This peak reaches an altitude of about 10,400 feet. A short distance to the north a great chasm marks the course of the river that bisects the mountain range and carries the united streams flowing from the valleys at Tehuacán, Puebla, at the north, Cuicatlán on the south, and other interior drainage east to the Gulf. Beyond this chasm a high, pine-covered ridge extends north along the eastern border of the tableland of Puebla to near the gap just south of Mount Orizaba.

From the bottom of the valley at Cuicatlán up the west slope to 4,000 feet the climate is hot, and extremely arid conditions prevail. This interior area may be assigned to the Arid Lower Tropical Zone, although it is invaded to some extent by Lower Austral elements. Between 4,000 and 6,000 feet is a zone of mixed oaks and pines, with *Acacia farnesiana* common as high as 5,800 feet. This belt seems to represent the Lower Austral Zone. From 6,000 to 8,500 feet, including the vicinity of Reyes, along with several species of oaks were

the common wild cherry, *Crataegus*, *Sambucus mexicanus*, a blackberry (*Ribes*), and madroño (*Arbutus*). Corn is one of the main crops, and English walnuts are an important article of commerce. Fine-flavored apples and chirimoyas are also grown. Sharp winter frosts occur. This section of the slope seems to be referable to the Upper Austral Zone. From 10,000 feet to the summit there are no oaks, but an open forest of rather stunted pines may represent the Transition Zone. This small area shows evidence of a colder, drier climate than that prevailing a thousand feet below, even on the west slope. Much more humid conditions prevail on the east slope, but our observations on that side were not extensive.

**Río Verde to Panixtlahuaca** (see Juquila).

**San Bartolo** (=San Bartolo Yautepec) (3,000 feet):

*April 21-22, 1895.*—San Bartolo is a village at 3,000 feet about 35 miles southeast of Totolapa, on a tributary of the Río Tequisistlán. It was an overnight stop on our route from Oaxaca to Tehuantepec. Arid Lower Tropical Zone.

**San Carlos** (=San Carlos Yautepec) (3,100 feet):

*April 20-21, 1895.*—A village at 3,100 feet about 18 miles northwest of the village of San Bartolo. The locality was an overnight stop on our route from Oaxaca to Tehuantepec.

**San Carlos to San Bartolo** (see San Bartolo).

**San Gerónimo** (also mapped as San Jerónimo Ixtepec) (300 feet):

*June 28-July 8, July 11-13, 1895; February 13-14, June 8-9, 11-13, 18-19, 1904.*—San Gerónimo is a town at 300 feet on the railroad about 20 miles north of Tehuantepec, on the southern side of the Isthmus of Tehuantepec. At this point the International Railways of Central America connect with the line of the National Railways of México across the Isthmus. The town was visited briefly several times en route to other places.

**San Mateo del Mar** (25 feet):

*May 14-18, 1895.*—San Mateo del Mar is a village of Indian fishermen on a narrow strip of sand dunes and flats lying between the sea and the salt lagoon, Laguna Inferior, about 21 miles southeast of the city of Tehuantepec. This strip, 1 to 2 miles across, is rolling in configuration, owing to the sand dunes formed by the winds that often blow violently from one side or the other. The land surface is mainly

open and covered with salt grass (*Distichlis*), but here and there narrow belts of scrubby trees and bushes appear. Arid Lower Tropical Zone.

**San Miguel Albarradas** (6,500 feet).

*June 30 to July 2, 1894.*—Leaving Mitla in the valley of Oaxaca on June 30 with pack and saddle animals we entered the rough mountains to the northeast and made about 15 miles to the village of San Miguel Albarradas at 6,500 feet. The village is on the steep eastern slope of the Continental Divide we had crossed at about 7,600 feet.

**San Miguel Huautla** (see Coixtlahuaca).

**San Miguel Suchixtepec** (erroneously given as "San Pedro Suchistepec" in mammal catalog) (9,000 feet):

*March 21-22, 1895.*—San Miguel Suchixtepec is a village at 9,000 feet near the top of the Sierra Madre del Sur, about 30 miles southeast of Miahuatlán, southern Oaxaca. Proceeding northerly from Pluma on March 21 we crossed a divide in the Sierra de Pluma, which took us up to 5,600 feet, and then descended to the valley of a river, probably the Río Tonameca, at 3,400 feet. Leaving the valley we ascended the long steep slopes of the main range, over zigzag trails, until we reached the top of a high ridge, soon plunging down again to the depths of another canyon, and beyond was another long climb up to the village of San Miguel Suchixtepec. Here on every hand the mountains rise with steep slopes but are not very rugged or rocky. On the slopes everywhere were evidences of abundant summer rains in the grass and other small vegetation, but trees and bushes were rather scattering especially on south slopes where the hot winter sun parches the ground. Streams and springs were very scarce in crossing this part of the range. On March 22 we continued northward about 30 miles mainly through the mountains, but in the afternoon we came out in sight of the broad basinlike southern arm of the Valley of Oaxaca, and descended to the town of Miahuatlán, at 5,700 feet. A change from warmer-country elements was noted in the vegetation at about 6,500 feet in ascending on the Pluma side of the mountains. A blue-flowered *Solanum* not noted before, *Ceanothus coeruleus*, a wild cherry, two or more oaks, and pines, were common up to about 8,000 feet. At 9,000 feet and above were two or more pines, oaks, alders, madroño, and other species. On the slope facing the Valley of Oaxaca there was evidence of a much more arid climate than at the same altitude on the coast slope.

**San Miguel Suchixtepec to Miahuatlán** (see San Miguel Suchixtepec).**San Pablo Yaganiza** (3,900 feet):

*July 2-3, 1894.*—On July 2 we covered about 16 miles of very steep, rough trails, from San Miguel Albarrados in a northeasterly course to the village of San Pablo Yaganiza at about 3,800 feet, in the rugged canyon of the upper course of the Río Cajones. At the river in the narrow bottom of the canyon the altitude is about 2,400 feet. The canyon is quite arid, but tropical conditions are here extended for a considerable distance back into the mountains. At Yaganiza bananas and sugarcane are grown by irrigation in a small way. Large sycamores were noted along the river.

**San Pedro Cajones**—near (8,000 feet):

*August 4-5, 1894.*—Leaving Yalalag on August 4 we crossed the Río Cajones, below the town, at 2,400 feet, and then laboriously ascended the long, steep slope on the opposite side, covering about 16 miles westerly to Rancho Crisantha, at 8,000 feet near San Pedro Cajones.

**San Pedro Mixtepec to Colotepec** (see Puerto Angel).**Santa Efigenia** (550 to 1,500 feet):

*July 17-31, 1895; February 19, 1904.*—Santa Efigenia was a hacienda at 550 feet, about 8 miles in a northerly direction from Tapanatepec, and within a few miles of the Chiapas boundary, in southeastern Oaxaca.

All the way from San Gerónimo, on the Isthmus of Tehuantepec, via Zanatepec and Tapanatepec to Santa Efigenia, our route in July 1895 was over the nearly level or very slightly rolling coast plain that slopes gently from the base of the mountains of the interior to the sea, forming a lowland strip 15 to 30 miles wide. I revisited the place in February 1904. Scattered here and there over the coast plain are small hills of slight elevation and little importance. The mountains, practically an eastern continuation of the Sierra Madre del Sur, locally known as Sierra de la Gineta, paralleling the Pacific coast, rise abruptly from the plain, the front of the range cut by many deep gorges, and the higher peaks near Santa Efigenia reaching 5,000 or 6,000 feet. These are composed, in part at least, of limestone. The climate, as shown by the vegetation, is much the same as near Tehuantepec, and the general area is assignable to the Arid Lower Tropical Zone.

Santa Efigenia was once a large hacienda. The naturalist Sumichrast married one of the daughters of the former owner and lived there three years. At the time of our visit the large headquarters building of masonry had been abandoned, and a few Indians living in the vicinity were herding the cattle of one of the heirs. Specimens were collected near the hacienda and up to about 1,500 feet on the slopes of the neighboring hills.

**Santa María Ozolotepec**—mountains near (10,000 feet):

*March 24-27, 1895.*—This locality is a ranch called La Cieneguilla at 10,000 feet in the Sierra Madre del Sur, near the village of Santa María Ozolotepec and about 24 miles by trail southeast of Miahuatlán. On March 24 we left Miahuatlán and traveling southeast returned again into the mountains of the main range only a few miles to the east of the trail we followed northward from San Miguel Suchixtepec. Our camp at La Cieneguilla was in one of the highest parts of the range, the altitude being 10,000 feet, with summits rising nearly 1,000 feet higher nearby. The flora of the valley at Miahuatlán is practically the same as near the City of Oaxaca. The mountains bordering the valley are largely bare of trees below 6,500 feet. Above that level the pine forest extends to the summit. It is interspersed with scrub oaks up to about 8,000 feet, and with larger oaks, alders, and madroños on most slopes above that point. Near our camp at 10,000 feet, however, a fine pine forest with a few oaks interspersed covered a large part of the mountain top. Although frosts are severe here and the climate is cold and damp, firs (*Abies religiosa*) are very few and limited to narrow strips along north-slope canyons near the top. This is probably due to a scarcity of soft soil, and the small amount of moisture retained in the ground.

**Santo Domingo** (900 feet):

*June 7-14, 1895.*—Santo Domingo is an Indian village at about 900 feet, 7 or 9 miles west of the station of Lagunas, on the railroad across the Isthmus of Tehuantepec. It was reached with our pack outfit, and we remained until June 14, collecting mainly along the lower slopes of neighboring foothills and lower parts of open canyons down which small headwater streams carry drainage to the Gulf. Owing to low elevation and distance from the Gulf, however, the rainfall is not excessive.

**Santo Domingo**—mountains near (1,500 feet):

*June 14-21, 1895.*—On June 14 we left Santo Domingo and entered the mountains for about 12 miles in a northwesterly direction to the

summer camp of the Santo Domingo Indians, known as La Rancharía. Specimens from there were labeled "Mts. near Santo Domingo."

From Santo Domingo the trail ascended a long canyon to the top of a ridge at 2,600 feet. After following the crests of some connecting ridges for a few miles it descended into a beautiful, narrow valley to the native village at about 1,500 feet on the bank of a small tributary of the Río Coatzacoalcos. Although not very high, the climate of the locality is delightful. These mountains rise to about 3,000 feet on the continental backbone, on the western side of the low gap across the Isthmus of Tehuantepec. Mountains similar in height represent a continuation of the Continental Divide east of the gap. A short distance up the canyon above Santo Domingo the limestone is left behind, and the mountains are composed of a more sterile formation extending to the village. The soil is kept humid, however, by never-failing rains, and on small areas along the bottom of the valley near the village various crops, including corn, beans, and coffee, are cultivated. The poor soil of the mountain tops supports a thin, scattered stand of pines and two species of scrubby oaks, with a ground cover of grasses, which do not become luxuriant. Some of the slopes bearing soil of a little better quality support a rather dense but low forest of various deciduous trees. Humid Lower Tropical Zone.

**Tamazulapam** (or Tamazulapan) (7,000 to 7,800 feet):

*November 12-16, 1894.*—Tamazulapam is on the western side of a basinlike valley at 7,000 feet, near the foot of a range of mountains rising to from 8,000 to 8,500 feet in northwestern Oaxaca. On November 12 we left Coixtlahuaca and followed the trail over a roundabout course across the broken plateau for about 22 miles a little south of west to Tamazulapam. As near Coixtlahuaca, the hills and ridges are of limestone, and the valleys and lower slopes are underlaid with "tepetate." The area is arid and for the most part treeless, except for the low, scrubby stand of oaks on the tops of the higher hills and ridges. Sharp frosts occur in winter. On warm slopes many *Ipomoea* trees with large woolly calyx were a feature of the vegetation. Upper Austral Zone.

**Tapana** (see Tapanatepec).

**Tapanatepec:**

*July 16-17, 1895; February 18-20, 1904.*—Tapanatepec is a town at low elevation on the coastal plain near the border of Chiapas in southeastern Oaxaca. An overnight stop was made by Nelson and me on

our way from Zanatepec and points west to Santa Efigenia, July 16, 1895, and the locality was revisited by me en route from Ixhuatán to the interior of Chiapas, February 18-20, 1904. Specimens collected were labeled "Tapanana," a local name for the town. The coast plain, broader farther west, is narrowed near Tapanatepec, where the Sierra de la Gineta approaches the coast, but continues as a narrow strip toward the east.

**Tehuantepec** (or City of Tehuantepec) (150 feet):

*April 24 to May 4, May 18 to June 1, 1895; March 31, 1896; February 9-12, 1904.*—The well-known City of Tehuantepec, at 150 feet, about 20 miles inland, is on the southern side of the Isthmus of Tehuantepec. Work here was in the vicinity of the town, and on May 22 we moved 8 miles up the Río Tehuantepec to near the base of the Cerro de Giengola. There we camped at 1,400 feet until May 24, when we returned to the city. Specimens taken at camp on the Cerro de Giengola were labeled "Near Tehuantepec." The Cerro de Giengola, the highest mountain in this vicinity, rises steeply to about 3,000 feet on the right bank of the Río Tehuantepec. It bears a thin stand of pines on the top but like the surrounding country is Arid Lower Tropical in zonal character. The mountain is exceedingly dry, with no apparent water supply during the dry season, but on the slopes and extending up to the summit extensive ruins are evidence of intensive human occupation in the distant past. Scattered through the coastal belt in the Tehuantepec region are various isolated hills rising from the broad plain, a few of which reach to about 1,000 feet. The Río Tehuantepec, flowing past the city and across the plain, is 25 to 50 yards across and easily fordable during dry weather but becomes a large stream difficult or impossible to cross at times during the rainy season.

The rainy season does not usually begin on the south side of the Isthmus of Tehuantepec until toward the end of May or early in June and lasts until October or November. During this period heavy showers may occur nearly every day. During the long dry season, however, practically no rain falls, and the contrast with conditions on the north side of the Isthmus is very striking. The winter storms, called northers, which give the north coast its humid climate, discharge their moisture over the north slope of the isthmus and affect the south coast merely as windstorms, called by the natives *norte seco*, meaning dry norther. In crossing the isthmus from north to south we noted a rather abrupt change in the character of the vegetation near the station of Matías Romero, formerly Rincón Antonio.

This change marks the passage from the Humid Lower Tropical to the Arid Lower Tropical Zone. The heavy, humid, evergreen forests give way to a forest of smaller growth with evidence of aridity progressive toward the Pacific coast. During the dry season the great majority of the trees drop their leaves, except along watercourses, and the forest takes on a northern winter general aspect. Near Tehuantepec a rather thin stand of trees and bushes is often overgrown with tangled vines of various kinds. The woods are low and fairly uniform in height, usually ranging from 20 to 30 feet. Stiff, thorny bushes abound, and the rigid character of the woody vegetation makes the thickets difficult to penetrate. Among the most common plants are the guásima (*Guazuma ulmifolia*), two species of *Jatropha*, two or more species of *Ficus*, a tree *Ipomoea*, an *Annona*, a silk-cotton tree, two species of *Pithecolobium*, a *Malvaviscus*, *Prosopis juliflora*, *Acacia farnesiana*, *Cassia*, the wild gourd tree, and various cactuses. Large fan palms occur singly or in groves here and there. Arid Lower Tropical Zone.

Tehuantepec was revisited by the writer alone February 9-12, 1904.

#### **Tehuantepec to Juchitán** (see Lagunas).

#### **Tequisistlán** (Tequisistlán on some maps) (600 feet):

*April 23-24, 1895.*—Tequisistlán is a town at 600 feet on the Río Tequisistlán, about 35 miles northwest of the City of Tehuantepec. It was an overnight stop on our route from Oaxaca to Tehuantepec. Arid Lower Tropical Zone.

#### **Tlapancingo** (5,200 to 7,500 feet):

*December 6-9, 1894.*—Tlapancingo is a town at 5,200 feet near the boundary of Guerrero in northwestern Oaxaca. On December 6 we proceeded eastward about 14 miles from Tlalixtaquilla, Guerrero, to Tlapancingo, crossing the state boundary about midway en route. On December 9 we returned to Tlalixtaquilla. From Tlalixtaquilla to Tlapancingo our route was up the same stream we followed on our way from Tlapa, with the exception of a short cut through the hills across a long bend. The country along the way rises steadily to Tlapancingo at the west base of a high mountain range covered with oaks and pines and forming a northern spur of the Sierra Madre del Sur, which has a general trend from west to east. The mountain range here slopes up steeply to form a narrow ridge at about 9,000 feet. Farther south toward the main range the mountains are higher and broader on top, with a colder climate and more abundant rains, according to the natives. Toward the north these mountains decrease in height. The

range is mainly of limestone in this vicinity. The rarity of springs and the stunted character of the oaks and pines show the general aridity of the climate. We worked in the vicinity of the town and one night set traps at 7,500 feet on the slope of the mountains to the east, lying between Tlapancingo and the town of Silacayoapan. Watchful and suspicious Indians made trapping difficult, as any traps that could be located by them were almost sure to be stolen. The vicinity of Tlapancingo is in the Lower Austral Zone. The town is near the upper limit for the growing of oranges. The appearance of small oaks, pines, and junipers at about 6,500 feet marks the transition to Upper Austral Zone.

**Tlapancingo to Tlalixtaquilla** (see Tlapancingo).

**Totolapa**—near (4,000 feet):

*April 18-19, 1895.*—Totolapa, or Totolapan, is a village at 3,400 feet on the Río Grande, the main upper branch of the Río Tehuantepec, about 25 miles southeast of Tlacolula in the south-central part of the state. Specimens labeled "Near Totolapa" were taken at the rancho of Los Bichones at 4,000 feet, about 14 miles southwest of Totolapa, on the trail to the city of Tehuantepec. This rancho and the village of San Carlos, 17 miles farther on, were overnight stops en route to Tehuantepec. Arid Tropical Zone.

**Totolapa to San Carlos** (see Totolapa).

**Totontepec** (3,700 to 6,500 feet):

*July 13-26, July 31 to August 2, 1894.*—On July 13 we left Yacochi on Cerro Zempoaltepec and followed the trail about 15 miles in a northerly direction, around and down the east slope diagonally to Totontepec. This is another Mije Indian town. One of the main mule trails of the region passes here. The people are more accustomed to seeing strangers, and we found them more friendly than at Yacochi. The time from July 20 to July 23 was spent at a group of Indian ranches located at 3,700 feet on a small stream farther down the slope. Specimens from there were labeled "Near Totontepec."

Totontepec is situated at about 6,000 feet within the humid belt on the east slope of the mountain range between the San Juan and Playa Vicente watersheds, north of Cerro Zempoaltepec. At the time of our visit during the wet season almost daily rains occurred and the air seemed saturated with moisture. The slopes of the mountains here are steep and cut by numerous canyons through which clear sparkling water descends in rapids and cascades toward the hot plains of Vera-

cruz. Totontepec is within the oak forest characteristic of the humid belt extending from 5,000 to 9,500 or 10,000 feet on the northern slopes of these mountains. Immediately about the town the slopes have been cleared for cultivation, so that open fields or low second-growth thickets of brush prevail. Farther away, particularly higher up the slope, are still great areas of unbroken forest. Between 4,000 and 5,000 feet below Totontepec to the northeast the trail passes through a magnificent forest consisting mainly of liquidambar (*Liquidambar styraciflua*) with trunks often 3 to 5 feet in diameter and 75 to 100 feet to the first limbs. Between 5,000 and 6,000 feet manzanita bushes (*Arctostaphylos*) occur. The main crops are corn and beans and such fruits as peaches, apples, and quinces. At the ranches below Totontepec some of the hills are covered with oaks, but the forest is open and grassy, and the reduced vegetation indicates far less rainfall. Here at 3,700 feet crops of sugarcane, coffee, bananas, pineapples, oranges, mangoes, and avocados of several kinds are produced. The locality is in the Humid Upper Tropical Zone.

#### Tuxtepec (300 feet):

*April 3-12, 1894.*—At Otatitlán on the Río Cosamaloapan, near the western border of Veracruz, we hired pack and saddle animals to take us about 15 miles southwest across country to Tuxtepec, at about 250 feet farther up on the same river and within the northern boundary of Oaxaca. Some work was done in the immediate vicinity of the town, but we were more successful during a visit of several days to the border of the virgin forest about 10 miles southwest of Tuxtepec.

Near Tuxtepec the outlying limestone foothills of the mountains of the interior begin to rise from the coastal plain at an altitude of 500 or 600 feet. Numerous small rivers draining the Gulf slope of the mountains, from the Río Blanco at Orizaba to the Río San Juan near the Isthmus of Tehuantepec, cross the lowland plain in tortuous but converging courses and unite with one another until all find an outlet in the large lagoon or Bay of Alvarado. The foothill region from Tuxtepec inland has a much more humid climate than the low plain extending toward the sea, as shown by the more luxuriant tropical vegetation, but both areas are included within the Humid Lower Tropical Zone.

#### Yalalag (renamed Villa Hidalgo) (3,000 feet):

*July 3-4, August 2-4, 1894.*—Yalalag is a large Indian town, more likely to be shown on recent maps as Villa Hidalgo, in the rugged east-slope mountain region east of the city of Oaxaca. The night of

July 3 was spent at Yalalag en route to Mount Zempoaltepec. On the return trip from Totontepec, on August 2, the high range separating the Río San Juan and Río Playa Vicente watersheds was crossed at about 8,000 feet some 10 miles north of Mount Zempoaltepec. From the summit we descended the west slope to Yalalag at 3,800 feet and about 22 miles from our starting point. We remained here two days, mainly to rest our nearly exhausted pack and saddle animals. From 2,800 to 5,000 feet along the canyon slopes near Yalalag an arid climate is evidently due to the high ridge on the east that intercepts the moisture-laden air currents from the Gulf. Among the common shrubs is *Acacia farnesiana*. A few sycamores grow at 2,400 feet along the river.

Zanatepec to Tapaná [=Tapanatepec] (see Santa Efigenia).

#### PUEBLA

**Acatlán (4,100 feet):**

*November 20-22, 1894.*—Acatlán is a town at 4,100 feet on the Río Mixteco, a branch of the Río Balsas in southwestern Puebla. From Huajuapán, across the state line, via Petlalcingo to Acatlán, Puebla, a distance of 26 miles, our route was through a rolling, moderately hilly country with long stretches of nearly level trail. The hills and ridges are of limestone and the intervening areas of "tepetate" due to limestone erosion. The general section is arid and the insignificant streams all flow westward toward the Río Balsas. The highest altitude on our route was a little over 6,500 feet, and the lowest was 4,100 feet at Acatlán. Here and there low mountains reach 7,000 to 8,000 feet, but from several vantage points along the way it became evident that a sloping region of moderate elevation extends across the upper part of the drainage basin of the Balsas River, leaving no pine-covered mountain connection between the Volcano of Popocatepetl and high mountains in western Oaxaca.

No pines were seen on any of the hills in this district. From 5,000 to 6,500 feet along the road fan palms were very abundant, and at the latter level might be mixed with the oaks that form the main tree-growth on the higher hills. Two species of tree *Ipomoea* were numerous, but below 5,000 feet the one with smooth calyx is commonest and often wholly replaces the woolly one, which thrives in higher, somewhat cooler situations. *Pithecollobium* is a common tree at lower elevations. Everywhere the hills are covered with low, brushy thickets, with stunted and gnarled trees of low stature and broad or rounded

tops rising above the general level. The scarcity of water, due to irregularity of rains, and the rocky sterile character of most of this section have prevented extensive settlement, and the population is widely scattered. Crops are corn, sugarcane, oranges, limes, pomegranates, bananas, guavas, and anonas. Acatlán may be placed near the border between the Arid Lower Tropical and Lower Austral Zones.

**Acatlán to Piaxtla** (see Piaxtla).

**Amolac** (4,100 feet):

*November 27-28, 1894.*—Amolac is a small Indian town at 4,100 feet south of the Río Mixteco and near the border of Guerrero, in southwestern Puebla. Leaving the valley at Piaxtla on November 27 we crossed a low divide in a southerly direction and descended a long slope to the Río Mixteco. At the point of crossing the river was 3 feet deep in the middle and 50 to 75 yards wide. It is evidently a large stream in the rainy season. As the upper course of the river is through limestone country the water is thoroughly impregnated with lime and has a peculiar milky color, becoming greenish in deep places. Continuing southward after fording the river we traversed another succession of hills with easy slopes until we reached Amolac, about 18 miles from Piaxtla. Arid Lower Tropical Zone.

**Atlixco** (5,400 feet):

*July 23 to August 1, 1893.*—Atlixco is a town at 5,400 feet about 20 miles southwest of the City of Puebla and few miles southeast of the base of the Volcán de Popocatepetl. The location is in the middle of a broad, nearly level valley, sloping from the border of the higher tableland near the City of Puebla toward the south. Drainage from the valley is into the Río Nexapa, a branch of the Río Balsas, at the southern edge of the plain of Puebla, north of Atlixco. At this point there is a gap in the continental backbone which is continued, however, in a low range of mountains to the southeast. Owing to proximity to Mount Popocatepetl the rainfall is plentiful in summer, the general area is fertile, and much of the land is in cultivation. It is near the frost line and upper limit for the growing of sugarcane, but fruits include oranges, lemons, pomegranates, guayabas, chirimoyas, mangoes, avocados, peaches, pears, apples, quinces, and a few sickly bananas. Lower Austral Zone.

**Chalchicomula** (see San Andrés Chalchicomula).

**Esperanza (8,000 feet):**

*April 8, 1893.*—Esperanza is a railroad station on the level plain at the extreme eastern border of the high tableland near the southwestern base of the Pico de Orizaba. A horse-car line connected Esperanza with Chalchicomula, the town at the extreme base of the mountain several miles away. Esperanza was visited by us en route to Chalchicomula.

**Huauchinango (5,000 feet):**

*January 3-16, 1898.*—Huauchinango is a large town at 5,000 feet at the base of the first steep slope leading down from the tableland toward the Gulf in northern Puebla. From Tulancingo, on the railroad in Hidalgo, I proceeded by stage about 31 miles northeast to Huauchinango, January 3. Collecting was carried on near the 5,000-foot level for several miles in all directions. The stage road from Tulancingo led for 15 or 20 miles through rolling country with timber only on the higher hills, ascending gradually to an altitude of about 7,300 feet, where it crossed a low range of mountains and descended rapidly to Huauchinango. This low range of mountains marks here the extreme eastern edge of the tableland. The town is situated near the head of a fine, fertile valley several miles across, which narrows to a canyon at the lower end. Below the town ridges lying parallel to one another and with deep canyons between slope down more gradually toward the coast. As noted elsewhere there is an abrupt change to a much more humid climate below the edge of the tableland. Slight frosts occur in the valley at Huauchinango in winter, but freezing rarely occurs at lower elevations on the Gulf slope.

From Tulancingo to the edge of the tableland the country is covered with a short and rather scanty growth of grass with pines only on the higher hills. From the edge of the tableland down to Huauchinango pines of at least three species are the most conspicuous trees. Of these three, one with long, drooping leaves is by far the most abundant. This pine was noted at various localities in the mountains along the eastern edge of the tableland from Las Vigas, Veracruz, to Pinal de Amoles, Querétaro. The liquidambar, alder, elder, guayaba, and several species of *Solanum* grow near the town. In the pine forest on the slope above the town there is very little undergrowth of any kind, but in the arroyos are many large ferns and shrubs of numerous species. Oaks and other trees, more tropical in character, gradually replace the pines a short distance below the town. The principal crop raised in the valley at Huauchinango is corn. Very little fruit of any kind is grown, but a short distance farther down the slope oranges,

bananas, chirimoyas, and other tropical fruits are produced in abundance. The valley at Huauchinango lies near the lower edge of the Lower Austral Zone.

Metlatoyuca (800 feet):

*January 18 to February 27, 1898.*—Metlatoyuca is a town at 800 feet near the base of the mountains and on the border of the broad coast plain in extreme northern Puebla. I left Huauchinango with a pack outfit on January 16 and descended the slope 27 miles to the little Indian village of San Pedro, to the northeast. On January 17 I continued on about 25 miles in the same direction to Rancho Nuevo, and on the following day reached Metlatoyuca, 6 miles farther. From Metlatoyuca as headquarters work in the forests extended for 8 or 10 miles in all directions. The town is situated on one of the flat-topped limestone hills or mesas common along the base of the mountains in this section. These hills usually rise 200 or 300 feet above the plain. The ridges along the east front of the mountains between Huauchinango and Metlatoyuca decrease rather gradually in height but are separated by very deep canyons through which flow swift streams with frequent high falls along their courses.

In descending from Huauchinango to Metlatoyuca the vegetation becomes progressively more tropical. The pines end a short distance below the town, and the oaks become restricted to scattered patches until an altitude of about 3,500 feet is reached and the rainfall becomes excessive. Within a rather narrow belt at about this elevation a heavy forest is made up largely of oaks and especially on northeast slopes the branches are loaded with orchids, bromelias, ferns, and other moisture-loving plants. Oaks are not common below this belt until the coastal plain is reached, where at least one species occurs on the flat-topped mesas. Most of the country near Metlatoyuca was covered at the time of my visit with a dense humid tropical forest. Tall bamboos grew in places along the streams.

The regular wet season is from June to December, but some rain falls throughout the year. Near the coast the climate is much drier, but more humid than the coastal plain in the vicinity of Veracruz. Frosts so slight as to be almost imperceptible were said to occur at Metlatoyuca nearly every winter. The only serious frost damage reported came several years before my visit and was coincidental with much damage in Florida. At that time most of the coffee trees were killed to the ground. The forest trees on exposed slopes above Metlatoyuca were severely frozen and many of them killed, as shown by the bare trunks that were still standing. I was told by the people that many

birds were killed. Some flew into the houses and died on the floor. The only birds they could positively identify, however, were the trogons, but there were many small birds of which they knew no names. Humid Lower Tropical Zone.

Petlalcingo to Acatlán (see Acatlán).

Piaxtla (3,900 feet):

*November 22-27, 1894.*—Piaxtla is a village at 3,900 feet about 22 miles by trail west of Acatlán, southwestern Puebla. From Acatlán to Piaxtla our route was across a series of rounded limestone hills rising from 5,000 to 6,500 feet, and then down along the winding course of a small stream, the hills suddenly giving way to the level valley several miles across at Acatlán. The climate is hot and dry. Several small mahogany trees were growing in the village and the species is said to be rather common in parts of the surrounding hills. Several species of wild fig and large cactuses were noted. Mesquites, acacias, cassias, and euphorbiaceous plants are common. Over the hilltops and ridges above 5,000 feet fan palms grow in profusion. Corn, sugarcane, and bananas are important crops. The birds at this locality show strongly the influence of the west coastal fauna. Arid Upper Tropical Zone.

Piaxtla to Amolac (see Amolac).

Pico de Orizaba (= Mount Orizaba) (9,500 to 12,500 feet):

*April 19-28, 1893; March 18-21, 1894.*—Leaving Chalchicomula in the morning of April 19 we were nearly 10 hours with saddle and pack animals in making about 15 miles to a rock shelter close to timber line on the southeast base of the main peak at an altitude of about 12,500 feet. We made camp, however, in time to set some traps. At 2 o'clock the next morning we were out preparing for the ascent of the peak and at 7 a.m. had reached the foot of the final long, steep slope at about 15,000 feet, where we left our horses. At 11 a.m. we were on the summit and returned to camp in time to gather and reset the traps. On April 21 we descended the west slope of the mountain to a point at about 9,500 feet, where a family of Indians was living by a potato field. Here we camped during the rest of the time we were on the mountain, working up and down the slopes in that vicinity.

On March 18, 1894, we again left Chalchicomula, ascended the western slope of the mountain, and crossed the pass between the main peak and the Cerro Negro to the sulfur-gatherer's cave near timber line. On the 19th I made a second ascent to the summit. On March 21

we skirted the upper border of the pines near timber line to the wall of a deep canyon, which leads directly down the east slope. There we turned and descended to the base of the main mountain at 10,000 feet. Farther down at about 8,500 feet we left the mountain flanks and turning toward the south entered the limestone hills and ridges that intervene between the mountain and the lowlands of Veracruz. The limestone is uptilted, and it is evident that the great lava mass of the peak is superimposed on this formation. We camped at an Indian village and continued to the City of Orizaba the following morning.

The Pico de Orizaba, or Volcán de Orizaba, commonly referred to as the Peak of Orizaba, or Mount Orizaba by English-speaking people, is the Citlaltepētli, meaning Star Mountain, of the Aztecs. It is an extinct volcano and the highest mountain in North America, south of Alaska. The altitude, according to the United States Coast Survey, is 18,314 feet. The Geographical Commission of México credits the mountain with still greater height. With the exception of a solitary spur, the Cerro Negro, on the southern side, the gigantic bulk of Mount Orizaba rises as a single, fairly regular cone from an altitude of 8,500 or 9,000 feet to the rim of the crater at the top. The crater walls are complete, surmounted on one side by a point known as El Púlpito, rising about 300 feet above the level of the opposite rim. To the east the descent is rapid through a series of hills and ridges toward the hot lowlands of Veracruz. We did not visit a rain-forest belt on this slope. To the south and west the summit overlooks the great plateau, and a magnificent panoramic view extends to the high mountains about the Valley of México. To the north a range of mountains connects the Peak of Orizaba with another high mountain mass, culminating above timber line in the Cofre de Perote. From about 15,000 feet to the summit the ascent of Mount Orizaba is very steep, but by following a ridge of broken lava extending up the south slope we climbed to within 600 or 800 feet of the lower rim of the crater before we were forced to cross any snow. This was owing to the fact that we ascended the mountain at the end of the dry season and the sun had melted the snow from this slope up to near the 17,500-foot level. On the north and northwest slopes the snow is permanent above about 15,000 feet, and small glaciers may remain there. Five or six miles south of the main peak of Mount Orizaba and rising like a huge spur on its shoulder is the Cerro Negro. This is an old crater peak about 15,000 feet high, separated from the main mountain by a narrow pass at about 12,500 feet. A great fissure is cut into the west face of the Cerro Negro where the former crater is broken down.

The western slopes of Mount Orizaba, from 8,500 feet to timber line, are well forested, and the distribution of the vegetation is in several distinct belts representing the major life zones. Final conclusions in regard to the delimitation of these zones should be based on more complete observations than we were able to make in so brief a time. A lower pine belt, also including some oaks and a wild cherry, extends upward from about 8,200 feet near the extreme base to about 9,500 feet. This seems to have much in common with the Transition Zone. A fir belt, on the west slope marked prominently by the occurrence of *Abies religiosa*, a large alder (*Alnus*), and sacatón grass from 9,500 to 11,000 feet, seems to be assignable to the Canadian Zone. On the east slope the firs do not form a complete belt but occur in scattered lines along canyons and ridges between 10,500 and 11,800 feet. An upper pine belt in which two species of pines occur reaches from about 11,000 feet to timber line (12,500 to 13,200 feet). Above 12,000 feet the forest gradually becomes thinner and the trees more stunted. At and just above pine timber line *Juniperus mexicana* was noted. The upper pine belt may be representative of the Hudsonian Zone of the far north. An alpine belt extends from timber line to the limit of vegetation. A few small herbaceous plants reach an altitude of about 14,500 feet. At about 15,000 feet on the south slope the last straggling tufts of grass ceased, but beyond this several species of mosses and lichens held their own in sheltered crevices among the rocks up to about 16,500 feet.

**San Andrés Chalchicomula (8,200 feet):**

*April 8-18, April 29 to May 1, 1893; January 14-15, March 14-17, 1894.*—A town located on the border of the plain near the southwest base of the Pico de Orizaba. Specimens were labeled "Chalchicomula." To the east and northeast the country rises in a rather gradual slope to an altitude of about 9,000 feet, 4 to 6 miles above the town, where it becomes more abrupt at the foot of the main mass of the Peak of Orizaba. To the north and west are low ridges and hills, mainly of limestone formation, rising from the generally level sandy plain. Beyond a few low hills to the southeast the sandy plain continues around the southern base of Mount Orizaba, to the extreme eastern border of the high tableland just east of the railroad station of Esperanza, where the abrupt descent begins down the east slope of the mountains into the hot country of Veracruz. The soil of the slope and plain near Chalchicomula for miles in every direction is made up of alternating layers of volcanic sand, ashes, and pumice with a mixture on the surface of fine detritus brought down from the

sites of ancient glaciers on Mount Orizaba. A favorable terrain is thus provided for the large pocket gopher *Cratogeomys fulvescens fulvescens*, which is very numerous. Owing to the extremely loose, porous character of the soil, water disappears almost as soon as it falls, and the few springs on the west slope of Mount Orizaba are so small that no streams flow out across the plain. The general drainage, however, is toward sinks near the border of Tlaxcala.

The country is cleared of most of its primitive growth over the general surface near Chalchicomula to make room for the cultivation of wheat, barley, garbanso, and other crops. Where uncultivated there is a considerable growth of grass, agaves, cactuses, small oaks, and thorny bushes. The tops of the hills and lower slopes of Mount Orizaba up to about 9,000 feet sustain a scattered growth of small pines.

**San Martín Texmelucan (7,400 feet) :**

*August 11-12, 1893.*—San Martín Texmelucan is a railroad station at 7,400 feet on the western border of the plain of Puebla and near the eastern base of Mount Ixtacihuatl. The drainage is southeast and south through affluents of the Río Balsas. It is a rather arid tableland locality, although summer rains are not infrequent. Frosts occur in winter. Upper Austral Zone.

**Tehuacán (5,400 feet) :**

*May 2-8, 1893.*—The town of Tehuacán is situated at 5,380 feet on the railroad in southeastern Puebla. At Tehuacán a narrow canyon, the Cañada Morelos, which begins the descent from the tableland near the town of the same name, opens on a broad, flat valley. The valley is nearly level in cross section and has a solid limestone floor, covered with a scanty layer of soil varying from several inches to several feet in depth. From the lower end of the valley the drainage is to the Río San Domingo, a branch of the Río Papaloapan. The valley is bordered on both sides by limestone foothills which rise abruptly to low mountains a few miles away. The valley near Tehuacán is very arid and barren, but all the surrounding foothills are covered with a remarkably luxuriant growth of desert plants. Tall slender yuccas, palmettos, and a large, many-branched cactus of the giant type, 15 to 40 feet high, are especially conspicuous. The locality is assignable to Lower Austral Zone.

**Tochimilco (6,000 to 7,500 feet) :**

*August 2-6, 1893.*—Tochimilco is a village about 8 miles west of Atlixco. It is at the eastern base of the high, pine-covered ridge that

extends southward from the southeast side of Mount Popocatepetl. From an altitude of a little above 6,000 feet it overlooks the valley in which Atlixco is situated. The locality is within the oaks that form the border of the wooded area of Mount Popocatepetl and its outlying spurs. From Tochimilco the slopes rise rapidly to timber line on the southeastern side of the volcano. Upper Austral Zone.

#### QUERÉTARO

Jalpan (3,000 feet):

*August 24-31, 1896.*—Jalpan is a town at 3,000 feet in northern Querétaro. On August 20 I proceeded by stage from San Bartolo, a railroad station in central San Luis Potosí, to Río Verde, a distance of 31 miles, in a southerly direction. A railroad covering about the same route has since been built. I spent August 21 in making arrangements for a horse and pack outfit to continue my journey to Jalpan. Leaving Río Verde on August 22, I reached Arroyo Seco, just across the line in Querétaro, after traveling 46 miles in a southeasterly direction. On August 23 I continued from Arroyo Seco 13 miles southeast to Concá, where I stopped to rest the animals, as they had no water at Arroyo Seco, the place being as dry as the name implies, and very little feed. I reached Jalpan, 16 miles farther in the same direction, on August 24. Specimens were collected mainly at about 2,000 feet.

From San Bartolo to Jalpan the general route followed was up and down across low ridges and stream valleys, and there are long, comparatively level stretches at 2,500 to 3,000 feet, which combine as a more or less broken terrace or plain along the front of the Sierra Madre Oriental, forming the elevated eastern border of the tableland. The lowest point on the road was where it crossed the Río Santa María at an altitude of 1,800 feet. To the east of the road, from Río Verde to Jalpan, hills varying in altitude from 200 or 300 feet to about 2,000 feet, rise as an outlying range, with breaks where streams from the interior pass through on their way to the coast. The general section is quite arid, as moisture from the Gulf is intercepted by the outlying mountains mentioned.

The biota of the area traversed from San Bartolo to Jalpan is mainly that of the Lower Austral parts of the higher adjacent tableland region. *Larrea tridentata* ranges down to San Bartolo and over the plain to Río Verde at 3,000 feet. Large mesquites, yuccas, and a tall cactus of the organ-cactus type are here conspicuous forms of vegetation. Many of the cactus plants had apparently been killed by an un-

usually severe freeze. The mesquites in many places, but notably along the road between San Bartolo and Río Verde, form veritable forests, many of the trees being more than a foot in diameter. South of the Río Santa María, however, the land surface is more broken, and a low, thin forest, including some tropical species, was nearly devoid of leaves at the time of my visit. Above 3,500 feet the vegetation gradually becomes more abundant and the climate evidently more humid. The locality is near the lower border of the Lower Austral Zone.

**Pinal de Amoles** (5,500 to 9,500 feet):

*September 1-22, 1896.*—Pinal de Amoles is a silver-mining town at 8,000 feet, near the summit of the Sierra Madre Oriental, about 30 miles southwest of Jalpan, northern Querétaro. From Jalpan I ascended the steep eastern slope of the mountains to Pinal de Amoles with pack outfit, September 1. Work at this locality extended from 5,500 feet on the slope up to 9,500 feet near the summit of a high mountain near the town. All specimens were labeled "Pinal de Amoles."

The Sierra Madre Oriental, forming the high eastern border of the tableland region in this section, extends in northwesterly and southeasterly directions from Pinal de Amoles and is 12 or 15 miles across. The mountains are mainly of limestone, the higher peaks, including one near Pinal de Amoles, reaching to about 10,000 feet. The eastern slopes, drained mainly by affluents of the Río Moctezuma, are cut by very deep canyons, flanked by high cliffs, and the area is one of the most rugged seen in México. The climate of the slope facing the Gulf coast is much more humid than that of the western slope. Winds from the direction of the coast blow over the dry Jalpan valley and discharge their moisture mainly on the eastern slope from about 5,000 feet to the top. The sudden transition from humid to arid conditions in crossing the summit from the eastern to the western side is quite remarkable here, as in other places along the eastern side of the interior plateau.

Above Jalpan the large cactuses and low arid forest are gradually replaced. Oaks of various species range from 4,000 feet to the top and are the principal forest trees from 4,000 to 5,000 feet. Black walnut begins at about 4,000 feet and extends up to 7,000 feet. The drooping-leaf pine (*Pinus patula*) begins at about 5,700 feet and extends from that level up to 9,000 feet. Another pine (*Pinus teocote*) extends from 6,000 feet to the tops of the highest mountains at 10,000 feet. Madroños, alders, thornapples (*Crataegus*), and wild cherry

(*Prunus*) are found sparingly from 6,000 feet upward. A few scattered hickory trees (*Carya mexicana*) were noted in a canyon at 6,500 feet. Firs occur only in the canyons on northeast slopes from 8,000 feet up to about 9,000 feet. Dense thickets of manzanita bushes (*Arctostaphylos*) grow on the summit and extend down for a considerable distance on the western slope. The highest points do not appear to have quite so humid a climate as the eastern slope at from 6,000 to 9,000 feet. On the eastern slope of the mountains near Pinal de Amoles altitudinal distribution of species by life zones is about as follows: Lower Sonoran, 3,000 to 5,000 feet; Upper Sonoran, 5,000 to 7,000 feet; Transition, 7,000 to 10,000 feet. The occurrence of the fir *Abies religiosa* near the head of canyons at 8,000 to 9,000 feet, however, suggests a limited admixture of Canadian Zone elements.

#### QUINTANA ROO

##### Isla Contoy (10 to 40 feet):

*April 22, 1901.*—Isla Contoy is situated 3 or 4 miles off the northeast coast of the mainland of Quintana Roo, just south of Cape Catoche. Specimens obtained here were labeled "Contoy Island." We spent about two hours on the southern end of the island on April 22, en route by boat to Progreso. The island is a long, narrow key of limestone with sandy points and dunes at each end. The surface rises 30 to 40 feet above the sea in the highest places. Some narrow inlets or lagoons penetrate the interior of the island. The lagoons are bordered by an almost impenetrable growth of mangroves. Humid Lower Tropical Zone.

##### Isla Cozumel (50 to 100 feet):

*April 4-18, 1901.*—Isla Cozumel is a large island off the east coast of Quintana Roo. On April 3 we left Puerto Morelos in a small open boat equipped with sail, for Isla Cozumel, distant about 25 or 30 miles, but a sudden storm forced us to take shelter behind a point on the mainland. The next morning we ran farther south along the coast and then crossed directly to San Miguel, the principal town on the island. From headquarters at San Miguel we worked out in various directions, including a boat trip to the mangrove swamps and lagoons at the north end of the island. Specimens collected were labeled "Cozumel Island."

Isla Cozumel is about 30 miles long from northeast to southwest and 10 or 15 miles wide. The island is separated from the mainland by a deep channel about 10 miles wide with a very swift current. The

island is nearly level, the surface being varied by slight undulations of the roughened surface of the limestone of which the island is composed. The formation is like that of the mainland. The surface of the limestone outcropping nearly everywhere is covered with a thin coat of soil supporting a forest varying from low scrubby growth near the shore, where the bedrock is much in evidence, to the heavier, humid tropical forest of the interior and eastern part of the island. The northern and southern ends of the island are low and have mangrove swamps and lagoons. There are a few shallow aguadas (water holes) and cenotes on the island but no streams. As on the mainland, fresh water can be obtained anywhere by sinking a well to about sea level. The year is divided into a dry season, from the end of November to the end of June, and a rainy season, from the end of June into November. Northers are frequent in winter, as they are all along the coast of the Yucatán Peninsula. Occasional rainstorms during the dry season serve to maintain the moderately humid character of the climate. The prevailing winds, especially in spring and summer, are from the northeast.

The same coast-line vegetation as that found along the adjacent mainland occurs around the shores of the island. Mangrove swamps are extensive on the north end. In the interior are several species of palms, wild figs, silk-cotton, and a great variety of trees and shrubs, also found on the mainland. The fauna as well as the flora is very similar in general to that of the mainland, but isolation has resulted in marked differentiation in some cases. The coati and the raccoon are diminutive representatives of their respective genera. One of the birds, the tanager *Spindalis zena benedicti*, representing a West Indian genus, is common on the island but apparently absent on the mainland. Humid Lower Tropical Zone.

#### Isla Mujeres (10 to 100 feet):

March 23-27, 1901.—Isla Mujeres is an island off the northeast coast of Quintana Roo. We left La Vega on the mainland, opposite Isla Cancun, on March 23 and reached Isla Mujeres by sailing boat the same afternoon. On March 27 we returned to Puerto Morelos. Specimens were labeled "Mujeres Island." Isla Mujeres lies about 25 miles northeast of Puerto Morelos and about 3 miles off the nearest point of the mainland. The island is of the same limestone formation as the mainland and extends parallel to the coast. It is about 8 miles long and varies from a few hundred yards to about 2 miles in width. The island rises about 100 feet above the sea at the highest point near the southern end. The surface is undulating and the bedrock very

scantly covered with soil in most parts. Many small areas are bare. The fishing village of the same name as the island is on a sandy point bordering a small bay near the north end facing the mainland.

The vegetation, including many small palms, is low and stunted owing to scanty soil. Many coconut palms grow about the village. Humid Lower Tropical Zone.

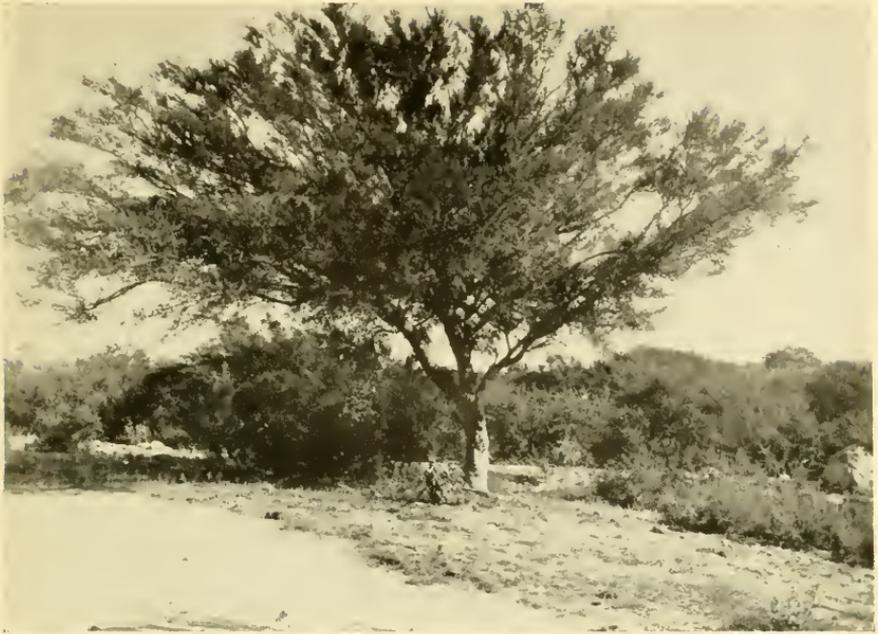
**La Vega (10 to 100 feet) :**

*March 14-23, 1901.*—La Vega is a village on the mainland coast opposite Isla Cancun, northeastern Quintana Roo. We made a stop here for additional work on the mainland coast en route by boat between Puerto Morelos and other localities. Conditions proved to be about the same as at Puerto Morelos. Quintana Roo had not been formally separated from Yucatán at the time of our visit. Humid Lower Tropical Zone.

**Puerto Morelos (10 to 100 feet) :**

*March 11-14, March 27 to April 3, 1901.*—Puerto Morelos is a seaport town on the mainland about halfway between Cozumel and Cancun Islands, on the northeast coast of Quintana Roo. At the time of our visit the territory Quintana Roo formed a part of the state of Yucatán. We left Progreso by steamer on March 8 and proceeding eastward reached the Isla de Holbox on March 9. The ship discharged cargo until the evening of March 10, when it continued, and after rounding Cape Catoche and Contoy Island ran south along the coast to Puerto Morelos. We remained at Puerto Morelos from March 11 to 14, when we moved to localities farther north; on March 27 we returned for additional work until April 3.

The mainland coast of northeastern Quintana Roo is all low and bordered with sandy beaches until Punta Maroma, opposite the north end of Cozumel Island, is passed. From there south, as far as we went, the coast is formed of low ledges of limestone rising from the water line to an elevation of 6 or 8 feet and to 75 and 100 feet a short distance back from the beach. The coast has a line of shallow lagoons and swampy flats, just behind a more or less sandy strip from 100 yards to half a mile wide, immediately along the shore. These lagoons or salt flats are 1 to 2 miles wide. They are flooded in the rainy season but have only 1 to 5 or 6 inches of water over most of them in the dry season. Back of this swampy belt the country is made up of a great underlying bed of limestone 20 to 100 feet above sea level, with its surface slightly undulating and honeycombed with small caves and irregular depressions. Although the surface is irregular it main-



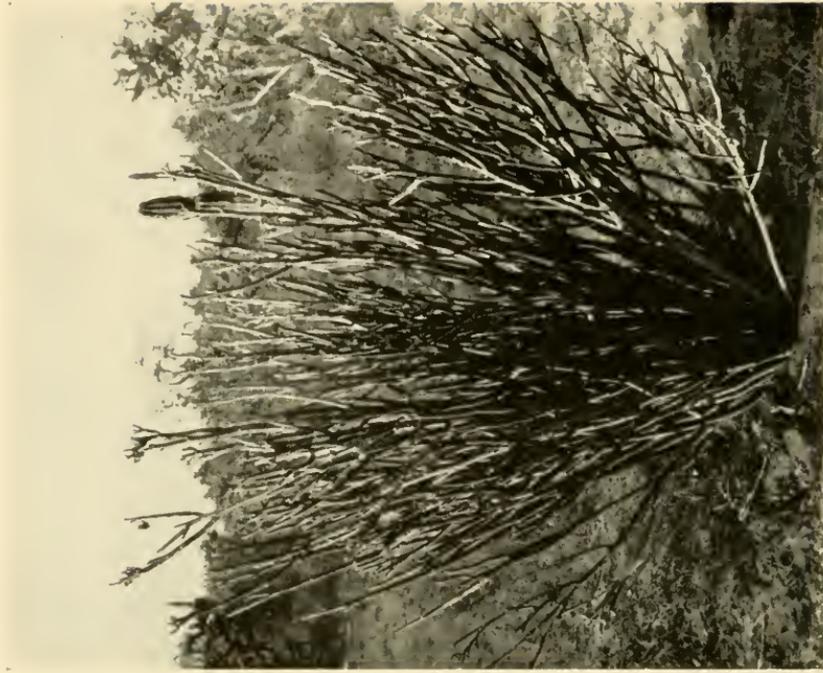
1. Paloverde (*Cercidium peninsulare*), near Santa Anita, southern Baja California. Branches are cut and leaves used for feeding horses and mules. Arid Upper Tropical Subzone.



2. Paloblanco (*Lysiloma candida*) forest in valley east of San Ignacio on trail to Santa Rosalía. Bark extensively cut and exported for tanning purposes. Arid Upper Tropical Subzone.



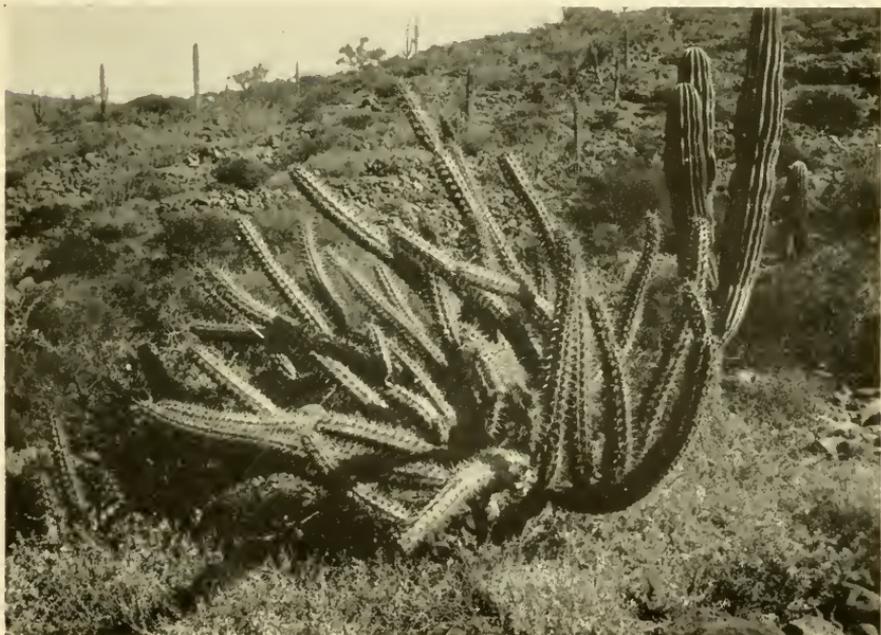
1. *Bursaria odorata*, near El Potrero, southern Baja California. Arid Upper Tropical Subzone.



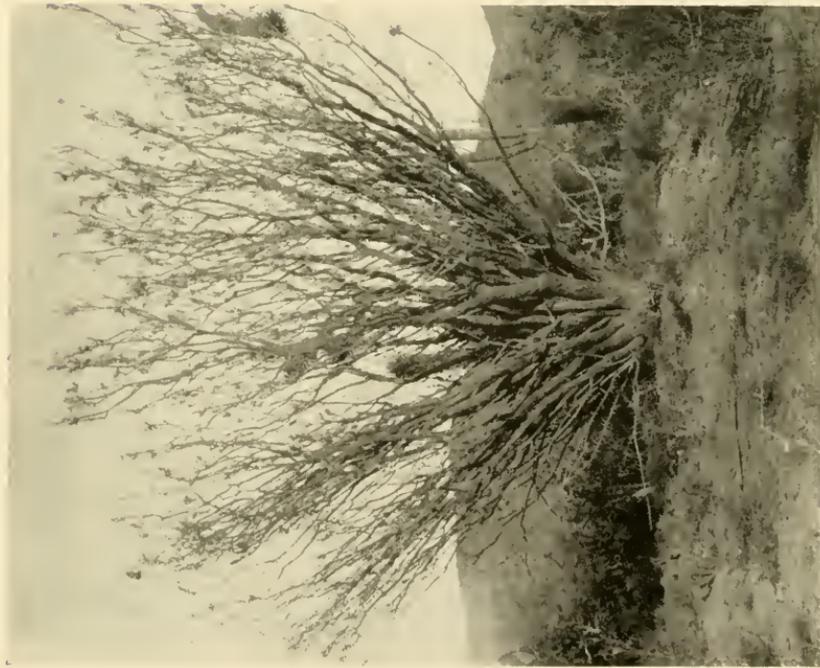
2. *Candelilla* (*Pedilanthus macrocarpus*), near Matancita, southern Baja California. Arid Upper Tropical Subzone, and ranging into lower part of Lower Austral Zone.



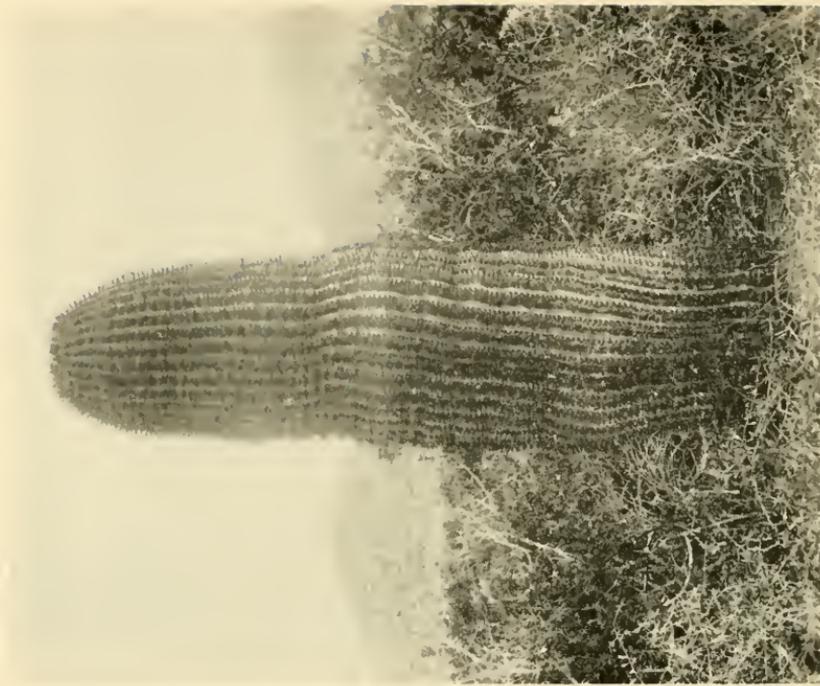
1. Matacora (*Jatropha spathulata*), near Santa Rosalía, southern Baja California. Arid Upper Tropical Subzone and lower part of Lower Austral Zone.



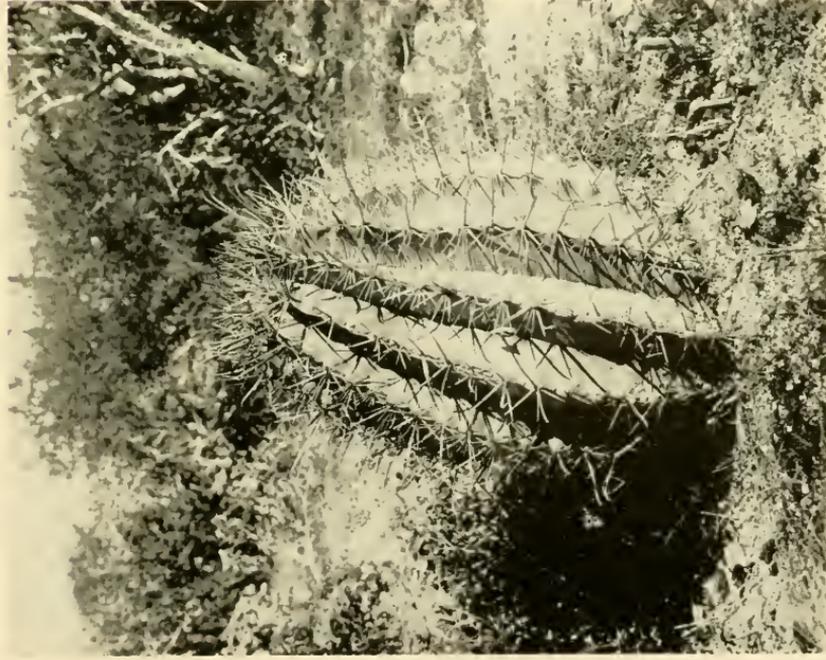
2. Pitahaya agria (*Machaeroceus gummosus*). Espiritu Santo Island, Baja California. The large fruit is slightly tart and very agreeable to the taste. Arid Upper Tropical Subzone.



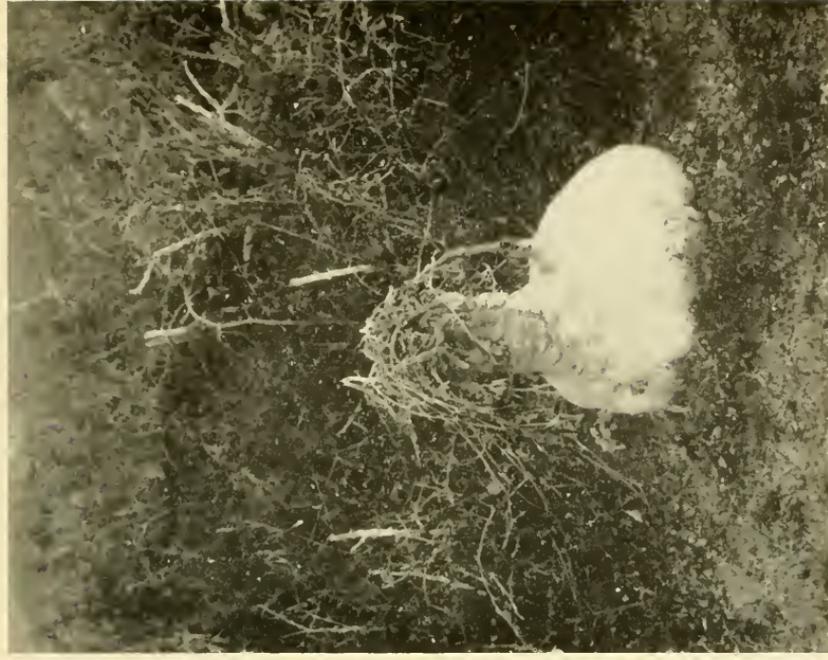
1. Palo de Adán (*Fouquieria penninsularis*), near San Andrés, southern Baja California. Arid Upper Tropical Subzone.



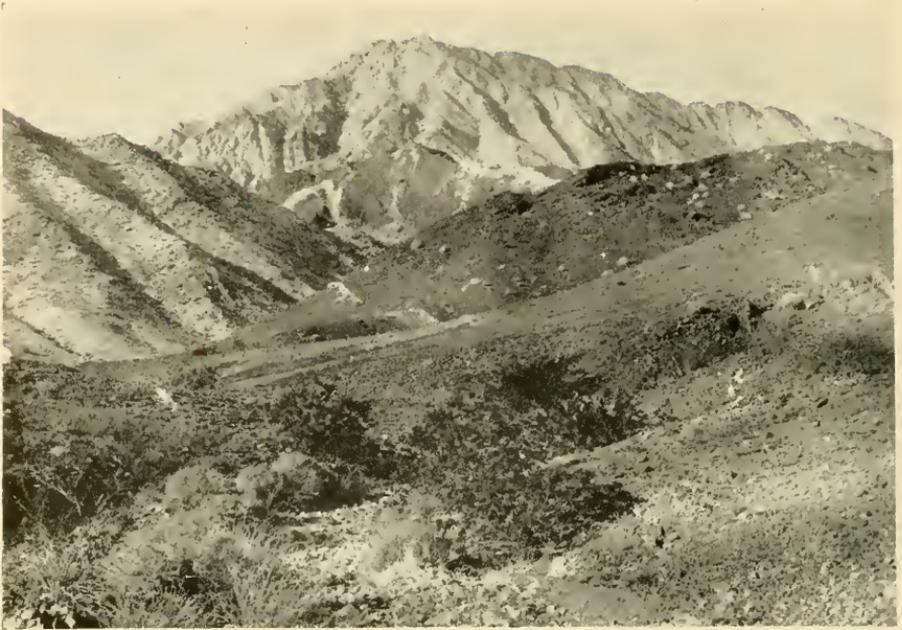
2. Giant viznaga (*Ferocactus diguetii*), a remarkable species known only from islands in the Gulf of California.



1. *Viznaga* (*Ferocactus wislizeni*), San José del Cabo, Baja California.



2. *Iberitella sonora*, Isla Cerralvo, Baja California. Arid Upper Tropical Subzone and lower part of Lower Austral Zone on both sides of the Gulf of California.



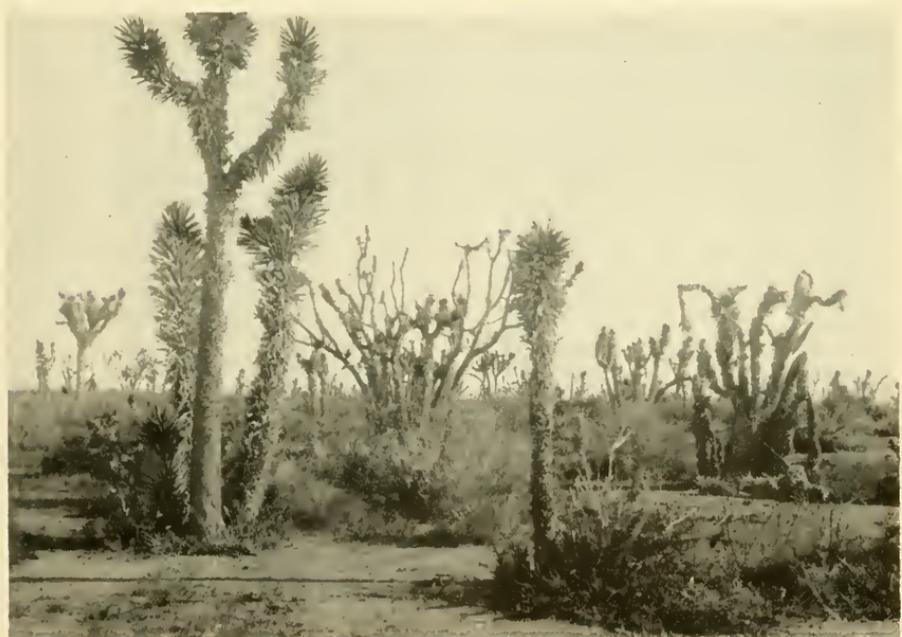
1. Sierra de los Cocopahs (east side), Baja California. An area of extreme aridity—plants widely spaced. Lower Austral Zone.



2. Ocotillo (*Fouquieria splendens*) and cholla cactus (*Opuntia bigelovii*), Calamahué, Baja California. Area of extreme aridity. Lower Austral Zone.



1. Cirio (*Idria columnaris*), near San Fernando, Baja California. This peculiar tree is the prevailing species for several hundred miles. Lower Austral Zone.



2. *Yucca valida*, near Santo Domingo, central Baja California. Heavy stands extend irregularly for miles. Lower Austral Zone.



1. Mixed vegetation near Camargo, Tamaulipas. Lower Austral Zone.



2. Mixed vegetation, viznaga (probably *Ferocactus orcutti*), *Ephedra*, and small species of *Agave*, San Matías Pass, between Sierra Juárez and Sierra San Pedro Mártir, Baja California. Lower Austral Zone.

tains a general level, and as in most other parts of the Yucatán Peninsula there are no surface streams.

Natural wells or cenotes occur here and there, from which the Indians formerly obtained their water supply. These cenotes and the wells that have been dug in various parts show that the country is underlaid by a general deposit of fresh water standing at about sea level. The climate of the east coast of the Yucatán Peninsula bordering the Caribbean Sea is more humid than that of the north coast facing the Gulf of México. The difference in humidity is due to rains more generally distributed throughout the year.

The vegetation in the vicinity of Puerto Morelos varies with the local situation. The sandy belt along the seashore is occupied by many small palms with a mixture of shrubs and some cactuses and is backed by the marshy strip including wild figs with curiously matted tops leaning away from the shore and the direction of the prevailing wind. The shore vegetation slopes back gradually from the low shrubs and plants near the beach to the tops of the fig trees bordering the marsh, so that from the sea one sees only a front of apparently brushy vegetation on sand dunes. The effect is rather startling where the masking brush along the shore has been cut away revealing the background of forest interior. Beyond the fringe of fig trees lies the swampy belt overgrown with mangroves and bordered with palms and various species of bushes. Beyond the marshy belt stands the real forest which is more like that of southern Campeche than that of northern Yucatán, although palms are more in evidence. As in southern Campeche, the chico zapote, which furnishes the chewing gum of commerce, is a common species. In this region occur low-lying areas occupied by forests of logwood.

Twenty-five to forty miles in the interior the forest is said to become lower, and there is a gradual approach to the arid conditions of central and northern Yucatán. A broad area extending north along the east coast of the peninsula to Cape Catoche seems to be assignable to Humid Lower Tropical Zone, although it is intermediate in character between Arid Lower Tropical northern Yucatán and more typically Humid Lower Tropical regions farther south.

#### SAN LUIS POTOSÍ

##### **Ahualulco** (6,000 feet):

*August 25-28, 1892.*—A small town near the railroad about 18 miles northwest of the City of San Luis Potosí. Only a few miles from Hacienda la Parada and general conditions about the same.

**Arenal (7,000 feet) :**

*August 30, 1892.*—Railroad station about 20 miles northwest of the City of San Luis Potosí. Lower Austral Zone.

**Hacienda la Parada (6,000 feet) :**

*August 15-22, 1892.*—Hacienda la Parada is located within 3 miles of the small station of Arenal on the railroad about 20 miles northwest of the city of San Luis Potosí. The hacienda lies in the midst of a series of dry, rolling hills covered with a growth of agaves, cactuses, thorny shrubs, and other desert plants. On the more level ground the creosotebush (*Larrea tridentata*), mesquite (*Prosopis juliflora*), huisache (*Acacia farnesiana*), and gatuño (*Mimosa biuncifera*) are characteristic species. In general aspect the region is much like many desert sections of the southwestern United States. The rainy season extends from May or June to October or November. Lower Austral Zone.

**Jesús María (6,000 feet) :**

*September 7-17, 1892.*—Hacienda and railroad station of the same name, about 18 miles south of the City of San Luis Potosí, in the same elevated valley or plain and same general local conditions. Lower Austral Zone.

**Jesús María—mountains near (6,500 to 8,500 feet) :**

*September 1-6, 1892.*—On September 1 we left the Hacienda of Jesús María with a pack outfit and proceeded in a westerly course, entering the mountains through a rugged canyon and camped by a water hole near a grassy meadow. During the next five days we moved camp from place to place in a semicircular course to the west, south, and east, returning to the plains near Jesús María, a few miles south of the point where we entered the mountains. Work was on the Hacienda of Jesús María, the principal mountain camps being at points locally known as Ciénega Grande and Las Jacalitos, but all specimens were labeled "Mountains near Jesús María."

This mountain range rises abruptly from the plain on the east to an altitude of about 8,500 feet, the slopes deeply cut by canyons, being rocky and precipitous. It is one of a series of small mountain chains which extend from north to south along the central tableland. In this region, however, these mountains form a part of the continental backbone, as the waters to the west flow through small branches into the Río Grande de Santiago, while those to the east drain toward the Río Pánuco. Rising from the central tableland with parallel ranges

of mountains cutting it off from the moisture-laden winds of both coasts this range partakes of the arid character of the adjacent plains. On the upper slopes, however, there is the usual evidence of heavier rainfall than at the lower levels. At about 6,500 feet pinyon pines, oaks, and manzanitas (*Arctostaphylos*) make their appearance, and the vegetation increases upward in profusion, both of species and individuals. The most abundant pine on the upper slopes (7,000 to 8,500 feet) is *Pinus leiophylla*. The aspen (*Populus tremuloides*) grows in the heads of canyons (7,500 to 8,500 feet).

**Jilitla** (also spelled Xilitla) (2,500 feet):

*May 1-4, 1898.*—Jilitla is a town at 2,500 feet about 30 miles south of Tancanhuitz in extreme southeastern San Luis Potosí. On April 29 we left Valles on the railroad in eastern San Luis Potosí with a pack outfit and traveled south about 22 miles to the village of Santa Cruz at 600 feet. The next day we continued 20 miles in a southerly course, passing through Tancanhuitz, to the village of Huehuetlán at 1,200 feet. Another 20 miles brought us to Jilitla on May 1. The object of our trip to Jilitla was to work on the upper slopes of the Cerro San Juan just north of the town and believed to be 9,000 or 10,000 feet high. Unfortunately heavy rains of the wet season had already begun, and we found that work on the mountain would be difficult with our limited facilities. There was no trail, and the lower slopes of the mountain were covered with huge tumbled limestone boulders and dense jungle filling all interspaces. So we turned back and returned to Valles on May 4.

The trail from Tancanhuitz is up over a steep, exceedingly rough limestone ridge about 3,000 feet high. The ridge is covered with a dense forest of large trees. The summit is broken and irregular, and after several miles of winding trail we came out on the edge of a deep canyon beyond which, on a sharp ridge, is situated the town of Jilitla, at 2,500 feet. The Cerro San Juan rises abruptly as an isolated mountain mass from the hot lowlands. It is separated from the highlands of the interior by valleys at low elevations. The mountain appears to be entirely of limestone.

From Valles to Tancanhuitz the vegetation indicates rather arid conditions, but at the latter point it becomes more luxuriant and is gradually merged with the fine, humid tropical forest that clothes the slopes of the mountains near Jilitla from about 800 feet up to at least 3,000 feet and probably higher. Coffee, bananas, and other tropical products are grown without irrigation on the mountains near Jilitla. Although the vegetation indicates tropical conditions, frosts are said to

occur now and then during the cold "nortes" or northern storms, which affect the entire east coast of México.

The humid tropical section near Jilitla marks the northern limit of the distribution of the little red forest deer (*Mazama*), the spider monkey (*Ateles*), and the kinkajou (*Potos*) along the eastern side of the Mexican tableland. Among the birds are the macaw (*Ara militaris*) and the green woodpecker (*Piculus*).

#### Río Verde (3,000 feet):

*January 5-19, 1897.*—Río Verde is a town at 3,000 feet at the end of a branch railroad in southern San Luis Potosí. On January 5 I left the City of San Luis Potosí and proceeded eastward by rail to the station of San Bartolo. At San Bartolo I left the railroad and took the stage in the afternoon to Río Verde, about 30 miles away in a southerly direction. A railroad has since been completed between these points. From San Luis Potosí, at 5,938 feet, the railroad traverses a slightly descending plain to Villar, at an altitude of about 5,500 feet. At the latter point the descent becomes very rapid to the plain at 3,000 to 3,500 feet, on which San Bartolo and Río Verde are situated. This plain, forming a broad terrace along the eastern front of the tableland, extends along the railroad east to Cárdenas near which a steep and final descent to the low coast country begins. The plain extends 40 or 50 miles from north to south and is bordered along the eastern side by a low range of mountains. The town of Río Verde is situated on the river of the same name, which rises in the mountains to the west, along the eastern border of the main tableland of the interior, and after traversing the plain breaks through the mountains and descends through deep canyons to the Río de Santa María, a branch of the Pánuco River system. The country near Río Verde resembles the higher parts of the tableland to the west in many respects, the climate being similarly dry but warmer, and much of the vegetation the same. Mesquites grow very large and over much of the plain form a veritable forest. The creosotebush (*Larrea tridentata*) also grows abundantly, along with acacias, yuccas, and several cactuses. The principal crops are sugarcane, corn, beans, and such fruits as oranges, lemons, limes, and bananas. Slight frosts occur in winter. The locality is near the lower edge of the Lower Austral Zone.

#### La Tinaja (6,000 feet):

*January 21-February 5, 1897.*—La Tinaja was a railroad station at 6,000 feet on the plain about 20 miles east of the City of San Luis Potosí. This locality was at or near the present railroad station of

Ventura, which is near the settlement of Puerta Tinaja. A brief visit was made to obtain specimens of pocket gophers, the mounds of which had been seen from the train in passing on a former occasion. The animal, later described as *Thomomys umbrinus potosinus*, appears to be very restricted in distribution. Lower Austral Zone.

**Matchuala:**

*June 20, 1898.*—Matchuala was the terminal of a branch railroad on the tableland in northeastern San Luis Potosí. It was visited by us en route from Doctor Arroyo, Nuevo León, to Durango, Durango.

**San Luis Potosí (6,000 feet):**

*August-September, 1892.*—The state capital in a broad valley on the tableland. Little field work was done here, but from the city as convenient headquarters trips were made to other localities in various directions during the months of August and September. The valley in which San Luis Potosí is located varies from 10 to 20 miles in width, forming a broad drainage way between ranges of barren hills or mountains. It extends from the arid plains region of Coahuila and northern Zacatecas south through the entire length of the state of San Luis Potosí into Guanajuato. Mountains generally barren in character reach an altitude of about 8,000 feet a few miles northeast of the city.

**Tancanhuitz (800 feet):**

*April 30 and May 3, 1898.*—Tancanhuitz is a town at about 800 feet, about midway between the valleys of the Río Santa María and the Río San Juan. We passed through the place on April 30 and again on May 3. Humid Lower Tropical Zone.

**Valles (400 feet):**

*April 27-29, May 4-8, 1898.*—Valles is a town at 400 feet near the railroad station of the same name in eastern San Luis Potosí. We arrived there by rail on April 27. A trip to Jilitla, requiring a pack outfit, was made, and we returned to Valles on May 4. The town is situated on the broad coast plain extending out from the base of the mountains, the foothills of which begin to rise abruptly a few miles farther west. Arid Lower Tropical Zone.

**Velasco (200 feet):**

*May 8-9, 1898.*—Velasco is a station at 200 feet on the railroad in extreme eastern San Luis Potosí. On May 8 we took the train from Valles to Velasco, where we stopped over for some deer and turkey hunting. We found the nearly level plain covered with an almost un-

broken forest of scrubby ebony trees 12 to 20 feet high, with dense thorny undergrowth. As the character of the forest rendered successful hunting so difficult we moved on May 9 to Chijol, Veracruz. Arid Tropical Zone.

Villar (5,500 to 6,500 feet):

*September 20-28, 1892.*—Villar is a station on the railroad at 5,500 feet, about 50 miles northeast of the City of San Luis Potosí. The station is located in a break through a rather low range of mountains along the eastern border of the more elevated part of the arid central tableland. From this point the descent is rapid toward the east to the plain at 3,000 to 4,000 feet, forming a broad terrace partaking of the character of the tableland, and extending east along the railroad to Cárdenas. Conditions near Villar are quite diversified as the mountains rise rather steeply from arid plains on the west. The mountains, largely of limestone, are well wooded and, especially on the eastern side, show the influence of moisture-laden winds from the Gulf of México. Spanish moss hangs in abundance on the larger trees, which include oaks of several species, a madroño (*Arbutus xalapensis*) and a black walnut (*Juglans mexicana*). A dwarf fan palm grows along the sides of canyons and spreads over the tops of some of the lower hills. The rainy season extends from May or June to October or November. The mountains are mainly Upper Austral in zonal character.

#### SINALOA

Altata:

*March 27-28, 1899.*—Altata is a small seaport about 38 miles southwest of Culiacán. It was there I boarded a small steamer for Mazatlán.

Culiacán (175 feet):

*February 18-21, March 10-27, 1899.*—Culiacán, the capital, is located at about 175 feet altitude on the coast plain in the north-central part of Sinaloa. I arrived there en route from Alamos, Sonora, on February 18, but no regular field work was undertaken until I returned from a side trip to Chacala, Durango, on March 10. Work on the plains and lower foothills near Culiacán was concluded on March 27. The town is situated at the junction of the Río Humaya and the Río Tamazula, which drain a section of the west slope of the Sierra Madre and unite to form the Río Culiacán. To the west of the town the nearly level coast plain slopes down to the seashore 38 miles away. A few miles to the east the coast plain is bounded by the first

low, rounded foothills of the Sierra Madre, which rise several hundred feet above it.

Heavy and frequent rains occur during the rainy season, which lasts from about June 20 to October 15. One or two rainstorms, called equipatos, sometimes occur in November. The equipatos last usually about three days, during which time a fine drizzle is almost continuous. The ground becomes so dry during the long dry season that practically no crops can be raised without irrigation. Very slight frosts, so slight that the sugarcane is seldom seriously injured, occur in winter.

The plains near Culiacán are nearly uniformly covered with a fairly dense growth of low forest, at this season almost entirely leafless. Among the principal plants are the morning-glory tree or paloblanco (*Ipomoea arborescens*), which is very abundant, the palo del Brazil or dyewood, mesquite, and various cactuses. A few cottonwood, guásima, wild fig, and guamúchil trees grow mainly near the river. The locality is near the boundary between the Arid Lower Tropical and Lower Austral Zones.

#### Escuinapa (100 feet):

*July 5-6, 1897.*—Escuinapa is a village about 14 miles southeast of Rosario, in southern Sinaloa. It was an overnight stop on our route from Acajoneta, Nayarit, to Rosario, Sinaloa.

#### Mazatlán—near (300 feet):

*March 30 to April 13, 1899.*—On March 30 I left Mazatlán by stage on the road to Rosario, as far as the hacienda of Castillo, 9 miles southeast of Mazatlán. I remained at Castillo until April 13, when I returned to Mazatlán. All specimens collected were labeled "Near Mazatlán." The hacienda of Castillo is on the narrow, nearly level coast plain close to the border of a large lagoon connected with the sea. The coast plain at this point is reduced to a strip only 2 to 3 or sometimes 4 miles wide. East of the ranch about 2 miles the first low, rounded hills begin and increase gradually in height toward the interior. The climate seemed very dry as my visit was in the dry season, when most of the trees are leafless, but heavy rains are very frequent during the wet season from May or June to the latter part of October. It is warmer than at Culiacán, and the temperature does not usually reach the freezing point during the coldest part of the year. The previous winter was said to have been exceptional, as slight frosts occurred in certain low places on the plain a few miles farther south. The climate is more nearly tropical at Mazatlán than at Culiacán. The most noticeable difference in the vegetation of the two sections is that

the arid tropical flora, extending north from Nayarit, reaches the coast, while to the northward near Culiacán a strip more nearly Lower Austral in character extends south along the coast. This change in flora along the coast is probably due in part to the absence of a broad coastal plain near Mazatlán. Very few plants near Mazatlán were in flower or even in leaf. The hills are uniformly covered with a fairly dense but low forest made up of rather small trees. Among those noted were the guásima, guanúchil, wild figs of several species, ceiba or silk-cotton tree, and morning-glory tree. Mangroves grow along the lagoons. Many other species of plants would be recognized by the botanist. Very little land is cultivated and corn is the principal crop.

**Plomosas** (2,500 to 3,000 feet) :

*July 13-20, 1897.*—Plomosas is a village at about 2,500 feet on the western slope of the Sierra Madre about 50 miles a little north of east of Rosario, in the extreme southeastern corner of Sinaloa. On July 12 we left Rosario, and traveled in a northeasterly direction for about 26 miles to a ranch called Palmarito, situated at 800 feet at the western base of the Sierra Madre. The following day, July 13, we went on up the slope about 20 miles to a little group of ranches known as Colomos, at 2,500 feet. This place is situated on the flank of the range near Plomosas, which is a few miles farther east at about the same altitude. From quarters at Colomos we worked almost entirely along the road between that place and Plomosas, and the latter more prominent locality was used on all specimen labels. Leaving Rosario our road ascended gradually to Palmarito, where a steeper slope led up to Colomos near the summit of a range of foothills lying parallel, but close against the main range at this point. Plomosas is in a narrow valley east of this ridge and at the base of the main range. These flanking ridges reach an altitude of nearly 4,000 feet above Colomos. Numerous small streams flowing down the small canyons on the slopes of these mountains at the time of our visit would be dry in winter when no rain falls. The main ridge of the Sierra Madre east of Plomosas does not appear to exceed 7,000 feet, and the top of the range is rather uniform, with no peaks or other elevations rising much above the general level. The vegetation of the mountain slopes up to about 3,600 feet near Plomosas is almost identical with that of the adjacent lowlands. Characteristic foothill species are two kinds of silk-cotton trees, morning-glory trees, *Enterolobium*, *Coccoloba*, nanche (*Byrsonima crassifolia*), cassias, acacias, mimosas, and many others. At about 3,800 feet pines of two species appear and at 4,000 feet the tops of the hills are overgrown with them. Arid Lower Tropical Zone.

**Rosario (100 feet):**

*July 6-12, 21-27, 1897.*—Rosario is a town at 100 feet on the Río del Baluarte, near the railroad crossing of the stream in southern Sinaloa. Three days' travel north with pack outfit over the coast plain brought us from Acaponeta, Nayarit, to Rosario, Sinaloa. The time from July 13 to 20 was devoted to a side trip to Plomosas in the adjacent mountains. Rosario is situated on the inland border of the coast plain near the base of the outlying foothills of the Sierra Madre, which looms on the horizon toward the interior. The Río del Baluarte, which passes the town, is a small, shallow stream, easily forded during the dry season. The vegetation is very similar to that found at Acaponeta, but the climate appeared to be somewhat drier, and many plant species more stunted than at Acaponeta. Arid Lower Tropical Zone.

**Sierra de Choix (4,500 to 5,000 feet):**

*October 14-21, 1898.*—The Sierra de Choix is a range of mountains about 5,000 feet high, in extreme northeastern Sinaloa. On October 12 I left Las Guásimas, a ranch about 20 miles west of Batopilas, Chihuahua, and traveled about 23 miles in a westerly direction to Calabazas, a ranch on the Río del Fuerte. On October 13 I made about 26 miles down along the river to El Realito, a large ranch. The route to this point was through arid, hilly country of the same general character as near Batopilas. On October 14 I continued from El Realito 26 miles to the ranch of La Culebra, on the east slope of the Sierra de Choix. A little to the west of El Realito the trail, which had been following along the left bank of the river, turned to the left across the boundary from Chihuahua into Sinaloa, and began the ascent of the Sierra de Choix. On October 15 I climbed on up for about 13 miles to the ranch of El Saucillo on the top, where I remained until October 21. Specimens were labeled "Sierra de Choix, 50 miles northeast of Choix." This was an estimate of distance, based at the time on local information. Maps indicate that the actual distance must be considerably less. The Sierra de Choix is a high ridge extending in a northwesterly direction into the valley of the Río del Fuerte, the river skirting the northern end as a spur from the Sierra Madre to the south. This ridge is steep on both sides, but the top where I crossed forms an undulating mesa 5 or 6 miles wide. The climate of the top is mild. The altitude frees it from the heat of the lower country on both sides, and the snow of the higher Sierra Madre. Considerable rain falls during the rainy season, and sharp frosts occur in winter.

Oaks and pines grow over the top. A few fan palms occur here and there along little arroyos that cut the mesalike top of the ridge. The top of the Sierra de Choix belongs mainly to the Upper Sonoran Zone but is invaded by Lower Austral Zone elements on the warmer slopes.

**Sinaloa (200 feet):**

*February 12-16, 1899.*—Sinaloa is a town on the Río de Sinaloa, which traverses the coast plain in the northern part of the state of the same name. One day's collecting was done by the writer, while en route to points farther south.

SONORA

**Alamos (1,200 feet):**

*October 24-26, 1898; December 14, 1898, to January 2, 1899; January 10 to February 5.*—Alamos is a large town at 1,200 feet in southern Sonora. On October 21 I left the Sierra de Choix, descending the steep western slope to the valley below, and after traveling about 26 miles, stopped at the little ranch of El Palmar on the road to Alamos. On October 22 I made about 31 miles in a westerly course to the ranch of Jaguari. On October 23 I kept on to the westward about 27 miles to the ranch of Agua Blanca and on October 24 continued about 16 miles to Alamos.

From the top of the Sierra de Choix the trail descended the steep western slope to the bottom of the valley of the Río del Fuerte. There the high mountains are left behind as the valley of the river broadens to extensive rolling plains, dotted with low, sharp-pointed hills and ridges on both sides. After leaving the Sierra de Choix the trail to Alamos, which had been following along the south side of the Río del Fuerte, turned slightly to the northward, crossed the river at the little town of Vaca and continued on to Alamos, situated on the northern side of the valley just within the foothills of the Sierra Madre.

The town is in a short, gently sloping valley about 3 miles wide, which separates the outlying foothills called the Sierra de Alamos from the lower hills east of it. The plains near Alamos are open, with slightly rolling surface, and descend slowly to sea level at the coast about 65 miles away.

The climate of the entire section is warm, but rather dry. In the immediate vicinity of Alamos sufficient rain usually falls during the wet season, which lasts from June to October, to mature crops of corn, beans, and some other vegetables. Light showers of rain occur occasionally during the winter months, and frosts at that season are so slight as to be almost imperceptible. There is less rainfall on the

plains, and crops without irrigation are very uncertain; winter temperatures also are lower, with frosts more frequent and more severe.

The vegetation from near Alamos up the valley and canyon of the Río del Fuerte as far as Batopilas, Chihuahua, is about the same. Among the most conspicuous trees are the guásima, guamúchil, morning-glory trees or batopilas, mesquite, wild figs of several species, and an *Elaphrium*. On the coast plain mesquites are more abundant, along with numerous small trees and shrubs, many of them thorny, and most of them at the time of my visit were leafless. The only conspicuous plants that were noted in abundance both in the foothills and on the coast plains were large cactuses. Upper Arid Tropical Subzone.

**Alamos—near (1,200 to 4,500 feet):**

*January 2-6, 1899.*—On January 2 I moved from Alamos to a wood camp among the oaks on the north slope of the Sierra de Alamos, 8 miles to the northwest of the town. Specimens collected were labeled "Near Alamos." I returned to town on January 6.

The Sierra de Alamos is a rugged group of outlying hills immediately west of the town of Alamos. These hills near the western base of the Sierra Madre are completely cut off from the foothills of the main range to the east. They rise abruptly with steep slopes and deep arroyos on all sides. The top, with an altitude of 4,500 feet to 5,000 feet, is a series of rocky points and sharp ridges. Considerable rain falls during the wet season, and sharp frosts occur in winter.

The vegetation of the Sierra de Alamos is similar in general to that of the Sierra de Choix, Sinaloa, but the single species of pine (*Pinus patula*) which grows sparingly over the upper part appeared to be different. Up to an altitude of about 3,000 feet the vegetation is that of the warm foothills in general. Among the numerous species are the morning-glory tree, guásima, silk-cotton, wild fig of several species, and large cactuses. Above this scrubby oaks begin, and most of the warm-country plants disappear. At about the 3,000-foot level on average slopes the Arid Upper Tropical Subzone gives way to the Lower Austral Zone, which is not very well marked and passes in turn into Upper Austral near the top.

**Batamotal (100 feet):**

*April 20-29, 1899.*—Batamotal is a small station at 100 feet about 8 miles northeast of Guaymas. On April 20 I moved out from Guaymas to Batamotal and remained there until April 29, working on the plain and in the neighboring hills for several miles in various directions. The locality is on the level plain about a mile from a large

lagoon connected with the sea. The plains extend northward indefinitely, gradually increasing in altitude toward the interior. Near Guaymas and scattered over the plains in every direction are ridges and groups of barren, rocky hills, ranging in height from 200 to 500 feet. The climate of this section is distinctly drier and colder than the coast plains region of southern Sonora. Considerable rain falls, however, during the rainy season, which lasts from June or July to October or November. The rains during the latter part of the season are of infrequent occurrence and are called equipatos or equinoctial storms. They usually last three or four days, during which time rain falls slowly but steadily. Sharp frosts occur in winter.

The vegetation is similar to that of the arid plains region along the northern boundary of México. In marked contrast with southern Sonora the desert plants are widely spaced, and the thinly clothed hills appear sharply delineated instead of having the fuzzy of more or less hidden profiles prevailing farther south. The woody plants are largely the creosotebush (*Larrea tridentata*), which is the dominant species over wide areas, the paloverde (*Cercidium torreyanum*), mesquite, and a few guamúchil trees (*Pithecollobium dulce*); also cactuses, including the prominent giant species, *Pachycereus pringlei*. A remarkable stand of the latter, including giants more than 3 feet in diameter, is located near the shore of a lagoon several miles north of Guaymas. Lower Austral Zone.

#### Camoa (800 feet):

*October 27 to November 9, November 28 to December 6, 1898; January 10-24, 1899.*—Camoa is a town at 800 feet on the Río Mayo in southern Sonora. I left Alamos on the afternoon of October 26 and rode 13 miles out among the low hills in a northwesterly direction to the ranch of El Ranchito. On the following day the road left the hills and led over the rolling coast plain about 27 miles to the little town of Camoa, on the Río Mayo. Work on the plains at Camoa and in the adjacent foothills was carried on at intervals as indicated. From Alamos the road leaves the foothills and descends gradually to Camoa. The town is located close to the Río Mayo, several miles below the point where the river emerges from the hills. The foothills east of Camoa rise 500 to 800 feet above the plain and are very similar in character to the lower hills near Alamos. To the west level or gently rolling plains slope down to the seacoast. The plains and foothills near Camoa receive a moderate rainfall as shown by the comparative density of the vegetation. Northward toward Guaymas the climate becomes gradually drier and the temperature lower in winter.

Near Camoa the foothills are fairly well covered with small trees and bushes of many kinds, but near Guaymas the vegetation is scanty, and except for a few giant cactuses the nearly bare hills present much the same appearance as the desert mountains of the interior tableland region. *Covillea tridentata* was not noted on the plains south of the Yaqui River Valley. Frosts occur at Camoa in winter. Lower Sonoran Zone.

**Colonia Lerdo (10 feet):**

*March 29 to April 1, 1905.*—A small settlement on the Sonora bank of the Colorado River, a short distance above its mouth. Visited by D. T. MacDougal and myself.

**Colorado River (10 miles south of U. S. boundary) (100 feet):**

*March 27-28, 1905.*—An overnight stop on the Sonora side while I was on a trip by boat down the Colorado River with a party, including the botanist Daniel Trembly MacDougal, of the Carnegie Institution of Washington.

**Colorado River (20 miles south of U. S. boundary) (100 feet):**

*March 28-29, 1905.*—An overnight stop on the high Sonora bank of the Colorado River while descending the stream at an unusually high flood stage. At this time the river was flowing along the base of the Sonora mesa, or bluff, bordering the flood plain on the eastern side. Soon thereafter the entire river turned into the Salton basin, where it ran for nearly a year. When finally diverted it did not resume the former channel along the Sonora mesa, but took a new course, probably marked by an old slough, through Volcano Lake, some 15 miles or more farther west. Visited by D. T. MacDougal and myself.

TABASCO

**Chilapa River (300 feet):**

*November 12, 1895.*—The Río Chilapa is one of the main river channels, uniting with the Río Grijalva in the delta region about 20 miles above the port of Frontera. A few specimens were taken by Nelson while en route by canoe.

**Frontera (near sea level):**

*March 4-13, April 24-30, 1900.*—Frontera is the port at the mouth of the Río Grijalva, on the north coast of Tabasco. On March 4 I arrived at Frontera, where collections were made in the surrounding forest until March 13. On that date I began the ascent of the Río Grijalva to work in the southern part of the state and did not return to

the town until April 24. Six days were then spent there, waiting for a steamer to ascend the Río Usumacinta, and in making additional collections in company with Nelson, who had arrived at Frontera one day before my return.

The port of Frontera is situated several miles within the mouth of the large stream formed by the union of the Grijalva and Usumacinta Rivers. Nearly the entire state is occupied by a broad, low, and nearly flat coastal plain, covered for the most part with almost unbroken lowland forest and marshes and swamps. The plain is everywhere low and marshy, but the northern portion, bordering immediately on the Gulf, is particularly low and nowhere more than a few feet above sea level. The rivers of Tabasco, like those of Veracruz, are short but drain a region of heavy rainfall and thus carry an immense volume of water, giving them great depth along the lower part of their courses. The lowlands embrace a vast delta region with many large and small channels forming a network subdividing or becoming confluent. Vessels that can pass the shallow water on the bars at the mouths of rivers are able to ascend for considerable distances. The highest and most fertile land has resulted from the deposition of silt along river banks. Large marshy or submerged tracts lie between river courses. During the rainy season, from about June to February, extensive areas are submerged, and it is possible to traverse the country by canoe in almost any direction.

The climate of northern Tabasco, the section lying along the Gulf and including the district about Frontera, is much drier than that of the southern part, bordering or extending up on the slope of the mountains where the rainfall is excessive.

The plain near Frontera is covered with rather low forest, with only occasional trees of large size. A few among the many species of trees are the logwood, mahogany, wild fig, and palms of several species. Mangroves, willows, and mimosas grow along the borders of the swamps. Although the climate is considerably drier than that of the mountains to the south, the Frontera region is well watered and seems referable to the Humid Lower Tropical Zone.

#### **Monte Cristo (200 feet) :**

*May 3-10, 21-26, 1900.*—Monte Cristo is a town at about 200 feet on the west bank of the Río Usumacinta in southeastern Tabasco. We left Frontera on May 1, on a small river steamer, and proceeded up the Río Grijalva and its large branch, the Usumacinta, about 140 miles, to Monte Cristo, where we arrived on May 3. On May 10 we left on a trip to Palenque, Chiapas, from which we returned to Monte

Cristo on May 21. On May 26 we took passage on a small steamer which descended the Río Palizada en route to Campeche, Campeche. From Frontera to Monte Cristo the rivers flow through low country much of which is overflowed during the rainy season. Here and there the banks rise in gentle undulations to a height of 10 or 15 feet above high-water mark, and occasional ridges near Monte Cristo reach 100 to 200 feet above the river. The Río Usumacinta varies from 40 to 50 feet between high- and low-water marks at Monte Cristo. About 40 miles in a straight line above Monte Cristo the Usumacinta comes out of a gap in the mountains and from there to the sea has a steady current of  $2\frac{1}{2}$  to 3 miles per hour in the dry season; in the wet season the current is considerably accelerated. The rains begin in the mountains of this region soon after the middle of May, and the river began to rise at Monte Cristo about May 20 the season we were there.

Along the way up the river the forest was rather low and irregularly distributed in belts and patches, usually fringing the river banks and occupying the higher ground, thus outlining grassy plains and marshes that are under water during the wet season. Above the general level of the matted growth of low trees and bushes occasional wild fig or silk-cotton trees loom as striking landmarks, owing to their great bulk. About Monte Cristo the country is more diversified and forms a rolling plain about equally divided into grassy savannas and low forests. The savannas and forests are irregularly mingled, and patches of bushes and small trees occur here and there on the grassy plains, giving them the appearance of old fields returning to a forested condition. The soil is poor and the vegetation not luxuriant, and at a short distance no tropical element may be apparent. Closer inspection, however, reveals palms and other tropical plants. Humid Tropical Zone.

#### Teapa (800 to 3,000 feet):

*March 18 to April 22, 1900.*—Teapa is a town at about 800 feet in the extreme southern portion of Tabasco. From Frontera I ascended the Río Grijalva by river steamer during the night of March 13 to San Juan Bautista (now Villa Hermosa), the capital of the state. I continued during the next four days up the Río Grijalva and the Río de Teapa by canoe until I reached a point about 10 miles below Teapa, where rapids prevent canoes from proceeding any farther. For the remainder of the journey I hired a pack outfit and followed the right bank of the river to the town, where I arrived on March 18. Most of the work was done in the foothills south of town, where a small ranch

at about 2,000 feet provided convenient headquarters, close to the border of the state of Chiapas.

The town of Teapa is situated at the northern base of the foothills of mountains that reach about 6,000 feet. The foothill region near Teapa begins abruptly with exceedingly steep and rugged limestone hills 500 to 1,000 feet high. These are succeeded by much less rocky and rugged, but steep-sided ridges, which lead up to the crest of the range well within the state of Chiapas. These ridges have extremely narrow crests along which follow the Indian footpaths leading to small towns in the interior. Steep footpaths are the only roads into the mountains in this vicinity for the reason that it is much easier to follow the narrow crests of the parallel ridges than the steep and irregularly cut canyons that separate them. From the town northward to the seacoast extends the vast, low, and nearly flat coastal plain that comprises nearly the whole state of Tabasco. Looking out toward the coast from high hills near Teapa large lagoons and marshes were seen in many places between the river courses. In airplane flight over the state in 1935 I was impressed with the intricate network of channels connecting the Río Grijalva with other large rivers that traverse the coastal plain. In this deltalike region river channels may change their courses, and large channels silted up at their upper ends form long narrow lagoons often bordered by mangroves. From the air such old channels are distinguished by the dark color of the water in contrast with the lighter tone of moving streams.

On the coast at Frontera the rainy season begins usually in June and ends in January or February. From near Villa Hermosa the rainfall becomes gradually more copious toward the mountains until in the foothill region near Teapa it is excessive, and the season lasts usually until March and in some years much later. The season of my visit was exceptional and frequent rainstorms interfered with the planting of the corn crop. During the early part of the rainy season heavy showers fall nearly every day during the afternoon or evening. In September or October the northerly storms or "nortes" begin and occur at frequent intervals until the end of the rainy season. The nortes are cold windstorms coming from the north and bringing steady rains that last for several days. During the latter part of the season and notably the year of my visit during the months of March and April, heavy nortes, discharging against the slopes near and above Teapa, caused floods, while on the coast little or no rain fell.

In general character the vegetation of the Teapa region is very similar to that of the humid tropical parts of Veracruz. Along the coast

the forests are low and made up largely of species that grow near permanent water and do not attain very great size. A few miles above Villa Hermosa the character of the forests begins to change gradually along with the change in climate. The forest becomes larger and heavier to the southward toward the mountains, and in the foothill region, where temperatures are fairly high and the rainfall reaches the maximum, towering forest trees also reach their greatest size, often measuring 6 to 10 feet in trunk diameter. In these heavy forests at the time of my visit, even on bright days, the heavy rain drops, or the dew that gathered on the leaves at night, never dried, and everything remained dripping with moisture. Though these forests with their heavy canopy are dark in places and very damp, they lack the excessive abundance of bromeliads, orchids, ferns, mosses, and other plants massed on the ground and on the trunks and branches of trees, which gives such a particularly gloomy aspect to the forest interior nearer the top of the range in Chiapas. Conditions there are evidently due to more continuous moisture as the clouds gather and lie upon the mountains, burying the forests in mists almost throughout the year. The zapote mamey (*Callocarpum mammosum*) was noted growing in the foothills under conditions strongly suggesting that this extensively cultivated tree is native here. Other common trees noted in the foothills and on the plain were the Spanish cedar (*Cedrela mexicana*), chico zapote (*Achras zapota*), caoba or mahogany (*Swietenia macrophylla*), at low elevations the hule or rubber tree (*Castilla elastica*), and an *Erythrina*. Fringes of willows grow along the rivers on the plain. The principal crops cultivated are corn, beans, sugarcane, rice, cacao, and tobacco. Humid Lower Tropical Zone.

## TAMAULIPAS

## Altamira (75 feet):

April 2-24, May 15-20, 1898.—Altamira is a small town near sea level on the shore of extensive fresh-water lagoons connected with the Río Tamesí in extreme southern Tamaulipas. I visited the locality alone in April 1898 and in company with Nelson in May 1898. Immediately about the town and stretching away for many miles to the north is a gently rolling, rather sandy plain. The climate is much drier than that of the country south of the Río Pánuco in Veracruz. Slight frosts occur here in winter but are not severe enough to prevent the production of bananas and mangoes along the banks of the Río Tamesí. The greater part of the plain near Altamira is covered by a low, thin growth of chaparral peculiar to a dry climate. This is

interrupted here and there by strips that may be several miles broad of tolerably heavy forest made up largely of live oaks and ojite (*Brosimum alicastrum*). The ojite is a large tree, the leaves of which are used extensively for feeding stock in many forested parts of tropical eastern México, where grass is not abundant.

About 10 miles north of Altamira open grassy plains begin and reach away to the north indefinitely. Scattered over the plain are patches of guayaba bushes, mesquites, acacias, and cactuses. In the shallow lagoons near Altamira are thousands of acres of tules and other aquatic plants, including the water-hyacinth, which as elsewhere is an impediment to canoe navigation. The Río Pánuco, which at its mouth is confluent with the Río Tamesí, a few miles south of Altamira, is near the boundary in the coast region between the Humid Lower Tropical and the Arid Upper Tropical Subzones. The transition is abrupt, owing in part to humid tropical conditions maintained as a result of heavy precipitation northward in the coast region along the eastern flank of the Sierra Madre Oriental to near the end of the main mountain range between the valleys of the Río Pánuco and Río Tamesí in eastern San Luis Potosí. Owing to the absence of mountain ranges near the coast and to low interior elevations in general, arid conditions to the northward become prevalent at once, and the Arid Upper Tropical Subzone soon passes into an area mainly Lower Austral in character.

#### Bagdad (10 feet):

*February 13-15, 1902.*—Bagdad is a village at very low elevation on the Río Grande about 6 miles above the mouth of the river. On February 13 we moved from Matamoros to Bagdad and returned on February 15. Brackish lagoons and salt flats occupy much of the plain bordering the lower course of the Río Grande in this vicinity. Owing to successive dry seasons, and perhaps to increasing use of water for irrigation farther up the Río Grande Valley, lagoons and marshy places near the mouth of the river, formerly affording feeding grounds for waterfowl, were dry. Even the ponds and sluggish sloughs marking former channels in the delta of the river were dry at the time of our visit. Lower Austral Zone.

#### Camargo (200 feet):

*January 4-29, 1902.*—Camargo, or Ciudad Camargo, is a town at about 200 feet near the mouth of the Río San Juan in the northwestern strip of Tamaulipas. I left Nuevo Laredo by slow stage on the evening of January 1 and arrived at Camargo shortly after midnight

on January 3. Camargo is situated near the southern bank of the Río Grande, a little over 100 miles from its mouth. The Río San Juan, a stream of moderate volume, rising in the mountains of Nuevo León and Coahuila, passes the town and enters the Río Grande about 2 miles below. The banks of the Río Grande are lower than at Nuevo Laredo, and during floods the water spreads over much of the adjoining country. Ridges of conglomerate limestone rise about 150 feet above the river valley on both sides of the Río San Juan about 10 miles above the point where it enters the Río Grande. The climate is warmer than at Nuevo Laredo but so dry that crops cannot be grown without irrigation. The winter storms or "nortes" often bring rain, and showers may occur at almost any time during the year, but crops depend almost entirely on the irrigation of land by the usual overflow of the Río Grande in July or August. Light frosts occur in winter, but there is seldom any snow.

The vegetation of the river valley at Camargo is similar to that of the plains near Nuevo Laredo, but some differences were noted. *Larrea tridentata* was not observed along the river valley below Nuevo Laredo. Some species, notably the ebano (*Pithecollobium*), had not previously been seen. This tree, with dark green foliage, is rather common and very conspicuous among the nearly leafless vegetation, both on the plain and along the river banks. The mesquite is still by far the most abundant species and much larger than at Nuevo Laredo, some near the river being trees more than a foot in diameter. Ranging with the mesquite is the huisache (*Acacia farnesiana*). Other trees are the cypress, *Taxodium mucronatum*, and willows, which grow along the river, and on the plain the tepehuaje and paloblanco. The latter are trees of large size with brightly colored bark. They were leafless but bore an abundant crop of small dark red berries at the time of my visit. The species is one of the most common of the trees at this locality, and ranges up the valley at least to Nuevo Laredo, where, however, only a few were seen.

Corn and beans are the principal crops, grown mainly on land irrigated by the annual overflow of the river in July or August. Some seasons, as during the year preceding my visit, the river did not overflow and the crops, where planted at all, were light. Very often two crops of corn are grown on the same land within the year. In the town some banana plants had been killed or severely injured by frost, which, however, was so slight that nearly all the native vegetation appeared to be unaffected. Many species still retained a few of their leaves, others were in nearly full leaf, and some were beginning to flower in January. Lower Austral Zone.

**Forlón (400 feet):**

*May 27-29, 1898.*—Forlón is a station at about 400 feet on the railroad about 30 miles south of Victoria. On May 27 we moved from Victoria to a point near the northern fork of the Tamesí River, just south of the railroad station. We returned to Victoria on May 29. Lower Austral Zone, invaded by numerous Arid Upper Tropical elements.

**Guerrero (300 feet):**

*January 2, 1902.*—Guerrero, or Ciudad Guerrero, is a town near the mouth of the Río Salado in the northwestern extension of Tamaulipas. Stop-over point en route to Camargo. Lower Austral Zone.

**Jaumave (1,500 to 2,000 feet):**

*June 1-6, 1898.*—Jaumave is a town at between 1,500 and 2,000 feet in southwestern Tamaulipas. On May 31 we left Victoria and traveled 26 miles with a pack outfit in a southwesterly direction to a ranch called La Mula. On June 1 we continued in the same direction for about 21 miles to Jaumave in the valley of the same name. Collections were made at slightly varying elevations in the valley near the town. From Victoria our road led us up over the narrow summit of a range of mountains about 4,000 feet high, apparently forming a low northern extension of the Sierra Madre Oriental. The mountains are of limestone and are steep and rocky with no water except in the bottoms of the deep canyons which cut through them and carry drainage from the interior to the Gulf. The Valley of Jaumave is about 40 miles long by 12 to 20 miles wide, rather irregular in outline, bordered by steeply sloping limestone mountains reaching 500 to 2,500 feet above its bottom. The valley is drained by headwaters of the north fork of the Río Tamesí, the bed of which is usually dry during the dry season, but carries extensive floods at intervals during the rainy season. The valley is subject to winter frosts.

The top of the ridge crossed west of Victoria bears a stunted growth of oaks, extending down about 800 feet below the summit. The vegetation is most abundant on the side of the range facing the Gulf. In the bottom of the valley mesquites grow along the watercourses and acacias, mimosas, cassias, and other shrubs, agaves, and cactuses are more generally distributed. Agaves are remarkably abundant. We had never seen in any other part of México such an extreme abundance of agaves as we found in this valley and on the adjacent hill slopes. These fiber-yielding plants are the source of an important industry in this region. Corn, beans, and some garden vegetables are cultivated. Lower Austral Zone.

**Matamoros (30 feet) :**

*February 1-13, 15-22, 1902.*—Matamoros is a town at 30 feet on the Mexican side of the Río Grande, opposite Brownsville, Tex. I reached Matamoros by rail on February 1 from San Miguel, the terminus of the road 20 miles below Camargo. On February 4 Nelson, who had been in Washington, arrived by stage at Brownsville, there being no railroad to extreme southern Texas at that time. Work in the field extended for several miles along the southern side of the Río Grande. For many miles in every direction from Matamoros the country is a nearly level plain only a few feet above the sea, toward which there is a very gradual descending slope. Through this plain the Río Grande winds its way in a series of irregular curves. The country is so low from Matamoros to the sea that at high water in the river nearly the entire district and sometimes the streets of the town are flooded.

The climate is hot and generally dry in summer, but frosts occur regularly from November to February, and cold storms or northers, bringing high wind and more or less rain, are frequent from November to March. At the time of our visit northers were so prevalent as to interfere with our field work, although the rainfall was light. Snow was said to fall at intervals of a few years, and in the winter of 1880 a storm brought between 1 and 2 feet of snow, the weight of which was said to have broken in the roofs of some of the flat-topped houses.

The vegetation includes many species of the warmer country farther south that here approach the northern limit of their distribution. Among these are a palmetto (*Inodes texana*), *Tecoma stans*, *Sapindus saponaria*, and a *Lysiloma*. However, such species as the mesquite and huisache (*Acacia farnesiana*), found more sparingly in tropical areas, are predominant. A yucca was common and just beginning to flower. Lower Austral Zone, invaded by some Arid Upper Tropical Subzone elements.

**Miquihuana (5,000 to 9,000 feet) :**

*June 7-16, 1898.*—Miquihuana is a town at 5,000 feet about 40 miles southwest of Ciudad Victoria, Tamaulipas. On June 6 we left Jaumave and traveled 23 miles in a northwesterly course to a sheep ranch called Angelito. On the following day we continued 22 miles in the same direction and reached Miquihuana, where we remained until June 16. Specimens collected at various elevations from the bottom of the valley up to near the top of the adjacent mountains were all labeled "Miquihuana." From Jaumave we followed a long open canyon, gradually ascending between low mountains with rounded summits to within 10 or 12 miles of Miquihuana. From the head of this

dry canyon the country became more open, forming a series of small valleys with rounded hills on all sides, until we finally entered the valley of Miquihuana, with the town lying on the north side. The valley is oval in outline, and from the northern border a picturesque group of steep mountains rise from 8,000 to 9,000 feet above sea level. Water is scarce, both on the plains and in the mountains throughout this region. At the time of our visit the annual summer rains were already past due, but the weather remained dry.

The bottom of the valley is open and supports only a thin growth of grasses, but the borders are covered with a mixture of mesquites, acacias, cassias, two species of yucca, and several species of agaves and cactuses. At about 6,000 feet on the mountains this lower-slope vegetation gives way to small oaks. A little higher pinyons begin and at 7,000 feet two other pines appear. At 8,500 feet, under cliffs on north slopes where moisture is retained the longest, firs (*Abies religiosa*) are common, along with a dense growth of bushes, and the ground may be covered with moss. The most striking feature of the vegetation of the mountains, however, was the remarkable stand of the plant later named *Nolina nelsoni*, which covers the south slope from 7,000 to 8,500 feet in great profusion, giving an exotic appearance to the area. The main industry of the people is gathering the fiber of a small *Agave* which grows here in nearly the same great abundance as at Jaumave.

The valley and lower mountain slopes up to about 6,000 feet are referable to the Lower Austral Zone. The Upper Austral Zone extends from about 6,000 feet up to 8,000 feet, above which some Transition Zone elements appear.

#### Nuevo Laredo (440 feet):

*December 18-31, 1901.*—Nuevo Laredo is the Mexican town opposite Laredo, Tex. I arrived in Nuevo Laredo from Washington, D. C., on December 18 and remained until December 31, working in the vicinity of the town and for several miles up and down along the Mexican side of the Río Grande.

Nuevo Laredo is situated at 440 feet on the southern bank of the Río Grande, about 175 miles from the mouth of the river. The valley of the Río Grande is here a great undulating plain with no mountains near. The river is confined to a comparatively narrow channel between banks 30 to 40 feet in height which effectually prevent its spread over much of the adjoining plain during floods, as occurs farther down where the banks are lower. The climate is very dry. The principal industry is stock raising, but owing to prolonged

drought much of the stock had died of starvation. The rains are irregular but may come at almost any time of year. During the winter months light rains sometimes accompany the "nortes" or northers, which are cold recurrent storms affecting the entire Gulf coast of México. In the Río Grande Valley these storms have a marked influence far inland, but farther south they are checked by the Sierra Madre Oriental lying parallel to and at no great distance from the coast. Frosts occur in winter but there is usually no snow. Very little land near Nuevo Laredo is suitable for agricultural purposes. Corn and beans are cultivated in a very limited way along the bed of the river.

On the plain near Nuevo Laredo the mesquite is by far the most abundant and conspicuous plant. Usually it grows as a mere shrub 5 to 10 feet high, but along the river a few reach tree size. Other desert plants are *Larrea tridentata*, *Acacia farnesiana*, yuccas, and cactuses. Along the river are narrow belts of willows and *Baccharis* bushes. Lower Austral Zone.

#### San Fernando to Jiménez (see Soto la Marina).

#### Soto la Marina (20 feet):

*March 1-10, 1902.*—Soto la Marina is a town near the head of tide-water, which extends far up the Río Soto la Marina in eastern Tamaulipas. On February 22 we left Matamoros for Soto la Marina by wagon. Four days' travel in a southwesterly course over the nearly level coastal plain brought us to San Fernando on the Río Conchos. The Río Conchos, the first stream we had seen since leaving Matamoros, is only a fair-sized creek. From San Fernando on February 26 we took the main road to Ciudad Victoria and after driving about 35 miles stopped at a ranch called Tres Palos. On the following day we reached the town of Santander Jiménez about 32 miles farther, on the Arroyo Jiménez, a branch of the Río Soto la Marina. From San Fernando to Santander Jiménez, where the altitude is 800 to 1,000 feet, the road traverses a hilly country and a broad mesa bordering a nearly level valley several miles wide at the latter town. At Santander Jiménez we left the road to Ciudad Victoria and on February 28 we reached the village of Abasolo, near the Río Soto la Marina, where we occupied the school house. On March 1 we drove 33 miles from Abasolo to Soto la Marina. Field work extended for several miles from the town and specimens collected on March 8 in the Sierra de Tamaulipas, 20 miles southwest of Soto la Marina, were labeled "Soto la Marina."

Soto la Marina is located 25 miles inland in a straight line from the coast. The fact that the tides extend up the Río Soto la Marina to within a short distance of the town is evidence of the low, level character of the coast plain. Within a few miles above Soto la Marina the coast plain gives way to rolling hills, which alternate with level valleys or narrow plains until the base of the Sierra Madre Oriental is reached. From near Jiménez the Sierra Madre is visible in the distance to the west, while here and there isolated mountains or short ranges may be seen rising from 500 to 2,000 feet above the general level. One of these, the Sierra de Tamaulipas, lies in the region to the southwest of Soto la Marina. A striking characteristic of the region between Matamoros and Soto la Marina was the extreme scarcity of surface water and general aridity caused by lack of rain. At Soto la Marina sharp frosts are said to be of regular occurrence in December and January, and snow sometimes falls to a depth of several inches.

At Soto la Marina we were informed that previous to the heavy stocking of the region with cattle much of the country was open, grassy plains, which, as a result of this stocking, became covered with thorny jungle. The change appears to have been due to overgrazing and to the eating of the seed pods of the mesquite and other leguminous shrubs, the seeds of which, after passing through the digestive tract of cattle, were widely distributed in a more variable condition than before. Along the route from Matamoros the coast plain was mainly covered with a scrubby jungle of mesquite, huisache, ebony, and other shrubs, alternating at intervals with grassy areas, some of which were still of considerable extent. In the more fertile belts the mesquites, huisaches, and other trees increased in size to form forests 20 to 30 feet high. Along the streams cottonwoods and bald cypresses (*Taxodium*) were common. A large branching cactus appeared near Jiménez and was abundant about Soto la Marina.

The effects of the severe frost that occurred in eastern México in February 1897 was still evident in the vast number of dead mesquite, huisache, and ebony trees, besides smaller species and the large cactus mentioned. Many of the trees had only their tops killed and were sending out green branches from the trunk or base, but over large areas the tops of the larger shrubs and trees were dead and gave the appearance of a fire-swept forest in which the green undergrowth had sprung up again. A small but very fiery pepper called chile juipin (*Capsicum frutescens* var.) grows nearly everywhere in the region and is gathered in great quantities and shipped out mainly from Jiménez and Soto la Marina. Lower Austral Zone.

**Victoria** (Ciudad Victoria on maps) (1,100 to 3,500 feet):

*May 20-27, 29-31, 1898.*—Victoria, the capital, is in the southern part of the state of Tamaulipas. It is a large town on the extreme western border of the coast plain, with the foothills of a range of mountains rising only about 2 miles away. Arriving by train, we worked in the vicinity until May 27, when we moved south along the railroad about 30 miles to a tank near a river crossing just south of Forlón. We returned to Victoria on May 29. Specimens taken in the mountains to the west after leaving the town on May 31 were labeled "Near Victoria." The plain slopes down gradually from the base of the mountains near Victoria to Tampico. It varies from nearly level to gently rolling and in places low hills rise islandlike. A few small streams flow from the mountains to the Gulf, but the country in general is scantily watered. Between Victoria and the vicinity of Tampico much of the country is covered with low forests of scrubby ebony and other trees, with dense undergrowth of brush, as noted at Velasco in eastern San Luis Potosí alternating with a mixture of open, grassy prairies and strips of low woods and brush as at Chijol, Veracruz. Near Victoria a mixture of mesquite, acacias, and other thorny shrubs, cassias and cactuses grow on the higher ground, with sycamores, cypresses, and mesquites of larger size near streams. Even the basal slopes of the mountains facing the distant Gulf are extremely arid and devoid of any but a very scanty growth of vegetation. The animal life is a mixture of Arid Upper Tropical and Lower Austral Zone elements. A number of tropical birds occur, but the area is preponderantly Lower Austral in life zone character.

## TLAXCALA

**Apizaco** (7,800 feet):

*April 4-7, 1893.*—A railroad junction near the center of the state. To the south and east extend wide plains broken only by low hills, except for the Cerro de Malinche to the southeast. Toward the north, however, there is a general rise of the country so that it reaches the lower pine limit within 2 or 3 miles of Apizaco. From this border of pines, at an altitude of about 8,000 feet, undulating hills covered with these trees extend away for many miles to the north and northeast. They form a part of a generally elevated pine-covered section which extends from northern Tlaxcala and southeastern Hidalgo east and northeast across parts of northern Puebla to the point where the plateau region breaks off abruptly into the tropical lowlands along the Gulf coast. The fauna and flora is very similar to that found at Irolo, Hidalgo.

**Cerro de Malinche (8,400 to 10,000 feet):**

*May 9-17, 1893.*—Work was carried on from a rancho at about 9,000 feet on the north slope, but trapping was not extended above about the 10,000-foot level. The peak was ascended on horseback to near timber line.

The Cerro de Malinche is the only high mountain between the Volcán de Popocatepetl and the Peak of Orizaba. It rises abruptly from the nearly level surrounding plain at 7,500 to 8,000 feet to an elevation of 13,562 feet. The mountain is an old volcano. Two deep canyons break the northeastern face and penetrate to the base of the main peak. These canyons apparently mark the site of the broken-down crater. As on the other high mountains of the southern end of the tableland the forest trees are distributed in well-marked belts. From about 8,400 feet up to 9,000 feet there is a mixed stand of pines, oaks, one or more junipers, and a wild cherry. From 9,500 to 12,000 feet there is a scattered growth of *Abies religiosa* and a large alder, and, especially on open slopes, a thick covering of the coarse sacatón grass noted on the other high mountains of the general region. Above the 12,000-foot level and extending to within a few hundred feet of the summit is a thinner stand of a smaller species of grass.

**Huamantla (8,300 feet):**

*May 10-11, 1893.*—The town of Huamantla is located on the railroad at 8,300 feet on the edge of the high interior plain close to the northern base of the Cerro de Malinche. The nearly level plain extends eastward into the state of Puebla. Upper Sonoran Zone.

**Mount Malinche (see Cerro de Malinche).**

## VERACRUZ

**Boca del Monte (7,800 feet):**

*March 12-14, 1894.*—Railroad station at about 7,800 feet at the extreme edge of the tableland west of Orizaba. Brief visit made to collect pocket gophers, which proved to be typical *Thomomys umbrinus umbrinus*. Upper Austral Zone.

**Carrizal (1,000 feet):**

*May 11-15, 1901.*—Carrizal is a town at 1,000 feet, a station on the railroad across the lowland plain about halfway between Jalapa and the coast of Veracruz. Several days were spent working in the vicinity by the writer alone. General conditions are much the same as at Chichicxtle. Arid Lower Tropical Zone.

**Catemaco (1,000 to 1,500 feet) :**

*April 25 to May 6, 1894.*—Catemaco is a small town at about 1,100 feet on the western shore of the lake of the same name in southern Veracruz. We reached Catemaco from San Andrés Tuxtla, the larger town 7 miles farther west. Beautifully clear streams were crossed at intervals along the way to the lake, which lies as a broad shining expanse in the midst of the hills. The lake is about 8 miles long in a southwest by northeast direction, and about 3 miles broad, but rather irregular in outline. It is 40 to 50 feet deep. The outlet is a small river that cuts the southwestern shore and descends toward the low country in a series of five waterfalls. The Catemaco district lies on the western basal slope of the Sierra de San Martín. The highest point of this range rises some miles southeast of Lake Catemaco and the next highest is the summit of the Volcán de Tuxtla (or San Martín) to the northeast of the lake.

Cloud formations from over the Gulf discharge most of their moisture on the Sierra de San Martín, and the vicinity of Catemaco behind this mountain barrier is near the borderline between Arid and Humid Tropical areas. The low hills, plains, and valleys about the western side of the lake are rather dry, being covered with small and sparse arboreal vegetation, and some open, grassy llanos are encountered. Elsewhere the heavy Humid Tropical forest prevails, descending to the water's edge along the eastern shore of the lake. Mahogany and Spanish cedar are among the forest trees. The main cultivated crop about Catemaco was tobacco. Corn, bananas, and coconuts were also grown, and a coffee plantation on the east shore of the lake appeared to be successful.

**Chichicaxtle (500 feet) :**

*February 13-15, 1894.*—Chichicaxtle is a station at 500 feet on the railroad, 25 or 30 miles northeast of Veracruz. From Santa María we continued with pack outfit on February 13 about 20 miles eastward to this village in the arid lowlands 10 or 12 miles from the Gulf. The sloping plain in this vicinity is covered with small trees, largely leafless, thorny bushes, scattered yuccas, palms, and cactuses, with occasional open stretches of grassland, dry and sun-bleached at this season. Large wild figs and other evergreen vegetation grow along the bottoms and shaded slopes of canyons where subsoil moisture is continuously received. February 15 we traveled by rail from Chichicaxtle to Veracruz, the route being along a part of the Gulf coast bordered by sand hills from 10 to 50 feet high. Arid Lower Tropical Zone.

**Chijol (200 feet):**

*May 9-11, 1898.*—Chijol is a station at 200 feet on the railroad in extreme northern Veracruz. It is located on a rolling part of the coastal plain, covered with alternating strips of scrubby forest and open grassland. Arid Lower Tropical Zone.

**Coatzacoalcos (now Puerto México) (50 to 75 feet):**

*April 9-17, May 9-14, 1896; January 26 to February 1, 1904.*—Coatzacoalcos, renamed Puerto México, is the seaport on the Gulf of México at the mouth of the Río Coatzacoalcos and the north end of the railroad across the Isthmus of Tehuantepec. We arrived at Coatzacoalcos on the evening of April 9, having spent two days in crossing the isthmus on a slow freight train. From Tehuantepec the arid coastal plain of the Pacific side of the isthmus rises gradually toward the interior for about 35 miles, and then the railroad ascends more rapidly to an altitude of a little more than 800 feet near Chivela, on the plain of Chivela, which forms a broad pass between bordering mountains. From this vicinity a much longer slope extends north to the Gulf of México. About 30 miles inland from Coatzacoalcos the land surface becomes very low, and during the rainy season much of it is flooded. Scattered through this low country are rounded hills rising from 25 to 100 feet above the level of the plain. Along the coast are sand dune ridges of about the same altitude. Coatzacoalcos is built mainly on one of these ridges.

The vegetation of the Gulf of México, or northern, side of the isthmus is much more luxuriant than that on the Pacific slope. Between La Puerta and Santa Lucrecia, on the railroad across the isthmus, there is a belt of heavy tropical forest. Here mahogany (*Swietenia macrophylla*), Spanish cedar (*Cedrela mexicana*), and fustic (*Chlorophora tinctoria*) were plentiful before most of the accessible timber was cut for exportation. Rubber trees (*Castilla elastica*), wild figs (*Ficus*), silk-cotton trees of several kinds, probably including *Ceiba pentandra*, *Pachira aquatica*, and *Bombax ellipticum*, are among the larger trees of the forest. From near Santa Lucrecia to the coast extends a low, flat plain much of which is swampy and supports vegetation peculiar to wet situations. In places the forest gives way to open, grassy areas, or savannas, or to broad marshes filled with water-lilies and other aquatic plants. The regular rains occur in this region between the end of May and December, but from December to May there are periods of stormy weather often accompanied by more or less rainfall. These are known as nortes owing to the cold north wind blowing at the time. The moisture on this side of the isthmus

is sufficient to keep the forest green throughout the year. A few trees lose their leaves during the dry season, but these are too few to affect the general green aspect of the forest. Lower Humid Tropical Zone.

**Cofre de Perote (9,500 to 12,500 feet) :**

*May 23-31, 1893.*—On May 23 we left Perote with a pack outfit and ascended the steep northwest side of the Cofre. We reached the hut occupied by an Indian snow-gatherer, near timber line, in a cold rainstorm that had just begun. For the next three days this storm continued almost without intermission. The hills above timber line nearby were covered with a thin layer of snow. Despite the storm a few mammals were trapped every night. The day after our arrival one of the mules died from exposure and the owner of the outfit took the others back to Perote to save them from the same end. Finally when the storm ceased we ascended to the summit of the Cofre and the same day descended to a deserted Indian ranch at about 9,500 feet where we camped for the remainder of our stay on the mountain. The distance from the town of Perote to the summit of the Cofre de Perote is 6 or 7 miles in a straight line and about twice as far by trail.

The Cofre de Perote is a high volcanic mountain mass rising abruptly from the plain to the southeast of the town of Perote, on the western border of Veracruz. According to the Comisión Geográfica Mexicana the altitude is 4,281.5 meters, or 14,047 feet. The mountain is an exposed northern outpost of a southern section of the Sierra Madre Oriental extending north from the Peak of Orizaba to form a high wall along the eastern edge of the tableland. The eastern side drops away steeply for 9,000 or 10,000 feet, and then a more gradual slope extends in undulating ridges down into the hot coast country. As the Cofre stands out like a high promontory at the north end of the range it is exposed to the full force of the "northers," or northerly storms that recur so frequently, as well as to the regular, almost daily, heavy precipitation of the rainy season. As a result the first and heaviest rainfall of nearly all storms is directed against the Gulf slope of this mountain, rendering it probably the wettest section of all México. The western base rests on the arid tableland at an altitude of about 7,850 feet. Reaching far away to the north and northwest from the Cofre a low, broken series of pine-covered ridges and knobs forms an extension of the mountains bordering the eastern side of the central plateau.

The Cofre de Perote is crowned by an oblong mass of lava, with perpendicular sides about 250 yards long and 200 feet high, resting

on a base composed of layers of loose volcanic material, the name evidently derived from the extraordinary boxlike shape. The top is evidently the remains of a heavy cap of lava that once covered the summit of the mountain but that has been worn away by glacial action to about its present form. The only feasible route to the top of this mass of lava is by a crevice that marks one side and up which we crept. The old crater wall was broken down on its eastern side, leaving the high peak on its western border. The upper slopes, below the summit of the Cofre, are marked with glacier basins and small valleys extending down to about 11,000 feet. As a result of extensive glacial action on the higher parts considerable fine soil has been deposited on the flanks of the mountain. It is a much older peak than Orizaba, with few signs of volcanic ashes on its slopes, although there is much volcanic sand on the plains extending west from the base of the mountain.

The arborescent vegetation and general character of the fauna of the west and northwest slopes of the Cofre are essentially the same as on the west slope of Mount Orizaba, both in species and distribution.

**Hacienda Mirador** (see Mirador).

**Jalapa** (5,000 feet):

*June 20, 1893; May 9-11, 1901.*—Jalapa is a city at 5,000 feet on the east slope of the mountains bordering the interior plateau, on the northern railroad line between Veracruz and the City of México. Brief stops were made, the second by myself alone, in passing through en route to other localities. Humid Upper Tropical Zone.

**Jaltipan** (100 feet):

*April 27 to May 4, 1896; February 1-9, 1904.*—Jaltipan is a town on the railroad at 100 feet about 15 miles southwest of Coatzacoalcos. The locality was visited again by me alone in 1904. In this vicinity are extensive open savannas, and cattle raising is an important industry. Arid Lower Tropical Zone.

**Jico** (or Xico) (4,800 to 6,500 feet):

*June 21 to July 23, 1893.*—From Jalapa we proceeded south 4 or 5 miles to Coatepec and then turned southwest 3 or 4 miles in a direct line to the small town of Jico at about 4,700 feet. From the vicinity of the town work was extended up to 6,500 feet, where I lived for two weeks with an Indian family at a small ranch in the rain forest on the slope of the Cofre de Perote. Field operations in the vicinity of Jico were carried on at a disadvantage, as the period covered was in the

rainy season. At this time the early morning may be fairly clear, but clouds gather and before noon heavy showers begin and may last through much of the night. At the higher elevations it is rarely clear. Between heavy showers, fog and mist are prevalent. This section, at 4,000 to 6,500 feet, along the eastern flank of the Cofre de Perote, fronting abruptly on the Gulf, probably has the wettest climate of any part of México.

The Cofre de Perote rises so steeply just west of Jico that it seems almost to overhang the place on a clear morning, and to the east the country sinks away rapidly in undulating descent, broken by low hills and ridges, to the hot coast region. To the south a series of east and west ridges, marking the descent of deep canyons, lie like ribs on the slope. Beyond these, on a clear day, there is a magnificent view of Mount Orizaba, rising in a long sweeping curve from 4,500 to more than 18,000 feet, with a cap of brilliant white snow on its upper 4,000 feet.

The combination of a rich volcanic soil, abundant moisture well distributed through the season, tropical climate, and diverse environmental conditions has resulted in the development of a flora and fauna of extraordinary variety. Much of the land up to about 5,500 feet near Jico has been denuded of its original forest cover and is now partly in cultivation and partly returned to subclimax stages in plant succession. At the higher elevations more of the climax forest remains. The contrast between the climax forest and the plant species that invade the cleared land, nearly all of which are different, is very striking, and similar differences in the fauna are clearly indicated. In the partially cleared lands, in comparison with the depths of the climax forest, observations are more readily made, and the variety of intrusive flowering plants, from herbs to shrubs and small trees, together with the numbers of tropical birds constantly met with, is bewildering. In the obscurity of the climax forest, on the other hand, conditions are more uniform. Birds of species unlike those of the cleared spaces are not rare, but they are more securely hidden. Many species of mammals are native and they also are affected by the clearing of the land. Aside from the squirrels most species are nocturnal in habits and comparatively little known.

Near Jico a small river is encountered every mile or two, rushing down its rocky course through a small canyon. Scattered along these streams are alders and tall sycamores whose white trunks gleam strangely in contrast with the brilliant green background of the fern and vine-hung canyon walls. These appear to be species intrusive

here in a tropical setting, owing to the cooling influence of water from high mountain sources. At 6,500 to 7,000 feet on the slope above Jico a heavy stand of magnificent oaks gives the forest a distinctive character. Occasional fir trees (*Abies religiosa*) range down among the oaks. Owing to the wealth of species, still very imperfectly known, and local modifying conditions, the life zones of the mountain slopes above Jico cannot be very sharply delimited. The explanation seems to be that the cool, damp climate, with continuously cloudy weather during the growing season, permits some boreal species of plants, and with them boreal animals, to range far down the slope. At the same time, owing to the heavy vegetation cover and absence of frost, species of the tropical lowland forests range high on the slope where they meet or overlap boreal species.

The generally cleared and cultivated area from 4,000 feet up to about 5,500 feet is truly tropical, as shown in part by the cultivation of tropical crops, and many tropical elements extend up the slope to undetermined limits. From 5,500 feet to 7,000 feet the mountain-sides are covered by a mixed forest in which oaks of several species predominate. A number of species of oaks have been described from the general region. One, the encina roble, is the largest tree of this forest, towering to great height and frequently 6 to 7 feet in diameter 6 feet above the ground. Between 6,500 feet and 7,000 feet a few firs (*Abies religiosa*) appear among the oaks. The slope above the 7,000-foot level was not visited here, but firs were later found by us in scattered lines in a pin-forested belt along the sides of canyons and ridges between 10,500 and 11,800 feet on the southeastern slope of Mount Orizaba.

#### Las Vigas (7,500 to 8,400 feet):

June 8-19, 1893.—Las Vigas is a station on the railroad at 7,938 feet, about 15 miles northeast of Perote. It is on the extreme edge of the tableland, and the descent to the hot coast country begins abruptly at this point. From our headquarters here we worked for several hundred feet both up and down neighboring slopes. The Cofre de Perote looms about 15 miles to the southwest of Las Vigas. The tableland reaches its eastern limit at Las Vigas in the form of a long, narrow strip of nearly level plain extending outward from near Perote to the rim between the northern foothills of the Cofre and the hilly country to the north. Northerly winds from over the Gulf are cooled and precipitate their moisture or envelop the seaward slope in dense clouds of fog and mist for days at a time. As a result there is a greater luxuriance of vegetation along this extreme eastern border of the

tableland than can be found a few miles toward the interior at the same altitude, and the contrast in climatic conditions is reflected in the fauna as well as in the flora. The tableland plain seems assignable to the Upper Sonoran Zone, while the upper part of the slope just below Las Vigas presents mixed affinities but is largely Transition in zonal character.

**Maltrata (6,000 feet):**

*March 24-26, 1894.*—Maltrata is a small town and railroad station at 6,000 feet in the basinlike valley near the headwaters of the Río Blanco, a few miles west of Orizaba. It is at the foot of the precipitous slope down which the railroad winds back and forth through magnificent mountain scenery. Limestone ridges flank the valley here, below lava beds descending from outlying spurs of Mount Orizaba. The town is above the frost line, and the biota of the vicinity is closely allied to that of the tableland above, which is Upper Sonoran in zonal character.

**Minatitlán (75 to 100 feet):**

*April 17-26, 1896.*—Minatitlán is a town at about 75 feet on the Río Coatzacoalcos about 24 miles above the port at its mouth. The town was reached by river steamer from Coatzacoalcos on April 17. It is built on a low ridge of stratified sand of dull red and yellow colors. The tide affects the river above Minatitlán for a few miles. Numerous small, sluggish streams tributary to the Coatzacoalcos wind about over the broad coastal plain. Some of these are of considerable size and are navigable by small steamers of 2 or 3 feet draft for 50 to 75 miles. Others are mere creeks that are nearly dry during the dry season. Land in cultivation is limited largely to rich alluvial strips along the rivers, where crops of corn, rice, beans, tobacco, sugarcane, bananas, pineapples, mangoes, oranges, and watermelons are grown. Humid Lower Tropical Zone.

**Mirador (3,800 feet):**

*February 2-12, 1894.*—Mirador was a hacienda at 3,800 feet on the eastern slope of the mountains 15 miles northeast of the town of Huatusco in west-central Veracruz. On January 31 we left Fortín, a station at 3,800 feet, on the railroad below Orizaba, with a hired pack outfit and proceeded north across the eastern slope of the foothills of Mount Orizaba to San Juan, at about the same altitude. On the following day we continued north to Huatusco, about 40 miles north of Fortín, at an altitude of 4,200 feet. This was a town of several thousand inhabitants and the most important point in one of

the richest coffee-producing districts in México. About 15 miles farther the trail, turning northeasterly, brought us to the hacienda of Mirador on February 2. Here we were welcomed by Don Florentino Sartorius and made comfortable during the period of our stay. The hacienda had been in the possession of the Sartorius family for many years. It is located on the slope of the mountains at 3,800 feet, with higher and lower levels easily accessible, in a region presenting faunal and floral richness in extraordinary variety. Elder members of the Sartorius family were interested in natural history, an interest shared by Don Florentino, and the hacienda was visited by various early naturalists, including Sumichrast, who made extensive collections there. These collections led to the description of new species and the place acquired fame as a type locality. The new species include the northern race of the forest deer or brocket, *Mazama sartorii sartorii*.

From Fortín to Huatusco the trail led in a general northerly course but wound here and there with the changing contour of the country. To the west rises the long basal slope of Mount Orizaba, which increases in steepness as the peak is neared. From Huatusco to Hacienda Mirador the trail crosses a series of low but steep hills and then leads out upon a broad open slope descending on the east and north and rising in a magnificent sweep to the southwest, where it culminates on the snowy summit of Mount Orizaba. To the northwest the high rounded bulk of the Cofre de Perote forms a sharp outline against the sky in clear weather. From Mirador the outlook was over a broad expanse of apparently unbroken forest coastward, but on our descent we found many cleared acres and stretches of prairie-like plains, while the courses of various streams formed deeply cut canyons which were unexpected until we came near them.

About Fortín and nearly to Huatusco the country is mainly of limestone formation. About Huatusco and thence on nearly to Mirador and far down toward the coast there is a mixture of limestone and volcanic rocks. In many places conglomerate fragments, evidently detritus from the mountains, overlie and completely conceal the earlier limestone formation, but limestone strata appear in the cut walls of canyons.

From Fortín to Huatusco and nearly to Mirador the vegetation as a whole was very similar to that found on the lower slopes and in the valley near Orizaba. The north slope of a deep canyon crossed by us near Huatusco was remarkable for the beautiful and varied display of ferns, mosses, and other plants favoring a cool, moist situation. In many places the winding trail was fairly overhung by the graceful

fronds of tall ferns, and many tree ferns 6 to 8 feet high and with trunks 3 or 4 inches in diameter were seen here for the first time. The trees along the trails were hung with several species of ferns, with many orchids, tillandsias, and bromelias. Nowhere along the route did primeval forest occur, however, as nearly all the land is or has been in cultivation. As a consequence there is a profusion of small second-growth trees and a great variety of shrubs. Some small oaks, wild figs, blackberry bushes 15 to 20 feet high, a few opuntias, yuccas, and acacias were among the most noticeable species. With these were innumerable herbaceous plants and grasses that in the more open situations on slopes of varying exposure brought constant changes of flower-strewn verdure.

As we approached Mirador the vegetation became more luxuriant on uncultivated hill slopes, and various trees not previously seen appeared with a few hundred feet of descent. At Mirador a heavy growth of forest trees with epiphytes and rank undergrowth was found in low, damp ground and on north slopes. There wild figs, guarumo (*Cecropia mexicana*), several oaks, and various other large, vine-hung and epiphyte-laden forest trees were found with a rank undergrowth of bamboo, vines, orchids, ferns, and mosses. As in many other localities, an abrupt change in the vegetation is noted as one passes over the summits of the hills and descends on the south slopes. The summits and south slopes being exposed to the hot sun during the dry season become quite dry at that time, and this determines the character of the vegetation. The trees are of much smaller growth than on north slopes and include a profusion of thorny, leguminous species.

Between 2,500 and 4,200 feet the absence of frost, a heavy precipitation in the rainy summer months, and fogs, dews, and not infrequent winter rains result in an abundant forest growth and favorable conditions for coffee culture. Other crops grown at the hacienda included bananas, oranges, lemons, pineapples, mangoes, guayabas, tobacco, corn, and sugarcane. Owing to some precipitation of moisture throughout the year the forest is evergreen and the area lies in the Humid Upper Tropical Zone.

#### Motzorongo (800 feet) ·

*February 22 to March 5, 1894.*—Motzorongo is a railroad station at the hacienda of the same name, about 25 miles southeast of Córdoba. From Córdoba to Motzorongo the general aspect of the country is about the same, the hills rising from 500 to 1,500 feet on every hand, as the road winds through tortuous valleys. The hills are wholly

of limestone and form the eastern outlying ridges of the cordillera of Veracruz. A short distance east of Motzorongo the hills end and a lowland plain extends to the Gulf coast. Looked at from the low eastern base these sharply accented ridges and hills, rising one beyond the other, form very striking mountain scenery, ranging up to 6,000 or 7,000 feet above sea level. When viewed from the vantage point of the edge of the tableland at 8,000 feet or more, in contrast they appear as rather insignificant foothills descending toward the sea.

At Motzorongo a small stream, a tributary of the Río Papaloapan, flows down the valley. The bottom of the narrow valley has been under cultivation for many years, the principal crop being sugarcane. Much of the land formerly cleared is now covered with new timber stands representing many stages in plant succession. The bordering hills are still covered with their original forests of tall trees with wide-spreading crowns and vines clinging to the trunks or hanging in rope-like festoons from the branches. On north hill slopes the ground is damper and vegetation much more dense, the forest interior dark and gloomy, with an undergrowth of bushes and matted vines, almost impenetrable without the use of a machete. On the tops and south slopes, although the undergrowth is abundant, one can move about with much less difficulty. The heavy forests of the hillsides are marked here and there by giant wild fig trees towering above the general treetop level, and tillandsias, bromelias, and orchids are everywhere.

The locality is in the Humid Lower Tropical Zone.

**Mount Orizaba** (see Pico de Orizaba, Puebla).

**Omealco:**

*March 6, 1894.*—A railroad station about 25 miles in a direct line southeast of Orizaba. Plants collected while en route by rail from Motzorongo to Orizaba.

**Orizaba** (4,000 to 4,200 feet):

*January 16-29, February 20, March 21, 1894.*—Work here was limited to within 3 or 4 miles. The city of Orizaba is situated at 4,200 feet, in a narrow valley among the low outlying mountains along the eastern border of the tableland. To the northwest towers the Peak of Orizaba, but between the city and the peak there are intervening limestone ridges about 8,000 feet high. These limestone mountains along the east slope of the tableland extend down to the border of the coastal plain at low elevations. The crests have a general north and south trend, although they are so uptilted, scattered, and broken that

there is little regularity in their contours and direction. The drainage is from west to east, directly across the limestone formation, and erosion has carved many picturesque canyons with falls and foaming cascades along the courses of streams. The Río Blanco, one of these small rivers, flows down the valley past Orizaba, and is broken by many falls and rapids and finally enters the sea at Alvarado. The climate is that of the Humid Upper Tropical Zone, and the seasons are two—a dry winter and a wet summer. Throughout the year, however, heavy fogs occur, and these often last for several days at a time. These fogs are usually so moisture-laden that everything is left dripping wet, and the effect is that of light rain.

The vegetation near Orizaba is a combination of that of the cooler country above and the more luxuriant growth of the warmer belt below. On the north slopes of the steep-sided surrounding hills there is an almost impenetrable jungle of bushes and vines up to from 5,000 to 6,000 feet. The tops and south slopes in marked contrast have a rather thin growth of grass, scattered bushes, and small trees not very different in general appearance from some parts of the Arid Tropical Zone nearer the seacoast, although the species are quite different. The locality is just below the frost line in the valley of the Río Blanco, and near the upper limit of the cultivation of bananas, coffee, and sugarcane. Maltrata, a station 2,000 feet higher in the same valley, is subject to some frost, and apples, peaches, pears, apricots, and other crops of temperate climates are grown successfully. A rather low frost line in the valley of the Río Blanco may be due to local topography and air drainage. Descending the slope from Orizaba to Córdoba at 3,000 feet a marked change is shown in the more tropical luxuriance of the vegetation, and the appearance of various plants not noted before. At Orizaba the growth of sycamores and willows along streams is probably due to the cooling influence of water from higher elevations. The locality is assignable to the lower part of the Upper Humid Tropical Zone.

#### Otatitlán (200 feet):

*April 13-18, 1894.*—Otatitlán is a town at 200 feet on the Río Cosamaloapan near the Oaxaca boundary. The course of the river here is across the coastal plain and the climate is drier than at Tuxtepec, only a few miles away, owing to the greater distance from the mountains. Lessened rainfall is indicated by a reduction of vegetation. Just north of Otatitlán are large grassy savannas with oak groves near the borders. The locality is near the boundary between the Arid and Humid Lower Tropical Subzones.

**Papantla (600 feet):**

*March 1-15, 1898.*—Papantla is a town at 600 feet about 35 miles south of the port of Tuxpan in northern Veracruz. I reached this locality on March 1, at the end of about 2½ days' travel through the coast country from Metlatoyuca, Puebla. The first night was spent at the plantation of Tepesala. The second overnight stop en route was at the village of Coatzintla, about 13 miles northwest of Papantla. The town is situated among some low hills in the coast strip about 15 miles southwest of the small port of Gutiérrez Zamora. General conditions are much the same as at Metlatoyuca, Puebla, but the country in the vicinity has been settled for many years and most of the original forest has been cut. Isolated patches that remain show the luxuriant character of the forest that once covered the region. The principal object of my visit was to obtain topotypes of *Sciurus deppii*. Of this species three specimens were collected. Humid Tropical Zone.

**Perote (7,800 to 8,000 feet):**

*May 17-22, June 1-7, 1893.*—The town of Perote is on the railroad close to the northwestern base of the Cofre de Perote in western Veracruz. It is situated near the northeastern border of the high sandy plain which covers central Puebla and extends into Tlaxcala and parts of extreme western Veracruz. Six or eight miles west of Perote is an extensive and very rough lava bed which reaches out from a volcanic peak to the north. The biota is in general that of elevated portions of the tableland region.

From May 17 to 22 the immediate vicinity of Perote was worked, including the lower edge of the slope of the Cofre de Perote and the bordering plain. Then we ascended the Cofre for work on the upper slopes. We returned to Perote and another week was spent there mainly in order to investigate the lava bed and adjacent plain some 10 miles west of town.

**San Andrés Tuxtla (1,000 to 1,400 feet):**

*April 24-25, May 6-11, 13-14, 1894.*—San Andrés Tuxtla is a town at 1,400 feet about 8 miles west of the Laguna de Catemaco, in the southern part of the state. The town, inaccessible by rail at the time of our visit, may now be reached by a branch line of the National Railways of México.

On April 23 we left Tlacotalpan by steamer, the route being along narrow, sluggish streams that wind about in crossing the low, flat country, which is overflowed during the height of each rainy season, to a station called Alonzo Lazaro, at the head of boat navigation. At

Alonzo Lazaro horses were hired to take us on about 28 miles to San Andrés Tuxtla the next day. From Alonzo Lazaro the route led northeasterly for some miles across a gently rising plain until the low foothills of the Sierra de San Martín were reached. The road then winds among undulating hills to Santiago Tuxtla, at an altitude of 750 feet. Seven miles beyond we came to San Andrés Tuxtla, the principal town of the district, located at about 1,400 feet, also among the foothills of the Sierra de San Martín. To the northeast rises a steep ridge about 800 feet higher, which is the front of the slope leading back to the Volcán de Tuxtla or San Martín.

The beautiful valleys in the vicinity of San Andrés Tuxtla produce the finest tobacco grown in México. Other crops are corn, rice, coffee, sugarcane, and many tropical fruits. Some specimens were collected here, but the town was used largely as a base of operations for work in other localities.

**Santa Lucrecia (300 feet):**

*January 23-26, 1904.*—Santa Lucrecia is a railroad junction at 300 feet on the Gulf slope of the Isthmus of Tehuantepec, near the border of the state of Oaxaca. I arrived at Santa Lucrecia by rail on January 23 and remained until January 26 awaiting the first train to Coatzacoalcos (now Puerto México). Santa Lucrecia is situated among the lower hills, marking the transition from the coastal plain to mountainous interior, but the general elevation is so low that much of the country near is subject to overflow in the rainy season. The higher ground is heavily forested. The rainfall is abundant and the locality is in the Lower Humid Tropical Zone.

**Santa María (1,800 feet):**

*February 12-13, 1894.*—Santa María is a village at 1,800 feet near the river of the same name, in the lowlands about 20 miles northeast of Mirador. The river known locally as the Santa María is probably the Río Pescados of some maps. We left Mirador on February 12 with a pack outfit. Between 2,500 and 3,000 feet we passed through a belt of oak forest several miles broad, with small, parklike, grassy openings interposed. In this oak forest the trees of several species are 40 to 75 feet high and 1 to 3 feet in diameter, with branches densely covered with *Tillandsia*, orchids, and bromeliaceous plants. This belt marks the lower limit of successful coffee culture in this region. Below the oak belt the country becomes rapidly drier as shown by the smaller vegetation, with many trees dropping their leaves at this season. We arrived in time to set some traps for mammals and some fishes were collected in the river.

**Santiago Tuxtla (750 feet) :**

*May 14-16, 1894.*—Santiago Tuxtla is a town at 750 feet about 7 miles west of San Andrés Tuxtla, on the trail to Alonzo Lazaro, the station at the head of river steamer navigation on the route to Tlacotalpan, Veracruz. A brief stop was made here en route. The flora and fauna are about the same as at San Andrés Tuxtla. The soil is less sandy than at San Andrés Tuxtla and may represent an older stage in the decomposition of volcanic material. The tobacco grown is said to be coarser, affording more tonnage per acre, but of inferior quality to that produced nearer San Andrés Tuxtla.

**Teocelo (5,000 feet) :**

*May 7-9, 1901.*—Teocelo is a town at about 5,000 feet on the east slope of the mountains 10 or 15 miles southwest of Jalapa and about 5 miles south of Jico. A branch railroad terminated at that point. Conditions are about the same as at Jico. Humid Tropical Zone.

**Tlacotalpan (or Tlacotalpan) (sea level) :**

*April 19-23, May 16-29, 1894.*—Tlacotalpan is a town at the junction of the Río Cosamaloapan, also called Río Tonto and Río San Juan, a few miles above the point where the combined rivers enter the Bay of Alvarado. We reached Tlacotalpan by river steamer from Otatitlán on April 19. On April 23 we left on a small steamer for Alonzo Lazaro, a small village at the head of river navigation, en route to San Andrés Tuxtla. On May 16 we returned to Tlacotalpan. Work was limited to the vicinity of the town.

**Volcán de Tuxtla (or San Martín) (4,800 feet) :**

*May 11-13, 1894.*—The Volcán de Tuxtla, or San Martín, about 5,650 feet in altitude, is at the northern end of the range of mountains, the Sierra de San Martín, which borders the Gulf from the Isthmus of Tehuantepec nearly to the Bay of Alvarado.

We left San Andrés Tuxtla on a northeasterly course for the volcano on May 11. We ascended a sharp slope to an altitude of about 1,000 feet higher than the town and then advanced over a sloping plain for about 5 miles to the 3,500-foot level near the base of the main ridge extending southeast from the crater. Ascending this we camped on the ridge at 4,800 feet and sent back our horses.

The volcano and all the surrounding country for miles, down to the edge of the sloping plain at about the 3,500-foot level, are covered with heavy layers of volcanic sand and ashes. This loose material absorbs all surface water, and no springs occur anywhere above this line; the country below, however, is well watered. As no water is

available on the mountain our entire supply had to be carried up. From the point where we camped on the ridge the local authorities had had a trail cut through the dense jungle to the top of the mountain, about 6 miles away, to facilitate our ascent. The trail led along a sharp ridge through dense thickets to the summit. The volcano is at the end of a high, sharp ridge of lava and volcanic ashes, which extend away to the southeast. There are two craters, partly merged, and both are easily accessible. The volcano is now extinct and is completely covered with vegetation. Two eruptions are recorded, one in 1664 and the other in 1793.

No land about the volcano is cultivated, and the main mountain and adjacent ridges from flanks to summit are covered with virgin forest, including many very fine trees. Among these were Spanish cedars, wild figs, and others of large size. From the sloping plain the heavy forest, full of small palms, vines, and other undergrowth up to 4,800 feet changed but little. Above 5,000 feet the vegetation became altered in character; trees gave way to thickets of bushes, patches of orchids, and mosses were common; on the extreme summit at 5,650 feet the bushes were only 6 or 8 feet high, and many small open areas were seen. The character of the vegetation and abundance of hanging and other mosses on trees indicated that the maximum moisture is received at altitudes ranging from 4,000 to 5,000 feet. Our return was more directly down the southwestern side of the volcano to 4,400 feet, where we camped in the forest. We returned to San Andrés Tuxtla on May 13 in a heavy rainstorm, which served as a reminder of the opening of the rainy season.

#### YUCATÁN

##### Chichén-Itzá (200 to 300 feet):

*January 27 to February 11, 1901.*—Chichén-Itzá is a hacienda at the famous Maya Indian ruins in east-central Yucatán. We left Mérida, Yucatán, on January 26 by the narrow-gauge railroad projected to Valladolid and about 60 miles southeast of Mérida reached the village of Tunkás, at that time the terminus of the road. On January 27 we left Tunkás in a type of vehicle then in current use, known as a volan-coche, or coche-volan. This was a heavy 2-wheeled cart without springs, built to withstand the wear and tear of solid rock roads about as rough as a stormy sea. Passengers customarily rode lying flat on the bottom, the only posture that could be maintained. We arrived at Chichén-Itzá, about 25 miles southeast of Tunkás, in a somewhat battered condition. At Chichén-Itzá we were the guests

of the owner, E. H. Thompson, U. S. consul. On February 11 we returned to Tunkás.

Northern Yucatán, as seen along the line of railroad from Progreso via Mérida to Tunkás, and on by cart road to Chichén-Itzá, is a nearly flat limestone plain. The bedrock crops out frequently in every direction and the soil is a thin sheet gathered in the slight depressions that form small flats where the depressions among the rocks are of larger extent. Near Progreso the plain is quite level and only a little above the sea. Near Mérida it is slightly higher, and the limestone outcroppings are more prominent. From Tunkás to Chichén-Itzá and all about the latter place the surface of the rock is wavy in form, the outcropping a succession of little ridges like the crests of waves 5 or 6 feet high with hollows 10 to 100 yards wide between. The country thus presents an exceedingly rocky surface of such uniform general level that there is no surface drainage, and consequently there is a total absence of surface streams.

The heavy summer rainfall sinks through crevices in the rocks, and all this section of Yucatán appears to be underlaid by water at a depth of less than 100 feet. Wells sunk anywhere strike abundant water, and natural sinkholes varying from a few yards to 200 yards across contain water at about the same depth. These open water holes, called cenotes, are usually circular with vertical walls at least on one side. The clear water is often of great depth and may extend away into great caverns. It is strongly charged with lime but not unpleasant to the taste. In some of the larger cenotes small fishes are numerous. The cenotes were the sources of water supply for the ancient inhabitants of Yucatán, as indicated by the large one at Chichén-Itzá. They still serve the same purpose, although bored wells equipped with modern windmills tend to replace them.

In northern Yucatán very arid general conditions prevail. General aridity is due not so much to any shortage in the total annual rainfall as to the length of the dry season and the lack of moisture-retaining qualities in a thin sheet of soil underlain with porous limestone. The year is divided into two seasons, the rainy season from June to about the first of December and the dry season from December to June. During the rainy season torrential showers fall mainly in the afternoon. The dry season is clear and hot, with slight showers now and then or an occasional misty day due to cold northerly winds blowing in from the Gulf. During clear weather in winter fog and heavy dew are common early in the morning.

Northern Yucatán is covered with a dense, low, tropical forest, which is scarcely more than brushy scrub 10 or 15 feet high near Progreso. The trees gradually increase in size until near Chichén-Itzá they form a stunted forest 25 to 40 feet high, with dense brushy undergrowth. With few exceptions the trees do not exceed a trunk diameter of 20 inches, and they are largely leafless during the dry season. Among the more prominent trees and shrubs are *Enterolobium cyclocarpum*, two or more species of *Ficus*, Spanish cedar, logwood, two species of silk-cotton, the chico zapote (*Achras zapota*), palo mulato (*Bursera*), two or more species of *Cassia*, and the giant nettle or mala mujer (*Urera caracasana*). In addition were noted a *Passiflora*, several morning-glory trees, two species of *Agave*, including the henequén (*Agave ixtli*), and several cactuses. The cultivation of henequén and production of sisal fiber form the principal industry of northern Yucatán. Oranges, limes, bananas, chirimoyas, papayas, and other tropical fruits are grown in gardens where they can be watered. Arid Lower Tropical Subzone.

**Mérida (200 feet):**

*February 18-23, 1901.*—Mérida is a city, the principal center of population in Yucatán. It was visited briefly in connection with work at other localities.

**Progreso (20 feet):**

*February 23 to March 8, 1901.*—Progreso is the principal seaport on the north coast of Yucatán. Some collections were made, but during most of the time we were obliged to hold ourselves in readiness for the departure of a small steamer making irregular trips to the east coast of the peninsula. We left aboard the *Ibero* on March 8. The seaport is on the nearly level plain, covered mainly with a scanty growth of low brush. Depressions back of the beach tend to form submarginal lagoons along the coast. Some of these are bordered by mangroves, but many are cut off from the sea, and the water level fluctuates with the season. In places saline flats, a mile or more in width, are nearly bare of vegetation. Arid Lower Tropical Zone.

**San Felipe (10 feet):**

*April 23, 1901.*—San Felipe is a small settlement on the coast in longitude about 88° 15' W. in the lagoon region of northeastern Yucatán. We landed near there on April 23 and after obtaining two specimens of the flamingo continued on our way by small sailboat to Progreso.

**Tunkás** (200 to 300 feet):

*February 11-18, 1901.*—Tunkás is a village on the railroad in east-central Yucatán. On January 26 and 27 we passed through Tunkás, en route to Chichén-Itzá. We returned to the village on February 11 and remained there until February 18. General conditions are about the same as at Chichén-Itzá, but more favorable for the collection of some of the larger mammals. Arid Lower Tropical Zone.

## ZACATECAS

**Berriozábal** (6,800 feet):

*December 27-29, 1893; July 8-11, 1896.*—Berriozábal is a small station at 6,800 feet on the railroad 29 miles south of the City of Zacatecas. The country in the vicinity is a rolling plain, the upper part of a broad open desertlike valley that extends south from the high divide at Zacatecas across the state of Aguascalientes. The drainage is through the Río San Pedro to the Río Grande de Santiago, which enters the Pacific near San Blas. To the east the rolling plain is broken by rounded hills, and to the west are higher hills and low mountains in irregular groups but all barren and showing no traces of plant growth larger than shrubs and cactuses. Uncultivated parts of the plain, as well as the low hills and slopes, are covered with a remarkably profuse growth of *Opuntia*, forming dense thickets 8 to 10 feet high, frequently extending for miles. Mesquites, acacias, mimosas, yuccas, and other desert plants are also abundant.

The climate is arid but the rainfall more copious than on parts of the tableland north of the divide at Zacatecas. In December 1893, following a season of abundant summer rain, grass and herbaceous plants were plentiful and small rodents very abundant. In July 1896, when the locality was revisited, nearly all this small vegetation was gone, as scarcely any rain had fallen for two years. Domestic stock had eaten about everything they could eat, and hundreds were dying from hunger and thirst. With the shortage of small vegetation most of the small rodents had also disappeared. Berriozábal is near the boundary between Upper and Lower Austral Zones.

**Calera** (7,000 feet):

*December 20, 1902.*—Calera is a station at about 7,000 feet on the railroad about 15 miles north of the City of Zacatecas. Upper Austral Zone.

**El Conejo** (6,600 feet):

*September 21-22, 1897.*—A ranch on the tableland in southwestern Zacatecas. An overnight stop en route from Bolaños, Jalisco, to Guadalajara, Jalisco.

**Florencio and La Laguna** [*Jalisco*]*—*between (see La Laguna, Jalisco).

**Hacienda de San Juan Capistrano** (3,700 feet):

*August 18-23, 1897.*—The Hacienda de San Juan Capistrano is located at 3,700 feet about 25 miles to the westward of Huejuquilla, Jalisco. From our camp on the summit of the Sierra Madre we proceeded on August 18 along the rolling top of the range in a northerly course for about 10 miles until we came out on the eastern brow at an altitude of 8,300 feet. There our course turned eastward, and a sharp descent led down for about 2,500 feet, followed by more gradual slopes and ridges cut into by canyons and gulches down to the hacienda. San Juan Capistrano is situated in a narrow valley between two table-topped ridges with cliffs fronting the west and more gradual slopes toward the east. Beyond the mesa to the east is the narrow valley of the Río Atenco, a branch of the Río Bolaños. The rock formation of "tepetate" noted on the Sierra Madre extends down the east slope and through the foothills to the tablelands. A lava cap extends over the tableland near San Juan Capistrano but has been worn away over considerable areas. Sharp frosts are frequent on the top of the mesas or tablelands, and light frosts occur at the hacienda in the valley every winter.

The vegetation of the valley near San Juan Capistrano includes tree morning-glories, *Bursera*, *Jatropha*, and acacias, extending up to about 5,000 feet, which gave way to small oaks above about this altitude on the slopes to the west. The 5,000-foot level, varying with slope exposure, appears to be near the boundary between the Upper and Lower Austral Life Zones in this region.

**Monte Escobedo** (5,900 to 6,900 feet):

*August 26-28, 1897.*—Monte Escobedo is a town at 6,900 feet in southwestern Zacatecas. We continued on August 26 from Mexquitic, in the upper part of the canyon of the Río Bolaños, Jalisco, about 18 miles in a southeasterly course to Monte Escobedo, Zacatecas. The latter part of the day's journey was across the flat-topped mountain Monte Escobedo, from which the town takes its name. This mountain is an isolated mesa 12 or 15 miles long and 6 or 8 miles broad. It reaches an elevation of 7,800 feet on the top, which is covered with

low oak forest with scattered pines intermixed. From the mesa we descended to the town at 6,900 feet. On August 27 we moved to a ranch a little south of east of Monte Escobedo but continued the use of the name of the town on labels of specimens taken. Upper Sonoran Zone.

**Plateado (7,600 to 8,500 feet) :**

*August 31 to September 4, 1897.*—Plateado is a village at 7,600 feet near the constriction of the neck of the long southwestern projection of the state of Zacatecas. We left the vicinity of Monte Escobedo on August 28 and traveled 30 miles in a southeasterly direction to Colotlán, Jalisco, where the altitude is 5,600 feet. On August 31 we continued from Colotlán about 28 miles southeast to Plateado. On the east side of the Colotlán valley a steep slope leads up to a broad bench from which rises a mountain ridge, the Sierra Maroni, about 8,500 feet high, which we crossed. Plateado is on the rolling plain near the north end of this ridge. Specimens taken at 7,600 feet near the town and at altitudes up to 8,500 feet in the nearby Sierra Moroni were all labeled "Plateado."

The rolling plains near Plateado are mainly open and grass-covered. The slopes of the Sierra Moroni above about 7,600 feet are covered with oaks, and pines grow along the crest of the range. Upper Sonoran Zone.

**Sierra Madre (8,500 feet) :**

*August 16-18, 1897.*—This locality is on the backbone of the Sierra Madre northeast of Huazamota, Durango, and near the Durango-Zacatecas boundary, about 25 miles west of the Hacienda de San Juan Capistrano. On August 16 we left our camp on the slope 10 miles northeast of Huazamota and late in the afternoon reached the top of the main ascent at an altitude of about 8,200 feet. We proceeded along the ridge in a northeasterly direction for some miles to a point at 8,500 feet, where we camped. The top of the range forms a rolling and somewhat broken plateau similar to that on the summit of the Sierra de Nayarit, but narrower. It is like the Sierra de Nayarit in presenting many abrupt escarpments on the western side along which the lines of stratification are nearly horizontal, while the eastern slope directly overlooking the great interior plateau is more gradual. As on the Sierra de Nayarit the "tepetate," which underlies much of the surface, is covered with a thin layer of rather sterile soil. The extreme summit, however, bears some lava as a cap. Water is scarce, even in the rainy season, and the day we reached the top we traveled

6 or 8 miles before we could find sufficient water for ourselves and our pack and saddle animals. No people were found living in the vicinity, and as we had no shelter the violent storms forced us to leave after a much shorter stay than we desired.

The vegetation of this part of the Sierra Madre is essentially the same as that of the Sierra de Nayarit, but owing to greater elevation and consequent cooler and more humid climate the forest is heavier, the pines being noticeably larger and more numerous. On the east slope a pine not noted on the more western range appeared. A thin sod of short grass was found in most parts of the forest, there being practically no brushy undergrowth. Numerous attractive little parks were carpeted with an abundant growth of grass and flowering plants. The pines extend for some distance down the east slope, but are more stunted, indicating a more arid climate. At about 6,000 feet on that slope there is an abrupt change. Below that level tree growth almost entirely disappears from the general slopes, giving way to small bushes and herbaceous vegetation with trees restricted to the more humid situations along the sides of gulches and small canyons. The slopes of the mountains from about 6,000 feet to 7,500 or 8,000 feet are mainly Upper Sonoran in zonal character, passing at higher elevations into Transition Zone.

**Valparaíso (6,200 to 6,700 feet) :**

*December 8-20, 1897.*—Valparaíso is a town at 6,200 feet on the tableland in western Zacatecas. I returned from the Valparaíso Mountains to the town near the eastern base of the range on December 8 and remained there until December 20, working in the bottom of the valley and on the bordering slopes for 4 or 5 miles in all directions. The rather broad, fertile valley at Valparaíso is drained by a small stream, one of the headwaters of the Río Bolaños. The climate is dry, as in the tableland region in general, but the rainfall is usually sufficient to mature good crops of corn, beans, garbanso or chick peas, and chile. Limited areas along the river are irrigated for crop production during the dry season. Frosts occur in winter, when there is sometimes snow on the Valparaíso Mountains, only 13 miles away.

The vegetation in the bottom of the valley is very similar to that of other parts of the tableland region. The principal woody plants are the mesquite (*Prosopis juliflora*), peppertree (*Schinus molle*), huisache (*Acacia farnesiana*), and other bushes. Other plants are yuccas, agaves, and cactuses. The country is largely open with an abundance of grass nearly everywhere. The tableland vegetation, indicating Lower Austral Zone, extends up to about 6,500 feet on the slopes of

the adjoining mountains, where it is replaced by Upper Sonoran elements.

**Valparaíso Mountains** (=Sierra de Valparaíso) (8,200 to 8,700 feet):

*November 26 to December 8, 1897.*—The Valparaíso Mountains form an outlying eastern range of the Sierra Madre in western Zacatecas. On November 24 I left Fresnillo on the railroad and traveled by stage about 50 miles southwest to the Hacienda de Saucedá. The next day I continued to Valparaíso, 20 miles farther in the same direction. On November 26 I left Valparaíso with a pack outfit and ascended to the summit of the Valparaíso Mountains at a point about 13 miles nearly due west from the town. There I remained until December 8, working mainly on the slopes from 8,200 feet to 8,700 feet.

From Fresnillo to near the Hacienda de Saucedá the road traverses an arid, nearly level plain at about 7,000 feet. Here and there over the plain are dry ridges and groups of rounded hills rising 500 to 1,000 feet above the general level. Near the hacienda the road becomes more rolling and rough and descends gradually to Valparaíso at 6,200 feet, in the upper part of the drainage basin of the Río Bolaños. The Valparaíso Mountains consist of the most easterly of the ranges of the Sierra Madre in this region. They extend about 75 miles in a north and south direction, nearly parallel to the ranges lying farther west, and are separated from them by the valley of a small stream, an upper affluent of the Río Bolaños that flows south past the town of Huejuquilla, Jalisco. The higher part of the range is a rolling mesa, 12 or 15 miles broad. It has an altitude of about 8,500 feet along the center and slopes gradually toward the sides. Here and there short ridges and isolated hills rise abruptly above the general level to an altitude of 9,000 feet. The climate appears to be drier than that of the ranges farther west. Light snows occur during the winter months but never remain long on the ground.

From Fresnillo to Valparaíso and up the eastern slope of the mountains to about 6,500 feet the vegetation is that of the arid tableland region in general. Mesquites, acacias, yuccas, magueyes, and prickly-pear cactuses are common. At about 6,500 feet on the east slope junipers, cypresses, and small oaks appear and increase in size toward the top. Pinyons occur on the east slope between 7,000 and 8,000 feet. The madroño and manzanita begin at about 7,000 feet and from that level to the top grow in abundance. Pine timber that once covered the upper slopes of the mountains has been cut for use in Zacatecas and the surrounding country. The soil appears to be better than on



1. Río de Zamora, near La Barca, Jalisco. An aquatic environment, vegetation mainly water hyacinths. Thousands of ducks, including Mexican black duck (*Anas diazi*) and pintail (*Dafila acuta*) winter here. Lower Austral Zone.



2. Cañón de Oblatos of the Río Grande de Santiago, near Guadalajara. General land surface is in Lower Austral Zone, but bottom of canyon is within Arid Upper Tropical Subzone.



1. *Pinus oocarpa*, Valley of Comitán, Chiapas. Lower Austral Zone.



2. Oak woods draped with Spanish moss (*Tillandsia*) on hills near Comitán, Chiapas. Lower Austral Zone.



1. Looking down the canyon from lava-capped plateau near Tinaja Santa Ana, central Baja California. Lower Austral Zone.



2. A few miles northeast of San Francisquito, near Gulf of California, Baja California, showing extremely arid and sterile character of the country. *Idria columnaris* and *Pachycormus discolor* more stunted than farther west. Lower Austral Zone.



1. Hardy River near Volcano Lake, Baja California, in April 1905. About a year later this became the main channel of the Colorado River. Vegetation mainly mesquite (*Prosopis juliflora*). Lower Austral Zone.



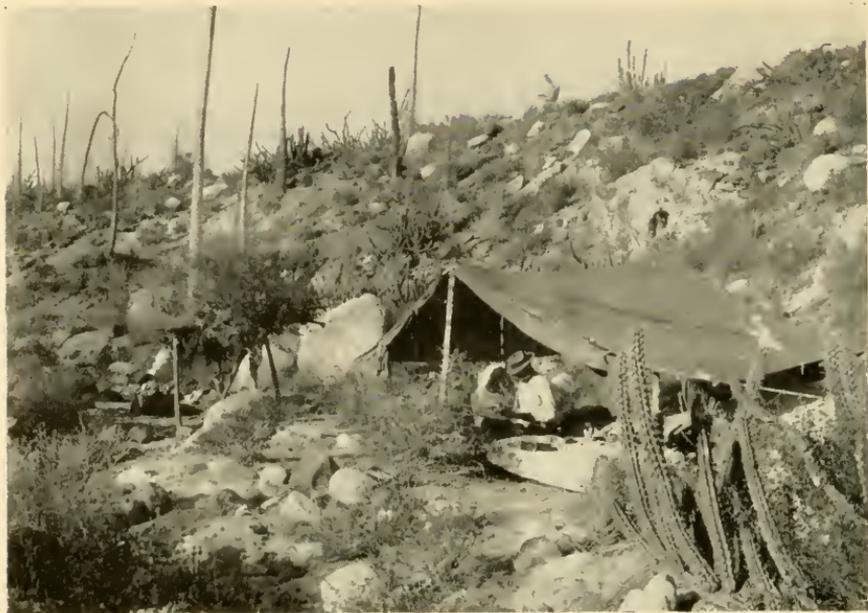
2. Laguna de Meyran, the sump in bottom of an interior basin, southern Coahuila, March 28, 1926. Lower Austral Zone.



1. Copalquín (*Pachycormus discolor*), Sierra de Santa Clara, Baja California. A veritable plant monstrosity, one of the dominant species in the central section of the peninsula. Lower Austral Zone.



2. Temporary camp at base of copalquín, at Tinaja de Santa Clara, in Sierra de Santa Clara, Baja California. Lower Austral Zone.



1. Camp at Yubay, central Baja California. E. W. Nelson at work. A dominant tree in this vicinity is the cirio (*Idria columnaris*). Lower Austral Zone.



2. *Pinus oocarpa* and fan palms, foothills of Sierra Madre del Sur, near Chilpancingo, Guerrero. Lower Austral Zone.



1. Sail cargo boat, near Ocotlán, on Lago de Chapala, Jalisco.



2. Cargo boat under sail on Río Grande de Santiago, near Ocotlán, Jalisco.



1. Houses of fishermen, made of tall cattail flags (*Typha*), near mouth of Río de Lerma, Lago de Chapala, Jalisco.



2. Dike at east end of Lago de Chapala, Jalisco, as it appeared January 18, 1935. Area at left was formerly a great marsh affording a wintering ground for geese and ducks in countless numbers.

most of the ranges farther west. Wet, open meadows are rather numerous and contain an abundance of grass. The Lower Austral Zone extends up along the east slope of the mountains to about 6,500 feet, giving way to Upper Sonoran Zone above that level. Transition Zone elements appear along the top of the range.

**Zacatecas (8,000 feet):**

*December 19-23, 1902.*—Zacatecas, at 8,000 feet, is the capital of the state of the same name. I arrived in Zacatecas by rail to begin work for the season on December 19. The principal object of my visit was to obtain topotypes of the cotton rat *Sigmodon fulviventer*, and in this I was unsuccessful. Zacatecas is situated near the top of a group of barren mountains in one of the driest sections of the entire tableland region. At the same altitude in most parts of México the rainfall is sufficient to promote forest growth, but in this section, about midway between the eastern and western coasts, it is apparent that distance and intervening mountains have robbed the air currents of all but a little of their moisture. Owing to scanty rainfall the mountain slopes near Zacatecas are open and support only a scanty growth of grass and herbaceous vegetation. The season had been a dry one and at the time of my visit the hills, overgrazed by goats, were nearly bare, leaving no local habitat suitable for the cotton rat. I left Zacatecas on December 23, joining Nelson on the train, and we proceeded to Ocotlán, Jalisco. Upper Austral Zone.

GUATEMALA

**Calel (10,200 feet):**

*January 11-15, 1896.*—Calel is an Indian village at 10,200 feet about 23 miles north of Quezaltenango on the trail to Huehuetenango. On January 10, 1896, we took the trail that zigzags down the southern side of the mountains from the Hacienda Chancól to Huehuetenango, a distance of 10 miles. From high on the trail the town was plainly visible, lying in a little basinlike valley at about 7,300 feet. A longer view to the south was across a broad expanse of jumbled mountains and hills at lower elevations, rising again to the high parallel range in which Calel is situated. The intervening mountains and hills have rounded tops varying in altitude up to about 8,500 feet, and among them the headwaters of the Río Sulegua, an affluent of the Río de Chiapas, interdigitate with those of the Río Chixoy, a tributary of the Río Usumacinta. These rivers take widely diverging courses to the west and east, respectively, around the highlands of Chiapas. From Huehuetenango we continued 12 miles farther to the

village of Malacatán, at 6,500 feet, where we remained overnight. On January 11 we traveled 18 miles, winding through the hills and finally up a long slope near a clear stream to Calel, situated in a narrow valley just below the summit of the range. The limestone was left behind near Huehuetenango and much volcanic scoria overlies the surface of the hills.

Ascending the mountains to Calel the pines of the arid and hot lower country give way to the taller pines and firs of the "tierra fria," but the stand is very thin, and alders, oaks, and madroños also occur. By far the greater part of the surface near the top is covered with a heavy growth of the mountain "sacatón," or large grass, the huge bunches recalling the characteristic appearance of the open slopes on the volcanoes of central México.

#### Hacienda Chancól (9,500 to 11,000 feet):

*January 2-10, 1896.*—Hacienda Chancól is situated at 11,000 feet near the top of the Sierra Chohumalanes, about 13 miles northwest of Huehuetenango. From Todos Santos, 22 miles east to Hacienda Chancól, on January 2, the trail led up the canyon, crossing and re-crossing the stream, and finally brought us out on the summit of the range at an altitude of about 11,500 feet. The top is here an irregular plateau, or tableland, 5 to 10 or 15 miles across, with open, grassy, valleylike plains, in some parts level and in other parts somewhat rolling. Bordering ridges and islandlike peaks rise 200 to 1,500 feet above the general level of the plateau, with ragged spurs and out-cropping rocks. The highest points in this portion of the range reach about 12,000 feet above the sea. The range is here made up wholly of massive limestone. The Hacienda Chancól lies on the plateau just at the verge of the abrupt descent of the southeast slope. Specimens were collected on the hills and ridges of the plateau, and down on the southeast slope to 9,500 feet at a ranch 3 miles from headquarters and to which we moved on January 8. All specimens, however, were labeled "Hacienda Chancól."

On the summit of the range severe frosts are prevalent throughout the winter. At the time of our visit in the dry season dense masses of clouds frequently shut in the mountains above 8,000 feet for days at a time. During such periods severe storms sometimes occur, and snow from a few inches to a foot in depth may fall over the summit. At the upper edge of the southeast slope of the range near Hacienda Chancól there is a mixed stand of firs, cypresses, and pines, as above Todos Santos, but below 10,000 feet these are replaced by a thin growth of stunted oaks of several species and two species of pines be-

longing to lower levels. At the time of our visit the southeast slope of the range had the appearance of a huge patchwork, as seen from a distance, the dark forest areas being replaced and intermingled with a multitude of corn and wheat fields showing dull yellow. The summit of the range is used for cattle, horse, and sheep grazing. This cold, high mountain area belongs to the same life zone as the high mountainous country near San Cristóbal, Chiapas, with which it shares many species.

Huehuetenango—near (see Calé).

Jacaltenango (5,400 feet) :

*December 18-24, 1895.*—Jacaltenango is an Indian village at 5,400 feet, 21 miles southeast of Nentón, on our route from Comitán, Chiapas, to Huehuetenango, Guatemala. From Nentón to Jacaltenango the trail ascended gradually, winding in and out among the outlying spurs of the Sierra Chohumalanes. The town is located on a shelf at the border of a narrow canyon 800 feet deep down which rushes a small river remarkable for the greenish-blue color of the water. The mountains all about are steeply sloping and are made up wholly of massive limestone. The character of the vegetation indicates that the humidity is moderate and that the locality is a little below the border between the Humid Upper Tropical and Lower Austral or Upper Austral Zones. Several small streams, headwaters of the Río de Chiapas, coming down past this place from the high frosty summits of neighboring mountains have a very low temperature and plants usually ranging at much higher altitude grow in the canyons cooled by the water.

The cypress (*Cupressus lusitanica*), appeared to find its lower limit near the town. Wild figs, wild plums, and wild guavas were noted. Other conspicuous plants were acacias, cassias, calliandras, mimosas, euphorbias, blackberry bushes, and sages. Among fruits grown are bananas, oranges, zapotes, and anonas. Large areas of cleared land were almost impenetrable thickets, matted with morning-glories, passion flowers, clematis, and leguminous vines of many kinds. A large part of the mountain slopes near the town had been denuded of its original forest for planting corn, and fields aggregating hundreds of acres were under cultivation. On the banks of a small stream just below town was a field of the tallest corn we had ever seen. Many of the stalks were more than 20 feet high, with ears in place 12 or 15 feet from the ground. The ears were of ordinary size and the stalks disproportionately slender.

Jacaltenango to San Martín (see Todos Santos).

**Nentón** (3,000 to 3,500 feet) :

*December 13-18, 1895.*—Nentón is a village at 3,000 feet near the Chiapas border and about 40 miles in a straight line northwest of Huehuetenango. The village was reached en route from Comitán, Chiapas, to Huehuetenango, Guatemala. Nentón is situated in a deep, narrow canyon cut through broken limestone country, descending steeply on the south side of the high Sierra Chohumalanes. A small clear river runs through the canyon, forming one of the headwaters of the Río de Chiapas. At the time of our visit the days were hot and the nights quite cold, although there was no frost, the cold apparently being due to air drainage from the high mountains near. The vegetation is very similar to that of adjoining parts of the dry Chiapas Valley. Arid Upper Tropical Zone.

Nentón to Jacaltenango (see Jacaltenango).

**Quezaltenango** (8,500 feet) :

*January 17, 20-21, 1896.*—This locality is the large city at 8,500 feet in the mountains of southwestern Guatemala. It is situated in a gently rolling valley extending 10 or 15 miles from east to west and about 3 miles broad. The valley forms a basinlike enclosure shut in by high mountains. We passed through the city on January 17 en route to Zunil, and an overnight stop was made January 20-21 on the way from Zunil to the Volcán de Santa María, about 10 miles to the southwest.

**Rodeo to Malacate** (1,400 to 3,500 feet) :

*January 31, 1896.*—These were ranches between which plants were collected while on a 26-mile journey from a place called El Pié de la Cuesta, at the base of the mountains in Guatemala, to Tuxtla Chico, just across the Mexican border.

**San Marcos** :

*January 30, 1896.*—San Marcos is the principal town in the department of the same name in southwestern Guatemala. We passed through the town on January 30, en route from Quezaltenango, Guatemala, to Tapachula, Chiapas.

San Martín to Todos Santos (see Todos Santos) :

**Todos Santos** (10,000 feet) :

*December 25, 1895, to January 2, 1896.*—Todos Santos is an Indian town at 10,000 feet on the southern slope of the Sierra Chohumalanes,

50 or 60 miles by winding trail northwest of Huehuetenango. On December 24 we left Jacaltenango and after crossing a high ridge entered the narrow valley of a small stream flowing out of the mountains. Ascending the course of this stream to an altitude of about 7,000 feet we reached the village of San Martín, where we camped, having made 16 miles. The next day we continued up the course of the same stream 11 miles farther to Todos Santos.

From Jacaltenango to Todos Santos high, steeply sloping ridges thrown off as spurs of the main range descend toward the lower country, alternating with deep, narrow valleys or canyons down which run foaming streams that rise on the higher slopes. From this side of the range the summit is outlined by a series of cliffs and ledges, rising just above Todos Santos and extending for miles like a gigantic rampart. Most of our work was done on the upper part of a spur-like ridge lying immediately back of the town, where patches of the original forest made up of giant cypresses, firs, and pines had been left. Elsewhere about Todos Santos the slopes had been deforested in many places to make room for wheat and corn fields. Corn is grown up to 9,500 feet here, and wheat a little higher. Numerous flocks of sheep and goats overgrazing open areas give them a desolate aspect. Severe frosts occur in winter.

**Volcán de Santa María** (9,000 to 11,000 feet):

*January 21-29, 1896.*—The Volcán de Santa María was a prominent volcanic cone, rising to about 12,000 feet, about 8 miles southwest of Quezaltenango. On January 21 we rode out from Quezaltenango about 8 miles to a sawmill at a place called Tepachi, at 9,200 feet on the southwestern base of the volcano. We remained there until January 29, working the slopes up to near the rim of the crater of the volcano. All specimens were labeled "Volcano Santa María."

From Quezaltenango our route led across a nearly level plain, passing along the base of the Cerro Quemado to the west base of the Volcán de Santa María. A high ridge connects the west slope of the volcano with a coast range of mountains which extends northwest to the volcanoes of Tacaná and Tajumulco, near the boundary of the state of Chiapas. Crossing the ridge at about 10,000 feet we descended the coastal slope a mile or two to the sawmill of Cedolfo Bentz. Toward the south the slopes of the mountains descend rapidly to the hot coast country. Water is scarce over all the higher parts of the mountains but numerous streams rise lower down. The slope of the mountains facing Quezaltenango is more arid than the coastal side

of the range. The greater rainfall of the latter slope results in a more vigorous growth of vegetation there, and many species of plants occur near the mill that are not found on the Quezaltenango slope. The most common trees on the slopes near the mill were two species of pines, the cypress, fir, two or three species of oaks, alder, a wild cherry 50 to 75 feet high, and a madroño. At about 10,500 to 11,000 feet these gave way to a thin, stunted growth of pines that extended to the rim of the crater. On the extreme summit the pines were dwarfed almost to the size of bushes. The southwest slopes of the Volcán de Santa María between 9,000 and 10,500 or 11,000 feet appear to be assignable to Transition Zone. Those above 10,500 or 11,000 feet may represent the Canadian Zone.

At the time of our visit the mountain was a volcanic cone, with a deep, nearly evenly rimmed crater. There were fumaroles in the bottom, but the volcano had been quiescent for a very long period, as shown by vegetation extending to the edge of the crater. Several years after our visit, however, a violent eruption buried the slopes deeply in ashes, and this must have been annihilating in effect on the fauna and flora. Three of the mammals collected by us on the volcano were described as new.

#### Zunil (7,000 feet):

*January 17-20, 1896.*—Zunil is a village at 7,000 feet about 6 miles south of Quezaltenango. From Calal on January 16 our route led for 21 miles directly across the summit of the range, in a southerly course, reaching an altitude of more than 11,000 feet. It then descended gradually to a high, broad, rolling plain or mesa, devoid of trees and covered with a vigorous growth of sacatón where not in cultivation for wheat or corn. This plain has an east and west direction, and its surface between 9,500 and 10,500 feet is broken by rolling hills and ridges. At about 9,600 feet we passed the village of Sija and finally reached the crest of a long ridge, thinly covered with pines and oaks, that forms the southern border of this somewhat broken mesa. Here we came abruptly into view of the valley of Quezaltenango. Almost at our feet and 500 feet below was the village of Olinstepeque, on a small river, where we stopped for the night, and on the farther side of the valley 2 or 3 miles beyond was the City of Quezaltenango at about 8,500 feet. From Olinstepeque we continued on January 17 about 9 miles, passing through Quezaltenango and on to Zunil. From Quezaltenango we crossed a spur of the Sierra Quemado and descended into the narrow canyon of the stream that drains the valley toward the Pacific. Here, in the narrow gorge cut out by the stream

between the volcanoes of Zunil and Santa María, we came to the town of Zunil.

The mountains here are volcanic and beds of scoria are everywhere visible, while the soil of the valley of Quezaltenango is of a soft, loose, dustlike material from the same source. Just back of Quezaltenango rise the high volcanoes of Santa María, Cerro Quemado or Volcán de Quezaltenango, and the Volcán de Zunil. The two latter were still sending up small jets of steam from cracks in their broken-down craters. The narrow canyon at Zunil, fronting the south, is much warmer than the higher, partially treeless country from Cael to Quezaltenango, and the vegetation is a combination of that of the warmer and colder climate.

## PHYSIOGRAPHY

### GENERAL FEATURES

México, extending from about latitude  $14^{\circ}$  to  $32^{\circ}42'$  N. and longitude  $86^{\circ}40'$  to  $117^{\circ}10'$  W. from Greenwich, presents an extraordinary diversity of physiographic conditions. It is crossed near the center by the Tropic of Cancer, well to the south of which the land mass culminates in Mount Orizaba, with an elevation of more than 18,000 feet. This extinct volcano is the highest mountain in North America south of Alaska. In the same elevated section are other timber-line peaks, one of which, Mount Ixtacihuatl, bears small receding glaciers on its upper slopes.

A western appendage of the Mexican mainland, the peninsula of Baja California, parallels the coast of Sonora and Sinaloa for about 600 miles. As most of the Mexican mainland is high and the land surface very irregular, the peninsula of Yucatán, fanning out to the eastward of the Bay of Campeche, presents a marked contrast. The areas embraced in Yucatán, Quintana Roo, and Campeche are very low and flat, with no mountains or even hills rising to more than 300 feet in the entire region.

The comparatively slight depth of water to a submarine escarpment far out along most parts of both coasts indicates that the Mexican mainland was formerly considerably broader than at present. Large islands, such as the Tres Marías off the west, lie on the outer edge of the continental shelf and may have formed parts of an ancient mainland. Soundings between the present mainland and the islands gradually deepen to less than 300 fathoms; but just west of the group the sea bottom drops rapidly to more than 1,500 fathoms.

All the 12 or 15 highest mountain peaks of México are of volcanic origin and are grouped about the southern border of the tableland, or great interior plateau. Mount Orizaba, on the east, fronts the Gulf of México, and the Volcán de Colima looks over the Pacific. Scattered irregularly between these peaks are the other higher mountains, including those about the high valleys of México and Toluca. The Volcán de Colima, between 12,000 and 13,000 feet, is still active at intervals; Mount Popocatepetl, at more than 17,000 feet, was long quiescent, but fumaroles in the bottom of the crater deposited high-grade sulfur, which was mined for many years. Great clouds of smoke in

recent years, however, are evidence of renewed activity. To the westward in northwestern Michoacán two ancient volcanic mountain masses, Cerro de Tancítaro and Cerro Patambán, rise to about 12,000 feet. Between these the new volcano of Parícutin burst suddenly into violent eruption from the level ground of a plowed field in February 1942. According to recent reports a lava mass about 1,500 feet high has already accumulated. In this latest outbreak we have a manifestation of the volcanism that has left the landscape in the general region dotted with literally hundreds of extinct volcanic cones of varying ages, some extending far back in geologic time. The last preceding eruption is that of the Volcán Jorullo, not far away in central Michoacán, from which lava flowed during the Colonial period.

#### THE TABLELAND OR GREAT INTERIOR PLATEAU

The salient physical features of the Mexican mainland are relatively simple but in details of drainage and land surface are exceedingly complex. The greater part of the area is occupied by what is termed the tableland, or great interior plateau. This is a roughly triangular area having an elevation of from 1,500 feet to 3,500 feet along the northern border and rising gradually to from 7,000 feet to 8,000 feet at the apex of the triangle, which forms its southern end in the region of the Valley of México. A somewhat lower tableland shelf, however, extends southeastward through southern Puebla to the Valley of Oaxaca. The tableland has the form of a rolling plain, broken here and there by escarpments, and with irregularly scattered mountains rising islandlike on its surface, some of them attaining altitudes of from 6,000 to 11,000 feet. On the west the tableland is bordered by the Sierra Madre Occidental, as the southern extension of the Rocky Mountains from the United States is called, and on the east by the shorter Sierra Madre Oriental. These lateral mountain ranges tend to converge near the apex or southern end of the triangle. Viewed from the coast on either side the walls of the tableland rise nearly everywhere as great mountain ranges. For most of the distance on the eastern and western sides of the tableland, however, the bordering mountains slope up so gradually from the high base level that from an interior viewpoint they do not appear very high. Through a broad gap in the Sierra Madre Occidental the tableland is considerably extended westward across the Continental Divide in Jalisco and northern Michoacán, where the descent to the low country is gradual. At narrower gaps in the lateral mountain barriers nearly level parts of the plateau may extend to the top of bold escarpments overlooking the

lowlands. Toward the northeast from near Monterrey, Nuevo León, desert ranges alternate with open, nearly level plains as the tableland extends down in a series of terraces to the Río Grande; but from near Monterrey to Saltillo, Coahuila, the plains rise abruptly to about 5,000 feet and mountains at the northern end of the Sierra Madre Oriental reach elevations of 8,000 to 9,000 feet above the sea.

The northern parts of the tableland in Chihuahua, Coahuila, and Durango form a great plain with extended areas that vary from nearly level to rolling, or broken by ranges of hills or low mountains, rising islandlike 1,000 to 5,000 feet above the general level. These mountain masses frequently lie in parallel courses and divide the plain into narrow, valleylike sections. In Zacatecas, southern San Luis Potosí, Guanajuato, Querétaro, and western and southern Hidalgo the tableland consists of numerous broad, flat areas between more or less rounded mountain groups. South of this region are the valleys of Toluca and México. These are elevated parklike extensions of the tableland, projected southward from the main body. They are oval in form, walled in by high mountain ranges on three sides and open toward the north. The Valley of México is an interior basin without natural drainage, the lowest barrier being the low hills across the northern end. Artificial drainage through a tunnel now carries the waters of Lake Texcoco to the Río de Tula in Hidalgo, an affluent of the Río Pánuco, which flows into the Gulf of México at Tampico. The Valley of Toluca contains the sources of the Río de Lerma, the name given to the upper portion of the Río Grande de Santiago which enters the Pacific.

The elevation of the western half of the tableland varies considerably. From Ciudad Juárez at an altitude of 3,700 feet on the Río Grande in Chihuahua the plain slopes upward along the line of the longest railroad to about 5,000 feet at Gallego and descends to 4,500 feet at the City of Chihuahua. Continuing southward between ranges of desert mountains appearing here and there the trend is slightly downward across the valley of the Río Conchos and on to Torreón at 3,720 feet on the Río Nazas in southwestern Coahuila. From this point there is a gradual but slightly irregular rise to the City of Zacatecas in the hills at more than 8,000 feet altitude, followed by another descent to the broad plains of Aguascalientes, eastern Jalisco, and Querétaro, at 5,500 to 6,000 feet, and a slight rise over the hills of southern Hidalgo and down to 7,350 feet in the Valley of México. West of this railroad, one of the National Railways, formerly the Mexican Central Railroad, the slopes are gradually upward to the

basal slopes of the Sierra Madre Occidental. East of the railroad are various interior depressions such as the Bolsón de Mapimí in south-eastern Chihuahua, and adjoining parts of Durango and Coahuila, and the Laguna de Mayrán in the latter state, which receives the flood waters of the Río Nazas and has no outlet.

The tableland of southern Hidalgo and the Valley of México is connected with the plains of Puebla by a narrow strip lying between the Sierra de Pachuca and Cerro Ixtacihuatl. The nearly level plains forming a high part of the interior plateau at 7,000 to 8,000 feet extend through Tlaxcala and across Puebla to the western base of Mount Orizaba and the western border of Veracruz. From southern Puebla a narrow southern extension of the tableland region dips down to about 5,000 feet to encompass the Valley of Oaxaca. As farther north this interior area is flanked by mountain barriers, toward the south the land surface slopes down to the Isthmus of Tehuantepec.

The Isthmus of Tehuantepec is a broad, trough-shaped pass, with an elevation of only about 800 feet in the highest part, extending across the narrowed continent between the Atlantic and Pacific coasts. Beyond this to the east again rises a broad, generally mountainous area, reaching an altitude of more than 8,000 feet, which extends southward as the elevated interior of Guatemala, and thence continues brokenly into other parts of Central America. Included, however, is the interior basin or valley of the Río de Chiapas in the state of the same name, much of which ranges from 3,000 to 5,000 feet in elevation and is quite plateaulike in character.

#### MOUNTAIN RANGES

The principal mountain range of México is the Sierra Madre Occidental, forming the continental backbone and rising like a wall along the western side of the tableland or great interior plateau. These mountains constitute the most extensive and continuous mountain system of México. The northern portion embraces a broad belt of extremely broken ranges, including a series lying parallel between the valleys of southward-flowing rivers in northeastern Sonora. The extreme northern end is marked by a spur known as the San Luis Mountains, the tip of which extends across the international boundary into southwestern New Mexico. From this point the mountains extend southward through western Chihuahua, western Durango, southwestern Zacatecas, eastern Nayarit, to northern Jalisco. These mountains consist largely of broad, more or less flat-topped ridges or mesas from 7,000 to 7,500 feet high, with a few elevations reaching 8,000 to 10,000

feet in altitude. At the southern end of this section in Jalisco there is a descent to lower elevations where the Río Grande de Santiago cuts through the tablelands on its way to the coast. South of the broad gap traversed by the Río Grande de Santiago, and west of Ameca, Jalisco, another high mountain marks the beginning of a continuation of the Sierra Madre in the form of a great series of mountain groups disposed in a chain which extends, with some interruptions, not far inland and parallel to the Pacific coast all the way into Central America. An important link in the chain is the somewhat isolated volcanic mountain mass culminating at about 14,000 feet in the Sierra Nevada de Colima, near the Colima boundary in southern Jalisco. The summit of this peak is a rocky pinnacle affording a view inside the walls of the crater of the still active Volcán de Colima, which rests against the southern flank of the mountain and is some 2,000 feet lower. Immediately east of this mountain there is a narrow gap where the tableland plains at 4,000 feet near Zapotlán slope down to the Plains of Colima at less than 2,000 feet altitude. Beginning again with a group of volcanic mountains, including Cerro de Tancítaro and Cerro Patambán, in northwestern Michoacán, there is a more continuous mountain belt extending in an easterly direction just south of Pátzcuaro and Morelia to the vicinity of Toluca, México, where the volcano of that name rises to an elevation of 15,000 feet. A high mountain ridge around the upper end of the Valley of Toluca connects the Volcán de Toluca with the Cerro de Ajusco and a continuation of this mountain wall along the southern border of the Valley of México turns northward to the Volcano of Popocatepetl and to Cerro Ixtacihuatl, the end of the chain in this direction. A spur more than 10,000 feet high, extending north from the main ridge between the valleys of México and Toluca, is known as the Sierra de las Cruces. Southeast of the Volcán de Popocatepetl there is a low pass where the tableland slopes down to the hot valley of the Río Balsas. Farther southeast, however, the mountains rise again as disconnected ridges and groups, which extend through southern Puebla and central Oaxaca where they form an irregular wall about the Valley of Oaxaca. Here, at the extreme southern end of the tableland, the mountains in broken array effect a junction with spurs from the Sierra Madre Oriental projecting west from the vicinity of Mount Zempoaltepec.

The Sierra Madre del Sur, as it is called, is a range about 10,000 feet high, lying south of the valley of the Río Balsas in Guerrero. The main section borders the lower part of the valley, but from a gap

at 4,600 feet near Chilpancingo the range extends east into Oaxaca, where it is connected with the mountains along the Continental Divide. Its isolation is due to the low, broad, hot valley of the Río Balsas with upper affluents extending far into the interior. Beyond a notable gap at the Isthmus of Tehuantepec, a prominent range of mountains 4,000 to 5,000 feet high parallels the Pacific coast southeastward through Chiapas to the border of Guatemala. To it the name Sierra Madre is also applied. Several peaks near the Guatemala border exceed 10,000 feet in height. Mountains rising to 9,500 feet altitude near San Cristóbal in central Chiapas are near the end of a spur extending northwest from the highlands of southwestern Guatemala. The northern part of the state of Chiapas is exceedingly rugged and broken, and a range of mountains extends from east to west. These mountains rise to 5,000 and 7,000 feet in altitude along a front dropping away abruptly to the hot lowlands of Tabasco. Owing to altitude and exposure to moisture-laden winds from over the Gulf, these mountains are among the wettest in México.

The Sierra Madre Oriental, named in contradistinction to the Sierra Madre Occidental, is a shorter but nearly continuous mountain wall along the eastern side of the interior tableland. This is a general range that begins at the north with steep, high mountain groups in southern Coahuila and southern Nuevo León and extends southward, except at narrow gaps, across eastern San Luis Potosí, eastern Guanajuato, Querétaro, Hidalgo, eastern Puebla and western Veracruz, to eastern Oaxaca in the vicinity of Mount Zempoaltepec. The highest and most notable part is the section marked at the northern end by the Cofre de Perote and which extends south along the boundary between Veracruz and Puebla to include the massive bulk of the Pico de Orizaba. The Cofre is so named from the boxlike form of the eroded remains of an ancient crater still extending to 14,000 feet altitude. The Pico de Orizaba at more than 18,000 feet is the most prominent landmark in México. The western base of this mountain rests at about 8,000 feet altitude on the arid eastern border of the tableland, and the eastern slopes descend sharply to the hot coastal lowlands of Veracruz. Along the eastern flank of the Pico de Orizaba a much lower limestone range is known locally as the Cordillera de Veracruz. Owing to altitude and exposure to moisture-laden winds from the Gulf, these mountain masses combined in the Cofre de Perote and the Pico de Orizaba embrace on their seaward sides a region of excessive rainfall, probably the wettest in México. At the northern base of the

Cofre and the southern base of Orizaba are narrow gaps traversed by railroads where the edges of the tableland drop away abruptly to the hot country below.

The Peninsula of Baja California has a single, definite mountain range of varying elevation extending near the eastern coast nearly its entire length, to end on the shore of La Paz Bay. This range has an abrupt slope fronting the Gulf of California, but descends gently toward the Pacific. The range begins at an elevation of about 4,000 feet on the California border as a southern extension of the San Jacinto Mountains of southern California, and about 150 miles farther south it rises to an altitude of more than 10,000 feet on La Providencia Peak in a high local section known as the Sierra San Pedro Mártir. North of La Paz a particularly rugged southern section is known as the Sierra de la Giganta. Near La Paz the mountains are interrupted by a low gap south of which rises the short ranges Sierra de la Victoria and Sierra de la Laguna, which are not very sharply differentiated. These ranges have altitudes of 3,000 to 6,000 feet, with occasional peaks reaching 1,000 to 2,000 feet higher.

A short, 10,000-foot range lies just south of the Big Bend of the Río Grande, in Coahuila. A somewhat isolated peak rises steeply from the desert to about 12,000 feet west of Galeana, Nuevo León. Another notable solitary mountain is the Cerro de Malinche that stands like a sentinel in the midst of the surrounding plain in southeastern Tlaxcala. The altitude of the plain is about 7,500 feet and that of the peak has been given as 13,562 feet. It is a volcanic peak, but of such great age that the crater has disappeared except for the site, which is undoubtedly marked by two great canyons that score the north and east face of the mountain.

Still another outlying volcanic group is the Volcán de San Martín and neighboring volcanic peaks in a different setting as they rise from very low elevations to about 5,000 feet from the tropical lowlands southeast of the delta of the Río Papaloapan near the coast of Veracruz. The Cerro de Malinche tends to bridge a gap between the volcanoes bordering the Valley of México and those along the eastern escarpment of the tableland and with the group about the Volcán de San Martín the volcanic chain is seen to have been nearly transcontinental in that general region.

In addition to the main mountains mentioned the land surface of México is here and there diversified by minor ranges.

## PLAINS

Plains varying from nearly level to undulating or more or less broken occupy most of the land surface and may be found in México at any elevation from sea level to about 8,000 feet altitude. The tableland or great interior plateau is typically a vast plains region, with broad, open, valleylike spaces interrupted by hills or ranges of low mountains that rise above the general surface. Over the higher part of the plateau slightly rolling plains at 7,500 to 8,000 feet extend eastward from the high mountains bordering the Valley of México to the western base of Mount Orizaba.

Coastal plains form a well-defined lowland belt, between the shore line and the basal slopes of the mountains, along the entire Pacific littoral of México, both on the mainland and in places on the western side of the peninsula of Baja California. These are interrupted in places where the mountain spurs or ridges extend to the shore line. The seaboard of the Gulf of México has a broader coastal plain which merges into that which covers all the peninsula of Yucatán, including the states of Yucatán and Campeche, and the territory of Quintana Roo, together with the neighboring state of Tabasco, the general area consisting almost wholly of nearly level or gently rolling tropical lowlands, with slight elevation.

## DRAINAGE

The long, narrow Valley of Toluca in the state of México is the highest in the republic. It has an altitude of about 8,200 feet and is enclosed on three sides by high mountains, the drainage being to the north. The valley floor, about 15 miles broad, consists of open, sloping, treeless plains with extensive marshes into which great springs discharge, forming the principal sources of the Río de Lerma, which flows north and westerly into the Pacific and is the longest river wholly within Mexican territory. The Valley of México, separated from the Valley of Toluca by the Sierra de las Cruces, is much larger and more oval in form, but of similar character. This basin, in which is located the City of México at about 7,350 feet altitude, formerly contained lakes Texcoco, Chalco, and Xochimilco and several smaller lakes, all discharging into Lake Texcoco from which there was no outlet. An elaborate drainage project by which the water is carried out to the Tula River, Hidalgo, through a tunnel, has reduced these lakes to a small sump in Lake Texcoco.

The largest lake in México is the Laguna de Chapala, about 50 miles in length and 10 miles in width, in the state of Jalisco. This lake

receives the waters of the Río de Lerma, which are discharged from an outlet not far from the mouth of this river. The stream below the lake is known as the Río Grande de Santiago. Other notable depressions are filled by lakes Cuitzeo and Pátzcuaro in Michoacán.

Owing to the shortness of watersheds and the mountainous character of the more humid portions of México, most of the rivers are torrential streams, of which the largest on the Gulf side are navigable for small steamers a short distance only from the sea. Aside from the Río Grande del Norte and the Río Colorado, both of which are mainly in the United States, the longest river of the Republic is the Río de Lerma, already mentioned, or Río Grande de Santiago as it is termed below Lake Chapala. This river cuts its way from its sources above 9,000 feet in the mountains and very large springs in the Valley of Toluca, northwesterly through the Laguna de Chapala and a western extension of the tableland to the Pacific in the state of Nayarit.

The Río Balsas drains the southern slopes of the lofty group of mountains forming the southern border of the Valley of México and the highlands of Puebla and northern Oaxaca and flows through a broad interior valley of arid tropical character. Its general course is westward into the Pacific in Guerrero. The Río Yaqui flows through great canyons from the high northern part of the western slope of the Sierra Madre Occidental into the Gulf of California. The Río Mayo, Río del Fuerte, and many other western-slope streams traverse rugged canyons in nearly parallel courses from the highest part of the Sierra Madre to the sea. The rivers of eastern México are short as compared with some western-slope streams, owing in part to the more abrupt eastern escarpment of the tableland region. As their watersheds, however, occupy regions of greater precipitation, the principal streams of the Gulf slope gather an immense volume of water and form torrents in the mountains which become sluggish floods in traversing the coastal plain where they afford navigation for short distances by small steamers. The Río Pánuco drains the eastern slopes of the tableland region with many ramifications, mainly in the states of Veracruz, Hidalgo, Querétaro, and San Luis Potosí, and enters the Gulf at Tampico. The Río Papaloapan, with a very short main trunk, combines near its mouth several large streams, including the San Juan, flowing from the mountains of northern Oaxaca into the Gulf south of the port of Veracruz. Two large rivers, the Río Grijalva and Río Usamacinta, rise not far apart in the high mountains of southwestern Guatemala and after following widely divergent courses flow through mouths not far apart into the Gulf of Campeche, on the coast of

Tabasco. The Río Nazas, of the northern part of the tableland region, carries the drainage of a section of the eastern slope of the Sierra Madre Occidental eastward from Durango to the sink of the Laguna de Mayrán, a small body of water with no outlet, in southwestern Coahuila.

Through long-continued erosion the drainage channels of several streams flowing into the Pacific have cut through the Sierra Madre Occidental in the states of Chihuahua and Durango and are now draining parts of the eastern slopes of these mountains and adjacent tablelands in both Durango and Chihuahua.

Along both the Pacific and Gulf coasts of the Mexican mainland narrow, shallow lagoons, often of considerable length and varying character, occupy low-lying belts behind fringing sand dunes. These are usually located near or across the mouths of rivers. Through wave action along the shores, lines of sand dunes have gradually been thrown up as a barrier behind which the fresh-water drainage tends to spread parallel to the coast line. The accumulated water, especially during the rainy season, deepens an outlet already existing, or breaks through the line of dunes and opens one or more channels or mouths to the sea, and the water pressure behind the line of dunes is relieved until further wave action may close the outlets or leave the water there very shallow. High tides may push into the lagoons, part or all of which become salty or brackish. More or less continued readjustment of water levels takes place, but the tendency is toward the stabilization of water areas of varied salinity suitable for aquatic plants and harboring wild life, especially birds of many kinds. Some lagoons, however, as the Laguna de Términos, Campeche, the Laguna Madre on the coast of Tamaulipas, and the Laguna de Tamiahua, Veracruz, are extensive inlets from the sea.

#### CLIMATE

Climatic conditions in México vary greatly, owing not only to differences in latitude between the northern and southern portions but also to highly diversified local conditions of elevation, slope exposure, direction of prevailing winds, and other factors. Most parts of the country are arid in character, but there are some notable exceptions. Temperatures cover a wide range in accordance with altitude as well as latitude. The climate of eastern México is warm and most humid in the southern portion, especially the seaward slope of the higher mountains, the precipitation decreasing rapidly toward the north in the tableland region where it slopes down to the lower Río Grande,

and in Baja California. Much of the peninsula of Yucatán, however, is comparatively arid, as are also some sections of the low Gulf strip in Veracruz and the narrow coastal plains of the Pacific. The driest regions of the republic are the desert plains and low mountains of the northeastern part of Baja California, a central section of the peninsula between the 27th and 30th parallels of north latitude, northwestern Sonora, northern Chihuahua and Coahuila.

In these regions, and to a somewhat lesser extent on the plains of northern México in general, the annual precipitation is slight and plants are widely spaced. The aridity of the tropical Pacific coastal plains of southern México is due to the distribution of the rainfall during the year, rather than to any lack of total precipitation. The year is divided into wet and dry seasons, and it is to the length of the dry season that the generally arid condition, so well reflected in the character of the vegetation, is due. The climate of the northern part of the Sierra Madre Occidental in summer is similar to that of the southern part of the Rocky Mountain region in southern Arizona and New Mexico. During this season there are abundant rains, but there is much less snow in winter. Low temperatures due to the elevation of the central plateau and the great height of the mountains of southern México carry boreal conditions far into tropical latitudes.

The rainfall of particular areas is strongly influenced by local conditions, especially variations in altitude, slope exposure, and direction of prevailing winds. As a result sections of rain forest or cloud forest may occur on mountain slopes in close proximity to areas of extreme aridity. The wettest regions of the republic are the Gulf slopes of high mountains in western Veracruz, northern Oaxaca, and northern Chiapas. The rainfall is also excessive on islandlike areas on the Pacific slopes of some of the mountains in Michoacán, Guerrero. Oaxaca, and southern Chiapas.

## BIOTIC RELATIONS

The geological structure and history of México are, as yet, very imperfectly known. Fossil remains from the Valley of México indicate that faunal conditions similar to those of the southwestern United States have long existed over the plateau region. The salient physical feature of the Mexican mainland is the great wedge-shaped interior plateau, with its apex near the Valley of México, increasing gradually in altitude and carrying northern conditions to near the 19th parallel of north latitude; and patches of northern coniferous forest recur farther south on the high mountains of Guerrero, Oaxaca, Chiapas, and in Guatemala. Through the lowlands bordering the coast, on the other hand, tropical areas split by the high interior wedge extend far to the north, through regions varying greatly in amount of moisture received and in other modifying conditions. As a result tropical and more northern elements are in direct contact along a much extended V-shaped front.

Near the southern end of the tableland the elevated land mass has been greatly increased in extreme height by volcanoes, one of which, the Volcán de Orizaba, rises to more than 18,000 feet in altitude. Small receding glaciers on Cerro Ixtacihuatl are evidence that the climate of the general area and doubtless of the tableland far to the north was formerly colder than at present. Temperature, moisture, and other conditions on the various slopes and in the vicinity of these mountains are highly diversified and set the region apart as unlike that of any other section of México.

Several of the genera of mammals, *Nelsonia*, *Neotomodon*, and the very sedentary pocket gophers, *Zygoeomys* and *Platygeomys*, are restricted to the area. The peculiar volcano rabbit, *Romerolagus diazi*, is known only on the upper slopes of the Volcán de Popocatepetl and Cerro Ixtacihuatl, where it appears to be a relict species.

Extending north along the eastern and western flanks of the tableland of México the great tropical floras and faunas of Central America, embracing multitudinous species, are gradually thinned and altered until the more northern survivors may conveniently be grouped in an Upper Tropical Zone. Among representatives of typically tropical mammals that range north in the Humid Lower Tropical Zone to Veracruz are *Ateles geoffroyi vellerosus*, *Mazama sartorii sartorii*, Cy-

*clopes mexicanus*, *Tamandua tetradactyla mexicana*, *Agouti paca nelsoni*, and *Coendou mexicanum mexicanum*. Most of these are absent in the Arid Lower Tropical Zone along the west coast north of the Isthmus of Tehuantepec, but *Coendou mexicanum mexicanum* and *Potos flavus guerrerensis* reach north to Guerrero. Among northern geographic races of mammals representing tropical species of wide dispersal on the Pacific side of the Mexican tableland are *Pecari angulatus sonoriensis*, *Nasua narica pallida*, *Felis yagouaroundi tolteca*, *Felis onca arizonensis*, and *Felis pardalis sonoriensis*. Paralleling these on the Gulf side are *Pecari angulatus angulatus*, *Nasua narica tamaulipensis*, *Felis yagouaroundi cacomitli*, *Felis onca veraecrucis*, and *Felis pardalis albescens*. The tableland plains and mountains are arid in general character, and the flora and fauna form modified southern extensions of similar areas in the United States. Many plants are very similar. Among species of mammals that range from the United States south over the tableland the following are representative regional races in or around the Valley of México: *Sorex vagrans orizabae*, *Bassariscus astutus astutus*, *Conepatus mesoleucus mesoleucus*, *Taxidea taxus sonoriensis*, *Citellus variegatus variegatus*, *Citellus mexicanus mexicanus*, *Thomomys umbrinus peregrinus*, *Microtus mexicanus mexicanus*, *Sylvilagus floridanus orizabae*, *Sylvilagus audubonii parvulus*, *Peromyscus maniculatus labecula*, *Peromyscus boylii levipes*, *Peromyscus truei gratus*, and *Perognathus flavus mexicanus*. A kangaroo rat, *Dipodomys phillipsii*, is regarded as specifically different but closely allied to, and a counterpart of, species ranging in the southwestern United States. Numerous species of birds are represented by geographic races that reach the southern end of the tableland.

The presence in the southern part of the peninsula of Baja California of a considerable number of arid tropical genera and species of plants common on the opposite mainland coast of México indicates a closer relationship of the two areas than is shown by the bird and mammal life. A few tropical birds are present, however, and among the tropical mammals are a few bats, including *Balantiopteryx plicata*, *Natalus mexicanus*, and *Dasypterus ega xanthinus*, the last, incidentally, a regional race of a species widely dispersed in South America, but apparently not known from the Mexican mainland or elsewhere in Middle America north of Panamá. A rice rat, *Oryzomys peninsulae*, representing a group mainly tropical in distribution, is restricted to extreme southern Baja California. The general fauna of the peninsula, however, is evidently derived chiefly from California. Some

of the desert mammals, including numerous regional and insular races of *Peromyscus eremicus*, *Peromyscus maniculatus*, *Neotoma lepida*, and *Perognathus spinatus*, extend into the Arid Upper Tropical Zone, where they are the dominant species. They evidently represent invaders from the Lower Austral Zone whose presence is due to favorable habitat relations rather than to temperature.

### GEOGRAPHIC DISTRIBUTION OF SPECIES

In dealing with the geographic distribution of species it is convenient to treat them as major assemblages from two principal points of view: (1) Many species are widespread in continuous range within areas embracing similar temperature, moisture, and other favorable environmental conditions, or may recur beyond gaps in range caused by unfavorable changes in the environmental complex. The gaps often result from variations in altitude and corresponding differences in temperature and moisture. The same species, or regional representatives of the same species may, therefore, occur on the slopes of widely separated mountain ranges. Such species or their constituent subspecies are assignable to life zones. (2) Many species or subspecies are restricted to particular regions, usually of rather large size, characterized by isolation or by topographic or climatic peculiarities that tend to set them apart in contrast with adjoining areas, as centers of distribution. These species may be grouped as assemblages assignable to biotic provinces. Some of the biotic provinces may be further subdivided as minor centers of distribution which may conveniently be termed biotic districts. Islands reposing on the continental shelf, and forming minor but distinctive distribution areas in themselves are obviously derived from, and therefore are included in, the same province as the adjacent mainland. Some of the larger islands seem worthy of recognition as biotic districts.

### LIFE ZONES

Seven major life zones below the Arctic-Alpine belt are recognizable in México. These zones are, as elsewhere, large-scale general expressions of the primary influence on organisms of climate in the broadest sense, including temperature and moisture, light and shade, in all their complex relations to one another. The zones are a reflex of the adaptation of species to all conditions of their environment and afford a clearer view of the geographic distribution of species and the relation of the plant and animal assemblages to one another.

The life-zone concept is not seriously in conflict with the biomes or plant-animal formations and associations as advanced by Clements and Shelford (*Bio-Ecology*, pp. 20-67, 1939), but is less restricted in scope. The term "biome" (p. 20) is regarded as the exact synonym of formation and climax when these are used in the biotic sense. The biomes are characterized by them as the ultimate climatic climax areas exemplified in great landscape types of vegetation with accompanying animals, such as tundra, grassland, coniferous forest, deciduous forest, and desert. They are restricted by purely ecological considerations, while life zones are natural biogeographical areas within which consideration is given to all environmental conditions without special reference to plant and animal succession. The life zone may, therefore, include climax associations and areas representing every stage in succession, in recognition of the disruptive forces always at work in climax areas. The life-zone and biome concepts represent different methods in approach to some of the same objectives, and each will be found useful and tend to supplement the other in the final interpretation of many of the facts bearing on plant and animal distribution.

The zones are divisions of the land surface into belts of approximately coordinate rank based primarily on temperature in varying combinations with moisture. The importance of favorable temperatures is demonstrated by the simple fact that no living thing can carry on vital physiological functions when subjected to extremes of heat or cold. Of similar importance, however, is a favorable amount of moisture, as no living organism can long withstand complete desiccation, and many land species are soon killed by being immersed in water. Very many species depend for existence on favorable combination of temperature and moisture. The linkage of temperature and moisture as basic determining life factors is, therefore, obvious.

Tropical species are killed by freezing, and the distribution of very many is doubtless determined by the dates of late-spring and early-fall frosts of killing effect, between which dates tropical temperatures prevail far to the north. On the other hand, certain plants of northern latitudes have been found to require low winter temperatures to enable them to carry on vital physiological functions. In arid tropical regions of México a number of trees exhibit the strange habit of completing their general growth during the wet season, but the flowering and maturing of fruit are deferred until near the middle of the dry season when the leaves have fallen and general growth has stopped. The various adaptations of desert plants to the rigors of a dry climate, and the migration or hibernation of animals to avoid winter conditions are

well known. It is evident, therefore, that the plants and animals of any locality depend for survival primarily on adjustment to the rhythm of temperatures and amounts of moisture received within the normal annual range; and as they differ greatly in temperature, moisture, and other requirements and tolerances they are correspondingly restricted in distribution to the belts recognized as life zones. Other more or less associated factors that should be mentioned in connection with zone limits and the distribution of species are the configuration of the continental land mass, Arctic conditions, ocean currents, latitude, altitude, geologic history, base level, slope exposure, soil, insolation, air drainage, radiation, direction of prevailing winds, and cloud formations.

In the delimitation of life zones plants are of first importance, owing to fixed location in their habitats and to the convenience with which they can be studied. Animals and birds directly or indirectly dependent on plants for food and often for shelter, are restricted in distribution by climatic conditions to much the same extent, but with powers of locomotion, and especially the ability to migrate with the changing seasons, are less readily utilized as life-zone indicators. The migrants are assigned to the zones in which they are known to breed, regardless of distribution at other seasons.

In ascending from sea level marked modification in the composition of the flora is usually observable with each 1,500 to 3,000 feet of increase in altitude, owing to changes in temperature, and the modification is greater if, as is likely to be the case, there is also a change in the amount of moisture received as rainfall. The critical importance of moisture is well shown in the tropical zones of which there are well-marked arid and humid divisions. Subject to local modifying conditions, especially base level, about 2,000 feet of altitude is assignable in México, as in the southwestern United States, to each of most of the major life zones. A timber-line belt above 11,000 to 11,500 feet, apparently representing the Hudsonian Zone, is well marked but of lesser altitudinal extent and limited to near the tops of a few of the higher mountains.

As some plants and animals are more tolerant than others and thrive under a more extensive range of environmental conditions they may differ greatly in zonal position. Some, for example, may be restricted to the upper or the lower part of a single life zone; others may occupy limited areas extending across zone boundaries; and still others may range in two or more zones. The more tolerant are of less value as life-

zone indicators, but their distribution may have significance, especially when considered in relation to zones from which they are excluded.

Owing to highly diversified conditions of local environment within the zones numerous minor associations of varying rank may be discerned. These minor associations, or plant and animal communities, commonly coincide with, and are obviously the result of, changes in landscape aspect, such as forests of varying composition, grassland, rock formations, sand dunes, marshes, and stream borders. Many of the changes are associated with moisture relations or soil conditions more or less local in scope. Minor ecological groups that may represent local climaxes, subclimaxes, or earlier stages in succession more or less closely allied but varying in combination of component parts, tend to appear and disappear at irregular intervals throughout the zones.

Owing to contiguity and similarity in conditions it is not surprising that the Lower Austral and Upper Austral Zones and the Transition and Canadian Zones of the southwestern United States should be traceable over the tableland region of México, including the mountain ranges. Conditions are more confused, however, near the lines of contact with the arid and humid divisions of the Upper Tropical Zone. Along the lateral borders of the tableland, especially where high mountains shrouded in cloud forest directly face tropical lowlands, tree ferns may grow in close proximity to firs, and other tropical and boreal elements are brought together owing to peculiar climatic conditions, as a result of which intermediate zones may be obliterated or so intermingled as to become difficult to distinguish. The explanation seems to be that on the higher parts of certain exposed slopes nearly continuous fog or rain has produced a heavy forest cover; with slow rate of evaporation and with much sunlight excluded there is slight range of variation in temperature or moisture throughout the year. As a result temperatures are relatively low and suited to the needs of the northern forest and accompanying fauna, while extreme humidity derived from comparatively warm cloud formations prevents frost and favors the upward extension of tropical elements.

The arid division of the Upper Tropical Zone (Arid Upper Tropical Subzone) is considerably extended northward between the Lower Austral Zone of the coastal plain and an area mainly Upper Austral in zone composition along the foothills and canyons of the western side of the Sierra Madre Occidental in southeastern Sonora and extreme southwestern Chihuahua. This unusual zonal arrangement is evidently due to air drainage and more rapid heat radiation on the plains,

especially at night, and to warm-slope exposures and generally sheltered conditions along the lower slopes of the mountains.

In the lowlands of eastern San Luis Potosí, northern Veracruz, and extreme southern Tamaulipas temperature and moisture relations are complex owing to the recession toward the interior of the mountains along the eastern front of the tableland, and to the convergence of the Río Tamesí and Río Pánuco, which combine to water a flat coastal area that would otherwise be very dry. North of the lower course of the Río Tamesí and along the valley toward the interior the transition from the humid division of the Lower Tropical Zone (Humid Lower Tropical Subzone) to the arid division of the Upper Tropical Zone (Arid Upper Tropical Subzone) is abrupt and this belt in turn soon gives way to the Lower Austral Zone. Small areas in which Arid Upper Tropical Subzone elements invade a region mainly Lower Austral in character occur, however, as far north as the lower Río Grande Valley. These areas include the warmer lower slopes of sheltered canyons in the mountains.

Owing to limited general knowledge of living forms as well as of detailed topography of the country and the local distribution of species in México, any attempt to delimit the life zones and the assignment of species at this time must be regarded as provisional. Though some generalizations based on field work already accomplished seem important, it is obvious that much more extensive investigations will be necessary before the life zones as a whole will be adequately known and the species of plants and animals accurately assigned. The lists are regarded as fairly representative and indicative of the large number that seem to be assignable to single zones, but not necessarily to be treated as salient indicators. A few included from two or more zones are examples of wider dispersal. The partial lists are, of course, subject to extensive correction.

In preparing the lists of plants the monumental work on the "Trees and Shrubs of Mexico," by Standley (*Contr. U. S. Nat. Herb.*, vol. 23, 5 pts., 1,721 pp., 1920-1926), has been freely drawn upon, usually with ranges as outlined by him. The lists of mammals are based on information obtained in connection with the field work of E. W. Nelson and myself. The lists of birds are from various sources, but the nomenclature and ranges given are largely from the "Birds of North and Middle America" (*U. S. Nat. Mus. Bull.* 50) of Ridgway and Friedmann, supplemented by much field data obtained by me. The arrangement of the families is in accordance with Wetmore's "Systematic Classification for the Birds of the World" (*Smithsonian Misc. Coll.*, vol. 99, No. 7, 11 pp., Oct. 10, 1940).

The following series of major life zones and subzones seem recognizable in México:

1. Lower Tropical Zone.
  - a. Humid Lower Tropical Subzone.
  - b. Arid Lower Tropical Subzone.
2. Upper Tropical Zone.
  - a. Humid Upper Tropical Subzone.
  - b. Arid Upper Tropical Subzone.
3. Lower Austral Zone.
4. Upper Austral Zone.
5. Transition Zone.
6. Canadian Zone.
7. Hudsonian Zone.
8. Arctic Alpine Zone.

#### LOWER TROPICAL ZONE

The Lower Tropical Zone is the lower division of the general region below the normal frost line, based mainly on temperature. It is a coastal lowland tropical belt limited to near sea level in northern Nayarit on the Pacific coast and in northern Veracruz, but it gradually increases in upward extent to the southward to about 2,500 feet on northerly slopes and to 3,000 feet on southerly slopes in southern México. It is subdivisible into humid and arid sections that for convenience are denominated the Humid Lower Tropical Subzone and the Arid Lower Tropical Subzone, respectively.

#### HUMID LOWER TROPICAL SUBZONE

This section of the Lower Tropical Zone occupies most of the lowlands and lower mountain slopes, including the rain forest, and is fairly uniformly covered with evergreen forest extending from near Tampico, Tamaulipas, southeast along the Gulf coast through Veracruz, eastern Puebla, northern Oaxaca, Tabasco, northern Chiapas, southern Campeche, Quintana Roo, and Cozumel Island. The most luxuriant tropical forests of México, distributed mainly along the lower slopes of the mountains, are in this subzone. The subzone gives way to its counterpart, the Arid Lower Tropical Subzone, near the Gulf coast in central Veracruz and in Yucatán and northern Campeche. It also meets this arid subzone on the Isthmus of Tehuantepec. The altitudinal range, about the same as that of the zone as a whole, is from sea level to about 2,500 feet on north slopes and to about 3,000 feet on south slopes in southern México, the upper limits gradually descending to near sea level in northern Veracruz.

High temperature in combination with abundant moisture has led to the development of a flora and dependent avifauna of extraordinary richness and variety. The coarse vegetation of this division with its heavy forest canopy is less favorable for mammals, however, and fewer species are present than in the arid division, where the admission of more light produces denser and more varied ground cover and more food for mammals. A number of the mammals are arboreal.

**Plants of Humid Lower Tropical Subzone:**

- Cyathea arborea* ..... Veracruz.  
*Alsophila schiedeana* ..... Veracruz and Chiapas (mountains of).  
*Zamia spartea* ..... Veracruz.  
*Geonoma mexicana* ..... Oaxaca.  
*Geonoma magnifica* ..... Tabasco.  
*Monstera karwinskyi* ..... Veracruz.  
*Agave endlichiana* ..... Veracruz.  
*Agave pendula* ..... Veracruz.  
*Piper sanctum* ..... Veracruz.  
*Piper jalapense* ..... Veracruz.  
*Brosimum alicastrum*<sup>1</sup> ..... Tamaulipas and Nayarit to Yucatán,  
Oaxaca, and Tabasco.  
*Castilla elastica* ..... Veracruz, Tabasco, Chiapas, Yucatán.  
*Sahagunia mexicana* ..... Veracruz.  
*Cecropia mexicana*<sup>1</sup> ..... Sinaloa to Veracruz and Oaxaca.  
*Urera caracasana*<sup>1</sup> ..... Sinaloa to Chiapas, Veracruz, Tabasco.  
*Coccoloba lindemiana* ..... Tabasco.  
*Persea schiedeana* ..... Veracruz.  
*Rubus fagifolius* ..... Veracruz.  
*Prunus tetradenia* ..... Veracruz, Oaxaca.  
*Mimosa pudica* ..... Veracruz.  
*Mimosa ervendbergii* ..... Veracruz.  
*Lysiloma aurita* ..... Veracruz.  
*Pithecolobium macrosiphon* ..... Chiapas.  
*Pithecolobium furcatum* ..... Tabasco.  
*Inga jinicuil* ..... Veracruz.  
*Inga radians* ..... Chiapas.  
*Inga pringlei* ..... Veracruz.  
*Inga fissicalyx* ..... Veracruz, Tabasco.  
*Bauhinia dipetala* ..... Veracruz, Puebla, Oaxaca.  
*Bauhinia mexicana* ..... Veracruz.  
*Parosela botteri* ..... Veracruz.  
*Desmodium plectocarpum* ..... Veracruz.  
*Desmodium foliosum* ..... Veracruz, Oaxaca.  
*Erythrina americana*<sup>1</sup> ..... México and Veracruz to Chiapas and  
Yucatán.  
*Dalbergia glomeratum* ..... Veracruz.  
*Erythroxylon tabascense* ..... Tabasco.  
*Guaiacum sanctum* ..... Yucatán, Tabasco.  
*Stauranthus perforatus* ..... Veracruz.  
*Zanthoxylum elephantiasis* ..... Veracruz.  
*Picramnia lindemiana* ..... Tabasco.  
*Bursera pannonosa* ..... Veracruz.

- Svietenia macrophylla* ..... Tabasco, Chiapas.  
*Cedrela mexicana* ..... Veracruz.  
*Bunchosia biocellata* ..... Tamaulipas, Veracruz.  
*Bunchosia lanceolata* ..... San Luis Potosí, Veracruz, Oaxaca.  
*Mascagnia mexicana* ..... Veracruz.  
*Stigmaphyllon lindenianum* ..... San Luis Potosí to Yucatán, Chiapas.  
*Euphorbia cotinifolia* ..... Oaxaca, Veracruz.  
*Pedilanthus finkii* ..... Veracruz.  
*Phyllanthus adenodiscus* ..... Tamaulipas, San Luis Potosí, Veracruz.  
*Croton glabellus* ..... Veracruz, Tabasco.  
*Croton draco* ..... San Luis Potosí, Veracruz, Chiapas.  
*Croton soliman* ..... Veracruz, Tabasco, Oaxaca.  
*Croton xalapensis* ..... Veracruz.  
*Acalypha melochiaefolia* ..... Veracruz.  
*Acalypha unibracteata* ..... Veracruz.  
*Acalypha schiedeana* ..... Veracruz.  
*Acalypha frederici* ..... Veracruz.  
*Jatropha multiloba* ..... Veracruz.  
*Jatropha curcas*<sup>1</sup> ..... Sinaloa to Veracruz, Yucatán, Chiapas.  
*Spondias lutea* ..... Veracruz, Tabasco, Yucatán, Oaxaca.  
*Tapirira mexicana* ..... Veracruz.  
*Serjania cambessediana* ..... Veracruz, Oaxaca.  
*Serjania impressa* ..... Veracruz.  
*Serjania goniocarpa* ..... Veracruz.  
*Colubrina celtidifolia* ..... Veracruz.  
*Heliocarpus appendiculatus* ..... San Luis Potosí, Veracruz, Tabasco, Chiapas.  
*Heliocarpus glabrescens* ..... Veracruz.  
*Triumfetta dumetorum* ..... Veracruz, Oaxaca.  
*Triumfetta speciosa* ..... Veracruz, Oaxaca.  
*Triumfetta columnaris* ..... Oaxaca, Chiapas.  
*Abutilon purpusii* ..... Veracruz, Chiapas.  
*Abutilon yucatanum* ..... Quintana Roo.  
*Malvaviscus oaxacanus* ..... Oaxaca.  
*Pachira macrocarpa* ..... Veracruz, Oaxaca.  
*Pachira aquatica* ..... Veracruz, Tabasco, Chiapas.  
*Sterculia mexicana* ..... Tabasco, Chiapas.  
*Theobroma cacao* ..... Chiapas, Tabasco.  
*Theobroma angustifolium* ..... Chiapas, Tabasco.  
*Theobroma bicolor* ..... Chiapas, Tabasco.  
*Guazuma ulmifolia* ..... Widely distributed throughout tropical México.  
*Marcgravia mexicana*<sup>1</sup> ..... Veracruz.  
*Ternstroemia sylvatica* ..... Veracruz, Hidalgo.  
*Ternstroemia tepezapote* ..... Veracruz.  
*Clusia orizabae* ..... Veracruz.  
*Clusia mexicana* ..... Veracruz.  
*Cactus salvador* ..... Veracruz.  
*Epiphyllum caudatum* ..... Oaxaca.  
*Chiapasiasia nelsonii* ..... Chiapas.  
*Daphnopsis mollis* ..... San Luis Potosí, Veracruz.  
*Daphnopsis lindenii* ..... Veracruz.  
*Cuphea salicifolia* ..... Veracruz.  
*Cuphea hyssopifolia* ..... Veracruz.  
*Cuphea nitidula* ..... Veracruz.



## Mammals of Humid Lower Tropical Subzone:

- Didelphis marsupialis tabascensis*. Tabasco.  
*Didelphis marsupialis cozumelae*. Cozumel Island, Quintana Roo.  
*Marmosa mexicana mexicana*. Chiapas, Oaxaca, Veracruz.  
*Metachirops opossom pallidus*. Veracruz.  
*Philander laniger aztecus*. Veracruz.  
*Saccopteryx bilineata centralis*. Tabasco.  
*Vampyrum spectrum nelsoni*. Veracruz.  
*Artibeus turpis*. Tabasco.  
*Pipistrellus cinnamomeus*. Tabasco.  
*Nasua narica narica*. Veracruz, eastern Puebla, Tabasco, northern Oaxaca, northern Chiapas.  
*Potos flavus aztecus*. Veracruz.  
*Potos flavus campechensis*. Campeche, Tabasco.  
*Bassariscus sumichrasti sumichrasti*. Veracruz.  
*Bassariscus sumichrasti campechensis*. Campeche, Tabasco.  
*Tayra barbara senex*. Veracruz.  
*Conepatus leuconotus leuconotus*. Veracruz.  
*Conepatus tropicalis tropicalis*. Veracruz.  
*Conepatus tropicalis yucatanicus*. Quintana Roo, Yucatán.  
*Felis onca goldmani*. Campeche, Yucatán.  
*Felis onca veraecrucis*<sup>1</sup>. Chiapas, Tabasco, Veracruz.  
*Felis pardalis pardalis*. Campeche, Oaxaca, Tabasco, Veracruz.  
*Alouatta palliata mexicana*. Tabasco, Veracruz, northern Chiapas.  
*Ateles geoffroyi vellerosus*. Veracruz, Tabasco, Campeche, Oaxaca, Quintana Roo, Chiapas, Yucatán.  
*Ateles geoffroyi yucatanensis*. Quintana Roo, Campeche, northern Guatemala.  
*Sciurus deppei deppei*<sup>1</sup>. Veracruz, Tabasco, Oaxaca, Chiapas.  
*Sciurus deppei vivax*. Campeche.  
*Sciurus aureogaster aureogaster*<sup>1</sup>. Southern Tamaulipas, Veracruz, eastern San Luis Potosí, eastern Querétaro and Puebla, northeastern Hidalgo, northern Oaxaca.  
*Sciurus aureogaster hypopyrrhus*. Southern Veracruz, southeastern Oaxaca, Tabasco, eastern Chiapas.  
*Sciurus yucatanensis baliolus*. Campeche.  
*Heterogeomys hispidus isthmicus*. Veracruz.  
*Heterogeomys hispidus tehuan-tepecus*. Oaxaca.  
*Heterogeomys hispidus teapensis*. Tabasco.  
*Heteromys desmarestianus desmarestianus*. Chiapas, Tabasco.  
*Heteromys desmarestianus griseus*. Chiapas, Oaxaca.  
*Heteromys longicaudatus*. Tabasco.  
*Heteromys goldmani*. Southern Chiapas.  
*Heteromys lepturus*. Oaxaca, Veracruz.  
*Heteromys temporalis*. Veracruz.  
*Peromyscus leucopus mesomelas*. Puebla, Veracruz.  
*Peromyscus leucopus castaneus*. Campeche.  
*Peromyscus mexicanus mexicanus*<sup>2</sup>. Chiapas, Oaxaca, Puebla, Veracruz.

- Peromyscus mexicanus*  
*totontepecus* ..... Oaxaca, Veracruz.  
*Peromyscus mexicanus teapensis*.. Southern Tabasco.  
*Peromyscus yucatanicus badius*... Southern Campeche.  
*Oryzomys couesi couesi*..... Campeche, Chiapas, Oaxaca, Puebla,  
 Quintana Roo, Tabasco, Veracruz, Yucatán.  
*Oryzomys cozumelae* ..... Cozumel Island.  
*Oryzomys rostratus rostratus*.... Oaxaca, Puebla, Tamaulipas, Veracruz.  
*Oryzomys rostratus megadon*.... Tabasco.  
*Oryzomys fulvescens*  
*fulvescens*<sup>1</sup> ..... Oaxaca, Tamaulipas, Veracruz.  
*Ototylomys phyllotis phaeus*..... Southern Campeche.  
*Nyctomys sumichrasti*  
*sumichrasti* ..... Veracruz.  
*Sigmodon hispidus saturatus*.... Tabasco, Chiapas, Veracruz.  
*Coendou mexicanum mexicanum*<sup>2</sup>. Veracruz, Tabasco, Oaxaca.  
*Dasyprocta mexicana* ..... Veracruz.  
*Cuniculus paca nelsoni*..... Veracruz.  
*Sylvilagus floridanus russatus*... Veracruz.  
*Sylvilagus gabbi truei*..... Puebla, Veracruz, Oaxaca, Tabasco,  
 Chiapas.  
*Pecari angulatus crassus*..... Puebla, Veracruz.  
*Tayassu pecari ringens*..... Campeche, Yucatán, Quintana Roo.  
*Odocoileus virginianus thomasi*<sup>2</sup>. Chiapas, Oaxaca, Tabasco, Veracruz.  
*Odocoileus virginianus toltecus*<sup>1</sup>.. Veracruz.  
*Odocoileus virginianus*  
*yucatanensis*<sup>1</sup> ..... Campeche, Yucatán.  
*Mazama satorii satorii*<sup>1</sup>..... Veracruz, Tabasco, Oaxaca, Chiapas.  
*Tapirella bairdii*<sup>1</sup> ..... Veracruz, Tabasco, Oaxaca, Chiapas.  
*Cyclopes dorsalis*<sup>2</sup> ..... Veracruz, Tabasco, Oaxaca, Chiapas.  
*Tamandua tetradactyla mexicana*<sup>2</sup>. Veracruz, Tabasco, Campeche, Oaxaca,  
 Chiapas.

<sup>1</sup> Also in Humid Upper Tropical Subzone.

<sup>2</sup> Also in Arid Lower Tropical Subzone.

**Birds of Humid Lower Tropical Subzone:**

- Tinamus major robustus*..... Southern Veracruz, Tabasco, Oaxaca,  
 Chiapas, Campeche.  
*Crypturellus soui meserythrus*... Southern Veracruz, Oaxaca, Chiapas.  
*Crypturellus boucardi boucardi*... Southern Veracruz, Tabasco, Chiapas.  
*Crypturellus cinnamomeus sallaci*. Veracruz, Puebla, Oaxaca, and Chiapas.  
*Colymbus dominicus*  
*brachypterus*<sup>1, 2</sup> ..... Southern Baja California to Tamaulipas  
 and southward to Chiapas.  
*Agamia agami* ..... Veracruz, Chiapas.  
*Heterocnus mexicanus*<sup>1</sup> ..... Southern Sonora and southern Tamaulipas  
 to Chiapas.  
*Cochlearius cochlearius zeledoni*.. Sinaloa and Veracruz, south to Chiapas.  
*Dendrocygna autumnalis*  
*fulgens*<sup>1, 2</sup> ..... Tamaulipas.  
*Dendrocygna autumnalis lucida*... Sinaloa, and Nuevo León, south along  
 both coasts to Chiapas.  
*Cairina moschata*<sup>1, 2</sup> ..... Southern Sinaloa and central Tamaulipas,  
 south along coast to Chiapas.

- Sarcoramphus papa*<sup>1</sup> ..... Southern Sinaloa, northern Veracruz, and eastern Puebla to Yucatán and Chiapas.
- Odontriorchis palliatus* ..... Southern Tamaulipas, Veracruz, Oaxaca, Yucatán, south through Central America.
- Ictinia plumbea* ..... Southern Veracruz, Oaxaca, Chiapas.
- Rostrhamus sociabilis major*<sup>1</sup>.... Veracruz, Yucatán.
- Chondrohierax uncinatus*  
*aquilonis*<sup>1</sup> ..... Tamaulipas to Oaxaca, Yucatán, and Chiapas.
- Accipiter bicolor fidens*..... Central Veracruz to southern Oaxaca.
- Buteo magnirostris griseocauda*... Southern Tamaulipas, Veracruz.
- Buteo magnirostris gracilis*..... Cozumel Island, Quintana Roo.
- Leucopternis albicollis*  
*ghiesbreghti* ..... Veracruz, Oaxaca.
- Hypomorphnus urubitinga*  
*ridgwayi*<sup>1</sup> ..... Southern Sonora and southern Tamaulipas to Yucatán and southern Chiapas.
- Busarellus nigricollis nigricollis*<sup>1</sup>. Sinaloa and Veracruz, south to Central America.
- Harpia harpyja*<sup>1</sup> ..... Central Veracruz and southeastern Oaxaca, southward through Central America.
- Spizastur melanoleucus*<sup>1</sup> ..... Southern Veracruz, Yucatán, Oaxaca, Chiapas.
- Spizaetus ornatus vicarius*..... Southern Veracruz, Oaxaca, Chiapas.
- Spizaetus tyrannus* ..... Southern Veracruz, Chiapas.
- Geranospiza nigra nigra*<sup>1</sup>..... Southern Tamaulipas, Veracruz, Yucatán, southern Sinaloa to Chiapas.
- Herpetotheres cachinnans*  
*chapmani*<sup>1</sup> ..... Southern Sinaloa, southern Veracruz, Yucatán, and Quintana Roo to Chiapas.
- Micrastur semitorquatus naso*.... Southern Sinaloa and southern Tamaulipas, Veracruz, Yucatán, Quintana Roo, and south through Chiapas.
- Micrastur ruficollis guerilla*..... Southern Veracruz, Campeche.
- Falco deiroleucus* ..... Southern Veracruz and southward through Central America.
- Falco albigularis albigularis*<sup>1</sup>.... Southern Tamaulipas, Veracruz, Yucatán, Quintana Roo, Nayarit and south through Oaxaca and Chiapas.
- Falco femoralis*  
*septentrionalis*<sup>1, 2, 3</sup> ..... Sinaloa (and undoubtedly Sonora), Tamaulipas, southward to Yucatán and Oaxaca.
- Crax rubra rubra*..... Southern Tamaulipas, Veracruz, Oaxaca, Campeche, Yucatán, Quintana Roo.
- Crax rubra griscomi*..... Cozumel Island, Quintana Roo.
- Penelope purpurascens*  
*purpurascens*<sup>1</sup> ..... Southern Sinaloa, southern Tamaulipas, Veracruz, Yucatán, and south through Chiapas.
- Ortalis vetula vetula*..... Veracruz, eastern Oaxaca, Tabasco, southern Campeche.
- Ortalis vetula leucogastra*..... Southern Chiapas.
- Odontophorus guttatus*<sup>4</sup> ..... Central and southern Veracruz, Tabasco, Campeche, Chiapas, Oaxaca.

- Agriocharis ocellata*<sup>1</sup> ..... Yucatán, Quintana Roo, Campeche.  
*Colinus virginianus pectoralis*.... Central Veracruz, south to eastern Oaxaca.  
*Colinus virginianus godmani*.... Lowlands of southern Veracruz.  
*Colinus virginianus minor*..... Southern Tabasco, northeastern Chiapas.  
*Dactylortyx thoracicus*  
*thoracicus*<sup>1</sup> ..... Veracruz and northern Puebla.  
*Aramus guarauna dolosus*<sup>1</sup>..... Southern Veracruz, Oaxaca, Yucatán, Quintana Roo.  
*Aramides cajanea mexicana*<sup>1</sup>.... Southern Tamaulipas, Veracruz, Oaxaca, Tabasco.  
*Aramides cajanea albiventris*.... Campeche, Yucatán, Quintana Roo.  
*Laterallus ruber ruber*..... Cozumel Island, Quintana Roo, and southward.  
*Heliornis fulica* ..... Southern Veracruz.  
*Charadrius collaris*<sup>1</sup> ..... Southern Veracruz, Tabasco, Oaxaca, Chiapas.  
*Oedicephus bistrriatus bistrriatus*<sup>1</sup>. Southern Veracruz, Oaxaca, Chiapas.  
*Columba flavirostris*  
*flavirostris*<sup>1, 2</sup> ..... Southern Sonora, Nuevo León and Tamaulipas, and southward along Atlantic and Pacific slopes to Yucatán and southern Chiapas.  
*Columba cayennensis pallidicrissa*. Southern Veracruz, Tabasco, northern Chiapas.  
*Columba speciosa*<sup>1</sup> ..... Southern Veracruz, northern Oaxaca, Yucatán.  
*Columba nigrirostris* ..... Southern Veracruz, northern Oaxaca, southern Quintana Roo.  
*Zenaida asiatica asiatica*<sup>1, 2, 3</sup>.... Tamaulipas, south through Veracruz to southern Oaxaca and east to Yucatán and Quintana Roo.  
*Scardafella inca*<sup>1, 2, 3</sup> ..... Southern Baja California, Sonora, Chihuahua, Nuevo León, Tamaulipas, and southward along eastern and western coasts, excluding Yucatán, and over interior plains to southern Chiapas.  
*Columbigallina passerina*  
*pallescens*<sup>1, 2, 3</sup> ..... Southern Baja California, Sonora, Chihuahua, Nuevo León, Tamaulipas, and southward along coasts and over interior plains throughout México.  
*Columbigallina minuta interrupta*. Veracruz, Tabasco, Campeche.  
*Columbigallina talpacoti*  
*rufipennis*<sup>1</sup> ..... Veracruz, Tabasco, Oaxaca, Campeche, Yucatán, Quintana Roo, Chiapas.  
*Claravis pretiosa*<sup>1</sup> ..... Southern Tamaulipas, Veracruz, Puebla, eastern San Luis Potosí, Oaxaca, Campeche, Yucatán, Quintana Roo.  
*Leptotila verreauxi*  
*fulviventris*<sup>1</sup> ..... Southeastern Veracruz, Tabasco, Campeche, Yucatán, Chiapas.  
*Leptotila verreauxi*  
*angelica*<sup>1, 2</sup> ..... Nuevo León, Tamaulipas, Veracruz, Puebla, and southern Sonora to Chiapas.

- Leptotila plumbeiceps* ..... Southern Tamaulipas, Veracruz, Tabasco.  
*Ara macao*<sup>1</sup> ..... Southern Tamaulipas, Veracruz, Oaxaca, Chiapas.  
*Aratinga holochlora holochlora*<sup>2</sup>. Southwestern Chihuahua, Nuevo León, Tamaulipas, Veracruz, San Luis Potosí, Puebla, Guanajuato, México.  
*Aratinga astec* ..... Southern Tamaulipas to Yucatán.  
*Bolborhynchus lineola lineola*.... Central Veracruz and southward to Central America.  
*Pionopsitta haematotis haematotis*. Southern Veracruz and southward through Guatemala.  
*Pionus senilis* ..... Central Veracruz, Oaxaca, Quintana Roo.  
*Amazona autumnalis autumnalis*<sup>1</sup>. Southern Tamaulipas, Veracruz, Puebla, México, Guanajuato, Oaxaca.  
*Amazona farinosa guatemalae*.... Southern Veracruz, Oaxaca.  
*Amazona ochrocephala oratrix*<sup>1, 2</sup>. Southern Tamaulipas, and Veracruz to Yucatán, and from Colima southward to Oaxaca.  
*Amazona albifrons nana*<sup>1</sup>. .... Yucatán, Campeche, and Chiapas.  
*Coccyzus minor minor*<sup>1</sup>. .... Southern Tamaulipas to Yucatán.  
*Piaya cayana thermophila*<sup>1</sup>. .... Southern Tamaulipas to Yucatán, southern Oaxaca and Chiapas.  
*Tapera naevia excellens*<sup>1</sup>. .... Veracruz, Tabasco, Oaxaca.  
*Geococcyx velox*<sup>1, 2</sup>. .... Southern Sonora, south along Pacific slope to southern Chiapas, and from central Veracruz to Yucatán.  
*Dromococcyx phasianellus*<sup>1</sup> .... Central Veracruz to Yucatán and southern Oaxaca.  
*Crotophaga sulcirostris*<sup>1, 2</sup> .... Southern Baja California, southern Sinaloa and Tamaulipas southward along Atlantic and Pacific slopes to Yucatán and Chiapas.  
*Otus guatemalae* ..... Veracruz, Oaxaca.  
*Pulsatrix perspicillata saturata*<sup>1</sup>. Veracruz, Oaxaca.  
*Ciccaba nigrolineata*<sup>1</sup> ..... Veracruz, Oaxaca, Chiapas.  
*Ciccaba virgata centralis*<sup>1</sup>. .... Veracruz, Tabasco, Oaxaca, Chiapas, Campeche, Yucatán.  
*Nyctidromus albicollis nelsoni* ... Southwestern Chiapas.  
*Nyctidromus albicollis yucatanensis*<sup>1</sup> ..... Eastern Tabasco, Campeche, Yucatán, Quintana Roo.  
*Otophanes yucatanicus* ..... Yucatán, Campeche.  
*Chordeiles acutipennis micromeris*<sup>1</sup> ..... Yucatán, Quintana Roo, Tabasco, Campeche, Jalisco, Guerrero, Oaxaca.  
*Nyctibius griseus mexicanus*<sup>1</sup>.... Veracruz, Tabasco, Oaxaca.  
*Streptoprocne zonaris mexicana*.. Veracruz, Guerrero, Oaxaca, Chiapas.  
*Chaetura vauxi richmondi*.... Southern Tamaulipas, Veracruz, Oaxaca.  
*Phaethornis superciliosus veraecrucis* ..... Veracruz, Oaxaca, Tabasco.  
*Phaethornis longuemareus adolphi*. Veracruz, Oaxaca, Tabasco, Chiapas.  
*Heliomaster longirostris pallidiceps*<sup>1</sup> ..... Guerrero, Veracruz, Chiapas, Oaxaca.  
*Pampa pampa curvipennis*.... San Luis Potosí, Puebla, Veracruz, Oaxaca, Campeche.

- Campylopterus hemileucurus*  
*hemileucurus*<sup>4</sup> .....Veracruz, Guerrero, Oaxaca, Tabasco,  
 Chiapas.
- Eupherusa eximia nelsoni*.....Veracruz, Oaxaca, Puebla.
- Amasilia tsacatl tsacatl*.....Southern Tamaulipas, Veracruz, Oaxaca,  
 Tabasco, Chiapas.
- Amasilia yucatanensis*  
*yucatanensis*<sup>1</sup> .....Tabasco, Campeche, Yucatán.
- Amasilia yucatanensis*  
*cerviniventris* .....Veracruz.
- Amasilia candida*<sup>1</sup> .....Veracruz, Oaxaca, Tabasco, Chiapas,  
 Campeche, Yucatán, Quintana Roo.
- Anthracothorax prevostii*  
*prevostii*<sup>1</sup> .....Southern Tamaulipas, Veracruz to Chia-  
 pas and Yucatán.
- Chlorostilbon canivetii forficatus*..Cozumel Island, Quintana Roo.
- Chlorostilbon canivetii*  
*canivetii*<sup>1</sup> .....Southern Tamaulipas, Veracruz, Oaxaca,  
 Chiapas, Yucatán.
- Doricha eliza*<sup>1</sup> .....Veracruz, Yucatán.
- Paphosia helenae* .....Veracruz, Chiapas.
- Curucujus massena* .....Veracruz, Oaxaca, Tabasco, Campeche,  
 Chiapas.
- Trogon citreolus*  
*melanocephala*<sup>1</sup> .....Southern Tamaulipas, Veracruz to Chia-  
 pas and Yucatán.
- Trogon collaris puella*<sup>4</sup>.....Veracruz, Puebla, Tabasco, Oaxaca, Cam-  
 peche, Yucatán.
- Trogon violaceus caligatus*<sup>1</sup>.....Southern Tamaulipas to Chiapas and  
 Yucatán.
- Ceryle torquata torquata*<sup>4</sup>.....Southern Tamaulipas, southern Sinaloa to  
 Tabasco and Chiapas.
- Chloroceryle amazona mexicana*<sup>1</sup>..Southern Sinaloa, central Veracruz to  
 Tabasco and Chiapas.
- Chloroceryle americana*  
*septentrionalis*<sup>1, 2, 3</sup> .....Sonora, Chihuahua, Nuevo León, Tamau-  
 lipas to Tabasco and Chiapas.
- Chloroceryle aenea strictoptera*<sup>1</sup>..Southern Veracruz, Campeche, Yucatán,  
 Quintana Roo to southern Oaxaca and  
 southern Chiapas.
- Momotus momota lessonii*<sup>1</sup>.....Chiapas.
- Momotus momota goldmani*.....Central and southern Veracruz, Oaxaca,  
 Tabasco.
- Electron carinatum* .....Veracruz, Tabasco.
- Eumomota superciliosa*  
*superciliosa*<sup>1</sup> .....Tabasco, Campeche, Yucatán, Quintana  
 Roo.
- Eumomota superciliosa bipartita*<sup>1</sup>..Southern Veracruz, Oaxaca, Chiapas.
- Hylomanes momotula momotula*..Central and southern Veracruz, Tabasco.
- Galbula ruficauda melanogenia* Veracruz, Chiapas.
- Malacoptila panamensis inornata*..Tabasco.
- Ramphastos sulfuratus sulfuratus*..Veracruz, Oaxaca, Tabasco, Yucatán.
- Pteroglossus torquatus torquatus*..Veracruz, Oaxaca, Tabasco, Chiapas.
- Melanerpes aurifrons verae crucis*..Veracruz, Tabasco, Chiapas.
- Melanerpes rubricapillus*  
*pygmaeus* .....Cozumel Island, Quintana Roo.

- Melanerpes aurifrons*  
*grateloupensis* ..... Southern Tamaulipas, Veracruz, Puebla,  
 Oaxaca.
- Melanerpes formicivorus*  
*formicivorus*<sup>5</sup> ..... Nuevo León, Tamaulipas Sinaloa, Zaca-  
 tecas, Veracruz, and south to Oaxaca  
 and Chiapas.
- Melanerpes pucherani perileucus*.. Veracruz, Tabasco, Chiapas.
- Piculus aeruginosus*<sup>2</sup> ..... Nuevo León, Tamaulipas, Veracruz, San  
 Luis Potosí.
- Piculus rubiginosus*  
*yucatanensis*<sup>1</sup> ..... Veracruz, Oaxaca, Tabasco, Chiapas, Yu-  
 catán.
- Celcus castaneus*<sup>1</sup> ..... Veracruz, Oaxaca, Tabasco, Yucatán.
- Dryocopus lineatus similis*<sup>1, 2</sup>.... Nuevo León, Tamaulipas, San Luis Po-  
 tosí, Veracruz, Oaxaca, Yucatán.
- Phloeocastes guatemalensis*  
*guatemalensis*<sup>1</sup> ..... Oaxaca, Tabasco, Chiapas, Campeche,  
 Yucatán.
- Phloeocastes guatemalensis*  
*regius* ..... Southern Tamaulipas, eastern San Luis  
 Potosí, Veracruz, Puebla.
- Veniliornis fumigatus oleaginus*.. San Luis Potosí, northern Veracruz,  
 Puebla.
- Veniliornis fumigatus*  
*sanguinolentus*<sup>1</sup> ..... Southern Veracruz, Oaxaca, Tabasco,  
 Yucatán, Quintana Roo.
- Dendrocopos scalaris scalaris*... Southern Tamaulipas to central Veracruz.
- Dendrocopos scalaris ridgwayi*... Southern Veracruz.
- Thamnistes anabatinus anabatinus*. Tabasco.
- Taraba major*  
*transandeanus* ..... Veracruz, Tabasco.
- Thamnophilus doliatus mexicanus*. Southern Tamaulipas and Veracruz to  
 Tabasco and northern Chiapas.
- Microrhopias quixensis boucardi*.. Veracruz, Tabasco.
- Ramphocaenus rufiventris*  
*rufiventris* ..... Veracruz, Oaxaca, Chiapas.
- Cercomacra tyrannina crepera*... Veracruz, Tabasco, northern Chiapas.
- Formicarius analis moniliger*.... Veracruz, Tabasco.
- Grallaria guatimalensis*  
*guatimalensis*<sup>4</sup> ..... Veracruz, Tabasco, northern Chiapas.
- Sclerurus mexicanus mexicanus*.. Veracruz.
- Sclerurus guatemalensis* ..... Veracruz, Tabasco.
- Xenops minutus mexicanus*.... Veracruz, Tabasco, Oaxaca, Quintana  
 Roo.
- Synallaxis erythrothorax*<sup>1</sup> ..... Veracruz, northern Oaxaca, Tabasco,  
 Chiapas, Yucatán.
- Xenicopsoides montanus*  
*variegaticeps* ..... Veracruz, Guerrero, Oaxaca.
- Antomolus rubiginosus*  
*rubiginosus* ..... Veracruz.
- Antomolus ochrolaemus*  
*cervinigularis* ..... Veracruz, Oaxaca, Tabasco.
- Dendrocolaptes certhia*  
*sancti-thomae* ..... Veracruz, Campeche.
- Xiphorhynchus flavigaster*  
*flavigaster*<sup>1</sup> ..... Southern Tamaulipas, and Guerrero to  
 Chiapas and Campeche.

- Lepidocolaptes souleyetii insignis*. Veracruz, Tabasco, Guerrero, Oaxaca.  
*Glyphorhynchus spirurus*  
*pectoralis* ..... Veracruz.  
*Sittasomus griseicapillus*  
*sybvioides*<sup>1</sup> ..... Veracruz, Puebla, Oaxaca, Tabasco, Campeche, Yucatán.  
*Dendrocincla anabatina anabatina*. Veracruz, Oaxaca, Tabasco.  
*Dendrocincla homochroa*  
*homochroa*<sup>1</sup> ..... Northern Oaxaca, Campeche, Yucatán.  
*Cotinga amabilis* ..... Veracruz, Oaxaca.  
*Microtriccus semiflavus*  
*semiflavus* ..... Veracruz, Tabasco, Chiapas.  
*Attila spadiceus flammulatus*..... Veracruz, Puebla, Oaxaca, Tabasco.  
*Attila spadiceus cozumelae*..... Cozumel Island, Quintana Roo.  
*Lipaugus unirufus unirufus*..... Veracruz, Tabasco.  
*Pachyramphus major major*..... Southern Tamaulipas, Nuevo León, Veracruz, Puebla, Oaxaca.  
*Pachyramphus cinnamomeus* .... Tabasco.  
*Platypsaris aglaiae sumichrasti*... Southern Tamaulipas, Veracruz, Oaxaca, Tabasco.  
*Tityra inquisitor albitorques*<sup>1</sup>... Veracruz, Oaxaca, Tabasco, Chiapas, Yucatán.  
*Tityra semifasciata personata*<sup>1</sup>... Southern Tamaulipas to Yucatán and southern Oaxaca.  
*Manacus candei* ..... Veracruz, Tabasco, Chiapas.  
*Pipra mentalis mentalis*..... Veracruz, Tabasco, Campeche, Yucatán.  
*Schiffornis turdinus*  
*verae-pacis* ..... Southern Veracruz.  
*Onychorhynchus mexicanus*  
*mexicanus*<sup>1</sup> ..... Veracruz, Oaxaca, Tabasco, Yucatán.  
*Todirostrum cinereum fuitimum*. Veracruz, Tabasco, Yucatán.  
*Platyrinchus cancrorninus* ..... Veracruz, Tabasco, Yucatán.  
*Rhynchocyclus brevirostris*  
*brevirostris* ..... Veracruz, Oaxaca, Yucatán.  
*Tolmomyias sulphurescens*  
*cinereiceps*<sup>1</sup> ..... Veracruz, Oaxaca, Chiapas.  
*Elaenia veridicata placens*<sup>1</sup>..... Veracruz, Campeche, Yucatán, Chiapas.  
*Elaenia flavogaster subpagana*... Veracruz, Oaxaca, Tabasco, Yucatán, Chiapas.  
*Legatus leucophaeus variegatus*... Veracruz, Tabasco, Chiapas.  
*Myiozetetes texensis texensis*<sup>1</sup>... Southern Sinaloa, Veracruz to Yucatán and Chiapas.  
*Pipromorpha oleaginea assimilis*.. Veracruz, Tabasco.  
*Leptopogon amaurocephalus*  
*pileatus* ..... Veracruz, Tabasco, Oaxaca.  
*Myiobius sulphureipygius*  
*sulphureipygius* ..... Veracruz, Tabasco, Yucatán.  
*Myiochanes cinereus brachytarsus*. Veracruz, Oaxaca, Tabasco, Campeche, Yucatán, Chiapas.  
*Myiodynastes maculatus insolens*.. Southern Tamaulipas to Tabasco and Yucatán.  
*Megarynchus pitangua*  
*mexicanus* ..... Southern Tamaulipas to southern Oaxaca and Yucatán.  
*Psilorhinus morio* ..... San Luis Potosí, Veracruz, Tabasco, Chiapas.  
*Psilorhinus mexicanus mexicanus*. Veracruz, Tabasco, Oaxaca, Chiapas.

- Xanthoura yncas luxuosa*..... Southern Tamaulipas, Veracruz, Puebla.  
*Cissolopha yucatanica*<sup>1</sup> ..... Yucatán, Tabasco.  
*Cistothorus platensis elegans*.... Veracruz, Chiapas.  
*Heleodytes rufinucha rufinucha*<sup>1</sup>. Veracruz, Puebla, Oaxaca.  
*Heleodytes zonatus zonatus*..... Veracruz, Oaxaca, Chiapas.  
*Heleodytes zonatus restrictus*.... Oaxaca, Tabasco.  
*Thryothorus rutilus*  
*maculipectus* ..... Veracruz, Puebla, Oaxaca.  
Oaxaca.  
*Thryothorus rutilus*  
*umbrinus* ..... Tabasco, Oaxaca, Chiapas.  
*Troglodytes musculus beani*..... Cozumel Island, Quintana Roo.  
*Henicorhina leucosticta*  
*prosthelauca* ..... Veracruz, Puebla, Oaxaca, Tabasco,  
Campeche.  
*Nannorchilus leucogaster*  
*leucogaster* ..... Southern Tamaulipas, Veracruz, Oaxaca.  
*Nannorchilus leucogaster musicus*. Tabasco, Chiapas.  
*Hylorchilus sumichrasti* ..... Lower mountain slopes in Veracruz.  
*Mimus gilvus gracilis*<sup>1</sup>..... Yucatán, Quintana Roo, Campeche.  
*Turdus assimilis assimilis*..... Veracruz, San Luis Potosí, Oaxaca.  
*Turdus grayi grayi*..... Tamaulipas to Yucatán.  
*Myadestes unicolor unicolor*<sup>4</sup>.... Veracruz, Chiapas.  
*Cyclarhis gujanensis*  
*flaviventris* ..... Veracruz, Puebla, Oaxaca, Chiapas.  
*Cyclarhis gujanensis insularis*.... Cozumel Island, Quintana Roo.  
*Vireo magister magister*..... Cozumel Island and adjacent mainland,  
Quintana Roo.  
*Vireo vireescens*  
*flavoviridis*<sup>1</sup> ..... Southern Sinaloa and southern Tamaulipas,  
southward through Central America.  
*Vireo bairdi* ..... Cozumel Island, Quintana Roo.  
*Vireo griseus perquisitor*..... Veracruz.  
*Hylophilus ochraceiceps*  
*ochraceiceps* ..... Tabasco, Oaxaca, Campeche.  
*Smaragdolanus pulchellus*  
*pulchellus* ..... Veracruz.  
*Coereba flaveola caboti*..... Cozumel Island, Quintana Roo.  
*Coereba flaveola mexicana*..... Veracruz, Oaxaca, Chiapas.  
*Dendroica petechia rufivertex*.... Cozumel Island, Quintana Roo.  
*Dendroica petechia bryanti*..... Southern Tamaulipas to Yucatán.  
*Chamaethlypis poliocephala*  
*palpebralis*<sup>1</sup> ..... Veracruz and Chiapas to Yucatán and  
Quintana Roo.  
*Granotellus sallaesi sallaesi*..... Veracruz, Oaxaca.  
*Basileuterus rufifrons rufifrons*... Veracruz, Puebla, Oaxaca, Chiapas.  
*Basileuterus rufifrons salvini*.... Southern Veracruz, Tabasco, Chiapas.  
*Basileuterus culicivorus*  
*culicivorus* ..... Veracruz, Puebla, Oaxaca, Tabasco, Campeche,  
Chiapas.  
*Chlorophonia occipitalis occipitalis*. Veracruz, Chiapas.  
*Tanagra affinis*<sup>1</sup> ..... Southern Tamaulipas, Veracruz, Oaxaca,  
Yucatán.  
*Tanagra lauta lauta*<sup>1</sup>..... Southern Tamaulipas, Veracruz, Oaxaca,  
Yucatán.



- Sporophila torquicola moreletii*<sup>2</sup>. Tamaulipas and Nuevo León, south through eastern lowlands to Yucatán and Chiapas.
- Cyanocompsa cyanoides concreta*. Veracruz, Oaxaca, Chiapas.
- Cyanocompsa parellina parellina*<sup>2</sup>. Nuevo León, Tamaulipas, San Luis Potosí, Puebla, Veracruz, Tabasco, Yucatán.
- Oryzoborus funerus* ..... Oaxaca, Tabasco.
- Richmondia cardinalis coccineus*. Southern Tamaulipas, Veracruz, Oaxaca.
- Richmondia cardinalis littoralis*. Southern Veracruz.
- Richmondia cardinalis saturatus*. Cozumel Island, Quintana Roo.
- Caryothraustes poliogaster poliogaster* ..... Veracruz, Oaxaca.
- Rhodotraupis celaeno* ..... Southern Tamaulipas, Veracruz, Puebla, Yucatán.
- Saltator atriceps atriceps* ..... Southern Tamaulipas, Veracruz, Oaxaca, Chiapas, Tabasco.
- Saltator maximus magnoides* .... Veracruz, Oaxaca.
- Saltator coerulescens grandis* .... Southern Tamaulipas, Veracruz, Puebla, Oaxaca, Tabasco, Yucatán.

<sup>1</sup> Also in Arid Lower Tropical Subzone.

<sup>2</sup> Also in Arid Upper Tropical Subzone.

<sup>3</sup> Also in Lower Sonoran Zone.

<sup>4</sup> Also in Humid Upper Tropical Subzone.

<sup>5</sup> Also in Upper Sonoran and Transition Zones.

#### ARID LOWER TROPICAL SUBZONE

The arid division of the Lower Tropical Zone, presenting landscapes of many aspects, includes the arid tropical deciduous forests, the distribution of which is more dependent on the length of the dry season than on the rainfall, and extensive savannas. Owing to arid character many landscape aspects are very similar to some of those of the Lower Austral Zone. At the height of the dry season most of the trees are truly deciduous, and the naked trunks and branches suggest northern winter conditions, except along streams and in low places where ground waters supply a moisture deficiency and local conditions approximate those of the Humid Lower Tropical Subzone. Included also within general areas assignable to this subzone are coastal swamp and marsh areas with water supplies more or less independent of rainfall.

The subzone occupies the Pacific coastal plains and lower slopes of mountains from southern Sinaloa to southern Chiapas, much of Yucatán, and narrow strips near the coast of central Veracruz. Along the Pacific coast the deciduous forest alternates with open savanna areas, and narrow strips of evergreen forest follow the courses of streams. The altitudinal range is from sea level to 2,500 feet on north slopes and to about 3,000 feet on south slopes in southern México, the upper limits gradually lowered to sea level toward the north in southern Sinaloa. Variable conditions within the area, which has a copious

seasonal rainfall, limiting the size of most of the vegetation, with much light reaching the ground, has favored the development of a large number of species of plants and animals. Many of the genera are common to the Humid Lower Tropical Subzone, but the species or subspecies are different.

#### Plants of Arid Lower Tropical Subzone:

- Acanthorrhiza mocinni* ..... Sinaloa to Guerrero, Oaxaca, Campeche.  
*Attalea cohume* ..... Jalisco to Oaxaca, Yucatán.  
*Acrocomia mexicana* ..... Sinaloa southward along Pacific coast  
 and in Yucatán.
- Baucaearna pliabilis* ..... Yucatán.  
*Baucaearna goldmanii* ..... Chiapas.  
*Agave sisalana* ..... Yucatán.  
*Agave fourcroydes* ..... Yucatán.  
*Agave ixtili* ..... Yucatán.  
*Alnus jorullensis* ..... Jalisco to Veracruz, Michoacán, Oaxaca.  
*Coccoloba lapathifolia* ..... Guerrero.  
*Coccoloba acapulcensis* ..... Guerrero.  
*Coccoloba liebmanni* ..... Oaxaca.  
*Celosia orcuttii* ..... Colima.  
*Annona diversifolia* ..... Colima.  
*Annona palmeri* ..... Guerrero.  
*Forchammeria pallida* ..... Colima to Oaxaca.  
*Prunus cortapico* ..... Colima.  
*Prunus erythroxyton* ..... Colima.  
*Couepia polyandra* ..... Sinaloa to Oaxaca.  
*Krameria revoluta* ..... Oaxaca.  
*Piptadenia constricta* ..... Sinaloa to Guerrero.  
*Mimosa rhododactyla* ..... Michoacán, Guerrero.  
*Mimosa goldmanii* ..... Oaxaca.  
*Mimosa manzanilloana* ..... Sinaloa to Guerrero.  
*Mimosa acapulcensis* ..... Guerrero.  
*Mimosa leptocarpa* ..... Colima to Guerrero.  
*Mimosa deamii* ..... Oaxaca.  
*Mimosa nelsonii* ..... Oaxaca.  
*Mimosa lacerata* ..... Puebla.  
*Mimosa micheliana* ..... Guerrero.  
*Mimosa colimensis* ..... Colima.  
*Leucaena macrophylla* ..... Guerrero.  
*Acacia cornigera* ..... San Luis Potosí and Veracruz to Chi-  
 apas.  
*Acacia globulifera* ..... Yucatán.  
*Acacia hindsii* ..... Colima.  
*Acacia pringlei* ..... Oaxaca.  
*Calliandra bijuga* ..... Jalisco to Veracruz, Guerrero, Chiapas.  
*Calliandra unijuga* ..... Oaxaca.  
*Calliandra oaxacana* ..... Oaxaca.  
*Lysiloma acapulcensis* ..... Guerrero.  
*Lysiloma tergemina* ..... Guerrero, Morelos, Puebla.  
*Lysiloma sabicu* ..... Yucatán.  
*Enterolobium cyclocarpum* ..... Sinaloa to Tamaulipas, Veracruz, Chi-  
 apas and Yucatán.  
*Pithecollobium dulce* <sup>2</sup> ..... Baja California to Chihuahua, Tamaulipas  
 and Chiapas.

- Pithecollobium unguis-cati* ..... Tamaulipas to Yucatán.  
*Pithecollobium leiocalyx* ..... Oaxaca.  
*Pithecollobium albicans* ..... Yucatán and Campeche.  
*Cassia occidentalis* ..... Chihuahua and Sinaloa to Chiapas and Yucatán.  
*Cassia laevigata* ..... Sinaloa to Tamaulipas, Veracruz and Chiapas.  
*Cassia alata* ..... Guerrero.  
*Bauhinia retifolia* ..... San Luis Potosí.  
*Bauhinia pes-caprae* ..... Guerrero.  
*Bauhinia lunaria* ..... Guerrero.  
*Bauhinia subrotundifolia* ..... Guerrero.  
*Bauhinia latifolia* ..... Sinaloa to Oaxaca and Veracruz.  
*Haematoxylum campechianum* ... Tabasco, Campeche, Yucatán.  
*Haematoxylum brasiletto*<sup>2</sup> ..... Baja California, Chihuahua, Morelos, Oaxaca.  
*Caesalpinia crista* ..... Along beaches of both coasts of México.  
*Caesalpinia vesicaria* ..... Yucatán.  
*Caesalpinia sclerocarpa* ..... Sinaloa to Oaxaca.  
*Caesalpinia cacalaco* ..... Sinaloa to Puebla and Oaxaca.  
*Caesalpinia gaumeri* ..... Yucatán.  
*Caesalpinia acapulcensis* ..... Guerrero.  
*Caesalpinia yucatanensis* ..... Yucatán.  
*Dalea elongata* ..... Morelos.  
*Dalea domingensis* ..... Yucatán.  
*Harpalyce mexicana* ..... Jalisco.  
*Brongniartia suberea* ..... Guerrero.  
*Brongniartia parvifolia* ..... Oaxaca.  
*Desmodium painteri* ..... Guerrero.  
*Desmodium angustata* ..... Jalisco.  
*Desmodium pallida* ..... Oaxaca.  
*Erythrina lanata* ..... Guerrero.  
*Erythrina occidentalis* ..... Sinaloa.  
*Erythrina americana*<sup>1</sup> ..... México, Puebla and Veracruz to Chiapas and Yucatán.  
*Dalbergia granadillo* ..... Michoacán to Oaxaca.  
*Dalbergia glabra* ..... Morelos, Veracruz and Oaxaca to Yucatán.  
*Ichthyomethia americana* ..... Michoacán and Guerrero.  
*Erythroxylon pringlei* ..... Guerrero.  
*Gniacum coulteri*<sup>2</sup> ..... Sonora to Oaxaca.  
*Xanthoxylum fagara*<sup>2</sup> ..... Baja California and Sonora to Tamaulipas, Veracruz, Chiapas and Yucatán.  
*Esenbeckia pentaphylla* ..... Yucatán.  
*Bursera kerberi* ..... Colima and Jalisco.  
*Bursera grandifolia* ..... Sinaloa to Oaxaca and Veracruz.  
*Bursera simaruba*<sup>2</sup> ..... Sinaloa to Tamaulipas, Veracruz, Yucatán and Chiapas.  
*Bursera bipinnata*<sup>2</sup> ..... Sinaloa and southern Chihuahua to Guerrero and Morelos.  
*Bursera pubescens* ..... Yucatán and Campeche.  
*Bursera longipedunculata* ..... Puebla and Oaxaca.  
*Swietenia humilis* ..... Michoacán to Chiapas.  
*Cedrela yucatanana* ..... Yucatán.  
*Byrsonima crassifolia* ..... Sinaloa to Chiapas and Veracruz.

- Malpighia mexicana* ..... Durango to Morelos and Oaxaca.  
*Malpighia incana* ..... Yucatán and Chiapas.  
*Malpighia ovata* ..... Sonora to Oaxaca.  
*Malpighia glabra* ..... Nuevo León and Tamaulipas to Tabasco  
 and Yucatán.  
*Bunchosia glandulosa* ..... Yucatán.  
*Thryallis palmeri* ..... Guerrero.  
*Banisteria pallida* ..... Oaxaca.  
*Banisteria gayana* ..... Colima to Oaxaca.  
*Euphorbia tresmariae* ..... María Madre Island, Nayarit.  
*Euphorbia colletioides* ..... Guerrero.  
*Pedilanthus itzacus* ..... Yucatán.  
*Pedilanthus nodiflorus* ..... Yucatán.  
*Pedilanthus spectabilis* ..... Guerrero.  
*Pedilanthus palmeri* ..... Nayarit.  
*Phyllanthus nobillis* ..... Yucatán.  
*Phyllanthus glaucescens* ..... Yucatán.  
*Astrocasia phyllanthoides* ..... Yucatán.  
*Croton suberosus* ..... Guerrero.  
*Ditaxis manzanilloana* ..... Colima.  
*Ditaxis tinctoria* ..... Yucatán.  
*Acalypha flagellata* ..... Yucatán.  
*Acalypha coryloides* ..... Colima.  
*Acalypha scleriana* ..... Yucatán.  
*Acalypha acapulcensis* ..... Guerrero.  
*Jatropha alamani* ..... Oaxaca.  
*Jatropha gaumeri* ..... Yucatán.  
*Manihot aesculifolia* ..... Yucatán.  
*Sebastiana adenophora* ..... Yucatán.  
*Spondias mombin* ..... Sinaloa and Jalisco to Yucatán and Chi-  
 apas.  
*Cyrtocarpha procera* ..... Jalisco to Puebla and Oaxaca.  
*Rhus barclayi* ..... Guerrero.  
*Hippocratea acapulcensis* ..... Sinaloa to Morelos, Guerrero, and Oa-  
 xaca.  
*Serjania trifoliolata* ..... Sinaloa to Colima and Guerrero.  
*Serjania adiantoides* ..... Yucatán.  
*Serjania oaxacana* ..... Oaxaca.  
*Serjania fuscopunctata* ..... Colima.  
*Dodonaea viscosa* <sup>2</sup> ..... Baja California to Chihuahua, Nuevo  
 León, México, and Chiapas.  
*Zizyphus mexicana* ..... Colima to Oaxaca.  
*Zizyphus acuminata* ..... Guerrero.  
*Heliocarpus tigrinus* ..... Michoacán.  
*Heliocarpus velutinus* ..... Morelos.  
*Heliocarpus pallidus* ..... Guerrero.  
*Triumfetta falcifera* ..... Michoacán and Guerrero.  
*Abutilon bastardioides* ..... Colima.  
*Hibiscus nelsoni* ..... Oaxaca.  
*Gossypium palmerii* ..... Guerrero.  
*Gossypium schottii* ..... Yucatán.  
*Ceiba parvifolia* ..... Morelos, Puebla, Oaxaca.  
*Ceiba aesculifolia* ..... Sinaloa and Jalisco to Querétaro, Yuca-  
 tán and Oaxaca.  
*Bombax ellipticum* ..... Jalisco and Guerrero to San Luis Potosí,  
 Veracruz, Yucatán and Oaxaca.

- Melochia glandulifera* ..... Chiapas.  
*Melochia tragiaefolia* ..... Michoacán.  
*Melochia tomentella* ..... Guerrero.  
*Guazuma ulmifolia*<sup>1, 2</sup> ..... Sonora and Tamaulipas to Yucatán and Chiapas.  
*Curatella americana* ..... Nayarit to Chiapas.  
*Ternstroemia maltbyana* ..... Tres Mariás Islands, Nayarit.  
*Ternstroemia sphaerocarpa* ..... Oaxaca.  
*Pereskia konzattii* ..... Oaxaca.  
*Cephalocereus gaumeri* ..... Yucatán.  
*Cephalocereus sartorianus* ..... Veracruz.  
*Pachycercus gaumeri* ..... Yucatán.  
*Pachycercus chrysomallus* ..... Puebla and Oaxaca.  
*Nyctocereus oaxaccensis* ..... Oaxaca.  
*Selenicereus coniflorus* ..... Veracruz.  
*Selenicereus donkelaarii* ..... Yucatán.  
*Selenicereus hamatus* ..... Southern and eastern México.  
*Selenicereus murrillii* ..... Colima.  
*Deamia testudo* ..... Veracruz.  
*Neomammillaria gaumeri* ..... Yucatán.  
*Neomammillaria collinsii* ..... Oaxaca.  
*Neomammillaria yucatanensis* ... Yucatán.  
*Neomammillaria occidentalis* ... Colima.  
*Neomammillaria nelsonii* ..... Michoacán.  
*Cuphea jorullensis* ..... Michoacán.  
*Combretum mexicanum* ..... Guerrero.  
*Combretum palmeri* ..... Guerrero.  
*Combretum farinosum* ..... Guerrero.  
*Psidium oerstedianum* ..... Nayarit to Veracruz and Chiapas.  
*Eugenia mayana* ..... Yucatán.  
*Eugenia avicenniae* ..... Guerrero.  
*Eugenia oaxacana* ..... Oaxaca.  
*Miconia glabrata* ..... Oaxaca.  
*Mouriria parvifolia* ..... Tres Mariás Islands, Nayarit.  
*Fuchsia microphylla* ..... Michoacán.  
*Jacquinia flammea* ..... Yucatán.  
*Bumelia stenosperma* ..... Oaxaca.  
*Bumelia retusa* ..... Yucatán.  
*Lucuma palmeri* ..... Guerrero.  
*Sideroxylon gaumeri* ..... Yucatán.  
*Sideroxylon capiri* ..... Sinaloa and Jalisco to Guerrero.  
*Maba albens* ..... Guerrero.  
*Maba acapulcensis* ..... Guerrero.  
*Maba rekoii* ..... Oaxaca.  
*Maba salicifolia* ..... Guerrero.  
*Diospyros oaxacana* ..... Oaxaca.  
*Diospyros konzattii* ..... Oaxaca.  
*Diospyros anisandra* ..... Yucatán.  
*Diospyros rosei* ..... Nayarit.  
*Ipomoea wolcottiana* ..... Colima to Morelos and Chiapas.  
*Cordia seleriana* ..... Michoacán and Oaxaca.  
*Cordia tinifolia* ..... Guerrero.  
*Bourreria pulchra* ..... Yucatán.  
*Bourreria formosa* ..... Oaxaca.  
*Bourreria purpusii* ..... Oaxaca.

- Lippia graveolens* ..... Yucatán and Campeche.  
*Solanum lignescens* ..... Guerrero to Chiapas.  
*Solanum oaxacanum* ..... Oaxaca.  
*Parmentiera edulis* ..... Sinaloa to Tamaulipas, Morelos, Campeche and Oaxaca.  
*Parmentiera aculeata* ..... Colima, Campeche, Yucatán.  
*Crescentia alata* ..... Sonora to Chiapas.  
*Ruellia cuphoides* ..... Guerrero.  
*Ruellia sororia* ..... Guerrero.  
*Ruellia albiflora* ..... Guerrero.  
*Ruellia palmeri* ..... Guerrero.  
*Randia armata* <sup>2</sup> ..... Southern Baja California and Sinaloa to Chiapas.  
*Randia tetraacantha* ..... Guerrero.  
*Randia cinerea* ..... Guerrero.  
*Randia nelsonii* ..... Oaxaca.  
*Randia truncata* ..... Yucatán.  
*Randia gaumeri* ..... Yucatán.  
*Zexmenia gracilis* ..... Colima.  
*Zexmenia microcephala* ..... Nayarit.  
*Zexmenia cordifolia* ..... Nayarit.  
*Zexmenia strigosa* ..... Oaxaca.

<sup>1</sup> Also in Humid Lower Tropical Subzone.

<sup>2</sup> Also in Arid Upper Tropical Subzone.

**Mammals of Arid Lower Tropical Subzone:**

- Didelphis marsupialis yucatanensis* ..... Yucatán.  
*Marmosa canescens canescens*.... Colima, Puebla, Guerrero, Michoacán, Yucatán, Nayarit.  
*Marmosa canescens insularis*.... María Madre Island, Nayarit.  
*Cryptotis mayensis* ..... Yucatán.  
*Cryptotis frontalis* ..... Oaxaca.  
*Cryptotis gigas* ..... Jalisco.  
*Noctilio leporinus mexicanus*.... Guerrero.  
*Macrotus pygmaeus* ..... Yucatán.  
*Artibeus jamaicensis yucatanicus*. Yucatán.  
*Artibeus phaeotis* ..... Yucatán.  
*Artibeus nanus* ..... Guerrero north to Sinaloa.  
*Procyon lotor insularis*..... María Madre Island, Nayarit.  
*Nasua narica yucatanica*..... Yucatán, Campeche, Quintana Roo.  
*Nasua narica molaris*..... Colima, Michoacán, Guerrero, Morelos.  
*Nasua narica isthmica*..... Southern Oaxaca.  
*Potos flavus guerrerensis*..... Guerrero, Oaxaca.  
*Grison canaster* ..... Yucatán (probably also in Humid Lower Tropical Zone).  
*Spilogale angustifrons tropicalis*.. Southern Oaxaca.  
*Spilogale pygmaea australis*.... Guerrero.  
*Mephitis macroura vittata*..... Southern Oaxaca.  
*Conepatus mesoleucus nelsoni*.... Colima.  
*Felis onca hernandesii*..... Colima, Guerrero, Nayarit, Oaxaca, Sinaloa.  
*Felis pardalis nelsoni*..... Colima, Guerrero, Oaxaca, Sinaloa.  
*Felis wiedii yucatanica*..... Yucatán.

- Citellus adocetus* ..... Michoacán, Guerrero.  
*Citellus annulatus annulatus*.... Colima, western Guerrero.  
*Citellus annulatus goldmani*.... Southern Nayarit.  
*Sciurus aureogaster aureogaster*<sup>1</sup>. Southern Tamaulipas, Veracruz, eastern  
 San Luis Potosí, eastern Querétaro,  
 Puebla and northeastern Hidalgo.  
*Sciurus poliopus senex*..... Southern Michoacán.  
*Sciurus poliopus colimensis*.... Colima.  
*Sciurus colliacae colliacae*..... Nayarit.  
*Sciurus colliacae muchalis*..... Colima.  
*Sciurus socialis socialis*..... Oaxaca, Chiapas.  
*Sciurus socialis cocos*..... Guerrero, Oaxaca.  
*Sciurus socialis littoralis*..... Oaxaca.  
*Sciurus yucatanensis yucatanensis*. Yucatán, Quintana Roo.  
*Sciurus goldmani* ..... Southeastern Chiapas.  
*Thomomys umbrinus extimus*.... Southern Nayarit.  
*Pappogeomys bulleri burti*..... Southwest coast of Jalisco.  
*Heterogeomys hispidus torridus*... Veracruz.  
*Heterogeomys hispidus*  
*yucatanensis* ..... Yucatán, Campeche.  
*Orthogeomys grandis scalops*.... Oaxaca.  
*Orthogeomys grandis alleni*.... Guerrero.  
*Orthogeomys grandis guerrenderensis*. Guerrero.  
*Platygeomys fumosus* ..... Colima.  
*Heteromys gaumeri* ..... Yucatán, Campeche, Quintana Roo.  
*Liomys pictus pictus*..... Western Jalisco.  
*Liomys pictus parviceps*..... Michoacán, Guerrero.  
*Liomys pictus rostratus*..... Guerrero.  
*Liomys pictus phaeurus*..... Oaxaca.  
*Liomys pictus isthmus*..... Chiapas, Oaxaca.  
*Liomys pictus obscurus*..... Veracruz.  
*Liomys crispus crispus*..... Southwestern Chiapas.  
*Reithrodontomys fulvescens*  
*nelsoni* ..... Colima, Nayarit.  
*Reithrodontomys fulvescens*  
*mustelinus* ..... Oaxaca, Guerrero.  
*Reithrodontomys amoenus* ..... Oaxaca.  
*Reithrodontomys gracilis* ..... Yucatán, Campeche.  
*Baiomys musculus musculus*<sup>2</sup>.... Colima, Guerrero, Jalisco, Michoacán,  
 Morelos, Oaxaca, Puebla, Sinaloa,  
 Veracruz, Zacatecas.  
*Peromyscus leucopus affinis*.... Oaxaca, Yucatán, Veracruz.  
*Peromyscus leucopus cozumelae*.. Cozumel Island, Quintana Roo.  
*Peromyscus boylii madrensis*.... Tres Mariás Islands, Nayarit.  
*Peromyscus melanophrys*  
*melanophrys* ..... Chiapas, Guerrero, Morelos, Oaxaca,  
 Puebla.  
*Peromyscus mexicanus*  
*mexicanus*<sup>1</sup> ..... Chiapas, Oaxaca, Puebla, Veracruz.  
*Peromyscus mexicanus*  
*saxatilis* ..... Chiapas.  
*Peromyscus mexicanus*  
*gymnotis* ..... Southern Chiapas.  
*Peromyscus allophylus* ..... Southern Chiapas.  
*Peromyscus bandaranus*  
*bandaranus* ..... Colima, Guerrero, Acapulco.

- Peromyscus bandaranus*  
*vicinior* ..... Guerrero, Michoacán.
- Peromyscus yucatanicus*  
*yucatanicus* ..... Yucatán, Quintana Roo.
- Oryzomys couesi zygomatiscus*.... Chiapas.
- Oryzomys couesi mexicanus*.... Colima, Guerrero, Jalisco, Michoacán,  
 Oaxaca, Sinaloa, Tepic.
- Oryzomys couesi aztecus*..... Guerrero, Morelos, Oaxaca, Puebla.
- Oryzomys couesi regillus*..... Michoacán.
- Oryzomys nelsoni* ..... María Madre Island, Nayarit.
- Oryzomys melanotis melanotis*... Jalisco, Sinaloa, Nayarit.
- Oryzomys melanotis colimensis*... Colima.
- Oryzomys rostratus yucatanensis*. Yucatán, Quintana Roo.
- Oryzomys fulvescens mayensis*.... Campeche, Yucatán.
- Oryzomys fulvescens lenis*..... Guerrero, Michoacán, Oaxaca.
- Tylomys bullaris* ..... Central Chiapas.
- Ototylomys phyllotis phyllotis*... Yucatán.
- Nyctomys sumichrasti pallidulus*.. Southeastern Oaxaca.
- Sigmodon hispidus mascotensis*... Jalisco, Colima, Guerrero, Oaxaca, More-  
 los Michoacán.
- Sigmodon hispidus tonalensis*.... Chiapas, Oaxaca.
- Sigmodon hispidus microdon*.... Campeche, Quintana Roo, Yucatán.
- Sigmodon alleni* ..... Jalisco, Nayarit.
- Neotoma ferruginea solitaria*.... Southwestern Guatemala.
- Neotoma ferruginea isthmica*<sup>2</sup>... Chiapas, Oaxaca.
- Hodomys alleni alleni*..... Colima, Jalisco, Sinaloa, Tepic.
- Hodomys alleni guerrerensis*.... Guerrero.
- Hodomys vetulus vetulus*<sup>2</sup>..... Guerrero, Michoacán, Morelos, Puebla.
- Xenomys nelsoni* ..... Colima.
- Coendou mexicanum yucataniae*.. Yucatán.
- Dasyprocta punctata chiapensis*... Chiapas.
- Dasyprocta punctata yucatanica*.. Yucatán.
- Lepus callotis flavigularis*..... Coastal plain in southeastern Oaxaca and  
 western Chiapas.
- Sylvilagus floridanus aztecus*.... Oaxaca.
- Sylvilagus floridanus yucatanicus*. Campeche, Yucatán.
- Sylvilagus cunicularius pacificus*.. Guerrero, Oaxaca.
- Sylvilagus cunicularius insolitus*<sup>3</sup>. Colima, Jalisco, Nayarit, Sinaloa.
- Sylvilagus graysoni* ..... Tres Mariás Islands, Nayarit.
- Pecari angulatus humeralis*..... Colima, Jalisco, Michoacán, Guerrero.
- Pecari angulatus nelsoni*..... Southern Chiapas, southern Oaxaca.
- Pecari angulatus yucatanensis*.... Yucatán.
- Pecari nanus* ..... Cozumel Island, Quintana Roo.
- Odocoileus virginianus*  
*acapulcensis* ..... Colima, Guerrero, Oaxaca.
- Odocoileus virginianus thomasi*<sup>1</sup>. Chiapas, Oaxaca, Tabasco, Veracruz,  
 Guatemala.
- Odocoileus virginianus*  
*yucatanensis*<sup>1</sup> ..... Campeche, Yucatán.
- Mazama satorii pandora*..... Yucatán.
- Cyclopes mexicanus*<sup>1</sup> ..... Veracruz, Oaxaca, Tabasco, Chiapas.
- Tamandua tetradactyla*  
*mexicana*<sup>1</sup> ..... Veracruz, Tabasco, Campeche, Oaxaca,  
 Chiapas.

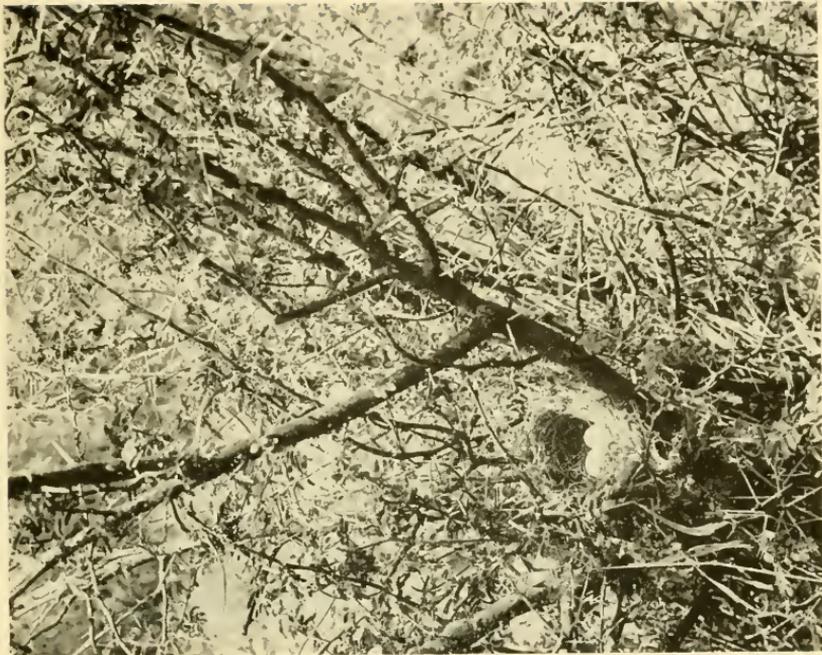
<sup>1</sup> Also in Humid Lower Tropical Subzone.

<sup>2</sup> Also in Lower Sonoran Zone.

<sup>3</sup> Also in Arid Upper Tropical Subzone.

## Birds of Arid Lower Tropical Subzone:

- Crypturellus cinnamomus*  
*goldmani*<sup>1, 2</sup> ..... Yucatán Peninsula.
- Colymbus dominicus*  
*brachypterus* ..... Southern Baja California to Tamaulipas,  
and southward to Chiapas.
- Heterocnus mexicanus*<sup>1</sup> ..... Southern Sonora and southern Tamaulipas  
to Chiapas.
- Cochlearius cochlearius*  
*zeledoni* ..... Sinaloa and Veracruz south to Chiapas.
- Dendrocygna autumnalis*  
*fulgens*<sup>1, 2</sup> ..... Tamaulipas.
- Dendrocygna autumnalis lucida*... Sinaloa and Nuevo León south to Chia-  
pas.
- Cairina moschata*<sup>1, 2</sup> ..... Southern Sinaloa and central Tamaulipas  
south to Chiapas.
- Sarcoramphus papa*<sup>1</sup> ..... Nayarit, northern Veracruz and eastern  
Puebla to Yucatán and Chiapas.
- Rostrhamus sociabilis major*<sup>1</sup>... Veracruz, Yucatán.
- Chondrohierax uncinatus*  
*uncinatus* ..... Southern Sinaloa, Guerrero, and south  
through Central America.
- Chondrohierax uncinatus*  
*aquilonis*<sup>1</sup> ..... Tamaulipas to Oaxaca, Yucatán and Chia-  
pas.
- Ictinia plumbea*<sup>1</sup> ..... Southern Tamaulipas, San Luis Potosí,  
Veracruz, Oaxaca, Yucatán.
- Accipiter bicolor bicolor*..... Yucatán and south through Central  
America.
- Accipiter bicolor fidens*..... Central Veracruz to southern Oaxaca.
- Buteo magnirostris xantusi*..... Colima, Guerrero, Oaxaca.
- Buteo magnirostris petersi*..... Southeastern Oaxaca, southwestern Chia-  
pas.
- Buteo magnirostris conspectus*... Yucatán.
- Hypomorphnus urubitinga*  
*ridgwayi*<sup>1</sup> ..... Southern Sonora and southern Tamaul-  
lipas to Yucatán and southern Chiapas.
- Busarellus nigricollis nigricollis*<sup>1</sup>. Sinaloa and Veracruz south to Central  
America.
- Harpia harpyja*<sup>1</sup> ..... Central Veracruz and southeastern Oa-  
xaca southward through Central Amer-  
ica.
- Spizastur melanoleucus*<sup>1</sup> ..... Southern Veracruz, Yucatán, Oaxaca,  
Chiapas.
- Spizactus ornatus vicarius*<sup>1</sup>..... Southern Veracruz, Oaxaca, Chiapas.
- Geranospiza nigra nigra*<sup>1</sup>..... Southern Tamaulipas, Veracruz, Yucatán  
southern Sinaloa to Chiapas.
- Herpetotheres cachinnans*  
*chapmani*<sup>1</sup> ..... Southern Sinaloa, southern Veracruz,  
Yucatán and Quintana Roo to Chiapas.
- Micrastur semitorquatus naso*... Southern Sinaloa and southern Tamaul-  
lipas, Veracruz, Yucatán, Quintana Roo,  
and south through Chiapas.
- Falco albigularis albigularis*<sup>1</sup>... Southern Tamaulipas, Veracruz, Yuca-  
tán, Quintana Roo, Nayarit and south  
through Oaxaca and Chiapas.



2. Nest of brown towhee (*Pipilo fuscus tolosinus*) in mesquite tree, La Barca, Jalisco, June 28, 1903. Lower Austral Zone.



1. E. W. Nelson taking eggs of glossy ibis (*Plegadis falcinellus*) from nest in tall flags at east end of Lago de Chapala, Jalisco, June 25, 1903.



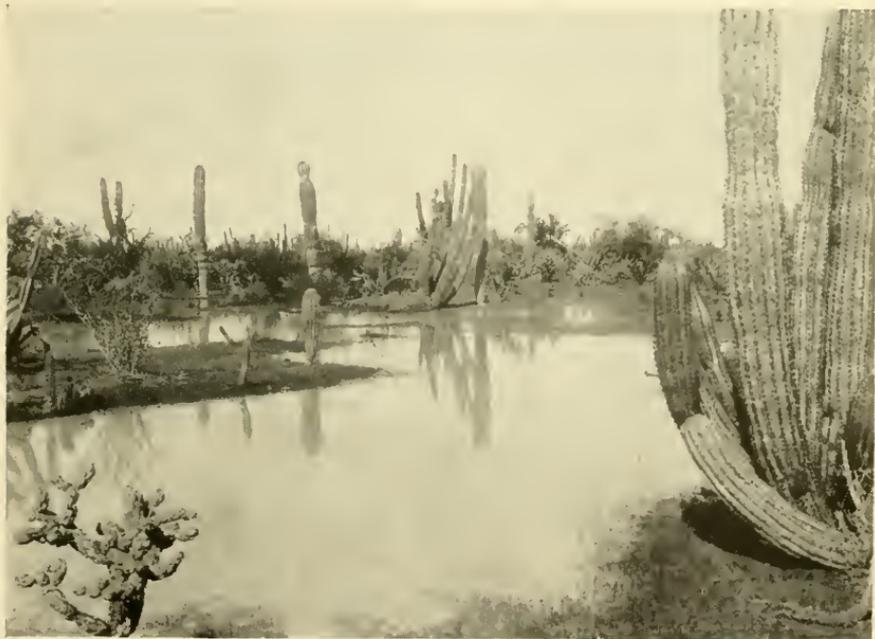
1. Delta of Río de Lerma, looking across Lago de Chapala, Jalisco. Thousands of white-fronted geese and ducks of many kinds wintering here January 18, 1935. Lower Austral Zone.



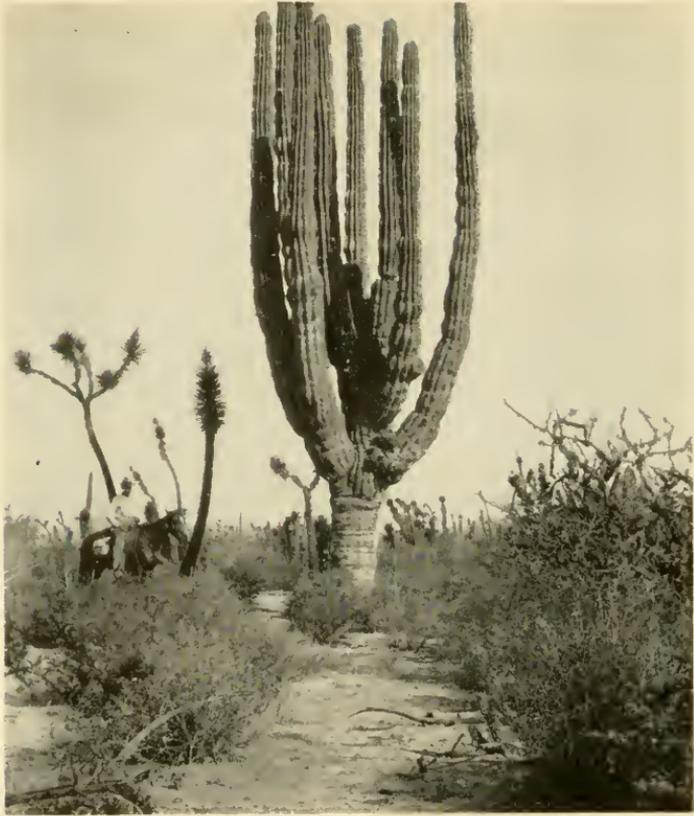
2. Mud geyser, or "volcano," near Volcano Lake, northern Baja California. Lower Austral Zone.



1. Tinaja de San Juan, a natural water-storage tank, in hard lava, 5 miles north of San Ignacio, Baja California. Wild fig trees (*Ficus palmeri*) on farther side. Lower Austral Zone.



2. Desert after torrential rain, near La Cruz, southern Baja California. Lower Austral Zone.



1. Giant cactus (*Pachycercus pringlei*) on road to Santo Domingo to Calmalli, Baja California. This giant of its kind was about 3 feet in diameter and about 60 feet high. Lower Austral Zone.



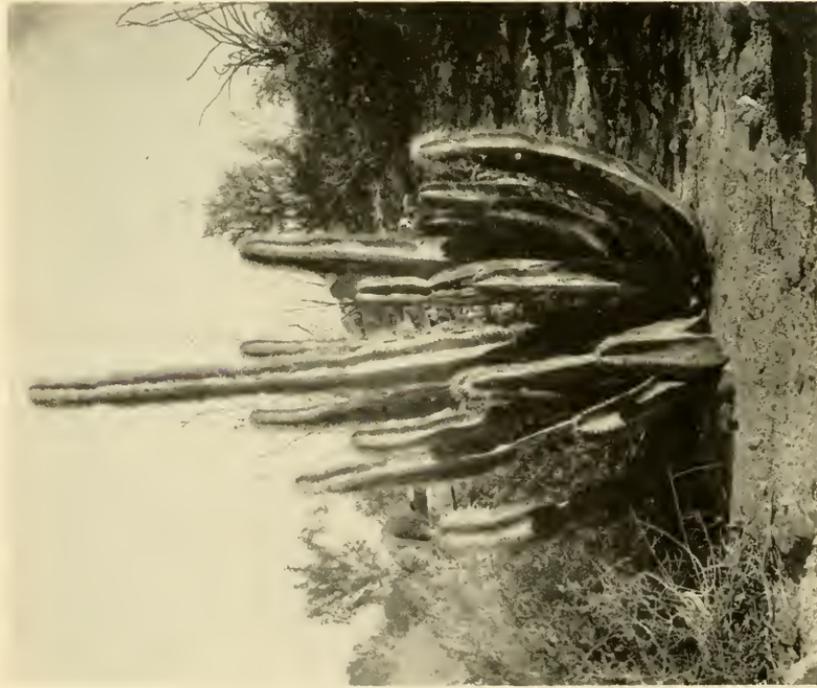
2. Giant cactus forest (*Pachycercus pringlei*), near Guaymas Sonora. A dense stand of unusually large cactuses. Lower Austral Zone.



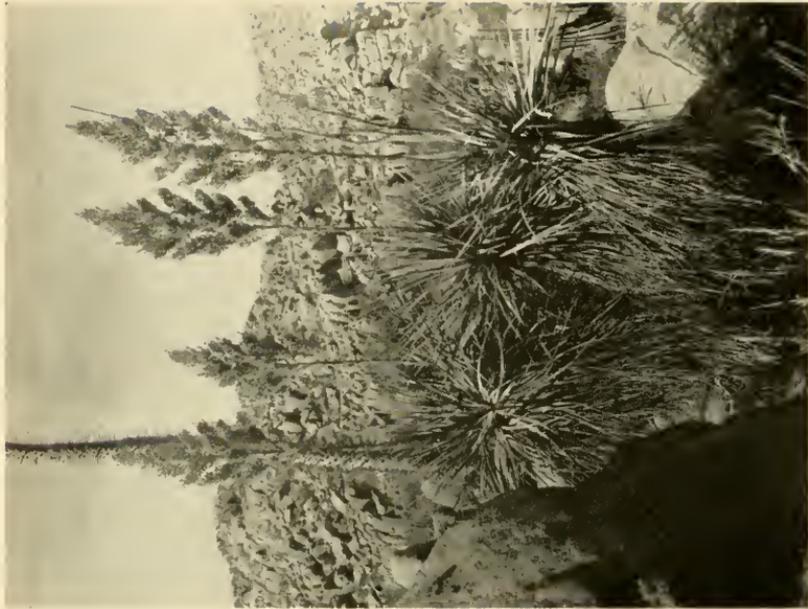
1. *Agave nelsoni* and the cirio (*Idria columnaris*), near San Fernando, Baja California, Lower Austral Zone.



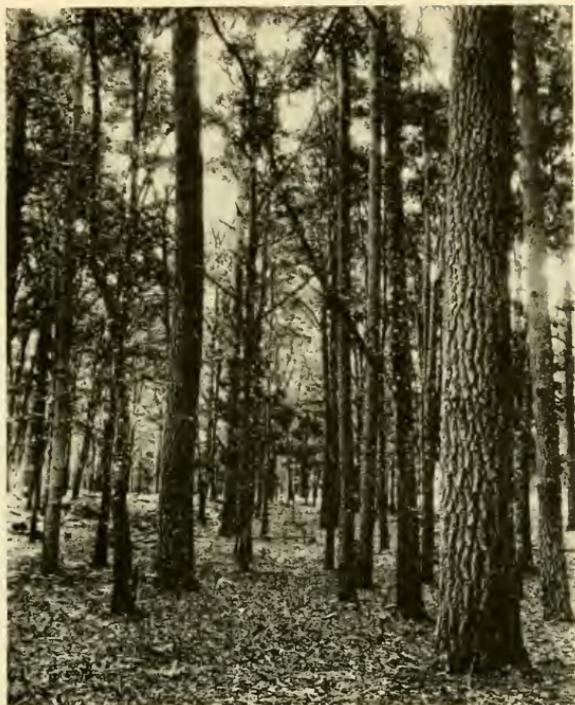
2. Nest of Gambel's quail (*Lophortyx gambelii*) in thicket near Volcano Lake, northern Baja California, Lower Austral Zone.



1. Garambullo (*Lophocereus schottii*), near San Francisco, Baja California. Widely distributed in extremely arid central section of Baja California and in central Sonora. Lower Austral Zone.



2. *Notina bigelovii*, a characteristic desert species of rocky hillsides from central Baja California and Sonora north to southern Arizona and California. Lower Austral Zone.



1. Pine and oak forest at 7,500 feet altitude, 20 miles southeast of Teopisca, Chiapas. Tillandsias and orchids grow on oaks. Upper Austral Zone.



2. Valley of Río San Antonio, where it emerges from the western side of the Sierra San Pedro Mártir, Baja California. Oaks and cottonwoods grow along the stream. Upper Austral Zone.



1. Laguna de Tultengo, near Apam, Hidalgo. A lake without outlet on high plateau. Bordering vegetation largely tules (*Scirpus*). An important wintering area for migratory waterfowl. Upper Austral Zone.



2. Marsh near Tochimilco, Valley of México, México. Boy with hooked knife stalking a carp. Upper Austral Zone.

- Falco femoralis septentrionalis*<sup>1, 2, 3</sup> ..... Sinaloa (and undoubtedly Sonora), Tamaulipas and southward to Yucatán and Oaxaca.
- Penelope purpurascens purpurascens*<sup>1</sup> ..... Southern Sinaloa, southern Tamaulipas, Veracruz, Yucatán and south through Chiapas.
- Ortalis vetula poliocephala* ..... Colima, Michoacán, Morelos, western Puebla, Guerrero, Oaxaca, Chiapas.
- Ortalis vetula pallidiventris* ..... Yucatán, Quintana Roo, Campeche.
- Ortalis wagleri wagleri* ..... Southern Sinaloa, western Durango, Nayarit, western Jalisco.
- Philortyx fasciatus* ..... Colima, Michoacán, Guerrero, Morelos.
- Lophortyx douglasii impedita* ..... Nayarit.
- Agriocharis ocellata*<sup>1</sup> ..... Yucatán, Quintana Roo, Campeche.
- Colinus virginianus salvini* ..... Coastal plains of southern Chiapas.
- Colinus virginianus coyolcos* ..... Coastal plains from Tehuantepec, Oaxaca to Tonalá, Chiapas.
- Colinus nigrogularis nigrogularis* ..... Yucatán.
- Dactylortyx thoracicus sharpei* ..... Yucatán, Quintana Roo, Campeche.
- Aramus guarauna dolosus*<sup>1</sup> ..... Southern Veracruz, Oaxaca, Yucatán, Quintana Roo.
- Rallus longirostris pallidus* ..... Yucatán.
- Rallus longirostris nayaritensis* ..... Nayarit.
- Aramides cajanea mexicana*<sup>1</sup> ..... Southern Tamaulipas, Veracruz, Oaxaca, Tabasco.
- Aramides axillaris* ..... Southern Sinaloa, Nayarit, Guerrero, Yucatán.
- Charadrius collaris*<sup>1</sup> ..... Southern Veracruz, Tabasco, Oaxaca, Chiapas.
- Oedinenus bistratus bistratus*<sup>1</sup> ..... Southern Veracruz, Oaxaca, Chiapas.
- Sterna anatheta nelsoni* ..... Guerrero.
- Sterna fuscata crissalis* ..... Southern Sinaloa, Nayarit.
- Columba flavirostris flavirostris*<sup>1, 2</sup> ..... Southern Sonora, Nuevo León, and Tamaulipas, and southward along Atlantic and Pacific slopes to Yucatán and southern Chiapas.
- Columba flavirostris madrensis* ..... Tres Mariás Islands, Nayarit.
- Columba leucocephala* ..... Yucatán, Quintana Roo.
- Columba speciosa*<sup>1</sup> ..... Southern Veracruz, northern Oaxaca, Yucatán.
- Zenaidura macroura tresmariae* ..... Tres Mariás Islands, Nayarit.
- Zenaidura macroura yucatanensis* ..... Yucatán.
- Zenaida zenaida yucatanensis* ..... Yucatán, Quintana Roo.
- Zenaida asiatica asiatica*<sup>1, 2, 3</sup> ..... Tamaulipas south through Veracruz to southern Oaxaca and east to Yucatán and Quintana Roo.
- Zenaida asiatica mearnsi*<sup>2, 3</sup> ..... Southern Baja California, Sonora, Nuevo León, San Luis Potosí, and southward to Guerrero, México, and Puebla.

- Scardafella inca*<sup>1, 2, 3</sup> ..... Southern Baja California, Sonora, Chihuahua, Nuevo León, Tamaulipas, and southward along eastern and western coasts, excluding Yucatán, and over interior plains to southern Chiapas.
- Columbigallina passerina pullescens*<sup>1, 2, 3</sup> ..... Southern Baja California, Sonora, Chihuahua, Nuevo León, Tamaulipas, and southward along both coasts and over interior plains throughout México.
- Columbigallina talpacoti rufipennis*<sup>1</sup> ..... Veracruz, Tabasco, Oaxaca, Campeche, Yucatán, Quintana Roo, Chiapas.
- Columbigallina talpacoti cluta* ..... Southern Sinaloa to Guerrero.
- Claravis pretiosa*<sup>1</sup> ..... Southern Tamaulipas, Veracruz, Puebla, eastern San Luis Potosí, Oaxaca, Campeche, Yucatán, Quintana Roo.
- Leptotila gaumeri* ..... Yucatán, Quintana Roo.
- Leptotila verreauxi fulviventris*<sup>1</sup> ..... Southeastern Veracruz, Tabasco, Campeche, Yucatán, northern Chiapas.
- Leptotila verreauxi angelica*<sup>1, 2</sup> ..... Nuevo León, Tamaulipas, Veracruz, Puebla, and southern Sonora to Chiapas.
- Leptotila verreauxi capitalis* ..... María Madre Island, Nayarit.
- Ara macao*<sup>1</sup> ..... Southern Tamaulipas, Veracruz, Oaxaca, Chiapas.
- Ara militaris mexicana*<sup>2</sup> ..... Southern Tamaulipas, and southern Sonora southward along Pacific slope to southern Oaxaca.
- Aratinga canicularis* ..... Southern Sinaloa and western Durango, southward to Chiapas.
- Aratinga astec* ..... Southern Tamaulipas to Yucatán.
- Protogeris jugularis jugularis* ..... Guerrero, Oaxaca, Chiapas.
- Forpus cyanopygius cyanopygius* ..... Southern Sinaloa to Colima.
- Forpus insularis* ..... Tres Mariás Islands, Nayarit.
- Amazona ochrocephala europalliata* ..... Southeastern Oaxaca, southern Chiapas.
- Amazona autumnalis autumnalis*<sup>1</sup> ..... Southern Tamaulipas, Veracruz, Puebla, México, Guanajuato, Oaxaca.
- Amazona finschi*<sup>2</sup> ..... Southern Sonora, southwestern Chihuahua to Oaxaca.
- Amazona ochrocephala oratrix*<sup>1, 2</sup> ..... Southern Tamaulipas and Veracruz to Yucatán, and from Colima southward to Oaxaca.
- Amazona ochrocephala tresmariae* ..... Tres Mariás Islands, Nayarit.
- Amazona albifrons albifrons* ..... Southern Sinaloa to southern Oaxaca.
- Amazona albifrons nana*<sup>1</sup> ..... Yucatán, Campeche, Chiapas.
- Amazona xantholora* ..... Yucatán, Cozumel Island, Quintana Roo.
- Coccyzus minor continentalis*<sup>1</sup> ..... Southern Tamaulipas to Yucatán.
- Coccyzus minor palloris* ..... Nayarit, Guerrero, Oaxaca.
- Piaya cayana thermophila*<sup>1</sup> ..... Southern Tamaulipas to Yucatán, southern Oaxaca and Chiapas.
- Piaya cayana mexicana*<sup>2</sup> ..... Southern Sinaloa south along Pacific slope to southern Oaxaca.

- Tapera naevia excellens*<sup>1</sup>.....Veracruz, Tabasco, Oaxaca.  
*Morococcyx erythropygus mexicanus* ..... Southern Sinaloa south along Pacific coast to southern Chiapas.  
*Geococcyx velox*<sup>1, 2</sup> ..... Southern Sonora south along Pacific slope to southern Chiapas and from central Veracruz to Yucatán.  
*Dromococcyx phasianellus*<sup>1</sup> ..... Central Veracruz to Yucatán and southern Oaxaca.  
*Crotophaga sulcirostris*<sup>1, 2</sup> ..... Southern Baja California, southern Sinaloa and Tamaulipas southward along Atlantic and Pacific slopes to Yucatán and Chiapas.  
*Tyto perlata pratincola*<sup>2, 3, 4</sup>.....Baja California and Sonora to Tamaulipas and south to Yucatán and Chiapas.  
*Otus guatemalae thompsoni*.....Yucatán.  
*Bubo virginianus mayensis*.....Yucatán.  
*Pulsatrix perspicillata saturata*<sup>1</sup>..Veracruz, Oaxaca.  
*Ciccaba nigrolineata*<sup>1</sup> ..... Veracruz, Oaxaca, Chiapas.  
*Ciccaba virgata centralis*<sup>1</sup>.....Veracruz, Tabasco, Oaxaca, Chiapas, Campeche, Yucatán.  
*Glaucidium minutissimum palmarum* ..... Nayarit, Guerrero.  
*Caprimulgus salvini badius*.....Yucatán.  
*Nyctidromus albicollis yucatanensis*<sup>1</sup> ..... Eastern Tabasco, Campeche, Yucatán, Quintana Roo.  
*Nyctidromus albicollis nelsoni*.... Southern Sinaloa, Nayarit, Jalisco, Colima, Guerrero, Oaxaca, Chiapas.  
*Nyctidromus albicollis insularis*..Tres Mariás Islands, Nayarit.  
*Otophanes yucatanicus* ..... Yucatán, Campeche.  
*Chordeiles acutipennis micromeris*<sup>1</sup> ..... Yucatán, Quintana Roo, Tabasco, Campeche, Jalisco, Guerrero, Oaxaca.  
*Nyctibius griseus mexicanus*<sup>1</sup>....Veracruz, Tabasco, Oaxaca.  
*Chaetura vauxi gaumeri*.....Yucatán, Quintana Roo.  
*Phaethornis superciliosus mexicanus* ..... Guerrero, Oaxaca.  
*Heliomaster longirostris pallidiceps*<sup>1</sup> ..... Guerrero, Veracruz, Chiapas, Oaxaca.  
*Heliomaster constantii leocadiac*.. Southern Sonora, Sinaloa, Jalisco, Michoacán, Guerrero, Oaxaca.  
*Pampa pampa pampa*.....Yucatán, Quintana Roo.  
*Cynanthus lawrencei* ..... Tres Mariás Islands, Nayarit.  
*Cynanthus doubledayi* ..... Guerrero, Oaxaca.  
*Amazilia yucatanensis yucatanensis*<sup>1</sup> ..... Tabasco, Campeche, Yucatán.  
*Amazilia rutila rutila*..... Southern Sinaloa to Chiapas and Yucatán.  
*Amazilia graysoni* ..... Tres Mariás Islands, Nayarit.  
*Amazilia viridifrons* ..... Guerrero, Oaxaca, Chiapas.  
*Amazilia violiceps violiceps*<sup>2</sup>.... Puebla, Morelos, Michoacán, Guerrero, Oaxaca.

- Amazila candida*<sup>1</sup> ..... Veracruz, Oaxaca, Tabasco, Chiapas, Campeche, Yucatán, Quintana Roo.
- Amazilia beryllina beryllina* ..... Southern Oaxaca.
- Anthracothorax prevostii*  
*prevostii*<sup>1</sup> ..... Southern Tamaulipas and Veracruz to Chiapas and Yucatán.
- Chlorostilbon canivetii*  
*canivetii*<sup>1</sup> ..... Southern Tamaulipas, Veracruz, Oaxaca, Chiapas, Yucatán.
- Doricha eliza*<sup>1</sup> ..... Veracruz, Yucatán.
- Trogon citreolus*  
*melanocephala*<sup>1</sup> ..... Southern Tamaulipas and Veracruz to Chiapas and Yucatán.
- Trogon citreolus citreolus* ..... Southern Sinaloa to southern Oaxaca and southern Chiapas.
- Trogon elegans goldmani* ..... Tres Marias Islands, Nayarit.
- Trogon collaris puella*<sup>1</sup> ..... Veracruz, Puebla, Tabasco, Oaxaca, Chiapas, Campeche, Yucatán.
- Trogon violaceus caligatus*<sup>1</sup> ..... Southern Tamaulipas to Chiapas and Yucatán.
- Ceryle torquata torquata*<sup>1</sup> ..... Southern Tamaulipas and southern Sinaloa to Tabasco and Chiapas.
- Chloroceryle amazona mexicana*<sup>1</sup> ..... Southern Sinaloa and central Veracruz to Tabasco and Chiapas.
- Chloroceryle americana*  
*septentrionalis*<sup>1, 2, 3</sup> ..... Sonora, Chihuahua, Nuevo León, and Tamaulipas to Tabasco and Chiapas.
- Chloroceryle aenea strictoptera*<sup>1</sup> ..... Southern Veracruz, Yucatán and Quintana Roo to southern Oaxaca and southern Chiapas.
- Momotus momota lessonii*<sup>1</sup> ..... Chiapas.
- Momotus momota exiguus* ..... Yucatán, Quintana Roo, Campeche.
- Momotus mexicanus saturatus* ..... Guerrero, Oaxaca, Chiapas.
- Eumomota superciliosa*  
*superciliosa*<sup>1</sup> ..... Tabasco, Campeche, Yucatán, Quintana Roo.
- Eumomota superciliosa*  
*bipartita*<sup>1</sup> ..... Southern Veracruz, Oaxaca, Chiapas.
- Notharchus macrorhynchos*  
*hyperrhynchus* ..... Oaxaca, Chiapas.
- Pteroglossus torquatus*  
*torquatus*<sup>1</sup> ..... Veracruz, Oaxaca, Tabasco, Chiapas.
- Pteroglossus torquatus*  
*erythrozonus* ..... Yucatán, Campeche.
- Melanerpes aurifrons dubius* ..... Campeche, Yucatán.
- Melanerpes rubricapillus*  
*rubricomus* ..... Yucatán, Quintana Roo.
- Melanerpes aurifrons*  
*polygrammus* ..... Southern Oaxaca and southwestern Chiapas.
- Melanerpes aurifrons*  
*frontalis* ..... Southern Chiapas.
- Melanerpes aurifrons santacruzi* ..... Southern Chiapas.
- Melanerpes chrysogenys*  
*flavinuchus* ..... Puebla, Jalisco, Michoacán, Colima, Guerrero, western Oaxaca.

- Piculus rubiginosus yucatanensis*<sup>1</sup> ..... Veracruz, Oaxaca, Tabasco, Chiapas, Yucatán.
- Celeus castaneus*<sup>1</sup> ..... Veracruz, Oaxaca, Tabasco, Yucatán.
- Dryocopus lineatus similis*<sup>1, 2</sup>.... Nuevo León, Tamaulipas, San Luis Potosí, Veracruz, Oaxaca, Yucatán.
- Dryocopus lineatus scapularis*<sup>2</sup>.. Sonora, Sinaloa, Nayarit, Colima, Guerrero, and western Oaxaca.
- Phloeocastes guatemalensis guatemalensis*<sup>1</sup> ..... Oaxaca, Tabasco, Chiapas, Campeche, Yucatán.
- Veniliornis fumigatus sanguinolentus*<sup>1</sup> ..... Southern Veracruz, Oaxaca, Tabasco, Yucatán, Quintana Roo.
- Dendrocopos scalaris parvus*.... Yucatán, Cozumel Island, Quintana Roo.
- Dendrocopos scalaris graysoni*.... Tres Mariás Islands, Nayarit.
- Thamnophilus doliatus pacificus*.. Southern Chiapas.
- Thamnophilus doliatus yucatanensis* ..... Yucatán, Quintana Roo, Campeche.
- Formicarius analis pallidus*..... Yucatán.
- Sittasomus griseicapillus sylvioides*<sup>1</sup> ..... Veracruz, Puebla, Oaxaca, Tabasco, Campeche, Yucatán.
- Dendrocinclá anabatina typhla*... Yucatán, Quintana Roo, Campeche.
- Dendrocinclá homochroa homochroa*<sup>1</sup> ..... Northern Oaxaca, Campeche, Yucatán.
- Synallaxis erythrothorax*<sup>1</sup> ..... Veracruz, northern Oaxaca, Tabasco, Chiapas, Yucatán.
- Xiphorhynchus flavigaster flavigaster*<sup>1</sup> ..... Southern Tamaulipas and Guerrero to Chiapas and Campeche.
- Xiphorhynchus flavigaster mentalis* ..... Southern Sinaloa and Durango to Michoacán.
- Xiphorhynchus flavigaster megarhynchus* ..... Guerrero, Oaxaca.
- Xiphorhynchus flavigaster yucatanensis* ..... Quintana Roo.
- Attila spadiceus flammulatus*<sup>1</sup>... Veracruz, Puebla, Oaxaca.
- Attila spadiceus cinnamomeus*.... Southern Sinaloa to Oaxaca.
- Attila spadiceus gaumeri*..... Yucatán, Quintana Roo.
- Pachyramphus major itzensis*.... Yucatán.
- Platyptaris aglaiae albiventris*<sup>1</sup>.. Southern Sonora and southwestern Chihuahua to Oaxaca.
- Platyptaris aglaiae insularis*.... Tres Mariás Islands, Nayarit.
- Platyptaris aglaiae yucatanensis*.. Yucatán, Quintana Roo.
- Tityra inquisitor albitorques*<sup>1</sup>.... Veracruz, Oaxaca, Tabasco, Chiapas, Yucatán.
- Tityra semifasciata personata*<sup>1</sup>.. Southern Tamaulipas to Yucatán and southern Oaxaca.
- Tityra semifasciata griseiceps*.... Southern Sinaloa to southern Oaxaca.
- Chiroxiphia linearis* ..... Southern Oaxaca to southern Chiapas.
- Onychorhynchus mexicanus mexicanus*<sup>1</sup> ..... Veracruz, Oaxaca, Tabasco, Yucatán.
- Tolmomyias sulphureus cinereiceps*<sup>1</sup> ..... Veracruz, Oaxaca, Chiapas.

- Elaenia viridicata placens*<sup>1</sup>.....Veracruz, Campeche, Yucatán, Chiapas.  
*Elaenia viridicata jalicensis*.....Jalisco.  
*Elaenia viridicata minima*.....Tres Mariás Islands, Nayarit.  
*Myiozetetes texensis texensis*<sup>1</sup>...Southern Sinaloa and Veracruz to Yucatán and Chiapas.  
*Myiochanes cinereus brachytarsus*.Veracruz, Oaxaca, Tabasco, Campeche, Yucatán, Chiapas.  
*Myiarchus yucatanensis* .....Yucatán, Quintana Roo.  
*Megarynchus pitangua*  
*mexicanus* .....Southern Tamaulipas to southern Oaxaca and Yucatán.  
*Tyrannus crassirostris* .....Southern Sinaloa to Oaxaca.  
*Stelgidopteryx ruficollis*  
*ridgwayi*<sup>1</sup> .....Tabasco, Yucatán.  
*Iridoprocne albilinea albilinea*<sup>1</sup>...Southern Sinaloa and Veracruz, southward through Central America.  
*Calocitta formosa formosa* .....Colima and Puebla to Oaxaca.  
*Calocitta formosa azurea*.....Southern Chiapas.  
*Psilorhinus mexicanus vociferus*..Yucatán.  
*Xanthoura yncas vivida*.....Oaxaca.  
*Xanthoura yncas speciosa*.....Western Jalisco.  
*Cissolopha san-blasiana*  
*san-blasiana* .....Nayarit, Jalisco, Colima.  
*Cissolopha san-blasiana*  
*pulchra* .....Guerrero.  
*Cissolopha yucatanica*<sup>1</sup> .....Yucatán, Tabasco.  
*Heleodytes rufinucha chiapensis*...Southern Chiapas.  
*Heleodytes rufinucha rufinucha*<sup>1</sup>.Veracruz, Puebla, Oaxaca.  
*Heleodytes rufinucha humilis*....Colima, Michoacán, Guerrero, Oaxaca.  
*Heleodytes brunneicapillus*  
*guttatus* .....Yucatán.  
*Thryothorus rutilus*  
*cano-brunneus* .....Yucatán, Campeche, Quintana Roo.  
*Thryothorus felix felix*.....Southern Jalisco, Guerrero, Oaxaca.  
*Thryothorus felix grandis*.....Morelos.  
*Thryothorus felix lawrencei*.....María Madre Island, Nayarit.  
*Thryothorus felix magdalenae*...María Magdalena Island, Nayarit.  
*Thryothorus sinaloa sinaloa*<sup>2</sup>....Southern Sinaloa, Jalisco, Colima, Nayarit.  
*Thryothorus sinaloa russeus*....Guerrero.  
*Thryomanes albinucha albinucha*..Yucatán, Quintana Roo.  
*Troglodytes musculus peninsularis*.Yucatán.  
*Nannorchilus leucogaster*  
*pacificus* .....Colima, Guerrero.  
*Nannorchilus leucogaster*  
*brachyurus* .....Yucatán, Quintana Roo.  
*Melanotis caerulescens*  
*caerulescens*<sup>1</sup> .....Southern Sinaloa and Veracruz to Oaxaca.  
*Melanotis caerulescens*  
*longirostris* .....Tres Mariás Islands, Nayarit.  
*Mimus gilvus gracilis*<sup>1</sup>.....Yucatán, Quintana Roo, Campeche.  
*Mimus gilvus lawrencii*.....Southern Oaxaca.  
*Turdus rufo-palliatus*  
*rufo-palliatus* .....Southern Sinaloa to Oaxaca.  
*Turdus rufo-palliatus graysoni*...Tres Mariás Islands, Nayarit.

- Turdus assimilis leucauchen*<sup>1</sup>.... Southern Sinaloa to Oaxaca.  
*Turdus grayi tamaulipensis*<sup>1</sup>.... Southern Tamaulipas to Yucatán.  
*Polioptila plumbea albiloris*..... Oaxaca.  
*Polioptila plumbea albiventris*.... Yucatán.  
*Polioptila nigriceps nigriceps*<sup>2</sup>... Southern Sonora to Oaxaca.  
*Cyclarhis gujanensis*  
*yucatanensis* ..... Yucatán, Campeche, Quintana Roo.  
*Vireo virescens*  
*flavoviridis*<sup>1</sup> ..... Southern Sinaloa and southern Tamaulipas southward through Central America.  
*Vireo griseus ochraceus*..... Campeche, Yucatán.  
*Vireo hypochryseus sordidus*.... Tres Mariás Islands, Nayarit.  
*Compsothlypis pitiayumi insularis*. Tres Mariás Islands, Nayarit.  
*Dendroica petechia castaneiceps*.. Southern Sinaloa south along Pacific coast to Central America.  
*Chamaethlypis poliocephala*  
*palpebralis*<sup>1</sup> ..... Veracruz and Chiapas to Yucatán and Quintana Roo.  
*Granatellus venustus venustus*.... Sinaloa, Colima, Guerrero, Oaxaca.  
*Granatellus venustus francescae*.. Tres Mariás Islands, Nayarit.  
*Granatellus sallaci boucardi*..... Yucatán.  
*Tanagra affinis*<sup>1</sup> ..... Southern Tamaulipas, Veracruz, Oaxaca, Yucatán.  
*Tanagra godmani*<sup>2</sup> ..... Sonora, Sinaloa, Nayarit, Colima, Guerrero.  
*Tanagra lauta lauta*<sup>1</sup>..... Southern Tamaulipas, Veracruz, Oaxaca, Yucatán.  
*Piranga roseo-gularis*  
*roseo-gularis* ..... Yucatán, Quintana Roo.  
*Piranga bidentata flammca*..... Tres Mariás Islands, Nayarit.  
*Eucometis penicillata pallida*.... Yucatán.  
*Habia rubica nelsoni*..... Yucatán Campeche.  
*Habia rubica affinis*..... Oaxaca.  
*Habia gutturalis*  
*peninsularis* ..... Yucatán, Quintana Roo.  
*Rhodinocichla rosea schistacea*... Southern Sinaloa, Nayarit, Jalisco, Colima.  
*Cassiculus melanicterus* ..... Southern Sinaloa, Nayarit, Jalisco, Colima, Guerrero, Oaxaca, Chiapas.  
*Amblycercus holosericeus*<sup>1</sup> ..... Southern Tamaulipas, Veracruz, Puebla, Tabasco, Chiapas, Campeche, Yucatán.  
*Psomocolax oryzivorus*  
*impacifus*<sup>1</sup> ..... Veracruz, Tabasco, Campeche.  
*Cassidix mexicanus obscurus*.... Nayarit, Jalisco, Colima, Guerrero.  
*Dives dives*<sup>1</sup> ..... Veracruz, Puebla, Oaxaca, Chiapas, Yucatán.  
*Icterus prothemelas*  
*prothemelas*<sup>1</sup> ..... Veracruz, Oaxaca, Chiapas, Yucatán.  
*Icterus pectoralis pectoralis*..... Oaxaca, Chiapas.  
*Icterus gularis gularis*..... Oaxaca, Chiapas.  
*Icterus gularis yucatanensis*..... Yucatán.  
*Icterus cucullatus igneus*..... Yucatán.  
*Icterus pustulatus pustulatus*<sup>2</sup>.... Southern Sonora, southwestern Chihuahua, south to Oaxaca and Chiapas.  
*Icterus formosus graysonii*..... Tres Mariás Islands, Nayarit.

- Icterus formosus sclateri*.....Oaxaca, Chiapas.  
*Icterus auratus* .....Yucatán.  
*Aimophila ruficauda lawrencii*...Oaxaca.  
*Aimophila ruficauda acuminata*...Colima, Guerrero, Jalisco, Morelos, Puebla, Durango.  
*Aimophila sumichrasti* .....Oaxaca.  
*Arremonops rufivirgatus sumichrasti* .....Colima, Guerrero, Oaxaca.  
*Arremonops rufivirgatus verticalis*.Yucatán.  
*Sicalis luteola chrysopt*<sup>1</sup>.....Chiapas, Morelos, Veracruz.  
*Volatinia jacarini splendens*<sup>1</sup>.....Southern Sinaloa, and eastern San Luis Potosí southward.  
*Sporophila minuta parva*.....Chiapas, Oaxaca.  
*Sporophila torqueola torqueola*<sup>2</sup>..Southern Sinaloa, Nayarit, Jalisco, Colima, Guanajuato, Guerrero, Puebla.  
*Passerina rositae* .....Oaxaca.  
*Passerina leclancheri* .....Colima, Guerrero, Puebla, Oaxaca.  
*Richmondena cardinalis yucatanicus* .....Yucatán.  
*Richmondena cardinalis mariae*...Tres Mariás Islands, Nayarit.  
*Richmondena carneus* .....Colima, Guerrero, Oaxaca.  
*Saltator coerulescens vigorsii*...Sinaloa, Durango, Jalisco, Colima, Nayarit, Oaxaca.

<sup>1</sup> Also in Humid Lower Tropical Subzone.

<sup>2</sup> Also in Arid Upper Tropical Subzone.

<sup>3</sup> Also in Lower Sonoran Zone.

<sup>4</sup> Also in Upper Sonoran Zone.

#### UPPER TROPICAL ZONE

The Upper Tropical Zone is the extensive area lying just below the normal frost line of killing severity for many species. It meets and tends to overlap or interdigitate with the Lower Austral Zone in arid regions, but not in humid sections and is not sharply differentiated from the Lower Tropical Zone. Many species are common to the upper and lower divisions of the tropical region, but so many differ that for convenience the divisions are recognized as zones. Like the Lower Tropical Zone the Upper Tropical Zone is subdivisible into arid and humid sections. Tropical elements extend north to southern Florida, where they tend to become predominant in an isolated area of moderate humidity. The part of southern Florida generally recognized as tropical may, therefore, be assigned to the Upper Tropical Zone.

#### HUMID UPPER TROPICAL SUBZONE

This subdivision of the Upper Tropical Zone includes most of the typical cloud-forest areas, which become merged below with the rain-forest areas of the Humid Lower Tropical Subzone imperceptibly at any particular point. The subzone is limited mainly to the easterly and northerly slopes of the Sierra Madre Oriental, facing the Gulf of México from eastern San Luis Potosí, southeasterly through eastern

Hidalgo, eastern Puebla, and western Veracruz to northern Oaxaca. Included also are the upper and eastern slopes of the Volcán de San Martín and neighboring mountains near the coast of southern Veracruz. East of the low gap at the Isthmus of Tehuantepec cloud forests also enshroud the mountains of northern Chiapas overlooking the Humid Lower Tropical lowlands of Tabasco. Much smaller cloud-forest areas occur as patches on the Pacific slopes of isolated mountains in Jalisco, Colima, the Sierra Madre del Sur in Guerrero, on the mountains in southern Oaxaca and southern Chiapas. Along the Pacific coast Humid Upper Tropical Subzone areas contrast strongly with the Arid Lower Tropical Subzone to which they give way at about 2,500 feet altitude. The distinctive flora and fauna of the Humid Upper Tropical Subzone is still very imperfectly known.

The cloud-forest belt is best developed in México along the seaward slopes of the mountain mass extending from the Cofre de Perote to Mount Orizaba, Veracruz. This general area, merged with the rain forest of the Lower Tropical Zone along the lower slopes of the mountains is probably the wettest in México. Its upward extent is here from about 3,000 or 4,000 feet to 6,500 or 7,000 feet. From 5,500 to 7,000 feet uncut sections of forest, apparently representing the climax, are extremely dense, with tall trees including several species of oaks as dominants. One of these, the encino roble, is the largest tree of this forest, reaching a great height and being frequently 6 to 7 feet in diameter 6 feet from the ground. Another large species is the encino blanco. Despite the constant shade and gloom prevailing, there is a rank undergrowth and the trunks and large branches of the trees are encased in masses of mosses, lichens, orchids, tillandsias, bromeliads and many other epiphytic plants. At about 7,000 feet tree ferns grow in close proximity to firs (*Abies religiosa*) and pines which displace the oaks rather abruptly. At about the same level a thinning of the forest and the appearance of sacatón grass along exposed ridges indicate a lessening of the rainfall and a change to a colder climate. Very similar conditions were noted on the seaward slopes of the Sierra Madre del Sur in Guerrero.

Owing to the comparatively cool, humid climate of this slope many species of the Transition or even Canadian Zone find congenial habitats down to levels where their ranges meet or overlap those of tropical species. At the same time the absence of frost, due largely to extreme humidity, enables tropical species to ascend to near the lower border of the fir belt of the Canadian Zone, apparently leaving no space suitable for counterparts of Lower and Upper Austral Zones to gain a foothold. Where the mountains are not so high and less extremely

humid conditions prevail, the Humid Upper Tropical Subzone may reach an upper limit at 4,000 to 5,000 feet, above which Lower and Upper Austral Zone elements may be in evidence.

The Upper Tropical Subzone has a rich and distinctive flora and fauna. Many genera of plants, mammals, and birds are the same, however, and suggest affinity with the higher zones of the tableland, and it seems reasonable to assume that the area may include remnants of colder Pleistocene conditions, as pointed out by Wetmore (Proc. U. S. Nat. Mus., vol. 93, p. 223, May 25, 1943) in dealing with the avifauna of southern Veracruz. He also records his impression that Upper Tropical elements, here near the northern limit of their altitudinal range, tend to descend to lower levels than in the mountains of Central America, either regularly or casually, or that the demarcation between Upper and Lower Tropical is less distinct than farther south.

Evidence that colder conditions must have extended formerly to lower elevations in the general region is also presented by the glacier-eroded top of the Cofre de Perote directly overlooking a major section of the Humid Upper Tropical Subzone, and by the receding glaciers that still persist near the top of Cerro Ixtacihuatl.

#### Plants of Humid Upper Tropical Subzone:

- Dicranopteris bancroftii* ..... Mountains of Veracruz and Chiapas.  
*Cyathea tuerckheimii* ..... Mountains of Veracruz.  
*Hemitelia lucida* ..... Oaxaca.  
*Pinus pseudostrabus* ..... Sinaloa and Durango to Veracruz and Chiapas.  
*Quercus lancifolia* ..... Veracruz.  
*Quercus cyclobalanoides* ..... Chiapas.  
*Quercus polymorpha* ..... Nuevo León, San Luis Potosí, Veracruz.  
*Talauma mexicana* ..... Veracruz, México, Morelos, Oaxaca.  
*Ribes orizabae* ..... Veracruz.  
*Platanus lindeniana* ..... Veracruz, Puebla, Chiapas.  
*Rubus adenotrichos* ..... Veracruz.  
*Rubus ceriifolius* ..... Veracruz.  
*Rubus schiedeianus* ..... Veracruz.  
*Picramnia xalapensis* ..... Veracruz.  
*Cornus urbiniana* ..... Veracruz.  
*Arctostaphylos lucida* ..... Veracruz, Oaxaca.  
*Bumelia persimilis* ..... Veracruz.

#### Mammals of Humid Upper Tropical Subzone:

- Sorex sclateri* ..... Chiapas.  
*Sorex macrodon* ..... Veracruz.  
*Cryptotis mexicana mexicana*... Veracruz.  
*Cryptotis nelsoni* ..... Veracruz.  
*Cryptotis magna* ..... Oaxaca.  
*Pipistrellus veraecrucis* ..... Veracruz.  
*Sciurus deppei deppei*<sup>1</sup>..... Veracruz, Tabasco, Oaxaca, Chiapas.

- Sciurus aurcogaster frumentor*...Mountains of western Veracruz.  
*Glaucomyz volans herrerae*...Veracruz.  
*Heterogeomys hispidus hispidus*..Puebla, Veracruz.  
*Heterogeomys hispidus concavus*..Querétaro.  
*Heteromys desmarestianus*  
*desmarestianus*<sup>1</sup> .....Chiapas, Tabasco.  
*Liomys pictus veracrucis*.....Oaxaca, Veracruz.  
*Liomys annectens* .....Oaxaca, Guerrero.  
*Liomys irroratus pretiosus*.....Eastern Puebla, Querétaro, San Luis Potosí, Veracruz.  
*Liomys guerrerensis* .....Guerrero.  
*Reithrodontomys fulvescens*  
*difficilis*<sup>2</sup> .....Veracruz, Puebla.  
*Reithrodontomys rufescens*  
*rufescens* .....Veracruz, Puebla, Querétaro, Oaxaca.  
*Reithrodontomys rufescens*  
*luteolus*<sup>2</sup> .....Oaxaca, Guerrero.  
*Reithrodontomys dorsalis*<sup>3</sup> .....Chiapas.  
*Reithrodontomys mexicanus*  
*mexicanus* .....Veracruz, Oaxaca, Chiapas.  
*Baiomys musculus brunneus*....Veracruz.  
*Peromyscus boylii evides*<sup>2</sup>.....Guerrero, Michoacán, Oaxaca.  
*Peromyscus boylii astecus*.....Puebla, Veracruz.  
*Peromyscus simulatus* .....Veracruz.  
*Peromyscus furvus* .....Veracruz.  
*Peromyscus mexicanus*  
*totontepecus*<sup>1</sup> .....Oaxaca, Veracruz.  
*Peromyscus megalops melanurus*.Southern Oaxaca.  
*Peromyscus zarhynchus*  
*zarhynchus* .....Northern Chiapas.  
*Peromyscus nelsoni* .....Veracruz.  
*Oryzomys alfaroi caudatus* .....Oaxaca.  
*Oryzomys alfaroi palatinus*.....Tabasco.  
*Oryzomys alfaroi saturator*.....Chiapas.  
*Oryzomys alfaroi chapmani*.....Veracruz.  
*Oryzomys alfaroi dilutior*.....Puebla.  
*Orzomys hylocetes* .....Southern Chiapas.  
*Tylomys tumbalensis* .....Northern Chiapas.  
*Sigmodon hispidus toltecus*<sup>4</sup>....Puebla, San Luis Potosí, Tamaulipas, Veracruz.  
*Sigmodon guerrerensis* .....Mountains near Chilpancingo, Guerrero.  
*Sigmodon planifrons* .....Mountains near Juquila, Oaxaca.  
*Scotinomys teguina subnubilus*...Chiapas.  
*Neotoma distincta* .....Mountains of Veracruz.  
*Neotoma tropicalis* .....Mountains of northeastern Oaxaca.  
*Neotoma parvidens* .....Mountains of southwestern Oaxaca.  
*Neotoma ferruginea ferruginea*...Guatemala.  
*Pitymys quasiater* .....Veracruz, Puebla.  
*Microtus umbrosus* .....Oaxaca.  
*Sylvilagus floridanus connectens*<sup>4</sup>.Tamaulipas, Veracruz, San Luis Potosí, Querétaro, Puebla, Oaxaca.  
*Sylvilagus insonus*<sup>3</sup> .....Guerrero.  
*Odocoileus virginianus*  
*veracrucis*<sup>4</sup> .....Tamaulipas, Veracruz.  
*Odocoileus virginianus toltecus*<sup>1</sup>.Veracruz.

- Mazama sartorii sartorii*<sup>1</sup>.....Veracruz, Tabasco, Oaxaca, Chiapas.  
*Tapirella bairdii*<sup>1</sup>.....Veracruz, Tabasco, Oaxaca, Chiapas.

<sup>1</sup> Also Humid Lower Tropical Zone.

<sup>2</sup> Also in Lower Sonoran Zone.

<sup>3</sup> Also in Canadian Zone.

<sup>4</sup> Also in Arid Upper Tropical Subzone.

### Birds of Humid Upper Tropical Subzone:

- Penelopina nigra nigra*.....Mountains of northern Chiapas.  
*Dendrortyx barbatus*.....Cloud-forest region of Veracruz.  
*Dendrortyx macroura diversus*...Jalisco.  
*Dendrortyx macroura oaxacae*<sup>3, 4</sup>.Mountain forest of eastern Oaxaca.  
*Odontophorus guttatus*<sup>5</sup>.....Central and southern Veracruz, Tabasco, Campeche, Chiapas, Oaxaca.  
*Dactylortyx thoracicus*  
*thoracicus*<sup>1</sup>.....Veracruz and northern Puebla.  
*Dactylortyx thoracicus devius*...Mountains of Guerrero and western Jalisco.  
*Laterallus ruber tamaulipensis*...Southern Tamaulipas.  
*Claravis mondetoura*.....Veracruz and southward to Central America.  
*Oreopeleia albifacies albifacies*...Central Veracruz, Oaxaca, Chiapas.  
*Oreopeleia albifacies rubida*.....Guerrero.  
*Otus guatemalae cassini*.....Veracruz.  
*Campylopterus hemileucurus*  
*hemileucurus*<sup>5</sup>.....Veracruz, Guerrero, Oaxaca, Tabasco, Chiapas.  
*Amazilia cyanocephala*  
*cyanocephala*.....Veracruz, Oaxaca, Chiapas.  
*Amazilia beryllina beryllina*<sup>6</sup>...Veracruz, Morelos, Oaxaca, Guanajuato.  
*Abeillia abeillei*.....Veracruz, Chiapas.  
*Florisuga mellivora mellivora*...Veracruz, Oaxaca.  
*Tilmatura dupontii*.....Veracruz to Central America.  
*Pharomachrus mocinno mocinno*..Chiapas.  
*Trogon mexicanus*<sup>7</sup>.....Chihuahua and Tamaulipas to Oaxaca and Chiapas.  
*Trogon collaris puella*<sup>5</sup>.....Veracruz, Puebla, Tabasco, Oaxaca, Chiapas, Campeche, Yucatán.  
*Momotus momota coeruliceps*<sup>6</sup>..Southern Nuevo León, southern Tamaulipas, northern Veracruz, eastern San Luis Potosí.  
*Aulacorhynchus prasinus wagleri*.Central Guerrero, southern Oaxaca.  
*Aulacorhynchus prasinus*  
*prasinus*.....Veracruz, Oaxaca, Chiapas.  
*Grallaria guatemalensis*  
*guatemalensis*<sup>5</sup>.....Veracruz, Tabasco, northern Chiapas.  
*Grallaria guatemalensis*  
*ochraceiventris*.....Jalisco, Guerrero.  
*Xiphocolaptes promeropirhynchus*  
*emigrans*.....Chiapas.  
*Xiphocolaptes promeropirhynchus*  
*sclateri*<sup>4</sup>.....Veracruz, Oaxaca.  
*Xiphocolaptes promeropirhynchus*  
*omiltemensis*<sup>4</sup>.....Mountains of Guerrero.  
*Xiphorhynchus triangularis*  
*erythropigiis*.....Veracruz, Oaxaca, Guerrero, Chiapas.

- Lepidocolaptes affinis affinis*<sup>4</sup>.....Veracruz, Puebla, México, Guerrero, Oaxaca, Chiapas.
- Xenicopsoides montanus variegaticeps* .....Veracruz, Guerrero, Oaxaca.
- Automolus rubiginosus guerrercensis* .....Guerrero, Oaxaca.
- Cyanolyca nana* .....Veracruz, Oaxaca.
- Cyanolyca pumilo pumilo*.....Chiapas.
- Cyanolyca pulchra mitrata*.....Oaxaca, Chiapas.
- Cyanolyca mirabilis* .....Guerrero.
- Aphelocoma unicolor concolor*<sup>4</sup>..Veracruz, Puebla, México.
- Aphelocoma unicolor unicolor*<sup>4</sup>..Chiapas.
- Helcodytes megalopterus megalopterus* .....Morelos, Michoacán, Oaxaca.
- Helcodytes nelsoni* .....Veracruz, Oaxaca.
- Troglodytes brunneicollis nitidus*..Mount Zempoaltepec, Oaxaca.
- Henicorhina leucophrys capitalis*..Chiapas.
- Henicorhina leucophrys mexicana*.Veracruz, Puebla, eastern Oaxaca.
- Catharus occidentalis alticola*<sup>4</sup>...Southern Chiapas.
- Catharus occidentalis fulvescens*<sup>4</sup>.Mountains near Chilpancingo, Guerrero.
- Catharus aurantiirostris melpomene* .....Veracruz, Oaxaca, Chiapas.
- Turdus infuscatus* .....Veracruz, Oaxaca, Chiapas.
- Myadestes unicolor unicolor*<sup>5</sup>.....Veracruz, Chiapas.
- Myadestes obscurus obscurus*.....Guerrero.
- Vircolanius mclitophrys mclitophrys* .....Veracruz.
- Vireo leucophrys amaurota* .....Veracruz.
- Vireo leucophrys strenuus*.....Chiapas.
- Neochloe brevipennis* .....Veracruz.
- Diglossa baritula baritula*.....Veracruz, Morelos, Michoacán, Guerrero, Oaxaca.
- Cyanerpes cyaneus carneipes*.....Southern Veracruz, Oaxaca, southern Campeche.
- Myioborus miniatus intermedius*..Chiapas.
- Basileuterus belli belli* .....Veracruz, Oaxaca.
- Basileuterus belli clarus*.....Guerrero, Jalisco.
- Tanagra musica elegantissima*...Veracruz, Puebla, México, Guanajuato, Oaxaca.
- Piranga erythrocephala erythrocephala* .....Chihuahua, Sinaloa, Jalisco, México, Oaxaca.
- Chlorospingus ophthalmicus dwighti* .....Chiapas.
- Chlorospingus ophthalmicus postocularis* .....Chiapas.
- Chlorospingus ophthalmicus ophthalmicus* .....Puebla, Veracruz, Oaxaca.
- Chlorospingus ophthalmicus albifrons* .....Guerrero.
- Spinus notatus notatus*.....Veracruz, Oaxaca, Chiapas.
- Aimophila rufescens rufescens*<sup>1</sup>..Veracruz, Puebla, México, San Luis Potosí, Guanajuato, Morelos, Oaxaca, Chiapas.
- Spizella passerina mexicana*<sup>2</sup>...Chiapas, Oaxaca, Puebla, Veracruz.
- Atlapetes albinucha* .....Veracruz, Puebla, Oaxaca, Chiapas.

*Ataleptes brunnei-nucha*<sup>3</sup>

*brunnei-nucha*<sup>3</sup> .....Veracruz, México, Oaxaca, Guerrero,  
Chiapas.

<sup>1</sup> Also in Lower Sonoran Zone.<sup>2</sup> Also in Upper Sonoran and Transition Zones.<sup>3</sup> Also in Canadian Zone.<sup>4</sup> Also in Transition Zone.<sup>5</sup> Also in Humid Lower Tropical Subzone.<sup>6</sup> Also in Arid Upper Tropical Subzone.<sup>7</sup> Also in Transition and Canadian Zones.

## ARID UPPER TROPICAL SUBZONE

The Arid Upper Tropical Subzone is the arid subdivision of the Upper Tropical Zone which occupies an arid or semiarid belt just below the normal killing frost line for most frost-sensitive tropical plants, along the lower border of the Lower Austral Zone. Within this area very slight frosts survived by many tropical species are not infrequent. From the upper border of the Arid Lower Tropical Subzone, from which it is not sharply differentiated, the subzone extends upward and ramifies in a complex pattern along the courses of stream valleys and canyons, some of which are cut far back from the coasts into the general surface of the tableland region, where slight variations in slope exposure may determine the zonal position of local areas between 4,000 and 5,000 feet in altitude. Near the coast in central western Sinaloa this subzone gives way to a southern extension of the Lower Austral Zone, but turns inland and is continued northward in a thermal strip along the foothills of the Sierra Madre to the valley of the Río Yaqui in southern Sonora and eastward up the valley of the Río del Fuerte in southwestern Chihuahua to about 2,500 feet altitude.

In extreme southern Tamaulipas and eastern San Luis Potosí a limited area assignable to this subzone extends to the Gulf coast and is interposed between the Humid Lower Tropical Subzone of northern Veracruz and the Lower Austral Zone of more northern Tamaulipas. A few hardy representatives of tropical species or genera of wide dispersal range northward in the warmer, more sheltered spots to the lower Río Grande Valley in an area mainly Lower Austral in character. Extensive overlapping of Arid Upper Tropical and Lower Austral elements in Tamaulipas is favored by the low flat land surface, but the northern extension of many tropical species is undoubtedly checked by the freezing weather accompanying "nortes," or northern storms of unusual severity that recur at irregular intervals.

The greater part of southern Baja California north to about latitude 27°30' N., outlined by Nelson (1921, map facing p. 120) as "Arid Tropical," is assignable to this subzone. Within this area frosts are too slight to interfere seriously with the growth of a great number

of plants representing tropical species or genera of wide distribution farther south. The tropical character of this section is somewhat masked by the prevalence of cactuses, yuccas, and agaves, which often give the landscape the general aspect of many localities in Lower Austral Zone. On the other hand, however, landscapes in which cactuses are similarly predominant extend far to the south in the Arid Lower Tropical Subzone of western México. The long list of mammals for the Arid Upper Tropical Subzone includes species and subspecies peculiar to the many islands along the coasts of southern Baja California. Many of these insular forms have become differentiated in essentially tropical settings, although obviously derived from widely dispersed species mainly Lower Austral in distribution.

#### Plants of Arid Upper Tropical Subzone:

- Ficus palmeri* ..... Southern Baja California.  
*Schoepfia californica* ..... Southern Baja California.  
*Coccoloba goldmanii* ..... Northern Sinaloa.  
*Celosia floribunda* ..... Southern Baja California.  
*Atamisquea emarginata* ..... Baja California, Sonora.  
*Forchammeria watsoni* ..... Southern Baja California, southern Sonora, northern Sinaloa.  
*Prosopis palmeri* ..... Southern Baja California.  
*Mimosa spirocarpa* ..... Sinaloa.  
*Mimosa rosei* ..... Jalisco.  
*Mimosa purpurascens* ..... Southern Baja California, Sonora, Sinaloa.  
*Mimosa coelocarpa* ..... Sinaloa.  
*Mimosa palmeri* ..... Southern Sonora.  
*Mimosa xanti* ..... Southern Baja California, Michoacán.  
*Leucaena pulverulenta* ..... Nuevo León, Tamaulipas, Veracruz.  
*Leucaena microcarpa* ..... Baja California, Sinaloa, Morelos, Guerrero.  
*Acacia cymbispina* ..... Sonora.  
*Acacia standleyi* ..... Nayarit.  
*Acacia gladiata* ..... Sinaloa.  
*Acacia rosei* ..... Sinaloa.  
*Acacia crinita* ..... Sinaloa.  
*Calliandra laevis* ..... Sinaloa.  
*Calliandra peninsularis* ..... Southern Baja California.  
*Lysiloma candida* ..... Southern Baja California.  
*Lysiloma watsoni* ..... Southern Sonora.  
*Albizia occidentalis* ..... Southern Baja California, Sinaloa.  
*Pithecollobium elastichophyllum* .. Coahuila, Nuevo León, San Luis Potosí.  
*Pithecollobium acatense* ..... Puebla.  
*Pithecollobium flexicaule* ..... Tamaulipas, Nuevo León.  
*Pithecollobium brevifolium* ..... Coahuila, Tamaulipas, San Luis Potosí.  
*Pithecollobium mexicanum* ..... Baja California, Sonora, Sinaloa.  
*Cassia greggii* ..... Nuevo León, Tamaulipas.  
*Haematoxylum brasiletto* <sup>2</sup> ..... Baja California, Chihuahua, Morelos, Oaxaca.  
*Caesalpinia pinnosa* ..... Southern Baja California.  
*Caesalpinia phyllanthoides* ..... Tamaulipas.

- Caesalpinia caladenia* ..... Sonora.  
*Cercidium peninsulare* ..... Southern Baja California.  
*Indigofera fruticosa* ..... Southern Baja California.  
*Dalea maritima* ..... Southern Baja California.  
*Dalea palmeri* ..... Southern Sonora, Sinaloa.  
*Dalea anthonyi* ..... Southern Baja California.  
*Dalea variegata* ..... Southern Baja California.  
*Dalea divaricata* ..... Southern Baja California.  
*Dalea oculata* ..... Cerralvo Island, Baja California.  
*Dalea brandegei* ..... Southern Baja California.  
*Brongniartia trifoliata* ..... Southern Baja California.  
*Brongniartia peninsularis* ..... Southern Baja California.  
*Brongniartia goldmanii* ..... Sinaloa.  
*Ichthyomethia mollis* ..... Sonora, Sinaloa.  
*Guaiacum palmeri* ..... Sonora, Sinaloa.  
*Sargentia greggii* ..... Nuevo León, Tamaulipas, San Luis Potosí.  
  
*Zanthoxylum goldmani* ..... Sinaloa.  
*Zanthoxylum arborescens* ..... Baja California, Sinaloa.  
*Esenbeckia flava* ..... Southern Baja California.  
*Bursera cerasifolia* ..... Southern Baja California.  
*Bursera tecomaca* ..... Sinaloa, southwestern Chihuahua.  
*Bursera filicifolia* ..... Southern Baja California.  
*Bursera rubra* ..... Sinaloa.  
*Bursera odorata* ..... Sonora and Baja California to Morelos and Puebla.  
  
*Bursera laxiflora* ..... Sonora, Sinaloa.  
*Bursera jorullensis* ..... Durango, Puebla, Guerrero.  
*Swietenia cirrhata* ..... Sinaloa to Oaxaca.  
*Cedrela rotunda* ..... Sinaloa.  
*Malpighia diversifolia* ..... Southern Baja California.  
*Bunchosia sonorensis* ..... Sonora, Sinaloa.  
*Thryallis angustifolia* ..... Baja California, Sonora, Tamaulipas.  
*Thryallis humilis* ..... Nayarit.  
*Thryallis tuberculata* ..... Sinaloa.  
*Mascagnia macroptera* ..... Baja California, Sonora, to Tamaulipas, Hidalgo, and Sinaloa.  
  
*Banisteria palmeri* ..... Sonora, Sinaloa.  
*Euphorbia californica* ..... Baja California, Sonora, Sinaloa.  
*Euphorbia xanti* ..... Southern Baja California.  
*Euphorbia plicata* ..... Sonora, Sinaloa, Chihuahua, Jalisco.  
*Pedilanthus macrocarpus* ..... Baja California, Sonora, Colima.  
*Pedilanthus rubescens* ..... Sinaloa.  
*Croton magdalenae* ..... Baja California.  
*Croton jucundus* ..... Sinaloa.  
*Ditaxis pringlei* ..... Morelos.  
*Acalypha leptoclada* ..... Nayarit.  
*Acalypha comoduana* ..... Baja California.  
*Jatropha purpurea* ..... Southern Baja California, Sonora, Sinaloa.  
  
*Jatropha spathulata*<sup>1</sup> ..... Baja California to Tamaulipas and Puebla.  
  
*Jatropha cinerea* ..... Baja California, Sonora, Sinaloa.  
*Manihot caudata* ..... Southern Chihuahua to Guanajuato and Michoacán.  
  
*Sebastiania pavoniana* ..... Sonora, Nayarit, San Luis Potosí.

- Sapium biloculare* ..... Southern Baja California, Sonora.  
*Sapium macrocarpum* ..... Guanajuato to Morelos.  
*Cyrtocarpa edulis* ..... Southern Baja California.  
*Hippocratea utilis* ..... Sinaloa.  
*Serjania californica* ..... Southern Baja California.  
*Serjania pacifica* ..... Sinaloa, Nayarit.  
*Karwinskia humboldtiana* ..... Baja California to Tamaulipas, Veracruz  
and Oaxaca.  
*Heliocarpus polyandrus* ..... Sonora, Sinaloa, Chihuahua.  
*Triumfetta dehiscens* ..... Sonora, Sinaloa.  
*Triumfetta goldmanii* ..... Northern Sinaloa.  
*Abutilon bakerianum* ..... Oaxaca.  
*Abutilon californicum* ..... Baja California.  
*Abutilon palmeri* ..... Baja California, Sonora.  
*Abutilon aurantiacum* ..... Southern Baja California.  
*Hibiscus ribifolius* ..... Southern Baja California.  
*Gossypium davidsonii* ..... Southern Baja California.  
*Bombax palmeri* ..... Sonora to Jalisco.  
*Ceiba acuminata* ..... Baja California, Chihuahua, Tamaulipas.  
*Fouquieria peninsularis* ..... Southern Baja California, Sonora, Sina-  
loa.  
*Pereskioopsis porteri* ..... Southern Baja California, Sinaloa.  
*Pachycereus pecten-aboriginum* .. Southern Baja California, Sonora, Chi-  
huahua, Colima.  
*Wilcoxia papillosa* ..... Sinaloa.  
*Machaerocereus cruce* ..... Southern Baja California.  
*Acanthocereus occidentalis* ..... Nayarit.  
*Rathbunia alamosensis* ..... Sonora to Nayarit.  
*Rathbunia kerberi* ..... Jalisco.  
*Selenicereus vagans* ..... Jalisco.  
*Echinocereus luteus* ..... Sonora, Sinaloa.  
*Echinocereus sciurus* ..... Southern Baja California.  
*Ferocactus townsendianus* ..... San José Island, Baja California.  
*Ferocactus diguetii* ..... Santa Catalina and Cerralvo Islands, Baja  
California.  
*Thelocactus hexaedrophorus* .... Southern Tamaulipas.  
*Cochemia poselgeri* ..... Southern Baja California.  
*Neomammillaria arida* ..... Southern Baja California.  
*Neomammillaria peninsularis* .... Southern Baja California.  
*Neomammillaria standleyi* ..... Sierra de Alamos, Sonora.  
*Neomammillaria evermanniana* .. Cerralvo Island, Baja California.  
*Neomammillaria cerralboa* ..... Cerralvo Island, Baja California.  
*Neomammillaria mazatlanensis* .. Southern Sinaloa.  
*Neomammillaria slevinii* ..... San José Island, Baja California.  
*Neomammillaria armillata* ..... Southern Baja California.  
*Cuphea roseana* ..... Sinaloa.  
*Eugenia sinaloae* ..... Sinaloa.  
*Eugenia inconspicua* ..... Sinaloa.  
*Miconia saxicola* ..... Sinaloa.  
*Aralia scopulorum* ..... Southern Baja California.  
*Bumelia occidentalis* ..... Southern Baja California, Sonora.  
*Bumelia brandegei* ..... Southern Baja California.  
*Sideroxylon leucophyllum* ..... Southern Baja California.  
*Sideroxylon angustifolium* ..... Sonora, Sinaloa.  
*Maba intricata* ..... Southern Baja California.  
*Diospyros palmeri* ..... Tamaulipas, San Luis Potosí.



- Citellus insularis* ..... Espiritu Santo Island, Baja California.  
*Sciurus negligens* ..... Eastern San Luis Potosí, extreme north-  
 ern Veracruz, and southern Tamaulipas.  
*Sciurus sinaloensis* ..... Sinaloa.  
*Sciurus truei* ..... Sonora, Sinaloa.  
*Thomomys umbrinus atrovarius* .. Sinaloa, Nayarit.  
*Thomomys umbrinus musculus*... Sierra de Teponahuastla, Nayarit.  
*Thomomys bottae anitae*..... Southern Baja California.  
*Thomomys bottae magdaleneae* .. Santa Magdalena Island, southern Baja  
 California.  
*Thomomys simulus simulus*..... Southern Sonora.  
*Thomomys simulus parviceps*.... Western Durango.  
*Geomys personatus tropicalis*... Southern Tamaulipas.  
*Liomys pictus escuinapae* ..... Sinaloa, Nayarit, Jalisco.  
*Liomys pictus sonoranus*..... Sonora, Chihuahua, Durango, Sinaloa.  
*Liomys pictus plantinarenensis* ... Jalisco, Michoacán.  
*Liomys irroratus torridus*<sup>1</sup> .... Oaxaca, Guerrero, Morelos, Puebla.  
*Liomys irroratus minor*<sup>1</sup> ..... Guerrero, Oaxaca.  
*Perognathus arenarius albus*... Santa Magdalena Island, Baja California.  
*Perognathus arcnarius*  
*ammophilus* ..... Santa Margarita Island, Baja California.  
*Perognathus arcnarius siccus*... Cerralvo Island, Baja California.  
*Perognathus arenarius*  
*sublucidus* ..... Southern Baja California.  
*Perognathus spinatus*  
*peninsulae* ..... Southern Baja California.  
*Perognathus spinatus*  
*magdaleneae* ..... Santa Magdalena Island, Baja California.  
*Perognathus spinatus*  
*margaritae* ..... Santa Margarita Island, Baja California.  
*Perognathus spinatus bryanti* ... San José Island, Baja California.  
*Perognathus spinatus occultus* ... Carmen Island, Baja California.  
*Perognathus spinatus lambi* .... Espiritu Santo Island, Baja California.  
*Perognathus spinatus pullus* .... Coronados Island, Baja California.  
*Perognathus spinatus seorsus* .... Danzante Island, Baja California.  
*Perognathus spinatus*  
*latijugularis* ..... San Francisco Island, Baja California.  
*Perognathus pernix* ..... Southern Sinaloa, Nayarit.  
*Perognathus artus* ..... Chihuahua, Durango, Sinaloa.  
*Perognathus baileyi extimus*<sup>1</sup>... Southern Baja California.  
*Perognathus baileyi fornicatus*... Monserrate Island, Baja California.  
*Dipodomys merriami melanurus*.. Southern Baja California.  
*Dipodomys merriami margaritae*.. Santa Margarita Island, Baja California.  
*Dipodomys merriami insularis*... San José Island, Baja California.  
*Baiomys taylori paulus*<sup>1</sup>..... Chihuahua, Colima, Durango, Jalisco, Si-  
 naloa, Nayarit.  
*Peromyscus eremicus eva* ..... Southern Baja California.  
*Peromyscus eremicus insulicola*.. Espiritu Santo Island, Baja California.  
*Peromyscus eremicus avius* .... Cerralvo Island, Baja California.  
*Peromyscus eremicus polypholius*.. Santa Margarita Island, Baja California.  
*Peromyscus eremicus carmeni* .. Carmen Island, Baja California.  
*Peromyscus maniculatus*  
*margaritae* ..... Santa Margarita Island, Baja California.  
*Peromyscus maniculatus*  
*magdaleneae* ..... Santa Magdalena Island, Baja California.  
*Peromyscus sejugis* ..... Santa Cruz Island, Baja California.

- Peromyscus boylii simulus*..... Sinaloa, Nayarit.  
*Oryzomys peninsulæ* ..... Southern Baja California.  
*Sigmodon hispidus major*..... Southern Sonora, Sinaloa, Nayarit.  
*Sigmodon hispidus toltecus*<sup>2</sup>..... Puebla, San Luis Potosí, Tamaulipas,  
 Veracruz.  
*Neotoma micropus littoralis* .... Southern Tamaulipas.  
*Neotoma albigula melanura*<sup>1</sup> .... Sonora, southwestern Chihuahua.  
*Neotoma palatina* ..... Jalisco.  
*Neotoma lepida pretiosa* ..... Southwestern coast and adjacent islands  
 of Baja California.  
*Neotoma lepida arenacea* ..... Southern Baja California.  
*Neotoma lepida vicina* ..... Espiritu Santo Island, Baja California.  
*Neotoma lepida perpallida* ..... San José Island, Baja California.  
*Neotoma lepida abbreviata* ..... San Francisco Island, Baja California.  
*Neotoma lepida nudicauda* ..... Carmen Island, Baja California.  
*Neotoma mexicana sinaloae*<sup>3</sup>.... Sinaloa, Durango, Sonora.  
*Lepus alleni palitans*..... Southern Sonora, Sinaloa, northern Na-  
 yarit.  
*Lepus callotis altamirae* ..... Southern Tamaulipas.  
*Lepus californicus magdalenae* .. Santa Magdalena and Santa Margarita  
 Islands, Baja California.  
*Lepus californicus xanti*<sup>1</sup> ..... Southern Baja California.  
*Lepus insularis* ..... Espiritu Santo Island, Baja California.  
*Sylvilagus auduboni goldmani*<sup>1</sup>.. Southern Sonora, northern Sinaloa.  
*Sylvilagus cunicularius*  
*cunicularius*<sup>1</sup> ..... Michoacán and Hidalgo to Veracruz and  
 Oaxaca.  
*Sylvilagus cunicularius*  
*insolitus*<sup>4</sup> ..... Colima, Jalisco, Nayarit, Sinaloa.  
*Sylvilagus bachmani*  
*peninsularis*<sup>1</sup> ..... Southern Baja California.  
*Sylvilagus mansuetus* ..... San José Island, Baja California.  
*Odocoileus virginianus sinaloae*<sup>5</sup>. Durango, Jalisco, Michoacán, Nayarit,  
 Sinaloa.  
*Odocoileus virginianus*  
*veraecrucis*<sup>2</sup> ..... Puebla, Tamaulipas, Veracruz.

<sup>1</sup> Also Lower Sonoran Zone.<sup>2</sup> Also Humid Upper Tropical Subzone.<sup>3</sup> Also up through intermediate zones to Canadian Zone.<sup>4</sup> Also Arid Lower Tropical Subzone.<sup>5</sup> Also up through intermediate zones to Transition Zone.

#### Birds of Arid Upper Tropical Subzone:

- Crypturellus cinnamomeus*  
*occidentalis* ..... Southern Sinaloa, Nayarit.  
*Crypturellus cinnamomeus*  
*mexicanus* ..... Southern Tamaulipas, northern Veracruz,  
 eastern Puebla.  
*Colymbus dominicus*  
*brachypterus*<sup>1, 2</sup> ..... Southern Baja California, to Tamaulipas  
 and southward to Chiapas.  
*Butorides virescens frazari*..... Southern Baja California.  
*Dendrocygna autumnalis*  
*fulgens*<sup>1, 2</sup> ..... Tamaulipas.

- Dendrocygna autumnalis lucida*...Sinaloa and Nuevo León south to Chiapas.
- Cairina moschata*<sup>1, 2</sup> .....Southern Sinaloa and central Tamaulipas south along coasts to Chiapas.
- Geranospiza nigra livens*.....Southern Sonora.
- Falco albicularis petrophilus*....Sonora, Sinaloa.
- Ortalis vetula mcallii*.....Nuevo León, Tamaulipas, southeastern San Luis Potosí.
- Ortalis wagleri griseiceps*.....Southern Sonora, southwestern Chihuahua, northern Sinaloa.
- Lophortyx douglasii douglasii*...Southern Sonora, Sinaloa, northwestern Durango.
- Colinus virginianus maculatus*....Central Tamaulipas, south to eastern San Luis Potosí.
- Colinus virginianus insignis*<sup>2</sup>....Río Grande River Valley in interior of Chiapas.
- Rallus longirostris beldingi*.....Southern Baja California.
- Columba flavirostris*  
*flavirostris*<sup>1, 2</sup>, .....Southern Sonora, Nuevo León and Tamaulipas and southward along Atlantic and Pacific slopes to Yucatán and southern Chiapas.
- Zenaida asiatica asiatica*<sup>1, 2, 3</sup>....Tamaulipas south through Veracruz to southern Oaxaca and east to Yucatán and Quintana Roo.
- Zenaida asiatica mearnsi*<sup>2, 3</sup>.....Southern Baja California, Sonora, Nuevo León, San Luis Potosí, and southward to Guerrero, México, and Puebla.
- Scardafella inca*<sup>1, 2, 3</sup> .....Southern Baja California, Sonora, Chihuahua, Nuevo León, Tamaulipas, and southward along eastern and western coasts, excluding Yucatán, and over interior plains to southern Chiapas.
- Columbigallina passerina*  
*pallescens*<sup>1, 2, 3</sup> .....Southern Baja California, Sonora, Chihuahua, Nuevo León, Tamaulipas, and southward along coasts and over interior plains throughout México.
- Leptotila verreauxi*  
*angelica*<sup>1, 2</sup> .....Nuevo León, Tamaulipas, Veracruz, Puebla, and southern Sonora to Chiapas.
- Ara militaris mexicana*<sup>2</sup>.....Southern Tamaulipas and southern Sonora southward along Pacific slope to southern Oaxaca.
- Aratinga holochlora holochlora*<sup>1</sup>..Southwestern Chihuahua, Nuevo León, Tamaulipas, Veracruz, San Luis Potosí, Puebla, Guanajuato, México.
- Forpus cyanopygius pallidus*.....Southern Sonora.
- Amazona viridigalis* .....Nuevo León, Tamaulipas, Veracruz, San Luis Potosí.
- Amazona finschi woodi*<sup>2</sup>.....Southern Sonora, southwestern Chihuahua, to Oaxaca.
- Amazona ochrocephala oratrix*<sup>1, 2</sup>.Southern Tamaulipas and Veracruz to Yucatán and from Colima southward to Oaxaca.

- Amazona albifrons saltuensis* ....Southern Sonora.
- Piaya cayana mexicana* <sup>2</sup>.....Southern Sinaloa, south along Pacific slope to southern Oaxaca.
- Geococcyx velox affinis* <sup>1, 2</sup>.....Southern Sonora south along Pacific slope to southern Chiapas, and from central Veracruz to Yucatán.
- Crotophaga sulcirostris* <sup>1, 2</sup> .....Southern Baja California, southern Sinaloa and Tamaulipas southward along Atlantic and Pacific slopes to Yucatán and Chiapas.
- Tyto perlata pratincola* <sup>2, 3, 6</sup>.....Baja California and Sonora to Tamaulipas and south to Yucatán and Chiapas.
- Otus asio xantusi*.....Southern Baja California.
- Caprimulgus ridgwayi ridgwayi*..Sinaloa.
- Cyanthus sordidus* <sup>3</sup> .....Northern Sonora to Morelos, Puebla, and Oaxaca.
- Amazilia violiceps ellioti* <sup>3</sup>.....Southern Sonora, Sinaloa, Jalisco, Michoacán, Morelos, Guanajuato, Puebla, México.
- Amazilia violiceps violiceps* <sup>2</sup>.....Puebla, Morelos, Michoacán, Guerrero, Oaxaca.
- Amazilia beryllina beryllina* <sup>4</sup>.....Veracruz, Morelos, Oaxaca, Guanajuato.
- Amazilia beryllina viola*.....Sinaloa, Nayarit, Jalisco, Michoacán, Guerrero.
- Trogon elegans ambiguus*.....Sonora, Chihuahua and Tamaulipas, to Guerrero and Oaxaca.
- Momotus momota coeruliceps* <sup>4</sup>...Southern Nuevo León, southern Tamaulipas, northern Veracruz, eastern Puebla, eastern San Luis Potosí.
- Momotus mexicanus mexicanus*...Southern Sinaloa, western Durango, Nayarit, Jalisco, Colima, Michoacán, México, Puebla.
- Melanerpes chrysogenys*  
*chrysogenys* .....Southern Sonora to Nayarit.
- Melanerpes hypopolius hypopolius*.Interior valleys in Puebla, Morelos, Guerrero, Oaxaca.
- Melanerpes hypopolius*  
*urophygialis* <sup>3</sup> .....Sonora, Sinaloa, Jalisco, Durango, Nayarit.
- Melanerpes hypopolius brewsteri* <sup>3</sup>.Southern Baja California.
- Picus auricularis auricularis*....Southern Sinaloa, Jalisco, Guerrero,
- Picus aeruginosus* <sup>1</sup> .....Nuevo León, Tamaulipas, Veracruz, San Luis Potosí.
- Dryocopus lineatus similis* <sup>5</sup>.....Nuevo León, Tamaulipas, San Luis Potosí, Veracruz, Oaxaca, Yucatán.
- Dryocopus lineatus scapularis* <sup>2</sup>..Sonora, Sinaloa, Nayarit, Colima, Guerrero, and western Oaxaca.
- Dendrocopos scalaris percus*.....Chiapas Valley, Chiapas.
- Dendrocopos scalaris sinaloensis*..Sinaloa.
- Dendrocopos scalaris azelus* <sup>3</sup>....Michoacán, Oaxaca.
- Xiphorhynchus striatigularis* ....Southern Tamaulipas.
- Pachyramphus major*  
*urophygialis* .....Sinaloa.
- Platypsaris aglaiae albiventris* <sup>2</sup>..Southern Sonora and southwestern Chihuahua to Oaxaca.
- Progne sinaloae* .....Sinaloa.

- Corvus ossifragus imperatus*<sup>3</sup>.... Sonora, Nuevo León, Tamaulipas, San Luis Potosí, Sinaloa, Nayarit, Colima.
- Calocitta formosa collei*..... Southern Sonora, southwestern Chihuahua, western Jalisco, western Durango, Guanajuato.
- Psilorhinus morio* ..... Nuevo León, Tamaulipas, San Luis Potosí, Hidalgo, northern Veracruz.
- Cissolopha beccheii* ..... Southern Sonora, Sinaloa.
- Aphelocoma coerulescens hypoleuca* ..... Southern Baja California.
- Auriparus flaviceps flaviceps* ..... Southern Baja California, southern Sonora.
- Helcodytes brunneicapillus brunneicapillus* ..... Southern Sonora.
- Helcodytes brunneicapillus affinis* ..... Southern Baja California.
- Helcodytes jocosus gularis*..... Sinaloa, Sonora, southwestern Chihuahua, Jalisco.
- Thryothorus sinaloa sinaloa*<sup>2</sup>.... Southern Sinaloa, Jalisco, Colima, Nayarit.
- Thryothorus sinaloa cinereus*.... Southern Sonora, southwestern Chihuahua, western Durango.
- Toxostoma curvirostre maculatum* ..... Southern Sonora, southwestern Chihuahua,
- Catharus aurantiirostris clarus*... Chihuahua, Jalisco, Colima, Puebla, México, Morelos.
- Poliophtila nigriceps nigriceps*<sup>2</sup>... Southern Sonora to Oaxaca.
- Vireo solitarius lucasanus*..... Southern Baja California.
- Vireo hypochryseus hypochryseus*. Southwestern Chihuahua, Sinaloa, western Jalisco, northern Oaxaca.
- Compsothlypis pitiayumi pulchra*. Southwestern Chihuahua, Sinaloa, Jalisco.
- Geothlypis beldingi beldingi*..... Southern Baja California.
- Geothlypis flavovellata* ..... Southern Tamaulipas.
- Euthlypis lachrymosa tephra*.... Chihuahua, Sinaloa, Jalisco.
- Basileuterus rufifrons caudatus*... Chihuahua, Sonora.
- Basileuterus culicivorus brasherii* ..... Tamaulipas, San Luis Potosí.
- Basileuterus culicivorus flavescens* ..... Mountains of western Jalisco.
- Tanagra godmani*<sup>2</sup> ..... Sonora, Sinaloa, Nayarit, Colima, Guerrero.
- Piranga bidentata bidentata*..... Sinaloa, Jalisco, México.
- Piranga bidentata sanguinolenta*<sup>1</sup>. Nuevo León, Veracruz, Chiapas.
- Piranga erythrocephala erythrocephala* ..... Chihuahua, Sinaloa, Jalisco, México, Oaxaca.
- Habia rubica rosea*..... Nayarit.
- Cassidix mexicanus graysoni*.... Sinaloa.
- Icterus cucullatus californicus*<sup>3</sup>.. Baja California, Sonora, Chihuahua, Sinaloa, Nayarit.
- Icterus pustulatus pustulatus*<sup>2</sup>... Southern Sonora, southwestern Chihuahua, south to Oaxaca and Chiapas.
- Carpodacus mexicanus sonoriensis* ..... Sonora, southwestern Chihuahua.

- Carpodacus mexicanus ruberrimus* ..... Southern Baja California.
- Aimophila quinquestriata quinquestriata* ..... Sonora, Durango, Chihuahua, Jalisco.
- Aimophila rufescens pallida* ..... Sinaloa.
- Aimophila rufescens mcleodii* ..... Sonora, Chihuahua, Durango.
- Pipilo fuscus albigula* ..... Southern Baja California.
- Melospiza kieneri rubricatam* ..... Guerrero, Oaxaca, Puebla.
- Melospiza kieneri grisior* ..... Colima, Jalisco, Sinaloa, Durango, Nayarit.
- Arremonops rufivirgatus sinaloae* ..... Southern Sinaloa to southern Nayarit.
- Sporophila torqueola moreletii*<sup>1</sup>.. Tamaulipas and Nuevo León, south through eastern lowlands to Yucatán and Chiapas.
- Sporophila torqueola torqueola*<sup>2</sup>.. Southern Sinaloa, Nayarit, Jalisco, Colima, Guanajuato, Guerrero, Puebla.
- Cyanocompsa parellina parellina*<sup>1</sup> ..... Nuevo León, Tamaulipas, San Luis Potosí, Puebla, Veracruz, Tabasco, Yucatán.
- Cyanocompsa parellina indigotica*. Colima, Jalisco, Sinaloa, Oaxaca.
- Pheucticus chrysopeplus chrysopeplus* ..... Sinaloa, Durango, Jalisco, Colima, Puebla.
- Pyrhuloxia sinuata sinuata*<sup>3</sup>... Chihuahua, Sonora, Sinaloa, Durango.
- Pyrhuloxia sinuata peninsulae* ... Southern Baja California.
- Richmondia cardinalis igneus*... Southern Baja California.
- Richmondia cardinalis affinis*... Southern Sonora, northern Sinaloa, southwestern Chihuahua.
- Richmondia cardinalis sinaloensis* ..... Sinaloa.

<sup>1</sup> Also Humid Lower Tropical Subzone.

<sup>2</sup> Also Arid Lower Tropical Subzone.

<sup>3</sup> Also Lower Sonoran Zone.

<sup>4</sup> Also Humid Upper Tropical Subzone.

<sup>5</sup> Also Humid Lower Tropical and Arid Lower Tropical Subzone.

<sup>6</sup> Also Upper Sonoran Zone.

#### LOWER AUSTRAL ZONE

Many regions presenting many differing landscape aspects, embracing in the aggregate the greater part of the land surface in México, represent southern extensions of the Lower Sonoran or arid division of the Lower Austral Zone, as recognized in the southwestern United States. As these areas are subject to considerable modification toward the south and the term Lower Sonoran seems inappropriate, the name Lower Austral may be applied to the entire area. The Lower Austral Zone is typified by the low arid plains extending southward west of the mountains from the Arizona border in a strip narrowing to the coast in southern Sonora. It includes much of the tableland region and is the belt bordering the tropical areas along a general line determined by the regular occurrence of winter frosts of moderate severity

as far south as southern Chiapas. It is allied to the tropical areas, as shown by the invasion of representatives of many tropical species. Owing to complex local conditions this zone is not recognizable along the steep humid seaward slopes of mountains bordering the tableland, especially along the eastern side where colder conditions undoubtedly prevailed in the past. In some areas, as along the bordering slopes of the interior basin in Chiapas, conditions approach those of the Austroriparian or humid division of the Lower Austral Zone in the southeastern United States. It seems significant that the faunal and floral composition is similar so far south. Along canyons extending far back into the interior of the tableland of México tropical elements deeply interdigitate the Lower Austral Zone, and where slopes are gradual there may be extensive overlapping.

The altitudinal limits of the Lower Austral Zone in México vary greatly in accordance with latitude, slope exposure, and base level. In northern Baja California, Sonora, and in Tamaulipas it extends from sea level along the coasts to about 4,000 feet along northerly slopes and to about 4,500 feet on southerly slopes of mountains. Owing to high base level on the tableland of the interior this zone reaches from 4,000 to 6,000 feet on northerly slopes and from 5,000 to 7,000 feet on southerly exposures. Despite the inclusion of extreme desert areas this zone, owing to great extent and regional variations in conditions, is remarkably rich in number of species of plants and animals represented.

#### Plants of Lower Austral Zone:

<i>Pinus oocarpa</i> .....	Sinaloa to Chiapas.
<i>Ephedra trifurca</i> .....	Chihuahua, Sonora, Baja California.
<i>Ephedra antisiphilitica</i> .....	Coahuila.
<i>Ephedra compacta</i> .....	Puebla, Oaxaca.
<i>Ephedra pedunculata</i> .....	Chihuahua, San Luis Potosí, Zacatecas.
<i>Inodes mexicana</i> .....	Nayarit, Zacatecas, Oaxaca.
<i>Inodes texana</i> .....	Tamaulipas.
<i>Washingtonia sonorae</i> .....	Sonora, Baja California.
<i>Washingtonia filifera</i> .....	Baja California.
<i>Erythea armata</i> .....	Baja California.
<i>Brahea dulcis</i> .....	Sinaloa, Nueva León, Oaxaca.
<i>Yucca elata</i> .....	Chihuahua.
<i>Yucca rigida</i> .....	Chihuahua, Durango, Zacatecas.
<i>Yucca australis</i> .....	Coahuila, Tamaulipas, Querétaro.
<i>Yucca valida</i> .....	Southern Baja California.
<i>Nolina bigelovii</i> .....	Sonora, Baja California.
<i>Dasyllirion parryanum</i> .....	San Luis Potosí.
<i>Agave tequilana</i> .....	Jalisco.
<i>Agave atrovirens</i> .....	Oaxaca, Puebla, México, Distrito Federal.
<i>Agave macroacantha</i> .....	Puebla.

- Agave yaquiana* ..... Sonora.  
*Agave chihuahuana* ..... Chihuahua.  
*Agave weberi* ..... Coahuila, Nuevo León, Durango, San Luis Potosí.  
*Agave lecheguilla* ..... Chihuahua, Tamaulipas, Zacatecas.  
*Agave funkiana* ..... Nuevo León, Tamaulipas.  
*Agave horrida* ..... Morelos.  
*Agave nelsoni* ..... Baja California.  
*Agave cerulata* ..... Baja California.  
*Agave pedrosana* ..... Jalisco.  
*Agave collina* ..... Morelos.  
*Populus wislizeni* ..... Chihuahua, Sonora.  
*Atriplex linearis* ..... Baja California, Sonora.  
*Atriplex matamoricensis* ..... Tamaulipas.  
*Atriplex obovata* ..... Chihuahua to Zacatecas.  
*Celosia palmeri* ..... Coahuila, Nuevo León, San Luis Potosí.  
*Krameria palmeri* ..... Sonora, Sinaloa.  
*Krameria glandulosa* ..... Baja California, Chihuahua.  
*Krameria secundiflora* ..... Chihuahua and Coahuila to Oaxaca.  
*Krameria ramosissima* ..... Tamaulipas.  
*Krameria paucifolia* ..... Baja California, Sonora.  
*Krameria parvifolia* ..... Baja California, Sonora.  
*Prosopis cinerascens* ..... Tamaulipas, Nuevo León.  
*Prosopis pubescens* ..... Northern Baja California, Sonora, Chihuahua.  
*Mimosa malacophylla* ..... Chihuahua, Coahuila, Tamaulipas.  
*Mimosa pringlei* ..... Chihuahua.  
*Acacia constricta* ..... Sonora to Tamaulipas, Puebla, Zacatecas.  
*Acacia anisophila* ..... Coahuila.  
*Acacia berlandieri* ..... Coahuila, Nuevo León, Veracruz, Querétaro.  
*Acacia occidentalis* ..... Sonora, Sinaloa.  
*Acacia micrantha* ..... Tamaulipas, San Luis Potosí.  
*Calliandra californica* ..... Baja California.  
*Calliandra capillata* ..... Guerrero and Puebla to Chiapas.  
*Pithecolobium schaffneri* ..... San Luis Potosí.  
*Pithecolobium sonorae* ..... Sonora, Sinaloa.  
*Cassia macdougaliana* ..... San Luis Potosí to Puebla.  
*Cassia purpusi* ..... Baja California.  
*Cassia holwayana* ..... Puebla, Oaxaca, Chiapas.  
*Bauhinia andrieuxii* ..... Oaxaca.  
*Bauhinia uniflora* ..... Coahuila, San Luis Potosí.  
*Hoffmanseggia microphylla* ..... Baja California, Sonora.  
*Hoffmanseggia intricata* ..... Baja California, Sonora.  
*Hoffmanseggia melanosticta* ..... Coahuila to Querétaro.  
*Hoffmanseggia fruticosa* ..... Coahuila.  
*Caesalpinia gracilis* ..... Sonora.  
*Caesalpinia sessilifolia* ..... Coahuila and Durango.  
*Caesalpinia melanadenia* ..... Puebla and Oaxaca.  
*Caesalpinia palmeri* ..... Baja California, Sonora, Sinaloa.  
*Parkinsonia microphylla* ..... Baja California, Sonora.  
*Cercidium floridum* ..... Coahuila to Tamaulipas.  
*Cercidium torreyanum* ..... Sonora to Nayarit.  
*Indigofera konzattii* ..... Puebla, Oaxaca.  
*Indigofera palmeri* ..... Durango, Jalisco.

- Eysenhardtia polystachya* ..... Chihuahua and Sonora to Oaxaca and Tamaulipas.  
*Eysenhardtia texana* ..... Coahuila, Tamaulipas.  
*Dalea berlandieri* ..... Tamaulipas to San Luis Potosí.  
*Dalea calycosa* ..... Sonora, Chihuahua, Nuevo León.  
*Dalea orcuttii* ..... Northern Baja California.  
*Dalea spinosa* ..... Baja California, Sonora.  
*Dalea schottii* ..... Northern Baja California.  
*Dalea goldmani* ..... Sinaloa.  
*Dalea parryi* ..... Baja California, Sonora.  
*Dalea tehucana* ..... Puebla.  
*Dalea occidentalis* ..... Sonora and Sinaloa.  
*Dalea caudata* ..... San Luis Potosí.  
*Dalea wardii* ..... Tamaulipas to San Luis Potosí.  
*Dalea plumosa* ..... Chihuahua.  
*Dalea purpusi* ..... Baja California.  
*Dalea greggii* ..... Sonora to Coahuila, San Luis Potosí, Puebla, and Oaxaca.  
*Dalea hospes* ..... Nuevo León.  
*Dalea emoryi* ..... Baja California, Sonora.  
*Harpalyce goldmani* ..... Chiapas.  
*Brongniartia inconstans* ..... Michoacán, Jalisco.  
*Brongniartia nudiflora* ..... Jalisco.  
*Brongniartia lasiocarpa* ..... Puebla.  
*Brongniartia parryi* ..... San Luis Potosí.  
*Olneya tesota* ..... Baja California, Sonora.  
*Desmodium rubricaulis* ..... Jalisco.  
*Erythrina montana* ..... Durango to Jalisco.  
*Erythrina herbacea* ..... Tamaulipas, San Luis Potosí.  
*Erythrina flabelliformis* ..... Baja California, San Luis Potosí, Morelos.  
*Erythroxyton compactum* ..... Puebla.  
*Larrea tridentata* ..... Baja California and Sonora, to Tamaulipas and south to San Luis Potosí.  
*Viscainoa geniculata* ..... Baja California, Sonora.  
*Zanthoxylum bijugum* ..... Oaxaca.  
*Megastigma galeottii* ..... Puebla.  
*Koerberlinia spinosa* ..... Sonora to Tamaulipas, south to Hidalgo.  
*Holacantha emoryi* ..... Northern Sonora.  
*Bursera schaffneri* ..... San Luis Potosí.  
*Bursera arida* ..... Puebla.  
*Bursera microphylla* ..... Baja California, Sonora, Zacatecas, Morelos, Puebla.  
*Bursera odorata* ..... Baja California, Sonora, to Morelos and Puebla.  
*Bursera queretarensis* ..... Querétaro.  
*Bursera rhoifolia* ..... Baja California.  
*Cedrela ciliolata* ..... Michoacán.  
*Malpighia umbellata* ..... Sonora.  
*Bunchosia montana* ..... Oaxaca.  
*Mascagnia seleriana* ..... Oaxaca.  
*Janusia gracilis* ..... Baja California, Coahuila.  
*Janusia californica* ..... Baja California, Sonora, Sinaloa.  
*Euphorbia fulva* ..... Jalisco, Guanajuato, Oaxaca.  
*Euphorbia calyculata* ..... Michoacán, Guanajuato.

- Euphorbia xylopoda* ..... Oaxaca.  
*Euphorbia misera* ..... Baja California, Sonora.  
*Euphorbia tomentulosa* ..... Baja California, Sonora.  
*Euphorbia fruticulosa* ..... Coahuila.  
*Euphorbia magdalenae* ..... Baja California.  
*Euphorbia tricolor* ..... Puebla.  
*Phyllanthus tequilensis* ..... Jalisco.  
*Phyllanthus subcuneatus* ..... Puebla.  
*Croton californicus* ..... Baja California, Sonora, Sinaloa.  
*Croton neomexicanus* ..... Chihuahua, Nuevo León.  
*Croton suaveolens* ..... Chihuahua, Coahuila, San Luis Potosí.  
*Croton corymbulosus* ..... Sonora, Chihuahua, Coahuila.  
*Ditaxis lanceolata* ..... Baja California, Sonora.  
*Ditaxis brandegei* ..... Baja California, Sonora.  
*Ditaxis palmeri* ..... Sonora.  
*Acalypha longestipularis* ..... Oaxaca.  
*Acalypha dioica* ..... Nuevo León.  
*Acalypha californica* ..... Baja California, Sonora.  
*Acalypha papillosa* ..... Sonora.  
*Acalypha pringlei* ..... Sonora.  
*Jatropha palmeri* ..... Sonora.  
*Jatropha angustidens* ..... Baja California, Sonora, Tamaulipas,  
Guerrero.  
*Jatropha cardiophylla* ..... Sonora.  
*Simmondsia chinensis* ..... Baja California, Sonora.  
*Pachycormus discolor* ..... Baja California.  
*Serjania heterocarpa* ..... Oaxaca.  
*Serjania brachycarpa* ..... Tamaulipas.  
*Serjania palmeri* ..... Sonora.  
*Serjania rutaefolia* ..... Sonora.  
*Zizyphus sonorensis* ..... Baja California, Sonora, to Jalisco and  
Oaxaca.  
*Condalia obovata* ..... Nuevo León, Tamaulipas.  
*Condalia spathulata* ..... Baja California, Sonora, Sinaloa, Coa-  
huila, Tamaulipas, to Zacatecas.  
*Condalia parryi* ..... Baja California.  
*Condalia obtusifolia* ..... Tamaulipas.  
*Condalia lycioides* ..... Baja California, Chihuahua, Nuevo León,  
San Luis Potosí, Zacatecas.  
*Colubrina californica* ..... Baja California.  
*Colubrina glabra* ..... Sonora.  
*Colubrina glomerata* ..... Baja California, Chihuahua, Guanajuato,  
Puebla, Oaxaca.  
*Sageretia wrightii* ..... Sonora to Jalisco.  
*Tilia floridana* ..... Chihuahua, Coahuila, Nuevo León.  
*Tilia occidentalis* ..... Michoacán, Guerrero.  
*Tilia houghi* ..... Morelos.  
*Abutilon percaudatum* ..... San Luis Potosí.  
*Abutilon wrightii* ..... Sonora, Coahuila.  
*Abutilon simulans* ..... Morelos.  
*Abutilon glabriflorum* ..... Tamaulipas.  
*Abutilon hypoleuca* ..... Coahuila, San Luis Potosí, Puebla.  
*Hibiscus coulteri* ..... Sonora, Chihuahua, Hidalgo.  
*Thurberia thespesioides* ..... Sonora, Chihuahua, Jalisco.  
*Ternstroemia pringlei* ..... Michoacán, Morelos.

- Idria columnaris* .....Baja California.  
*Fouquieria splendens* .....Baja California, Sonora, Chihuahua, Coahuila.  
*Fouquieria purpusii* .....Oaxaca.  
*Fouquieria fasciculata* .....Durango, Querétaro, Hidalgo.  
*Fouquieria formosa* .....Jalisco, Morelos, México, Oaxaca.  
*Fouquieria macdougalii* .....Sonora.  
*Fouquieria peninsularis* .....Baja California.  
*Peresklopsis velutina* .....Querétaro.  
*Peresklopsis diguetii* .....Jalisco.  
*Opuntia arbuscula* .....Sonora.  
*Opuntia thurberi* .....Sonora, Sinaloa.  
*Opuntia basilaris* .....Sonora.  
*Opuntia clavellina* .....Baja California.  
*Opuntia imbricata* .....Central and northern México.  
*Cephalocereus leucocephalus* .....Sonora.  
*Pachycereus pringlei* .....Baja California, Sonora.  
*Pachycereus marginatus* .....Hidalgo, Querétaro, Guanajuato.  
*Pachycereus ruficeps* .....Puebla.  
*Lemaireocereus treleasii* .....Oaxaca.  
*Lemaireocereus weberi* .....Puebla.  
*Lemaireocereus queretaroensis* ...Querétaro.  
*Lemaireocereus thurberi* .....Baja California, Sonora.  
*Lemaireocereus dumortieri* .....Morelos, Hidalgo.  
*Machaerocereus gummosus* .....Baja California.  
*Machaerocereus eruca* .....Southern Baja California.  
*Wilcoxia poselgeri* .....Coahuila.  
*Wilcoxia striata* .....Baja California, Sonora.  
*Acanthocereus subinermis* .....Oaxaca.  
*Carnegiea gigantea* .....Sonora.  
*Lophocereus schottii* .....Baja California, Sonora.  
*Myrtillocactus geometrizans* .... San Luis Potosí to Oaxaca.  
*Myrtillocactus cochal* .....Baja California.  
*Selenicereus spinulosus* .....Tamaulipas.  
*Echinocereus delaetii* .....Coahuila.  
*Echinocereus salm-dyckianus* ...Chihuahua.  
*Echinocereus subinermis* .....Chihuahua.  
*Echinocereus blanckii* .....Tamaulipas.  
*Echinocereus scopulorum* .....Sonora, Sinaloa.  
*Echinocereus amoenus* .....San Luis Potosí.  
*Echinocereus palmeri* .....Chihuahua.  
*Echinocereus brandegeei* .....Baja California.  
*Echinocereus engelmannii* .....Baja California, Sonora.  
*Ariocarpus fissuratus* .....Coahuila, Zacatecas.  
*Lophophora williamsii* .....Central and northeastern México.  
*Ferocactus pringlei* .....Coahuila.  
*Ferocactus wislizeni* .....Sonora, Sinaloa, Chihuahua.  
*Ferocactus horridus* .....Baja California.  
*Ferocactus lecontei* .....Baja California, Sonora.  
*Ferocactus orcuttii* .....Northern Baja California.  
*Ferocactus robustus* .....Puebla.  
*Ferocactus echidne* .....Tamaulipas to Hidalgo.  
*Ferocactus alamosanus* .....Sonora.  
*Ferocactus flavovirens* .....Puebla.  
*Ferocactus hamatacanthus* .....Northern México.

- Echinomastus intertextus* ..... Northern México.  
*Echinomastus unguispinus* ..... Chihuahua.  
*Echinocactus grandis* ..... Puebla.  
*Echinocactus polycephalus* ..... Northern Sonora.  
*Astrophytum asterias* ..... Tamaulipas, Nuevo León.  
*Ancistrocactus megarhizus* ..... Tamaulipas.  
*Thelocactus rinconensis* ..... Nuevo León.  
*Thelocactus lophothele* ..... Chihuahua.  
*Coryphantha poselgeriana* ..... Coahuila, Zacatecas.  
*Coryphantha exsudans* ..... Hidalgo.  
*Coryphantha robustispina* ..... Sonora.  
*Coryphantha connivens* ..... Distrito Federal.  
*Coryphantha pallida* ..... Puebla.  
*Coryphantha pycnacantha* ..... Oaxaca.  
*Coryphantha durangensis* ..... Durango.  
*Escobaria dasyacantha* ..... Northern Chihuahua.  
*Escobaria chihuahuensis* ..... Chihuahua.  
*Escobaria runyonii* ..... Tamaulipas.  
*Dolichothele longimamma* ..... Tamaulipas and central México.  
*Neomammillaria brandegeei* ..... Baja California.  
*Neomammillaria magnimamma* .. Central México.  
*Neomammillaria melanocentra* .. Nuevo León.  
*Neomammillaria denudata* ..... Coahuila.  
*Neomammillaria lenta* ..... Coahuila.  
*Neomammillaria sheldonii* ..... Sonora.  
*Cuphea micropetala* ..... Colima to Morelos and Oaxaca.  
*Cuphea watsoniana* ..... Jalisco.  
*Hauya barcenae* ..... Oaxaca.  
*Xylonagra arborea* ..... Baja California.  
*Bumelia spiniflora* ..... Tamaulipas, Nuevo León.  
*Forestiera angustifolia* ..... Nuevo León, Coahuila, Tamaulipas.  
*Forestiera tomentosa* ..... Jalisco.  
*Buddleia marrubiiifolia* ..... Chihuahua, Coahuila, Nuevo León, Zacatecas.  
*Buddleia chapalana* ..... Jalisco.  
*Ipomoea murucoides* ..... Querétaro, Puebla, México, Michoacán, Oaxaca.  
*Ipomoea intrapilosa* ..... Sonora, Durango, Jalisco, Zacatecas, Morelos.  
*Cordia greggii* ..... Baja California, Sinaloa, Durango, Coahuila, Zacatecas.  
*Cordia boissieri* ..... Coahuila and Tamaulipas, to San Luis Potosí.  
*Cordia morelosana* ..... Morelos.  
*Cordia podocephala* ..... Nuevo León, Tamaulipas.  
*Lippia ligustrina* ..... Sonora, Nuevo León, Zacatecas, Puebla.  
*Lippia wrightii* ..... Sonora, Coahuila, Durango, Zacatecas.  
*Lippia appendiculata* ..... Coahuila, Durango.  
*Lantana macropoda* ..... Chihuahua, Coahuila, Durango.  
*Salvia lantanaefolia* ..... Puebla.  
*Salvia nelsonii* ..... Puebla, Morelos, Guerrero.  
*Salvia confinis* ..... Sonora.  
*Salvia californica* ..... Baja California.  
*Salvia thymoides* ..... Oaxaca.  
*Salvia coahuilensis* ..... Coahuila.  
*Hyptis nelsonii* ..... Jalisco.

- Hyptis rhytidea* ..... Sinaloa and Durango to Jalisco and Aguascalientes.
- Hyptis albida* ..... Sonora and Chihuahua to San Luis Potosí, Guanajuato, and Guerrero.
- Hyptis emoryi* ..... Baja California, Sonora, Nayarit, Sonora.
- Lycium macrodon* ..... Sonora.
- Lycium schaffneri* ..... San Luis Potosí, Zacatecas.
- Lycium exsertum* ..... Sonora.
- Lycium gracilipes* ..... Sonora.
- Lycium carinatum* ..... Sonora.
- Lycium berlandieri* ..... Baja California, Nuevo León, Durango.
- Lycium torreyi* ..... Chihuahua.
- Solanum hindsianum* ..... Baja California, Sonora.
- Chilopsis linearis* ..... Baja California, Sonora, Tamaulipas, Durango, Zacatecas.
- Anisacanthus thurberi* ..... Sonora, Chihuahua.
- Anisacanthus wrightii* ..... Sonora to Tamaulipas and Zacatecas.
- Randia pringlei* ..... Coahuila.
- Baccharis texana* ..... Tamaulipas.
- Baccharis neglecta* ..... Chihuahua, Coahuila, Durango.
- Baccharis sarothroides* ..... Sonora, Sinaloa, Baja California.
- Baccharis conferta* ..... San Luis Potosí, Puebla, Veracruz, Morelos.
- Baccharis glutinosa* ..... Tamaulipas, Sonora, and Baja California south to Oaxaca.
- Pluchea sericea* ..... Sonora, Chihuahua, Baja California.
- Parthenium argentatum* ..... Coahuila, Durango, Zacatecas, San Luis Potosí.
- Parthenium incanum* ..... Sonora, Coahuila, south to Hidalgo.
- Hymenoclea monogyra* ..... Baja California, Sonora, Sinaloa, Chihuahua.
- Hymenoclea salsola* ..... Northern Baja California, Sonora.
- Hymenoclea pentalepis* ..... Baja California, Sonora.
- Franseria ilicifolia* ..... Baja California.
- Franseria bryantii* ..... Baja California.
- Franseria acuminata* ..... Baja California.
- Franseria hispida* ..... Baja California.
- Franseria dumosa* ..... Baja California, Sonora.
- Franseria cordifolia* ..... Sonora, Sinaloa, San Luis Potosí.
- Franseria deltoidea* ..... Sonora.
- Franseria ambrosioides* ..... Baja California, Sonora, Sinaloa, Durango.
- Flourensia cernua* ..... Sonora, Nuevo León, Zacatecas, San Luis Potosí.
- Flourensia collodes* ..... Chiapas.
- Flourensia pringlei* ..... Chihuahua.
- Flourensia microphylla* ..... Coahuila.
- Flourensia resinosa* ..... Hidalgo.
- Encelia farinosa* ..... Baja California, Sonora, Sinaloa.
- Zexmenia michoacana* ..... Michoacán.
- Zexmenia fasciculata* ..... Sinaloa, Chihuahua, Tamaulipas, Jalisco, San Luis Potosí.
- Zexmenia pringlei* ..... Puebla.
- Senecio lemmoni* ..... Northern Baja California.
- Senecio eriophyllus* ..... Oaxaca.
- Senecio acerifolius* ..... Oaxaca.
- Senecio velatus* ..... Jalisco.

## Mammals of Lower Austral Zone:

- Didelphis marsupialis texensis*....Tamaulipas.  
*Marmosa canescens oaxacae*.....Oaxaca.  
*Cryptotis berlandieri*.....Tamaulipas.  
*Cryptotis pergracilis pergracilis*..Jalisco.  
*Macrotus californicus*.....Baja California, Sonora.  
*Pipistrellus hesperus hesperus*...Northeastern Baja California, Sonora.  
*Antrozous pallidus pallidus*.....Sonora.  
*Procyon lotor fuscipes*.....Coahuila, Nuevo León, Tamaulipas.  
*Procyon lotor pallidus*.....Northeastern Baja California, northwestern Sonora.  
*Nasua narica tamaulipensis*.....Nuevo León, Tamaulipas.  
*Conepatus sonoriensis*.....Southern Sonora.  
*Taxidea taxus sonoriensis*.....Southern Sonora.  
*Felis pardalis sonoriensis*.....Sonora.  
*Felis pardalis albescens*.....Tamaulipas.  
*Citellus variegatus variegatus*<sup>1</sup>..Colima, Guanajuato, Jalisco, Michoacán, Morelos, San Luis Potosí.  
*Citellus variegatus rupestris*<sup>1</sup>...Chihuahua, Durango, Sinaloa, Sonora.  
*Citellus variegatus couchii*<sup>1</sup>....Coahuila, Nuevo León, Tamaulipas.  
*Citellus variegatus grammurus*<sup>1</sup>..Chihuahua, Sonora.  
*Citellus beecheyi rupinarum*....Baja California.  
*Citellus atricapillus*.....Southern Baja California.  
*Citellus harrisi harrisi*.....Sonora.  
*Citellus harrisi saxicola*.....Northwestern Sonora.  
*Citellus leucurus leucurus*.....Northeastern Baja California.  
*Citellus leucurus canfieldae*....Central Baja California.  
*Citellus leucurus extimus*<sup>2</sup>....Southern Baja California.  
*Citellus interpres*.....Coahuila.  
*Citellus tereticaudus*  
*tereticaudus*.....Northeastern Baja California.  
*Citellus tereticaudus neglectus*..Northwestern Sonora.  
*Citellus tereticaudus apricus*...Trinidad Valley, Northern Baja California.  
*Citellus mexicanus mexicanus*<sup>1</sup>..Guanajuato, Jalisco, México, Puebla, Querétaro, Tlaxcala.  
*Citellus mexicanus parvidens*...Coahuila, Nuevo León, Tamaulipas.  
*Citellus spilosoma spilosoma*....Aguascalientes, Durango, San Luis Potosí, Zacatecas.  
*Citellus spilosoma pallescens*...Chihuahua, Coahuila, Nuevo León, San Luis Potosí, Zacatecas.  
*Citellus spilosoma canescens*...Northern Chihuahua.  
*Cynomys mexicanus*.....Coahuila.  
*Eutamias merriami meridionalis*..Central Baja California.  
*Sciurus niger limitis*.....Nuevo León, Coahuila.  
*Thomomys umbrinus goldmani*..Durango.  
*Thomomys umbrinus perditus*..Coahuila, Nuevo León.  
*Thomomys umbrinus sonoriensis*..Northern Sonora.  
*Thomomys umbrinus eximius*...Sierra de Choix, Sinaloa.  
*Thomomys bottae modicus*.....Northern Sonora.  
*Thomomys bottae estanciae*.....Northern Sonora.  
*Thomomys bottae phasma*.....Northwestern Sonora.  
*Thomomys bottae winthropi*....Central Sonora.  
*Thomomys bottae divergens*....Northeastern Sonora.

- Thomomys bottae convergens* ... Central western Sonora.  
*Thomomys bottae sinaloae* ..... Sinaloa, Sonora.  
*Thomomys bottae abbotti* ..... Northern Baja California.  
*Thomomys bottae russeolus* ..... Central Baja California.  
*Thomomys baileyi mearnsi* ..... Northwestern Chihuahua.  
*Thomomys baileyi nelsoni* ..... Durango, Chihuahua.  
*Thomomys umbrinus analogus*<sup>1</sup>.. Coahuila.  
*Cratogeomys castanops clarkii* .. Northern Chihuahua.  
*Cratogeomys castanops consitus*.. Chihuahua.  
*Cratogeomys castanops tamaulipensis* ..... Tamaulipas, Nuevo León, Coahuila.  
*Cratogeomys castanops convexus* ..... Northeastern Coahuila.  
*Cratogeomys castanops excelsus* ..... Coahuila.  
*Cratogeomys castanops subsimus* ..... Coahuila.  
*Cratogeomys castanops subnubilus*<sup>1</sup> ..... Coahuila.  
*Cratogeomys castanops planifrons* ..... Southern Tamaulipas.  
*Cratogeomys castanops peridoneus* ..... San Luis Potosí.  
*Cratogeomys castanops saccharalis* ..... Puebla.  
*Cratogeomys fulvescens fulvescens* ..... Puebla.  
*Cratogeomys fulvescens subluteus* ..... Veracruz.  
*Pappogeomys bulleri bulleri* .... Sierra de Mascota, Jalisco.  
*Pappogeomys bulleri albinasus* .. Jalisco.  
*Pappogeomys bulleri nayaritensis* ..... Nayarit.  
*Pappogeomys bulleri flammeus* .. Jalisco.  
*Platygeomys gymmurus gymmurus* ..... Jalisco.  
*Platygeomys varius* ..... Michoacán.  
*Platygeomys zinseri* ..... Jalisco, Guanajuato.  
*Liomys irroratus irroratus* ..... Oaxaca.  
*Liomys irroratus torridus*<sup>2</sup> .... Oaxaca, Guerrero, Morelos, Puebla.  
*Liomys irroratus minor*<sup>2</sup> ..... Guerrero, Oaxaca.  
*Liomys irroratus alleni*<sup>1</sup> ..... Widely distributed over central table-lands.  
*Liomys irroratus texensis* ..... Nuevo León, Tamaulipas.  
*Liomys irroratus canus*<sup>1</sup> ..... Chihuahua, Durango, Zacatecas.  
*Liomys irroratus jalicensis*<sup>1</sup> .... Jalisco, Michoacán.  
*Perognathus longimembris bombycinus* ..... Northeastern Baja California.  
*Perognathus baileyi baileyi* .... Sonora.  
*Perognathus baileyi rudinoris* .. Baja California.  
*Perognathus baileyi hueyi* ..... Northeastern Baja California.  
*Perognathus baileyi extimus*<sup>2</sup> ... Southern Baja California.  
*Perognathus penicillatus angustirostris* ..... Northeastern Baja California.  
*Perognathus penicillatus seri* .... Tiburón Island, Sonora.

- Perognathus penicillatus pricei* ..... Sonora.  
*Perognathus penicillatus minimus* ..... Turner Island, Sonora.  
*Perognathus arenarius arenarius* ..... Central Baja California.  
*Perognathus arenarius albescens* ..... Northeastern Baja California.  
*Perognathus arenarius helleri* .. Northwestern Baja California.  
*Perognathus arenarius ambiguus* ..... Central Baja California.  
*Perognathus fallax pallidus* .... Baja California.  
*Perognathus fallax inopinus* .... Baja California.  
*Perognathus anthonyi* ..... Cedros Island, Baja California.  
*Perognathus spinatus spinatus* ... Northeastern and central Baja California.  
*Perognathus spinatus guardiaae* .. Angel de la Guarda Island, Baja California.  
  
*Perognathus spinatus marcosensis* ..... San Marcos Island, Baja California.  
*Perognathus spinatus evermanni* ..... Mejía Island, Baja California.  
*Perognathus formosus cinerascens* ..... Northeastern Baja California.  
*Perognathus flavus flavus* ..... Chihuahua.  
*Perognathus flavus mexicanus*<sup>1</sup> .. Guanajuato, Hidalgo, Jalisco, México, San Luis Potosí, Zacatecas.  
  
*Perognathus flavus sonoriensis* ..... Sonora.  
*Perognathus pernix rostratus* ... Southern Sonora, northern Sinaloa.  
*Perognathus nelsoni nelsoni*<sup>1</sup> .. Aguascalientes, Coahuila, Durango, Jalisco, San Luis Potosí, Zacatecas.  
  
*Perognathus nelsoni canescens* .. Coahuila.  
*Perognathus intermedius intermedius* ..... Chihuahua.  
*Perognathus goldmani* ..... Southern Sonora, northern Sinaloa.  
*Dipodomys spectabilis spectabilis*. Chihuahua.  
*Dipodomys spectabilis zygomaticus* ..... Southern Chihuahua.  
*Dipodomys spectabilis cratodon* .. Aguascalientes.  
*Dipodomys spectabilis perblandus* ..... Northern Sonora.  
*Dipodomys nelsoni* ..... Coahuila.  
*Dipodomys merriami atronasus* .. San Luis Potosí.  
*Dipodomys merriami merriami* .. Northern Sonora, Chihuahua.  
*Dipodomys merriami mayensis* .. Southern Sonora.  
*Dipodomys merriami atronasus* ..... San Luis Potosí.  
*Dipodomys merriami arenivagus* ..... Northeastern Baja California.  
*Dipodomys merriami platycephalus* ..... Central Baja California.  
*Dipodomys merriami mitchelli* .. Tiburón Island, Sonora.  
*Dipodomys ordii ordii* ..... Chihuahua, Coahuila, Tamaulipas.  
*Dipodomys ordii palmeri* ..... San Luis Potosí.

- Dipodomys agilis peninsularis* ...Central Baja California.  
*Dipodomys deserti deserti* .....Northeastern Baja California.  
*Dipodomys deserti sonoriensis* ...Sonora.  
*Onychomys leucogaster*  
*albescens* .....Chihuahua.  
*Onychomys leucogaster*  
*longipes* .....Nuevo León, Tamaulipas.  
*Onychomys torridus torridus* ...Northern Sonora, northern Chihuahua.  
*Onychomys torridus yakiensis* ...Southern Sonora.  
*Onychomys torridus canus* .....Zacatecas, Aguascalientes, San Luis Potosí.  
*Onychomys torridus surrufus* ...Tamaulipas.  
*Onychomys torridus pulcher* ....Northeastern Baja California.  
*Reithrodontomys megalotis*  
*megalotis* .....Northeastern Baja California, northern Sonora, Chihuahua to Zacatecas.  
*Reithrodontomys fulvescens*  
*fulvescens* .....Sonora, Chihuahua, Durango.  
*Reithrodontomys fulvescens*  
*intermedius* .....Tamaulipas.  
*Reithrodontomys fulvescens*  
*helvulus* .....Oaxaca, Guerrero.  
*Reithrodontomys fulvescens*  
*chiapensis* .....Chiapas.  
*Reithrodontomys levipes* .....Jalisco.  
*Reithrodontomys hirsutus* .....Jalisco.  
*Baiomys taylori taylori* .....Nuevo León, Tamaulipas.  
*Baiomys taylori paulus*<sup>2</sup> .....Chihuahua, Colima, Durango, Jalisco, Sinaloa, Nayarit.  
*Baiomys taylori analogus*<sup>2</sup> .....Jalisco, México, Michoacán, Nayarit.  
*Baiomys musculus nigrescens*<sup>3</sup> ..Chiapas.  
*Peromyscus eremicus eremicus* ..Northeastern and central Baja California, northwestern Sonora, Chihuahua, Coahuila, Durango.  
*Peromyscus eremicus*  
*cedrosensis* .....Cedros Island, Baja California.  
*Peromyscus eremicus anthonyi* ..Chihuahua, Sonora, Sinaloa.  
*Peromyscus eremicus*  
*tiburónensis* .....Tiburón Island, Sonora.  
*Peromyscus eremicus phacurus* ..Coahuila, Nuevo León, San Luis Potosí, Zacatecas.  
*Peromyscus eremicus*  
*papagensis* .....Pinacate Mountains, Sonora.  
*Peromyscus guardia* .....Angel de la Guarda Island, Baja California.  
*Peromyscus guardia mejiae* ....Mejía Island, Baja California.  
*Peromyscus guardia*  
*interparietalis* .....San Lorenzo Island, Baja California.  
*Peromyscus stephani* .....San Esteban Island, Baja California.  
*Peromyscus dickeyi* .....Tortuga Island, Baja California.  
*Peromyscus pembertoni* .....San Pedro Nolasco Island, Sonora.  
*Peromyscus goldmani* .....Southern Sonora.  
*Peromyscus maniculatus*  
*blandus* .....Chihuahua and Tamaulipas to Zacatecas.

- Peromyscus maniculatus fulvus*<sup>1</sup> ..... Hidalgo, México, Oaxaca, Tlaxcala, Veracruz.
- Peromyscus maniculatus labecula*<sup>1</sup> ..... Jalisco and Nayarit to Zacatecas.
- Peromyscus maniculatus sonoriensis*<sup>1</sup> ..... Baja California, Sonora.
- Peromyscus maniculatus hueyi* .. Ganzaga Bay, northeastern Baja California.
- Peromyscus maniculatus coolidgei* ..... Baja California.
- Peromyscus maniculatus geronimensis* ..... San Gerónimo Island, Baja California.
- Peromyscus maniculatus cineritius* ..... San Roque Island, Baja California.
- Peromyscus maniculatus martinensis* ..... San Martín Island, Baja California.
- Peromyscus maniculatus dorsalis* ..... Natividad Island, Baja California.
- Peromyscus leucopus tornillo*<sup>1</sup> .. Chihuahua, Durango.
- Peromyscus leucopus texanus* ... Tamaulipas, Nuevo León.
- Peromyscus boylii spicilegus*<sup>1</sup> ... Sonora and Chihuahua to Colima and Zacatecas.
- Peromyscus pectoralis pectoralis* ..... Jalisco, Nuevo León, Querétaro, San Luis Potosí, Tamaulipas Zacatecas.
- Peromyscus pectoralis eremicoides* ..... Chihuahua, Coahuila, Durango, Nuevo León, Tamaulipas.
- Peromyscus pectoralis laceianus* ..... Coahuila.
- Peromyscus truei truei*<sup>1</sup> ..... Chihuahua.
- Peromyscus melanophrys zamorae* ..... Hidalgo, Michoacán.
- Peromyscus melanophrys consobrinus* ..... Aguascalientes, Guanajuato, Jalisco, San Luis Potosí, Zacatecas.
- Peromyscus crinitus stephensi* ... Northeastern Baja California.
- Peromyscus crinitus pallidissimus* ..... Northeastern Baja California.
- Oryzomys couesi aquaticus* .... Tamaulipas.
- Oryzomys couesi albiventer* .... Jalisco.
- Oryzomys couesi peragrus* ..... Eastern San Luis Potosí.
- Sigmodon hispidus berlandieri* .. Chihuahua, Coahuila, Jalisco, Nuevo León, Tamaulipas, San Luis Potosí, Querétaro, Zacatecas.
- Sigmodon hispidus cremicus* .... Northeastern Baja California.
- Sigmodon melanotis* ..... Lake Pátzcuaro, Michoacán.
- Neotoma micropus canescens* ... Coahuila.
- Neotoma micropus planiceps* .... Southern San Luis Potosí.
- Neotoma albigula albigula* .... Sonora, Chihuahua, Coahuila, Durango.
- Neotoma albigula venusta* ..... Colorado River Valley in northeastern Baja California, and northwestern Sonora.
- Neotoma albigula leucodon*<sup>1</sup> .... Plateau region Nuevo León south to Hidalgo.

- Neotoma albigula melanura*<sup>2</sup> .... Sonora, southwestern Chihuahua.  
*Neotoma albigula latifrons* .... Michoacán.  
*Neotoma albigula seri* ..... Tiburón Island, Sonora.  
*Neotoma varia* ..... Turner Island, Sonora.  
*Neotoma lepida intermedia*<sup>1</sup> .... Northwestern Baja California.  
*Neotoma lepida gilva* ..... Northern Baja California.  
*Neotoma lepida felipensis* ..... Northeastern Baja California.  
*Neotoma lepida ravidata*<sup>2</sup> ..... Central Baja California.  
*Neotoma lepida insularis* ..... Angel de la Guarda Island, Baja California.  
*Neotoma lepida marcosensis* .... San Marcos Island, Baja California.  
*Neotoma lepida bryanti* ..... Cedros Island, Baja California.  
*Neotoma goldmani* ..... Coahuila.  
*Neotoma ferruginea ochracea* .. Jalisco.  
*Teanopus phenax* ..... Southern Sonora.  
*Hodomys vetulus vetulus*<sup>2</sup> .... Guerrero, Michoacán, Morelos, Puebla.  
*Hodomys vetulus elatturus* .... Guerrero.  
*Ondatra zibethica bernardi* ..... Colorado River Valley in northeastern Baja California and northwestern Sonora.  
*Lepus alleni alleni* ..... Sonora.  
*Lepus callotis callotis*<sup>1</sup> ..... Durango, Zacatecas, San Luis Potosí, Jalisco, Michoacán, Guanajuato, Hidalgo, Morelos, Puebla, Oaxaca.  
*Lepus californicus deserticola* ... Northeastern Baja California.  
*Lepus californicus eremicus* .... Chihuahua, Sonora.  
*Lepus californicus texianus*<sup>1</sup> .... Chihuahua, Durango.  
*Lepus californicus merriami* .... Tamaulipas, Nuevo León, Coahuila.  
*Lepus californicus asellus*<sup>1</sup> ..... Coahuila, Nuevo León, San Luis Potosí, Aguascalientes, Zacatecas.  
*Lepus californicus martirensis*<sup>4</sup> .. Baja California.  
*Lepus californicus xanti*<sup>2</sup> ..... Southern Baja California.  
*Sylvilagus floridanus chapmani*... Tamaulipas, Nuevo León, Coahuila.  
*Sylvilagus floridanus subcinctus* ..... Jalisco, Michoacán.  
*Sylvilagus floridanus restrictus*<sup>5</sup> ..... Jalisco, Michoacán, Nayarit.  
*Sylvilagus floridanus chiapensis*<sup>4</sup> ..... Chiapas.  
*Sylvilagus audubonii confinis*.... Southern Baja California.  
*Sylvilagus audubonii arizonae*.... Northeastern Baja California, northern Sonora.  
*Sylvilagus audubonii goldmani*<sup>2</sup>.. Southern Sonora, northern Sinaloa.  
*Sylvilagus audubonii minor*<sup>1</sup>.... Chihuahua, Durango.  
*Sylvilagus audubonii parvulus*<sup>1</sup>.. Coahuila and Tamaulipas to Puebla and Veracruz.  
*Sylvilagus bachmani exiguus*<sup>1</sup> .. Central Baja California.  
*Sylvilagus bachmani peninsularis*<sup>2</sup> ..... Southern Baja California.  
*Pecari angulatus angulatus* .... Coahuila, Nuevo León, Tamaulipas.  
*Pecari angulatus sonoriensis*<sup>2</sup> .. Sonora, Sinaloa, western Durango.  
*Odocoileus virginianus texanus*... Chihuahua, Coahuila, Nuevo León, Tamaulipas.  
*Antilocapra americana mexicana* ..... Chihuahua, Sonora.

- Antilocapra americana*  
*peninsularis* ..... Baja California.  
*Ovis canadensis cremnobates*<sup>1</sup> ... Northern Baja California.  
*Ovis canadensis weemsi* ..... Southern Baja California.  
*Ovis canadensis gaillardii* ..... Northern Sonora.  
*Ovis canadensis mexicana* ..... Northern Chihuahua, Coahuila.

<sup>1</sup> Also Upper Sonoran Zone.<sup>2</sup> Also Arid Upper Tropical Subzone.<sup>3</sup> Also Arid Upper and Arid Lower Tropical Subzones.<sup>4</sup> Also Upper Sonoran and Transition Zones.<sup>5</sup> Also Arid Upper Tropical and up to Transition Zones.

### Birds of Lower Austral Zone:

- Dendrocygna bicolor helva* ..... Northern México and south over tableland to Lake Chapala and Valley of México.
- Falco femoralis*  
*septentrionalis*<sup>2, 3, 4</sup> ..... Sinaloa and undoubtedly Sonora, Tamaulipas, southward to Yucatán and Oaxaca.
- Callipepla squamata*  
*castanogastris* ..... Northern Nuevo León, northern Tamaulipas.
- Callipepla squamata squamata*<sup>1</sup> ... Southern Coahuila, southern Chihuahua, southern Sonora, south over tableland to Guanajuato.
- Lophortyx californica plumbea* ... Northern Baja California.
- Lophortyx californica*  
*achruster* ..... Southern Baja California.
- Lophortyx gambelii gambelii* ... Northeastern Baja California, northern Sonora.
- Lophortyx gambelii fulvipectus* .. Southern Sonora.
- Lophortyx gambelii penbertoni* .. Tiburón Island, Sonora.
- Lophortyx douglasii bensoni* .... Northern Sonora.
- Colinus virginianus texanus* ..... Northeastern Coahuila, Nuevo León, and central Tamaulipas.
- Colinus virginianus graysoni* .... Tableland region from northern Jalisco, western and southern San Luis Potosí, south to Valley of México.
- Colinus virginianus nigripectus* .. Tableland in southern Puebla, and Morelos.
- Colinus virginianus insignis*<sup>2</sup> ... Río Grande River Valley in interior of Chiapas.
- Colinus virginianus ridgwayi* ... Northeastern Sonora.
- Rallus longirostris rhizophorae* ... Coast of southern Sonora.
- Zenaida asiatica asiatica*<sup>2, 3, 4</sup> ... Tamaulipas south through Veracruz to southern Oaxaca and east to Yucatán and Quintana Roo.
- Zenaida asiatica mcarnsi*<sup>2, 4</sup> ..... Southern Baja California, Sonora, Nuevo León, San Luis Potosí, and southward to Guerrero, México, and Puebla.
- Scardafella inca*<sup>2, 3, 4</sup> ..... Southern Baja California, Sonora, Chihuahua, Nuevo León, Tamaulipas, and southward along eastern and western coasts, excluding Yucatán, and over interior plains to southern Chiapas.

- Columbigallina passerina*  
*pallascens*<sup>2, 3, 4</sup> ..... Southern Baja California, Sonora, Chihuahua, Nuevo León, Tamaulipas, and southward along coasts and over interior plains throughout México.
- Coccyzus americanus*  
*americanus* ..... Nuevo León, Tamaulipas.
- Coccyzus americanus*  
*occidentalis* ..... Baja California, Sonora, Sinaloa, Chihuahua.
- Geococcyx californianus* ..... Baja California, Sonora, Sinaloa, Chihuahua, to Tamaulipas and south over tableland to Puebla and Michoacán.
- Tyto perlata pratincola*<sup>1, 2, 4</sup> ..... Baja California and Sonora to Tamaulipas, and south to Yucatán and Chiapas.
- Otus asio mcallii* ..... Nuevo León, Tamaulipas.
- Bubo virginianus pallascens* ..... Northwestern Baja California, Sonora, Chihuahua, Nuevo León, Coahuila, Durango.
- Micrathene whitneyi whitneyi* ..... Sonora, Lower Río Grande Valley, south to Guanajuato and Puebla.
- Micrathene whitneyi sanfordi* ..... Southern Baja California.
- Nyctidromus albicollis merrilli* ..... Tamaulipas.
- Chordeiles acutipennis*  
*texensis*<sup>1</sup> ..... Sonora, Chihuahua, Coahuila, and Tamaulipas, to Tlaxcala, Puebla, and México.
- Cyananthus sordidus*<sup>2</sup> ..... Northern Sonora to Morelos, Puebla and Oaxaca.
- Amazilia yucatanensis*  
*chalconota* ..... Nuevo León, Tamaulipas.
- Amazilia violiceps ellioti*<sup>2</sup> ..... Southern Sonora, Sinaloa, Jalisco, Michoacán, Morelos, Guanajuato, Puebla, México.
- Calypte costae* ..... Baja California.
- Colaptes chrysoides chrysoides* ..... Southern Baja California.
- Colaptes chrysoides brunescens* ..... Western Baja California.
- Colaptes chrysoides mearnsi* ..... Sonora, Sinaloa.
- Melanerpes aurifrons aurifrons* ..... Coahuila, Nuevo León and Tamaulipas south over tableland to Hidalgo, Jalisco and Michoacán.
- Melanerpes hypopolius*  
*urophygialis*<sup>2</sup> ..... Northern Baja California, Sonora, Sinaloa, Jalisco, Durango, Nayarit.
- Melanerpes hypopolius*  
*brewsteri*<sup>2</sup> ..... Southern Baja California.
- Dendrocopos scalaris azelus*<sup>2</sup> ..... Michoacán, Oaxaca.
- Dendrocopos scalaris agnus* ..... Southern Sonora.
- Dendrocopos scalaris lucasani* ..... Southern Baja California.
- Dendrocopos scalaris eremicus* ..... Northern Baja California.
- Dendrocopos scalaris cactophilus* ..... Northeastern Baja California, Sonora, Chihuahua.
- Dendrocopos scalaris centrophilus* ..... Southern Durango through Zacatecas and Jalisco to Michoacán and Nayarit.
- Dendrocopos scalaris symplectus* ..... Northern and central Tamaulipas, Nuevo León and northern Coahuila.

- Dendrocopos scalaris bairdi*<sup>1</sup>....Southern Coahuila, San Luis Potosí, Puebla, Hidalgo, Guanajuato, México.
- Chloroceryle americana*  
*septentrionalis*<sup>2, 3, 4</sup> .....Sonora, Chihuahua, Nuevo León and Tamaulipas to Tabasco and Chiapas.
- Corvus ossifragus imperatus*<sup>2</sup>....Sonora, Nuevo León, Tamaulipas, San Luis Potosí, Sinaloa, Nayarit, Colima.
- Xanthoura yncas glaucescens*....Northern Tamaulipas, Nuevo León.
- Parus atricristatus*  
*atricristatus*<sup>1</sup> .....Coahuila, Nuevo León, Tamaulipas, San Luis Potosí.
- Auriparus flaviceps flaviceps*....Sonora, Chihuahua, Coahuila, Nuevo León, Tamaulipas, Durango.
- Heleodytes brunneicapillus*  
*guttatus* .....Southern Tamaulipas, Durango, and Zacatecas south to México.
- Heleodytes brunneicapillus*  
*couesi* .....Northern Sonora, Chihuahua, Coahuila, Nuevo León, and northern Tamaulipas.
- Heleodytes jocosus jocosus*.....Guerrero, Puebla, Morelos, Jalisco, Oaxaca.
- Thryothorus ludovicianus*  
*berlandieri* .....Nuevo León, Coahuila, western Tamaulipas.
- Thryothorus ludovicianus*  
*tomitensis* .....Northern Tamaulipas.
- Thryomanes bewickii*  
*eremophilus* .....Chihuahua, Coahuila, Durango.
- Thryomanes bewickii bairdi*<sup>1</sup> ....Southern Puebla, southwestern Veracruz, Oaxaca.
- Thryomanes bewickii percnus* ...Jalisco, Zacatecas.
- Polioptila caerulea nelsoni*.....Oaxaca, Chiapas.
- Polioptila plumbea plumbea*.....Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, Tamaulipas.
- Toxostoma longirostre sennetti* ..Nuevo León, Coahuila, Tamaulipas, San Luis Potosí.
- Toxostoma cinereum cinereum* ..Southern Baja California.
- Toxostoma cinereum mearnsi* ...Central western Baja California.
- Toxostoma bendirci* .....Sonora.
- Toxostoma curvirostre*  
*curvirostre* .....Chihuahua and Tamaulipas, south to Puebla and Oaxaca.
- Toxostoma curvirostre palmeri* ..Northern Sonora, northwestern Chihuahua.
- Toxostoma lecontei lecontei*.....Northwestern Sonora.
- Toxostoma lecontei arenicola* ...Western Baja California.
- Toxostoma dorsale dorsale*.....Northeastern Baja California, northern Sonora.
- Lanius ludovicianus*  
*excubitorides* .....Sonora, Chihuahua, Durango.
- Lanius ludovicianus*  
*mexicanus* .....Tamaulipas, south over tableland to Puebla.
- Vireo noveboracensis micrus*....Tamaulipas, Nuevo León, San Luis Potosí.

- Virco nanus* ..... Michoacán.  
*Virco bellii medius* ..... Coahuila, south to Guanajuato.  
*Virco bellii arizonae* ..... Sonora, Sinaloa, Chihuahua.  
*Compsothlypis pitiaiyumi*  
*nigrilora* ..... Tamaulipas, Nuevo León, San Luis Potosí.  
*Dendroica petechia sonorana* ..... Sonora, Chihuahua.  
*Cassidix mexicanus macrourus* ... Tamaulipas, south through Veracruz, east to Yucatán and west to Michoacán and Jalisco.  
*Cassidix mexicanus nelsoni* ..... Sonora.  
*Icterus melanocephalus*  
*audubonii* ..... Nuevo León, Tamaulipas, San Luis Potosí.  
*Icterus cucullatus sennetti*<sup>2</sup> .... Tamaulipas.  
*Icterus cucullatus californicus* ... Baja California, Sonora, Chihuahua, Sinaloa, Nayarit.  
*Agelaius phoeniceus gubernator* .. Durango, Zacatecas, Jalisco, Guanajuato, Michoacán.  
*Sturnella magna hoopesi* ..... Sonora, Chihuahua, Tamaulipas.  
*Carpodacus mexicanus*  
*mexicanus*<sup>1</sup> ..... Tamaulipas, Morelos, Hidalgo, Veracruz, Puebla, México, Tlaxcala.  
*Carpodacus mexicanus*  
*roseipectus* ..... Oaxaca.  
*Carpodacus mexicanus*  
*rhodocolpus* ..... Southwestern part of Mexican Plateau, in Morelos, Jalisco, Colima, Michoacán, Guanajuato, Durango.  
*Carpodacus mexicanus*  
*frontalis* ..... Tamaulipas, Nuevo León, northern Chihuahua, northern Sonora, northern Baja California.  
*Ammodramus savannarum*  
*bimaculatus* ..... Mexican Plateau region.  
*Aimophila mysticalis* ..... Veracruz, Puebla, Oaxaca.  
*Aimophila humeralis humeralis* ... Puebla, Morelos, Guerrero.  
*Aimophila carpalis carpalis* ..... Sonora, Sinaloa.  
*Aimophila notosticta* ..... Oaxaca.  
*Aimophila rufescens pallida* .... Michoacán, Jalisco, Sinaloa.  
*Aimophila ruficeps australis* .... Oaxaca.  
*Aimophila ruficeps fusca* ..... Jalisco, Michoacán, Zacatecas.  
*Aimophila botteri botteri* ..... Mexican Plateau region and south to interior of Chiapas.  
*Amphispiza bilineata bilineata* ... Northeastern Mexican states.  
*Amphispiza bilineata*  
*deserticola* ..... Baja California, Sonora.  
*Amphispiza bilineata grisea* .... Plateau region, Durango to Hidalgo.  
*Amphispiza belli cinerea* ..... Central Baja California.  
*Spizella wortheni* ..... Tamaulipas.  
*Spizella atrogularis atrogularis* ... Northern Baja California and tableland plains south to Puebla and México.  
*Melospiza melodia fallax* ..... Northeastern Baja California, Sonora.  
*Melospiza melodia rivularis* ..... Southern Baja California.

- Pipilo aberti* ..... Colorado River Valley in northeastern Baja California and northwestern Sonora.
- Pipilo rutilus* ..... Guerrero, Oaxaca.
- Pipilo fuscus fuscus*<sup>1</sup> ..... México, Michoacán, Jalisco, Nayarit.
- Pipilo fuscus potosinus*<sup>1</sup> ..... Central portion of plateau from southern Nuevo León and southern Chihuahua south to Puebla.
- Pipilo fuscus intermedius* ..... Southern Sonora, northern Sinaloa.
- Pipilo fuscus mesoleucus*<sup>1</sup> ..... Northeastern Sonora, northwestern Chihuahua.
- Pipilo fuscus senicula*<sup>1</sup> ..... Northwestern Baja California.
- Arremonops rufivirgatus*  
*rufivirgatus* ..... Tamaulipas, Nuevo León, San Luis Potosí.
- Pyrrhuloxia sinuata sinuata*<sup>2</sup> ... Chihuahua, Sonora, Sinaloa, Durango.
- Pyrrhuloxia sinuata texana* ..... Nuevo León, Tamaulipas, Coahuila, San Luis Potosí, Puebla.
- Richmondena cardinalis*  
*canicaudus*. ..... Nuevo León, Tamaulipas, San Luis Potosí, Hidalgo, Puebla.
- Richmondena cardinalis superbus*. Sonora.

<sup>1</sup> Also Upper Sonoran Zone.

<sup>2</sup> Also Arid Upper Tropical Subzone.

<sup>3</sup> Also Humid Lower Tropical Subzone.

<sup>4</sup> Also Arid Lower Tropical Subzone.

#### UPPER AUSTRAL ZONE

A definite belt corresponding closely with the Upper Sonoran division of the Upper Austral Zone of the southwestern United States extends south along the slopes of the Sierra Madre Occidental and other mountains of the tableland region. A narrow strip of this zone extends southward along the Pacific slope of the Sierra Juárez and San Pedro Mártir Mountains in northwestern Baja California and it covers the upper slopes of the mountains of the southern end of the Baja California peninsula. East of the Isthmus of Tehuantepec it reappears on the slopes of the highlands of central Chiapas. It is difficult to trace on the steep seaward slope of some of the mountains along the eastern side of the tableland where, owing to cloud-forest conditions Upper Tropical and Transition or Canadian Zone elements are brought into close proximity or may overlap. On the high mountains near the southern end of the tableland and in Chiapas the zone extends from about 6,000 to 7,500 feet on north slopes, and from about 7,000 to 8,500 feet altitude on south slopes. This zone in México is closely allied to and not everywhere clearly distinguishable from the Transition Zone.

## Plants of Upper Austral Zone:

- Pinus monophylla* ..... Northern Baja California.  
*Pinus patula* ..... Querétaro, Veracruz, Puebla.  
*Pinus edulis* ..... Northern Baja California.  
*Pinus teocote*<sup>1</sup> ..... Nuevo León to Nayarit and Chiapas.  
*Pinus cembroides* ..... Baja California, Chihuahua, Hidalgo.  
*Pinus quadrifolia* ..... Northern Baja California.  
*Pinus nelsoni* ..... Nuevo León.  
*Juniperus pachyphloea* ..... Sonora and Chihuahua to Zacatecas and  
Puebla.  
*Nolina belldingi* ..... Southern Baja California.  
*Dasyllirion glaucophyllum* ..... Hidalgo.  
*Agave orcuttiana* ..... Northwestern Baja California.  
*Agave pachyacantha* ..... Northwestern Baja California.  
*Agave parryi* ..... Northern Chihuahua.  
*Agave striata* ..... Hidalgo.  
*Populus monticola* ..... Southern Baja California.  
*Salix lasiolepis* ..... Baja California, Chihuahua, Coahuila.  
*Juglans mollis* ..... Nuevo León, San Luis Potosí.  
*Juglans rupestris* ..... Coahuila.  
*Juglans major* ..... Chihuahua, Durango.  
*Carya mexicana* ..... San Luis Potosí, Querétaro.  
*Ostrya guatemalensis* ..... Veracruz, Tabasco, Chiapas.  
*Quercus standleyi* ..... Sonora.  
*Quercus reticulata* ..... Chihuahua to México and Oaxaca.  
*Quercus arizonica* ..... Sonora, Chihuahua.  
*Quercus greggii* ..... Coahuila.  
*Quercus pringlei* ..... Coahuila.  
*Quercus emoryi* ..... Sonora, Chihuahua.  
*Quercus hypoleuca* ..... Sonora, Chihuahua.  
*Celtis reticulata* ..... Baja California to Coahuila.  
*Isomeris arborea* ..... Baja California, Sonora.  
*Philadelphus pumilus* ..... Northern Baja California.  
*Philadelphus coulteri* ..... Nuevo León to Hidalgo.  
*Fendlera linearis* ..... Nuevo León.  
*Grossularia quercetorum* ..... Northern Baja California.  
*Ribes indecorum* ..... Northern Baja California.  
*Ribes braudegei* ..... Mountains of southern Baja California.  
*Liquidambar styraciflua* ..... Mountains, Veracruz and Puebla to Chia-  
pas.  
*Platanus mexicana* ..... Nuevo León, Tamaulipas, San Luis Po-  
tosi, Veracruz.  
*Platanus wrightii* ..... Sonora, Chihuahua.  
*Platanus chiapensis* ..... Chiapas.  
*Platanus oaxacana* ..... Oaxaca.  
*Sericotheca pachydisca* ..... Distrito Federal.  
*Adenostoma fasciculatum* ..... Baja California.  
*Adenostoma sparsifolium* ..... Baja California.  
*Fallugia paradoxa* ..... Chihuahua, Coahuila, Durango.  
*Cowania plicata* ..... Coahuila, San Luis Potosí, Zacatecas,  
Guanajuato.  
*Cowania mexicana* ..... Durango, Guanajuato.  
*Cowania stansburiana* ..... Sonora, Chihuahua.  
*Cercocarpus macrophyllus* ..... Jalisco, Veracruz, Guerrero.  
*Cercocarpus fothergilloides* ..... México, Puebla.

- Cercocarpus mojadensis* ..... Coahuila.  
*Cercocarpus eximius* ..... Sonora, Chihuahua.  
*Cercocarpus paucidentatus* ..... San Luis Potosí, Hidalgo.  
*Cercocarpus breviflorus* ..... Sonora, Chihuahua, Coahuila.  
*Rubus cymosus* ..... Distrito Federal.  
*Rosa minutifolia* ..... Northern Baja California.  
*Rosa montezumae* ..... México, Hidalgo.  
*Crataegus mexicana* ..... San Luis Potosí, Jalisco, Veracruz, Oaxaca.  
*Crataegus nelsoni* ..... Mountains of Chiapas.  
*Heteromeles salicifolia* ..... Baja California.  
*Amelanchier denticulata* ..... Chihuahua to Oaxaca.  
*Prunus microphylla* ..... Hidalgo.  
*Prunus virens* ..... Chihuahua to San Luis Potosí.  
*Prunus ilicifolia* ..... Northern Baja California.  
*Mimosa puberula* ..... Hidalgo.  
*Mimosa galeocarpa* ..... Sonora, Chihuahua, Durango.  
*Mimosa galeottii* ..... Morelos, Guerrero, Oaxaca.  
*Mimosa leucaenoides* ..... Hidalgo.  
*Mimosa tenuiflora* ..... Hidalgo.  
*Mimosa biuncifera* ..... Chihuahua, Durango, and San Luis Potosí to México and Oaxaca.  
*Acacia coulteri* ..... Sonora to Tamaulipas and Hidalgo.  
*Calliandra humilis* ..... Sonora, Jalisco, Zacatecas, Hidalgo.  
*Cercis canadensis* ..... Coahuila to San Luis Potosí.  
*Bauhinia ramosissima* ..... Hidalgo.  
*Bauhinia unguicularis* ..... Hidalgo.  
*Bauhinia macranthera* ..... Hidalgo.  
*Bauhinia coulteri* ..... Hidalgo.  
*Dalea neglecta* ..... Guanajuato.  
*Dalea schaffneri* ..... Distrito Federal.  
*Dalea viridiflora* ..... Chihuahua to Hidalgo.  
*Dalea submontana* ..... Zacatecas.  
*Dalea zimapanica* ..... Hidalgo, Puebla, Oaxaca.  
*Dalea painteri* ..... Querétaro.  
*Dalea smithii* ..... Oaxaca.  
*Dalea oaxacana* ..... Oaxaca.  
*Dalea lumholtzii* ..... Sonora.  
*Brongniartia foliolosa* ..... Hidalgo.  
*Brongniartia benthamiana* ..... Guanajuato, Hidalgo, México.  
*Robinia pringlei* ..... Hidalgo.  
*Erythroxylon pallidum* ..... Zacatecas.  
*Ptelea trifoliata* ..... Sonora to Tamaulipas and Oaxaca.  
*Croton amphileucus* ..... Hidalgo.  
*Croton hypoleucus* ..... Hidalgo.  
*Rhus laurina* ..... Northern Baja California.  
*Rhus ovata* ..... Northern Baja California.  
*Rhus trilobata* ..... Baja California to Chihuahua, Guanajuato, Hidalgo and Colima.  
*Rhus schiedcana* ..... Baja California to San Luis Potosí, Puebla and Chiapas.  
*Ilex dugesii* ..... Guanajuato.  
*Ilex brandegeana* ..... Baja California, Sinaloa, Durango.  
*Ilex tolucana* ..... Baja California, Veracruz, Hidalgo, México, Oaxaca.

- Acer orizabense* .....Veracruz, México, Michoacán.  
*Acer brachypterum* .....Sonora, Chihuahua.  
*Acer serratum* .....Tlaxcala, México, Puebla, Chiapas.  
*Aesculus parryi* .....Northern Baja California.  
*Serjania vesicosa* .....Querétaro.  
*Adolphia infesta* .....Northern Baja California.  
*Ceanothus verrucosus* .....Northern Baja California.  
*Ceanothus goldmanii* .....Northern Baja California.  
*Ceanothus cuneatus* .....Northern Baja California.  
*Ceanothus lamuginosus* .....Chihuahua and Coahuila.  
*Ceanothus greggii* .....Chihuahua and Coahuila to San Luis Potosí, Hidalgo, Puebla, Oaxaca.  
  
*Ceanothus spinosus* .....Northern Baja California.  
*Ceanothus divaricatus* .....Northern Baja California.  
*Ceanothus tomentosus* .....Northern Baja California.  
*Ceanothus coeruleus* .....Sinaloa to Chihuahua, Coahuila, Veracruz, and Chiapas.  
  
*Ceanothus huichagorare* .....Sonora, Chihuahua, Coahuila, Jalisco.  
*Ceanothus puablensis* .....Puebla.  
*Ceanothus durangoinus* .....Durango.  
*Ceanothus ferox* .....Tamaulipas.  
*Ceanothus depressus* .....Zacatecas.  
*Ceanothus endlichii* .....Sonora and Chihuahua.  
*Ceanothus buxifolius* .....Chihuahua, Durango, Hidalgo.  
*Rhamnus californica* .....Northern Baja California.  
*Rhamnus betulaeifolia* .....Sonora, Chihuahua, Nuevo León, Durango.  
  
*Rhamnus ilicifolia* .....Northern Baja California.  
*Rhamnus microphylla* .....Coahuila, San Luis Potosí, Hidalgo.  
*Rhamnus pringlei* .....Oaxaca.  
*Rhamnus mucronata* .....Nayarit to Zacatecas, Michoacán, México and Chiapas.  
  
*Rhamnus macrocarpa* .....Michoacán.  
*Vitis arizonica* .....Baja California to Sonora, Coahuila, and Tamaulipas.  
  
*Abutilon parvulum* .....Sonora, Chihuahua.  
*Abutilon dugesii* .....Guanajuato, Querétaro.  
*Malvastrum densiflorum* .....Northern Baja California.  
*Fremontodendron mexicanum* ....Northern Baja California.  
*Bergerocactus emoryi* .....Northern Baja California.  
*Heliocereus schrankii* .....Hidalgo.  
*Heliocereus amecensis* .....México.  
*Echinocereus huitcholensis* ....Nayarit.  
*Echinocereus pensilis* .....Southern Baja California.  
*Echinocereus polyacanthus* ....Chihuahua.  
*Echinocereus pacificus* .....Northern Baja California.  
*Echinocereus maritimus* .....Northern Baja California.  
*Echinocereus adustus* .....Chihuahua.  
*Echinocereus rigidissimus* .....Sonora.  
*Echinocereus chlorophthalmus* ....Hidalgo.  
*Echinocereus fendleri* .....Sonora, Chihuahua.  
*Strombocactus disciformis* ....Hidalgo.  
*Leuchtenbergia principis* .....Hidalgo.  
*Echinofossulocactus heteracanthus* .....Hidalgo.

- Ferocactus chrysacanthus* ..... Cedros Island, Baja California.  
*Ferocactus viridescens* ..... Northern Baja California.  
*Mamillopsis senilis* ..... High mountains, Chihuahua, Durango.  
*Mamillopsis diguetii* ..... Sinaloa, Jalisco, Nayarit.  
*Cochemia pondii* ..... Cedros Island, Baja California.  
*Coryphantha ottonis* ..... Hidalgo.  
*Escobaria lloydii* ..... Zacatecas.  
*Dolichothele uberiformis* ..... Pachuca.  
*Neomammillaria petrophila* ..... Mountains, southern Baja California.  
*Neomammillaria mystax* ..... Puebla, Oaxaca.  
*Neomammillaria pyrrhocephala* .. Hidalgo.  
*Neomammillaria chinocephala* .. Highlands of central México.  
*Neomammillaria konzattii* ..... Cerro San Felipe, Oaxaca.  
*Neomammillaria collina* ..... Puebla.  
*Neomammillaria spinosissima* ... High mountains, México and Morelos.  
*Miconia madreensis* ..... Nayarit.  
*Zauschneria californica* ..... Northern Baja California.  
*Aralia humilis* ..... Sonora, Chihuahua, Morelos, Oaxaca.  
*Garrya wetchii* ..... Cedros Island, Baja California.  
*Garrya wrightii* ..... Sonora, Chihuahua.  
*Garrya ovata* ..... Chihuahua to San Luis Potosí and Puebla.  
*Garrya salicifolia* ..... Southern Baja California.  
*Garrya longifolia* ..... Morelos.  
*Garrya laurifolia* ..... Chihuahua, Guanajuato, Jalisco, Veracruz, Chiapas.  
*Cornus excelsa* ..... Distrito Federal.  
*Cornus disciflora* ..... Nayarit, Zacatecas, México, Morelos, Oaxaca.  
*Arctostaphylos oppositifolia* .... Northern Baja California.  
*Arctostaphylos arguta* ..... Jalisco, México, Oaxaca.  
*Arctostaphylos drupacea* ..... Northern Baja California.  
*Arctostaphylos pungens* ..... Baja California, Chihuahua, Coahuila, Veracruz, Oaxaca.  
*Arctostaphylos diversifolia* .... Northern Baja California.  
*Arctostaphylos konzattii* ..... Puebla, Oaxaca, Chiapas.  
*Arctostaphylos longifolia* ..... Michoacán.  
*Arctostaphylos rupestris* ..... Michoacán.  
*Arctostaphylos glaucescens* ..... Guanajuato.  
*Arctostaphylos minor* ..... Tamaulipas.  
*Arctostaphylos lanata* ..... San Luis Potosí.  
*Arctostaphylos caeciliana* ..... Oaxaca.  
*Arctostaphylos polifolia* ..... Sinaloa to San Luis Potosí, Tlaxcala, and Oaxaca.  
*Arctostaphylos bicolor* ..... Cedros Island, Baja California.  
*Arctostaphylos tomentosa* ..... Northern Baja California.  
*Arctostaphylos glauca* ..... Northern Baja California.  
*Arbutus glandulosa* ..... Sinaloa and Chihuahua to Veracruz, Oaxaca and Chiapas.  
*Arbutus arizonica* ..... Sonora and Chihuahua to Jalisco and San Luis Potosí.  
*Arbutus laurina* ..... Oaxaca.  
*Arbutus peninsularis* ..... Mountains, southern Baja California.  
*Arbutus donnell-smithii* ..... Chiapas.  
*Arbutus spinulosa* ..... Michoacán.

- Arbutus xalapensis* .....Sinaloa, Chihuahua, Nuevo León to Veracruz and Oaxaca.  
*Bumelia lanuginosa* .....Coahuila, Nuevo León.  
*Bumelia altamiranoi* .....Querétaro.  
*Bumelia laetevirens* .....Sinaloa to Tamaulipas, Veracruz, Puebla and Oaxaca.  
*Bumelia peninsularis* .....Baja California.  
*Fraxinus velutina* .....Sonora, Chihuahua.  
*Fraxinus greggii* .....Coahuila, Tamaulipas, Zacatecas.  
*Ramona pachystachya* .....Northern Baja California.  
*Ramona clevelandi* .....Northern Baja California.  
*Ramona vaseyi* .....Northern Baja California.  
*Salvia similis* .....Mountains, southern Baja California.  
*Salvia microphylla* .....Guanajuato.  
*Viburnum rhombifolium* .....Puebla.  
*Viburnum stellatum* .....Veracruz, Puebla (Mount Orizaba).  
*Lonicera albiflora* .....Sonora, Chihuahua, Coahuila.  
*Lonicera subspicata* .....Northern Baja California.  
*Baccharis wrightii* .....Chihuahua, Durango.  
*Baccharis thesioides* .....Sonora, Jalisco, México, Guanajuato.  
*Baccharis multiflora* .....México, Chiapas.  
*Artemisia tridentata*<sup>1</sup> .....Northern Baja California.  
*Artemisia californica* .....Northern Baja California.  
*Artemisia filifolia* .....Chihuahua.  
*Senecio aschenbornianus* .....México.  
*Senecio seemanni* .....Chihuahua.  
*Senecio andrieuxii* .....México.

<sup>1</sup> Also Transition Zone.

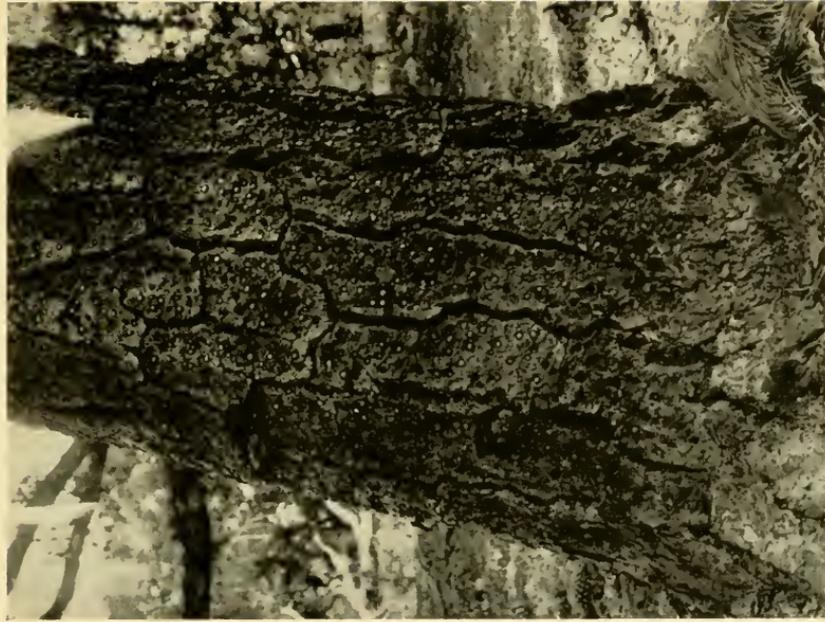
## Mammals of Upper Austral Zone:

- Sorex ornatus ornatus* .....Northern Baja California.  
*Sorex ornatus lagunae* .....Southern Baja California.  
*Cryptotis pergracilis macra* ....Guanajuato.  
*Cryptotis soricina* .....Distrito Federal.  
*Citellus variegatus variegatus* ..Guanajuato, Hidalgo, Jalisco, México, Michoacán, Morelos, Nayarit, Puebla, Querétaro, San Luis Potosí, Zacatecas.  
*Citellus variegatus rupestris* ....Chihuahua, Durango, Sinaloa, Sonora.  
*Citellus variegatus couchii*<sup>1</sup> ....Coahuila, Nuevo León, Tamaulipas.  
*Citellus variegatus grammurus*<sup>1</sup> .Chihuahua, Sonora.  
*Citellus beecheyi nudipes* .....Northwestern Baja California.  
*Citellus leucurus peninsulae* ....Northwestern Baja California.  
*Citellus mexicanus mexicanus*<sup>1</sup> ..Guanajuato, Jalisco, México, Puebla, Querétaro, Tlaxcala.  
*Citellus perotensis* .....Western Veracruz.  
*Sciurus alleni*<sup>2</sup> .....Nuevo León, Tamaulipas.  
*Sciurus apache*<sup>2</sup> .....Chihuahua, Durango, Sonora.  
*Glaucomys volans madrensis* ...Chihuahua.  
*Glaucomys volans goldmani* ....Chiapas.  
*Thomomys umbrinus umbrinus* ..Veracruz.  
*Thomomys umbrinus martinensis*.Puebla.  
*Thomomys umbrinus atrodorsalis*.San Luis Potosí.  
*Thomomys umbrinus zacatecae* ..Zacatecas.





1. Mixed forest on north slope of Sierra de la Laguna, southern Baja California, Upper Austral Zone at higher levels.



2. Results of peculiar habit of ant-eating woodpecker (*Metamorphus formicivorus formicivorus*), near Canjob, Chiapas. The species has a wide range, but this subspecies is mainly Upper Austral in distribution.



1. Lago de Pátzcuaro, Michoacán. An aquatic environment on the plateau. Upper Austral Zone.



2. Shallow lake near San Martín, Texmelucán, Puebla. An aquatic environment on the higher plains (7,400 feet altitude) of the interior plateau, Volcán de Popocatepetl on left and Cerro Ixtacihuatl on right in far distance. Upper Austral Zone.



1. Marshes near head of Río de Lerma in Valley of Toluca, México. An aquatic environment at 8,200 feet altitude. Upper Austral Zone.



2. Interior of marsh near Lerma, México. Vegetation here mainly tules (*Scirpus*). Upper Austral Zone.



1. Washerwomen utilizing the great springs at Almoloya del Río. These springs, at the upper end of the Valley of Toluca, México, form the principal sources of the Río de Lerma; they discharge into a marsh out of which flows the Río de Lerma at about 8,200 feet. Upper Austral Zone.



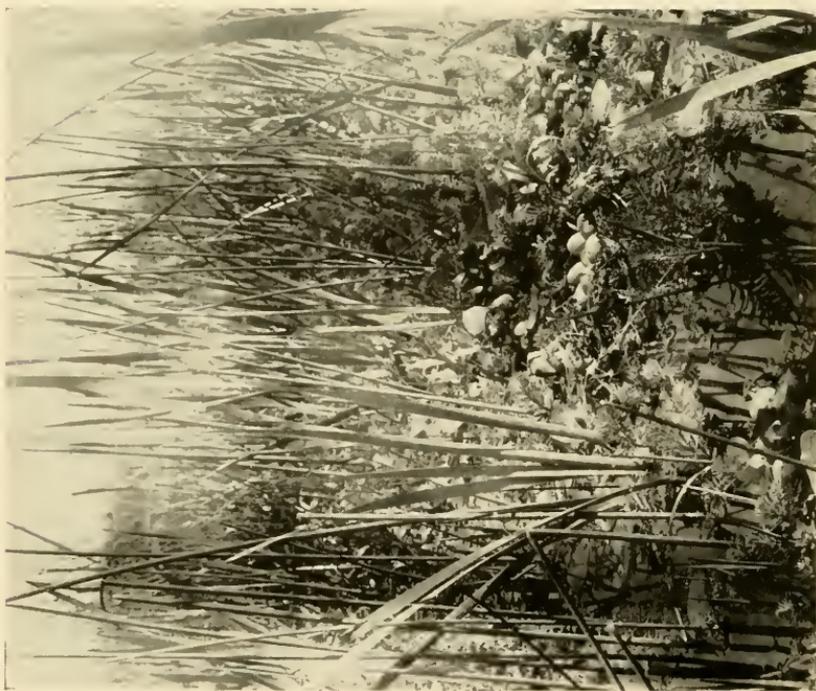
2. Marsh just below the springs at Almoloya del Río, México. Men fishing for carp and for large edible water dogs or axolotes (*Siredon lermacensis*). Upper Austral Zone.



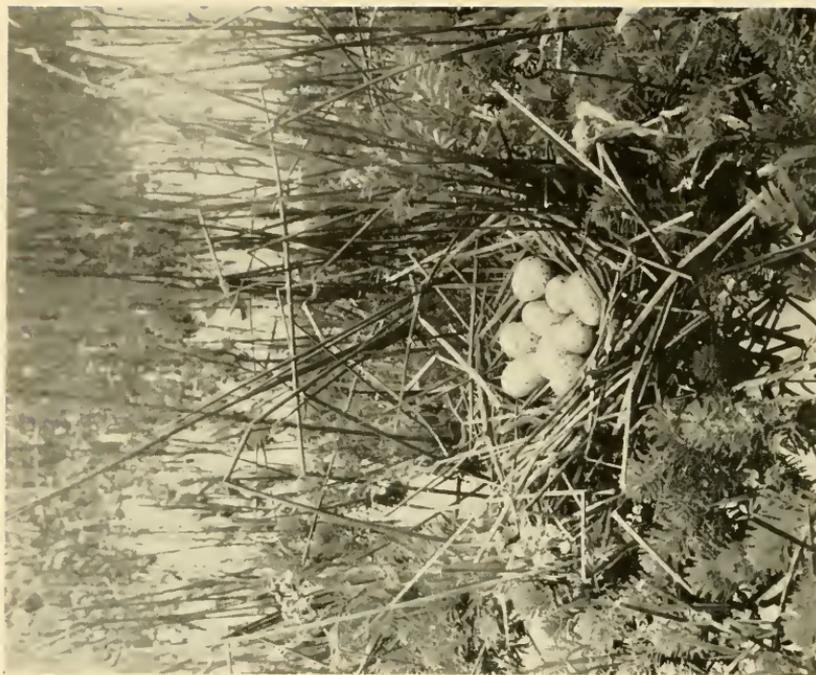
1. Nest of Virginia rail (*Rallus limicola*) in marsh near Lerma, México, July 8, 1904. Upper Austral Zone.



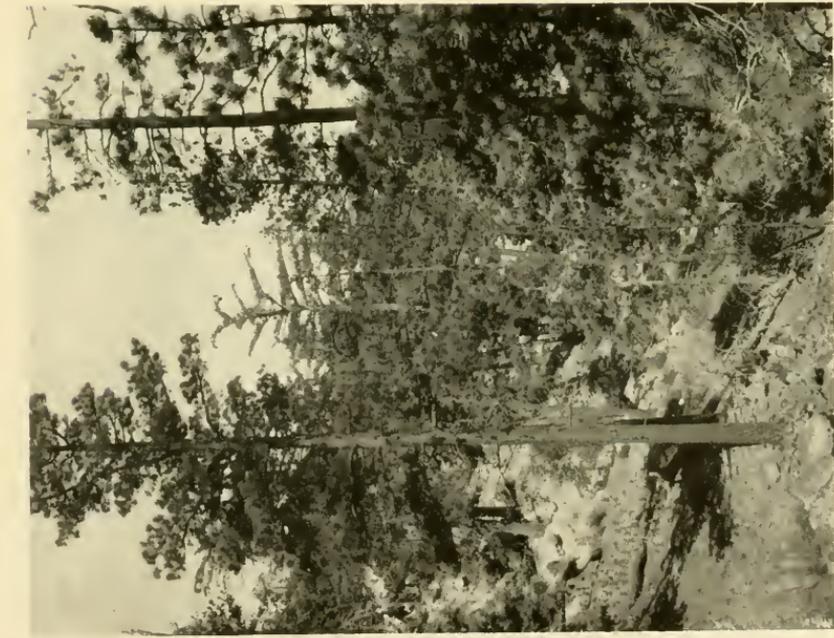
2. Nest of Mexican black duck (*Ayas diasi diasi*) in marsh near Lerma, México, July 8, 1904. Upper Austral Zone.



1. Nest of grebe (*Podilymbus podiceps*) in marsh near Lerma, Mexico, July 2, 1904. Upper Austral Zone.



2. Nest of gallinule (*Gallinula chloropus*) in marsh near Lerma, Mexico, July 5, 1904. Upper Austral Zone.



1. Forest, chiefly of yellow pine (*Pinus ponderosa*) and sugar pine (*P. lambertiana*), at 8,000 feet altitude, in Sierra San Pedro Mártir, Baja California, Transition Zone.



2. Forest of oaks, large dogwoods, and alders at 8,500 feet altitude, on north slope of Cerro de Tancitaro, Michoacán, Transition Zone.



1. Mixed pine forest and open, grassy meadows at La Grulla (7,000 feet altitude), near the southern end of the Sierra San Pedro Mártir, Baja California.



2. Camp at 9,000 feet altitude on Cerro de Tancítaro, Michoacán. Owing to the dry season (February) no tent was pitched. Forest mainly of oaks, but near upper border of Transition Zone.

- Reithrodontomys colimae*  
*nerterus* ..... Sierra Nevada de Colima, Jalisco.  
*Peromyscus eremicus*  
*fraterculus* ..... Northwestern Baja California.  
*Peromyscus maniculatus*  
*gambelii* ..... Northwestern Baja California.  
*Peromyscus maniculatus*  
*fulvus*<sup>1</sup> ..... Hidalgo, México, Oaxaca, Puebla, Tlaxcala, Veracruz.  
*Peromyscus maniculatus*  
*labecula*<sup>1</sup> ..... Jalisco and Nayarit to Zacatecas.  
*Peromyscus maniculatus*  
*sonoriensis*<sup>1</sup> ..... Baja California, Sonora.  
*Peromyscus maniculatus*  
*dubius* ..... Todos Santos Island, Baja California.  
*Peromyscus maniculatus*  
*assimilis* ..... Coronados Island, Northwestern Baja California.  
*Peromyscus leucopus tornillo*<sup>1</sup> ... Chihuahua, Durango.  
*Peromyscus boylii rowleyi* ..... Baja California, Chihuahua, Durango, San Luis Potosí, Sonora.  
*Peromyscus boylii spicilegus*<sup>1</sup> ... Sonora and Chihuahua to Colima and Zacatecas.  
*Peromyscus truei martirensis* ... Northern Baja California.  
*Peromyscus truei lagunae* ..... Mountains of southern Baja California.  
*Peromyscus truei gratus*<sup>1</sup> ..... Hidalgo, México, Michoacán, Oaxaca, Querétaro.  
*Peromyscus truei gentilis*<sup>1</sup> ..... Coahuila, Chihuahua, Durango, Guanajuato, Jalisco, San Luis Potosí, Zacatecas.  
*Peromyscus polius* ..... Chihuahua.  
*Peromyscus difficilis difficilis* ... Hidalgo, San Luis Potosí, Tamaulipas, Zacatecas.  
*Peromyscus difficilis amplus* ... Hidalgo, Oaxaca, Puebla, Tlaxcala, Veracruz.  
*Peromyscus bullatus* ..... Veracruz.  
*Peromyscus xenurus* ..... Durango.  
*Peromyscus mehisturus* ..... Puebla.  
*Sigmodon fulviventris* ..... Zacatecas, Durango.  
*Sigmodon minimus* ..... Chihuahua, Sonora.  
*Sigmodon ochrognathus* ..... Durango.  
*Sigmodon alticola amoles* ..... Querétaro.  
*Neotoma albigula leucodon*<sup>1</sup> ..... Plateau region, Nuevo León south to Hidalgo.  
*Neotoma albigula durangae* ..... Durango, Chihuahua.  
*Neotoma albigula zacatecae* ..... Zacatecas.  
*Neotoma nelsoni* ..... Veracruz.  
*Neotoma montezumae* ..... Hidalgo.  
*Neotoma lepida intermedia*<sup>1</sup> ..... Northwestern Baja California.  
*Neotoma lepida notia* ..... Mountains of southern Baja California.  
*Neotoma anthonyi* ..... Todos Santos Island, Baja California.  
*Neotoma martinensis* ..... San Martín Island, Baja California.  
*Neotoma mexicana mexicana*<sup>2</sup> .. Chihuahua, Durango.  
*Neotoma torquata*<sup>3</sup> ..... Morelos, Distrito Federal, Hidalgo, México, Puebla, Tlaxcala, Veracruz.

- Neotoma fuscipes macrotis* .....Northwestern Baja California.  
*Microtus californicus*  
*aequivocatus* .....Northwestern Baja California.  
*Lepus gaillardi gaillardi* .....Northern Chihuahua.  
*Lepus gaillardi battyi* .....Northwestern Durango.  
*Lepus californicus bennetti* .....Northwestern Baja California.  
*Lepus californicus texianus*<sup>1</sup> ....Chihuahua, Durango.  
*Lepus californicus asellus*<sup>1</sup> ....Coahuila, Nuevo León, San Luis Potosí,  
 Aguascalientes, Zacatecas.  
*Lepus californicus festinus* .....Hidalgo, Querétaro.  
*Sylvilagus floridanus orizabae*<sup>3</sup> ..High mountains and high plateau region  
 from Coahuila south to Puebla.  
*Sylvilagus audubonii sanctidiégi*..Northwestern Baja California.  
*Sylvilagus audubonii minor*<sup>1</sup>....Chihuahua, Durango.  
*Sylvilagus audubonii parvulus*<sup>1</sup>..Coahuila and Tamaulipas to Puebla and  
 Veracruz.  
*Sylvilagus bachmani*  
*cinerascens* .....Northwestern Baja California.  
*Sylvilagus bachmani*  
*exiguus*<sup>1</sup> .....Central Baja California.  
*Sylvilagus bachmani*  
*cerrosensis* .....Cedros Island, Baja California.  
*Odocoileus virginianus*  
*carminis*<sup>2</sup> .....Sierra del Carmen, Coahuila.  
*Odocoileus virginianus*  
*couesi*<sup>2</sup> .....Chihuahua, Durango, Jalisco, Nayarit, So-  
 nora, Zacatecas.  
*Odocoileus virginianus*  
*mexicanus*<sup>2</sup> .....Distrito Federal, Guanajuato, México.  
*Odocoileus virginianus*  
*miquihuanensis*<sup>2</sup> .....Coahuila, Nuevo León, San Luis Potosí,  
 Tamaulipas.  
*Odocoileus hemionus*  
*californicus* .....Northwestern Baja California.  
*Ovis canadensis cremnobates*<sup>1</sup> ..Northern Baja California.

<sup>1</sup> Also Lower Sonoran Zone.<sup>2</sup> Also Transition Zone.<sup>3</sup> Also Transition, Canadian, and Hudsonian Zones.

### Birds of Upper Austral Zone:

- Anas diazi diazi*.....High valleys of central México.  
*Oreortyx pictus confinis*<sup>3</sup>.....San Pedro Mártir Mountains, Baja Cali-  
 fornia.  
*Callipepla squamata squamata*<sup>1</sup> ..Southern Coahuila, southern Chihuahua,  
 southern Sonora, south over tableland  
 to Guanajuato.  
*Callipepla squamata pallida* .....Northeastern Sonora, northwestern Chi-  
 huahua.  
*Cyrtonyx montezumae*  
*montezumae*<sup>3</sup> .....Southern Sonora, southern Chihuahua,  
 Nuevo León, and west-central Tamau-  
 lipas, south to Jalisco, México and  
 Puebla.

- Cyrtonyx montezumae*  
*mearnsi* ..... Eastern Sonora, Chihuahua, and Coahuila.
- Cyrtonyx ocellatus ocellatus*<sup>3</sup> ... Mountains of Oaxaca and Chiapas.
- Rallus longirostris tenuirostris*... Marshes in high valleys of state of México.
- Coturnicops noveboracensis*  
*goldmani* ..... Valley of Toluca, México.
- Columba fasciata vioscae*..... Mountains of southern Baja California.
- Tyto perlata pratincola*<sup>1,4</sup>..... Baja California and Sonora to Tamaulipas and south to Yucatán and Chiapas.
- Otus trichopsis pinosus*..... Veracruz.
- Glaucidium gnoma hoskinsii*..... Sierra de la Laguna, Baja California.
- Chordeiles acutipennis*  
*texensis*<sup>1</sup> ..... Sonora, Chihuahua, Coahuila, and Tamaulipas to Tlaxcala, Puebla, and México.
- Streptoprocne semicollaris* ..... High plateau region in México and Hidalgo.
- Hylocharis leucotis leucotis*<sup>2</sup>.... Sonora, Chihuahua, and Tamaulipas to Oaxaca and Chiapas.
- Hylocharis xantusi* ..... Mountains of southern Baja California.
- Amazilia violiceps ellioti*..... Sonora.
- Selasphorus platycercus*  
*platycercus*<sup>2</sup> ..... Sonora, Chihuahua, and Tamaulipas to Oaxaca.
- Selasphorus sasin sasin*<sup>3</sup>..... San Pedro Mártir Mountains, Baja California.
- Calypte anna* ..... Northwestern Baja California.
- Melanerpes formicivorus*  
*formicivorus* ..... Nuevo León, Tamaulipas, Sinaloa, Zacatecas, Veracruz and south to Oaxaca and Chiapas.
- Melanerpes formicivorus*  
*aculeata*<sup>3</sup> ..... Sonora, Chihuahua, Durango.
- Melanerpes formicivorus*  
*bairdi*<sup>3</sup> ..... Northwestern Baja California.
- Melanerpes formicivorus*  
*angustifrons*<sup>3</sup> ..... Mountains of southern Baja California.
- Dendrocopos villosus icastus*<sup>3</sup>.... Sonora, Chihuahua, Durango, Jalisco, Zacatecas, Coahuila.
- Dendrocopos villosus*  
*intermedius*<sup>3</sup> ..... Southwestern Tamaulipas, San Luis Potosí.
- Dendrocopos nuttallii* ..... Northwestern Baja California.
- Dendrocopos scalaris bairdi*<sup>1</sup> ... Southern Coahuila, San Luis Potosí, Puebla, Hidalgo, Guanajuato, México.
- Dendrocopos arizonae arizonae*<sup>3</sup>.. Sonora, Chihuahua, northwestern Durango.
- Dendrocopos arizonae*  
*fraterculus*<sup>3</sup> ..... Sinaloa, Nayarit, Jalisco, Colima, Zacatecas.
- Lepidocolaptes leucogaster*<sup>3</sup> ..... Sonora, Durango, Zacatecas, and Veracruz to Oaxaca.
- Myiochanes richardsonii*  
*peninsulae* ..... Mountains of southern Baja California.
- Otocoris alpestris chrysolaeama*... Plateau region in western Veracruz, Puebla, México, Tlaxcala, Guanajuato, Jalisco, Zacatecas.

- Tachycineta thalassina*  
*brachyptera* .....Mountains of southern Baja California.
- Cyanocephalus cyanocephalus* ...San Pedro Mártir Mountains, Baja California.
- Aphelocoma coerulescens obscura*.San Pedro Mártir Mountains, Baja California.
- Aphelocoma coerulescens cyanotis*.Coahuila, Durango, San Luis Potosí, Hidalgo, México.
- Aphelocoma coerulescens*  
*sumichrasti* .....Veracruz, Puebla, Tlaxcala, Oaxaca.
- Aphelocoma coerulescens grisea*..Chihuahua.
- Aphelocoma sordida sieberii*.....Veracruz, Puebla, México, Morelos, Michoacán.
- Aphelocoma sordida colimae*.....Colima, Jalisco.
- Aphelocoma sordida sordida*.....Southern Tamaulipas, Coahuila, San Luis Potosí, Hidalgo.
- Aphelocoma sordida arizonae*...Sonora, Chihuahua.
- Aphelocoma sordida wollweberi*..Sonora, Chihuahua, Sinaloa, Nayarit, San Luis Potosí, Zacatecas, Jalisco.
- Aphelocoma sordida couchi*.....Nuevo León.
- Parus atricristatus*  
*atricristatus*<sup>1</sup> .....Coahuila, Nuevo León, Tamaulipas, San Luis Potosí.
- Parus inornatus murinus*.....Northwestern Baja California.
- Parus inornatus cineraceus*.....Sierra de la Laguna, southern Baja California.
- Parus wollweberi*  
*wollweberi*<sup>3</sup> .....Zacatecas to Oaxaca.
- Parus wollweberi annexus*<sup>3</sup>.....Sonora, Chihuahua.
- Parus sclateri*<sup>3</sup> .....Chihuahua south to Oaxaca.
- Parus gambeli atratus*<sup>3</sup>.....San Pedro Mártir Mountains, northwestern Baja California.
- Psaltriparus minimus*  
*melanotis*<sup>2</sup> .....Guanajuato and Hidalgo to Oaxaca and Chiapas.
- Psaltriparus minimus plumbeus*<sup>3</sup>.Northern Sonora, and northern Chihuahua.
- Psaltriparus minimus grindae*...Sierra de la Laguna, southern Baja California.
- Sitta carolinensis lagunae*.....Sierra de la Laguna, southern Baja California.
- Helcodytes brunneicapillus*  
*bryanti* .....Northwestern Baja California.
- Thryomanes bewickii murinus* ...San Luis Potosí, Hidalgo, México, Morelos, Tlaxcala.
- Thryomanes bewickii bairdi*<sup>1</sup> ...Southern Puebla, southwestern Veracruz, Oaxaca.
- Chamaea fasciata henshawi*.....Mountains of northwestern Baja California.
- Toxostoma ocellatum* .....Puebla, México, Oaxaca.
- Toxostoma redivivum redivivum*.Northwestern Baja California.
- Planesticus confinis* .....Mountains of southern Baja California.
- Lanius ludovicianus gambeli*.....Northwestern Baja California.
- Vireo huttoni cognatus* .....Sierra de la Laguna, southern Baja California.
- Vireo bellii pusillus*.....Northwestern Baja California.

- Dendroica petechia dugesi*.....Guanajuato, Morelos, Tlaxcala.  
*Cassidix palustris* .....México.  
*Carpodacus mexicanus*  
*mexicanus*<sup>1</sup> .....Tamaulipas, Morelos, Hidalgo, Veracruz,  
Puebla, México, Tlaxcala.  
*Aimophila ruficeps ruficeps* ....Northwestern Baja California.  
*Aimophila ruficeps sororia* .....Mountains of southern Baja California.  
*Aimophila ruficeps scottii* .....Sonora, Chihuahua, Durango.  
*Aimophila ruficeps boucardi* ....Tamaulipas, Coahuila, San Luis Potosí,  
Hidalgo, Veracruz, Tlaxcala, Puebla,  
México, Guerrero.  
*Amphispiza belli belli*.....Northwestern Baja California.  
*Spizella passerina mexicana*<sup>2</sup>....Chiapas, Oaxaca, Puebla, Veracruz.  
*Melospiza melodia cooperi*.....Northwestern Baja California.  
*Melospiza melodia mexicana*....Puebla, Hidalgo, Tlaxcala, México.  
*Melospiza melodia adusta*.....Michoacán.  
*Melospiza melodia goldmani*.....Mountains of Durango.  
*Pipilo maculatus maculatus* ....Central and southern portions of plateau,  
and south to highlands of Chiapas.  
*Pipilo maculatus magnirostris* ...Mountains of southern Baja California.  
*Pipilo maculatus megalonyx*<sup>3</sup> ...Sonora, Chihuahua, Coahuila, Nuevo  
León, Tamaulipas.  
*Pipilo maculatus atratus* .....Northwestern Baja California.  
*Pipilo fuscus fuscus*<sup>1</sup> .....México, Michoacán, Jalisco, Nayarit.  
*Pipilo fuscus potosinus*<sup>1</sup> .....Central portion of plateau from southern  
Nuevo León and southern Chihuahua  
south to Puebla.  
*Pipilo fuscus mesoleucus*<sup>1</sup> .....Northeastern Sonora, northwestern Chi-  
huahua.  
*Pipilo fuscus senicula*<sup>1</sup>.....Northwestern Baja California.  
*Atlapetes torquatus virenticeps*...Jalisco, Michoacán, México, Morelos.  
*Hedymeles melanocephalus*  
*melanocephalus*<sup>3</sup> .....Plateau region in general.

<sup>1</sup> Also Lower Sonoran Zone.<sup>2</sup> Also Transition and Canadian Zones.<sup>3</sup> Also Transition Zone.<sup>4</sup> Also Arid Upper Tropical and Arid Lower Tropical Subzones.

#### TRANSITION ZONE

The Transition Zone, corresponding closely to the same zone in the western United States, includes most of the higher part of the Sierra Madre Occidental and the slopes of the mountains along the eastern border and near the southern end of the tableland. In altitudinal extent it ranges from about 7,500 feet to 9,000 feet on northerly slopes and from 8,500 feet to 10,000 feet on southerly slopes. Included also are slopes at similar elevations in the highlands of Chiapas. It is a rather narrow belt extensively invaded by the Upper Austral Zone from below and by the Canadian Zone from above, and in some regions it is not easily recognized or satisfactorily delimited. Comparatively few species are definitely known to be characteristic and it is the most poorly marked of the major life zones.

## Plants of Transition Zone:

- Pinus ayacahuite*<sup>2</sup> ..... Chihuahua to México, Guerrero, Chiapas.  
*Pinus lambertiana* ..... Northern Baja California.  
*Pinus teocote*<sup>1</sup> ..... Nuevo León to Nayarit and Chiapas.  
*Pinus chihuahuana* ..... Chihuahua to Zacatecas and Nayarit.  
*Pinus ponderosa* ..... Northern Baja California, Chihuahua, Durango.  
*Pinus arizonica* ..... Chihuahua, Nuevo León.  
*Pinus patula* ..... Querétaro, Veracruz, Puebla.  
*Pinus montezumae* ..... Durango and Zacatecas to Chiapas.  
*Philadelphus pumilus* ..... Northern Baja California.  
*Ribes ceriferum* ..... Chihuahua, Durango.  
*Ribes nelsoni* ..... Chihuahua.  
*Rubus strigosus* ..... Chihuahua.  
*Rubus nelsoni* ..... Oaxaca (Mount Zempoaltepec).  
*Rosa fendleri* ..... Chihuahua.  
*Prunus capuli* ..... Sonora to Veracruz and Chiapas.  
*Robinia neomexicana* ..... Northern Sonora.  
*Aralia racemosa* ..... Chihuahua, Durango.  
*Cornus stolonifera* ..... Chihuahua.  
*Fraxinus papillosa* ..... Chihuahua.  
*Sambucus caerulea* ..... Northern Baja California, Sonora, Chihuahua.  
*Symphoricarpos rotundifolius* ... Northeastern Sonora.  
*Lonicera involucrata* ..... Mountains of Chihuahua.  
*Senecio lanicaulis* ..... Chiapas.

<sup>1</sup> Also in Upper Sonoran Zone.<sup>2</sup> Also in Canadian Zone.

## Mammals of Transition Zone:

- Scapanus anthonyi* ..... Northern Baja California.  
*Sorex durangae* ..... Durango.  
*Sorex milleri* ..... Coahuila.  
*Sorex saussurei cristobalensis* ... Chiapas.  
*Sorex emarginatus* ..... Jalisco, Zacatecas.  
*Cryptotis obscura* ..... Hidalgo.  
*Citellus madrensis* ..... Southwestern Chihuahua, northwestern Durango.  
*Eutamias merriami obscurus* ... Northern Baja California.  
*Eutamias dorsalis dorsalis* ..... Western Chihuahua, northwestern Durango.  
*Eutamias dorsalis carminis* ..... Northern Coahuila.  
*Eutamias bulleri bulleri* ..... Western Zacatecas.  
*Eutamias bulleri durangae* ..... Southwestern Chihuahua, western Durango.  
*Eutamias bulleri solivagus* ..... Coahuila.  
*Sciurus poliopterus poliopterus*<sup>1</sup> ..... Oaxaca.  
*Sciurus poliopterus nemoralis*<sup>1</sup> ... México, Michoacán.  
*Sciurus poliopterus effugius* ..... Guerrero.  
*Sciurus nelsoni nelsoni*<sup>1</sup> ..... Morelos.  
*Sciurus nelsoni hirtus*<sup>1</sup> ..... Puebla.  
*Sciurus griseoflavus griseoflavus*<sup>1</sup> ..... Southeastern Chiapas.

- Sciurus aberti durangi* ..... Chihuahua, Durango.  
*Sciurus ocellatus ocellatus*<sup>1</sup> ..... San Luis Potosí, Querétaro, Veracruz.  
*Sciurus ocellatus tolucac*<sup>1</sup> ..... México, Michoacán, Guanajuato, San Luis Potosí.  
*Sciurus alleni*<sup>2</sup> ..... Nuevo León, Tamaulipas.  
*Sciurus nayaritensis* ..... Zacatecas.  
*Sciurus apache*<sup>2</sup> ..... Chihuahua, Durango, Sonora.  
*Sciurus arizonensis huachuca* ... Sonora.  
*Thomomys umbrinus. supernus* ... Guanajuato.  
*Thomomys umbrinus enixus* ... Sierra Moroni, Zacatecas.  
*Thomomys umbrinus crassidens* .. Sierra de Valparaíso, Zacatecas.  
*Thomomys umbrinus sheldoni* ... Sierra de Nayarit, Nayarit.  
*Thomomys umbrinus chihuahuae*. Sierra Madre, Chihuahua.  
*Thomomys umbrinus evexus* .... Durango.  
*Thomomys umbrinus madrensis*.. Sierra Madre, Chihuahua.  
*Thomomys umbrinus caliginosus*.. Sierra Madre, Chihuahua.  
*Cratogeomys merriami*  
*merriami*<sup>2</sup> ..... México.  
*Heterogeomys hispidus chiapensis*. Chiapas.  
*Zygoeomys trichopus*<sup>1</sup> ..... Michoacán.  
*Platygeomys gymnurus inclarus* . Sierra Nevada de Jalisco.  
*Heteromys nelsoni* ..... Southern Chiapas.  
*Reithrodontomys megalotis*  
*zacatecae* ..... Chihuahua, Durango, Jalisco, Michoacán, Zacatecas.  
*Reithrodontomys amoles* ..... Querétaro.  
*Peromyscus boylii rowleyi*<sup>2</sup> ..... Baja California, Chihuahua, Durango, San Luis Potosí, Sonora.  
*Peromyscus oaxacensis*<sup>1</sup> ..... Chiapas, Oaxaca.  
*Peromyscus hylocetes*<sup>1</sup> ..... Jalisco, México, Michoacán, Morelos.  
*Peromyscus difficilis felipensis*<sup>1</sup>.. México, Oaxaca.  
*Peromyscus lepturus* ..... Mount Zempoaltepec, Oaxaca.  
*Peromyscus lophurus* ..... Chiapas.  
*Peromyscus melanocarpus* ..... Mount Zempoaltepec, Oaxaca.  
*Oryzomys guerrerensis* ..... Guerrero, Oaxaca.  
*Sigmodon leucotis* ..... Zacatecas.  
*Neotomodon alstoni alstoni*<sup>1</sup>... Michoacán, México, Morelos.  
*Nelsonia neotomodon* ..... Jalisco, Zacatecas.  
*Neotoma mexicana mexicana*<sup>2</sup> .. Chihuahua, Durango.  
*Neotoma mexicana madrensis* ... Chihuahua, Durango, Zacatecas.  
*Neotoma navus* ..... Sierra Guadalupe, Coahuila.  
*Neotoma torquata*<sup>3</sup> ..... Morelos, Distrito Federal, Hidalgo, México, Puebla, Tlaxcala, Veracruz.  
*Neotoma ferruginea chamula*<sup>1</sup> .. Chiapas.  
*Neotoma ferruginea picta*<sup>1</sup> ..... Guerrero, Oaxaca.  
*Microtus californicus*  
*hyperuthrus* ..... Northwestern Baja California.  
*Microtus mexicanus mexicanus*<sup>3</sup>. Puebla, Veracruz, Tlaxcala, Hidalgo, Morelos, México.  
*Microtus mexicanus phacus*<sup>1</sup> ... Jalisco, Michoacán, Durango.  
*Microtus mexicanus madrensis* .. Sierra Madre of Chihuahua.  
*Microtus mexicanus subsimus* ... High mountains, Coahuila, Tamaulipas.  
*Lepus californicus martirensis*<sup>4</sup>.. Baja California.  
*Sylvilagus floridanus holzneri*<sup>2</sup>... Sonora, Chihuahua, Durango, Zacatecas.

- Sylvilagus floridanus orizabae*<sup>3</sup>..High mountains and high plateau region  
from Coahuila south to Puebla.
- Sylvilagus floridanus chiapensis*<sup>4</sup>.Chiapas.
- Odocoileus virginianus*  
*carminis*<sup>2</sup> .....Sierra del Carmen, Coahuila.
- Odocoileus virginianus*  
*couesi*<sup>2</sup> .....Chihuahua, Durango, Jalisco, Nayarit, So-  
nora, Zacatecas.
- Odocoileus virginianus*  
*mexicanus*<sup>2</sup> .....Distrito Federal, Guanajuato, México.
- Odocoileus virginianus*  
*miquihuanensis*<sup>2</sup> .....Coahuila, Nuevo León, San Luis Potosí,  
Tamaulipas.
- Odocoileus virginianus*  
*nelsoni*<sup>5</sup> .....Chiapas, Guatemala.

<sup>1</sup> Also in Canadian Zone.<sup>2</sup> Also in Upper Sonoran Zone.<sup>3</sup> Also in Upper Sonoran and Canadian Zones.<sup>4</sup> Also in Upper and Lower Sonoran Zones.<sup>5</sup> Also down to Humid Lower Tropical Subzone.

#### Birds of Transition Zone:

- Dendrortyx macroura striatus*<sup>3</sup> ..Guerrero, Michoacán.
- Dendrortyx macroura*  
*oaxacae*<sup>3, 6</sup> .....Mountain forest of eastern Oaxaca.
- Oreortyx pictus confinis*<sup>5</sup> .....San Pedro Mártir Mountains, Baja Cali-  
fornia.
- Cyrtonyx montezumae*  
*montezumae*<sup>5</sup> .....Southern Sonora, southern Chihuahua,  
Nuevo León, and west-central Tamaulipas south to Jalisco, México, and Pue-  
bla.
- Cyrtonyx montezumae*  
*mcarnsi* .....Eastern Sonora, Chihuahua, and Coahuila.
- Cyrtonyx ocellatus ocellatus*<sup>5</sup> ...Mountains of Oaxaca and Chiapas.
- Rhynchopsitta pachyrhyncha* ....Mountains of Chihuahua, Durango, Mé-  
xico, Veracruz.
- Strix varia sartorii* .....Veracruz, Puebla, México, Michoacán,  
Oaxaca.
- Strix occidentalis lucida* .....Guanajuato, Michoacán.
- Glaucidium gnoma gnoma*<sup>1</sup>.....Chihuahua, Nuevo León, Tamaulipas, to  
México, Morelos, Guerrero, and Chia-  
pas.
- Caprimulgus vociferus*  
*oaxacae*<sup>3</sup> .....Sonora, Chihuahua, Coahuila, and Tamaulipas,  
and south to Guerrero and Mé-  
xico, mountains of Oaxaca.
- Hylocharis leucotis leucotis*<sup>4</sup>.....Sonora, Chihuahua, and Tamaulipas to  
Oaxaca and Chiapas.
- Eugenes fulgens fulgens*.....Chihuahua and Tamaulipas to Oaxaca.
- Scelasphorus platycercus*<sup>4</sup> .....Sonora, Chihuahua, and Tamaulipas to  
Oaxaca.
- Scelasphorus sasin sasin*<sup>5</sup>.....San Pedro Mártir Mountains, Baja Cali-  
fornia.

- Euptilotis neoxenus* ..... Sierra Madre of Chihuahua, Durango, Nayarit, Zacatecas.
- Trogon mexicanus mexicanus* <sup>7</sup>.. Chihuahua and Tamaulipas to Oaxaca and Chiapas.
- Colaptes cafer mexicanoides*..... Highlands of Chiapas.
- Melanerpes formicivorus formicivorus* <sup>5</sup> ..... Nuevo León, Tamaulipas, Sinaloa, Zacatecas, Veracruz, and south to Oaxaca and Chiapas.
- Melanerpes formicivorus aculeatus* <sup>5</sup> ..... Sonora, Chihuahua, Durango.
- Melanerpes formicivorus bairdi* <sup>5</sup> ..... Northwestern Baja California.
- Campephilus imperialis* ..... Sierra Madre of Sonora, Chihuahua, Durango, Zacatecas, Jalisco, Michoacán.
- Dendrocopos villosus icastus* <sup>5</sup>.... Sonora, Chihuahua, Durango, Jalisco, Zacatecas, Coahuila.
- Dendrocopos villosus intermedius* <sup>5</sup> ..... Southwestern Tamaulipas, San Luis Potosí.
- Dendrocopos villosus jardini* <sup>3</sup>... Veracruz, Puebla, México, Guerrero, Michoacán, Jalisco, Oaxaca.
- Dendrocopos villosus sanctorum* <sup>3</sup>.. Highlands of Chiapas.
- Dendrocopos arizonae arizonae* <sup>5</sup>.. Sonora, Chihuahua, northwestern Durango.
- Dendrocopos arizonae fraterculus* <sup>5</sup> ..... Sinaloa, Nayarit, Jalisco, Colima, Zacatecas.
- Xiphocolaptes promeropirhynchus sclateri* <sup>6</sup> ..... Veracruz, Oaxaca.
- Xiphocolaptes promeropirhynchus omiltemensis* <sup>6</sup> ..... Mountains of Guerrero.
- Lepidocolaptes leucogaster* <sup>5</sup> ..... Sonora, Durango, Zacatecas, and Veracruz to Oaxaca.
- Lepidocolaptes affinis affinis* <sup>6</sup>.... Veracruz, Puebla, México, Guerrero, Oaxaca, Chiapas.
- Myiochanes pertinax pallidiventris* ..... Chihuahua, Sonora, Durango.
- Empidonax pulverius* ..... Chihuahua, Sonora, Durango.
- Tachycineta thalassina thalassina* <sup>1</sup> ..... In mountains, Chihuahua south to Veracruz, México, and Oaxaca.
- Aphelocoma unicolor concolor* <sup>6</sup>.. Veracruz, Puebla, México.
- Aphelocoma unicolor unicolor* <sup>6</sup>... Chiapas.
- Cyanocitta stelleri diademata* .... Sonora, Chihuahua, Sinaloa, Durango, Jalisco, Nayarit, Zacatecas.
- Cyanocitta stelleri azteca* <sup>1</sup> ..... Veracruz, Puebla, Morelos, México, Michoacán.
- Parus wollweberi wollweberi* <sup>5</sup> ..... Zacatecas to Oaxaca.
- Parus wollweberi annexus* <sup>5</sup>.... Sonora, Chihuahua.
- Parus sclateri* <sup>5</sup> ..... Chihuahua south to Oaxaca.
- Parus gambeli atratus* <sup>5</sup>..... San Pedro Mártir Mountains, northwestern Baja California.
- Psaltriparus minimus melanotis* <sup>4</sup> ..... Guanajuato and Hidalgo to Oaxaca and Chiapas.

- Psaltriparus minimus lloydi* . . . . . Chihuahua, Durango, Coahuila.  
*Psaltriparus minimus plumbeus* <sup>5</sup>. Northern Sonora and northern Chihuahua.  
*Sitta carolinensis aculeata* . . . . . Northwestern Baja California.  
*Sitta carolinensis nelsoni* . . . . . Sonora, Chihuahua, Coahuila.  
*Sitta carolinensis mexicana* <sup>1</sup> . . . . . Southern Chihuahua south to Oaxaca.  
*Sitta pygmaea pygmaea* <sup>1</sup> . . . . . Sonora and Chihuahua south to México and Puebla.  
*Sitta pygmaea leuconucha* . . . . . San Pedro Mártir Mountains, northern Baja California.  
*Certhia familiaris alticola* <sup>1</sup> . . . . . Hidalgo and Puebla south to Chiapas.  
*Certhia familiaris albescens* . . . . . Sonora and Chihuahua south to Zacatecas.  
*Troglodytes brunneicollis brunneicollis* <sup>3</sup> . . . . . Mountains of San Luis Potosí and Hidalgo and south to Guerrero and Oaxaca.  
*Troglodytes brunneicollis cahooni* . . . . . Mountains of Sonora, Chihuahua, Coahuila, Nuevo León, Tamaulipas, Durango, Jalisco, Nayarit.  
*Troglodytes rufociliatus* . . . . . Chiapas.  
*Hemicorhina leucophrys festiva* . . . . . Mountains of Michoacán and Guerrero.  
*Catharus occidentalis occidentalis* <sup>3</sup> . . . . . Veracruz, Puebla, Oaxaca.  
*Catharus occidentalis fulvescens* . . . . . México, Hidalgo, Morelos, Guerrero, Michoacán, Jalisco.  
*Catharus occidentalis olivascens* . . . . . Chihuahua.  
*Catharus occidentalis alticola* <sup>6</sup> . . . . . Southern Chiapas.  
*Catharus occidentalis fulvescens* <sup>6</sup>. Mountains near Chilpancingo, Guerrero.  
*Turdus rufitorques* <sup>3</sup> . . . . . Chiapas.  
*Turdus migratorius propinquus* <sup>3</sup> . . . . . Jalisco, Nayarit, Guerrero, Oaxaca, Veracruz.  
*Turdus ignobilis differens* . . . . . Chiapas.  
*Ridgwayia pinicola* . . . . . Chihuahua and Durango to Veracruz and Michoacán.  
*Sialia mexicana mexicana* . . . . . Nuevo León, Coahuila, Tamaulipas, San Luis Potosí, northern Veracruz.  
*Sialia mexicana anabetae* . . . . . Northern Baja California.  
*Sialia mexicana australis* . . . . . Veracruz, Puebla, México, Michoacán.  
*Ptilogonys cinereus cinereus* . . . . . Mountains, Durango south to Oaxaca.  
*Vircolanius melitophrys goldmani*. Mountains in Morelos.  
*Vermivora superciliosa superciliosa* . . . . . Chihuahua and Durango south to Oaxaca and Chiapas.  
*Peucedramus olivaceus olivaceus* <sup>3</sup> . . . . . Chihuahua and Coahuila to Oaxaca and Chiapas.  
*Dendroica auduboni nigrifrons* . . . . . Chihuahua, Durango.  
*Cardellina rubrifrons rubrifrons* . . . . . Chihuahua, Durango.  
*Setophaga picta picta* . . . . . Chihuahua south to Oaxaca.  
*Setophaga picta guatemalae* . . . . . Chiapas.  
*Myioborus miniatus miniatus* <sup>1</sup> . . . . . Chihuahua and Sinaloa to Veracruz and Oaxaca.

- Hesperiphona vespertina*  
*montana* .....Highlands of southern México.  
*Hesperiphona abeillei abeillei*.....Mountains of southern México.  
*Plagiospiza superciliosa*<sup>1</sup> .....Méxican plateau Chihuahua to Veracruz.  
*Junco oreganus towensendi*.....San Pedro Mártir Mountains, Baja California.  
*Junco phaeonotus phaeonotus*<sup>1</sup>...High mountains, Chihuahua to Oaxaca.  
*Junco phaeonotus palliatus* .....Mountains of Sonora, Chihuahua, Coahuila.  
*Junco phaeonotus fulvescens*.....Chiapas.  
*Spizella passerina mexicana*<sup>2</sup>.....Chiapas, Oaxaca, Puebla, Veracruz.  
*Pipilo torquatus torquatus*<sup>3</sup> .....Puebla, Veracruz, Oaxaca.  
*Pipilo torquatus alticola* .....Jalisco.  
*Pipilo macronyx macronyx*<sup>3</sup> ....México, Morelos, Hidalgo, Puebla.  
*Pipilo macronyx virescens*<sup>3</sup> .....México, Oaxaca.  
*Pipilo maculatus maculatus*<sup>4</sup> ....Central and southern portions of plateau and south to highlands of Chiapas.  
*Pipilo maculatus megalonyx*<sup>5</sup> ...Sonora, Chihuahua, Coahuila, Nuevo León, Tamaulipas.  
*Hedymeles melanocephalus*  
*melanocephalus*<sup>5</sup> .....Plateau region in general.

<sup>1</sup> Also in Canadian and Hudsonian Zones.<sup>2</sup> Also in Upper Sonoran and Upper Humid Tropical Zones.<sup>3</sup> Also in Canadian Zone.<sup>4</sup> Also in Upper Sonoran and Canadian Zones.<sup>5</sup> Also in Upper Sonoran Zone.<sup>6</sup> Also in Humid Upper Tropical Subzone.<sup>7</sup> Also in Canadian Zone and Humid Upper Tropical Subzone.

## CANADIAN ZONE

The Canadian Zone occupies a well-marked belt on the upper slopes of the higher mountains. In the latitude of the high mountains about the Valley of México this zone extends from about 9,000 feet to 11,000 feet on north slopes, and from about 9,500 to 11,500 feet on southern exposures. On the steep cloud-forested seaward slopes of the mountains along the eastern border of the tableland it reaches at least 1,000 feet lower and nearly meets the Humid Upper Tropical Subzone. It probably extended still lower in the recent past when larger glaciers occupied some of the upper slopes of the higher mountains. The zone is characterized by dominant stands of fir (*Abies religiosa*), Douglas fir (*Pseudotsuga mucronata*), pine (*Pinus ayacahuite*), and other trees and numerous shrubs associated with the Canadian Zone of the western United States. The dependent fauna is also allied to that of the northern coniferous forest. At 11,000 to 11,500 feet there is an abrupt change in forest aspect. The stand becomes much thinner and more open, the firs and most of the other trees and shrubs cease and another species of pine (perhaps *Pinus hartwegii*) becomes the dominant tree. *Juniperus mexicana* persists, but most of the dense shrubby undergrowth is replaced by grasses.

## Plants of Canadian Zone:

- Pinus flexilis* ..... Coahuila.  
*Pinus contorta* ..... Northern Baja California.  
*Pinus ayacahuite* ..... Chihuahua to Chiapas.  
*Pseudotsuga mucronata* ..... Chihuahua and Sonora to Hidalgo.  
*Abies religiosa* ..... San Luis Potosí and Jalisco to Guerrero and México.  
*Abies concolor* ..... Northern Baja California.  
*Juniperus mexicana* ..... Chihuahua, Durango, Hidalgo and México, to Oaxaca.  
*Cupressus benthamii* ..... Nayarit to Veracruz.  
*Populus tremuloides* ..... Mountains of Chihuahua, Sonora, Durango, San Luis Potosí.  
*Alnus firmifolia* ..... High mountains of central southern México.  
*Quercus griesbreghtii* ..... Veracruz (Mount Orizaba, 3,300 m.)  
*Ribes pringlei* ..... High mountains, San Luis Potosí to México.  
*Ribes ciliatum* ..... High mountains, Colima to Veracruz and Oaxaca.  
*Sericotheca fissa* ..... High mountains, Michoacán to Veracruz and Oaxaca.  
*Sericotheca dumosa* ..... Northern Baja California, Chihuahua.  
*Sericotheca velutina* ..... Oaxaca.  
*Rubus parviflorus* ..... Mountains of Chihuahua.  
*Pachystima myrsinites* ..... High mountains of Coahuila.  
*Fuchsia intermedia* ..... High mountains of eastern Oaxaca.

## Mammals of Canadian Zone:

- Sorex vagrans orizabae*<sup>3</sup> ..... México, Michoacán, Puebla, Tlaxcala, Veracruz.  
*Sorex stizodon* ..... Chiapas.  
*Sorex veraepacis chiapensis* ..... Chiapas.  
*Sorex veraepacis mutabilis* ..... Oaxaca.  
*Sorex saussurei saussurei*<sup>4</sup> ..... Coahuila to Oaxaca.  
*Sorex saussurei oaxacae* ..... Oaxaca.  
*Sorex ventralis* ..... Oaxaca.  
*Sorex oreopolus* ..... Jalisco.  
*Cryptotis mexicana peregrina* ... Oaxaca.  
*Cryptotis mexicana goldmani* ... Guerrero.  
*Cryptotis mexicana machetes* ... Oaxaca.  
*Cryptotis alticola* ..... México.  
*Cryptotis fossor* ..... Oaxaca.  
*Sciurus polioopus polioopus*<sup>1</sup> ..... Oaxaca.  
*Sciurus polioopus nemoralis*<sup>1</sup> ..... México, Michoacán.  
*Sciurus nelsoni nelsoni*<sup>1</sup> ..... Morelos.  
*Sciurus nelsoni hirtus*<sup>3</sup> ..... Puebla, México, Morelos.  
*Sciurus griseoflavus chiapensis*<sup>1</sup> ..... Chiapas.  
*Sciurus oculatus oculatus*<sup>7</sup> ..... Puebla, Hidalgo, San Luis Potosí, Querétaro, Veracruz.  
*Sciurus oculatus tolucae* ..... México, Michoacán, Guanajuato, San Luis Potosí.  
*Thomomys umbrinus orizabae* ... Mount Orizaba, Puebla.

- Thomomys umbrinus albigularis*..Sierra de Pachuca, Hidalgo.  
*Thomomys umbrinus peregrinus*..Sierra de las Cruces, México.  
*Thomomys umbrinus tolucae* ....Volcán de Toluca, México.  
*Cratogeomys merriami orcoctes*.Volcán de Popocatepetl, México.  
*Cratogeomys perotensis*  
*perotensis* .....Cofre de Perote, Veracruz.  
*Orthogeomys grandis felipensis*..Cerro San Felipe, Oaxaca.  
*Zygoeomys trichopus*<sup>8</sup> .....Michoacán.  
*Platygeomys gymnurus inclarus*<sup>1</sup>.Sierra Nevada de Colima, Jalisco.  
*Platygeomys angustirostris* .....Mount Patambán, Michoacán.  
*Platygeomys planiceps* .....Volcán de Toluca, México.  
*Platygeomys neglectus* .....Cerro de la Calentura, Querétaro.  
*Reithrodontomys megalotis*  
*alticolus* .....Cerro San Felipe, Oaxaca.  
*Reithrodontomys alleni* .....Mountains near Ozolotepec, Oaxaca.  
*Reithrodontomys dorsalis*<sup>2</sup> .....Chiapas.  
*Reithrodontomys chrysopsis*  
*chrysopsis*<sup>3</sup> .....México, Morelos, Michoacán.  
*Reithrodontomys chrysopsis*  
*orizabae* .....Mount Orizaba, Puebla (9,500 feet).  
*Reithrodontomys chrysopsis*  
*perotensis* .....Cofre de Perote, Veracruz (9,500 feet).  
*Reithrodontomys microdon*  
*albilabris* .....Cerro San Felipe, Oaxaca, (10,000 feet).  
*Peromyscus melanotis*<sup>3</sup> .....High mountains, Chihuahua and Tamaulipas to México (Mount Ixtacihuatl, 13,500 feet).  
*Peromyscus oaxacensis*<sup>1</sup> .....Chiapas, Oaxaca.  
*Peromyscus hylocetes*<sup>1</sup> .....Jalisco, México, Michoacán, Morelos.  
*Peromyscus difficilis*  
*felipensis*<sup>1</sup> .....México, Oaxaca.  
*Peromyscus guatemalensis* .....Chiapas.  
*Peromyscus megalops megalops*..Mountains near Ozolotepec, Oaxaca (10,000 feet).  
*Peromyscus megalops auritus* ...Guerrero.  
*Peromyscus zarhynchus*  
*crisobalensis* .....Mountains near San Cristóbal, Chiapas.  
*Peromyscus thomasi thomasi* ...Mountains near Chilpancingo, Guerrero.  
*Sigmodon alticola* .....Cerro San Felipe, Oaxaca (10,000 feet).  
*Neotomodon orizabae* .....Mount Orizaba, Puebla.  
*Neotomodon perotensis* .....Cofre de Perote, Veracruz.  
*Neotomodon alstoni*<sup>3</sup> .....Michoacán, México, Morelos.  
*Nelsonia goldmani* .....Michoacán.  
*Neotoma torquata*<sup>4</sup> .....Morelos, Distrito Federal, Hidalgo, México, Puebla, Tlaxcala, Veracruz.  
*Neotoma ferruginea chamula*<sup>1</sup> ..Chiapas.  
*Neotoma ferruginea picta*<sup>1</sup> ....Guerrero, Oaxaca.  
*Neotoma ferruginea tenuicauda*<sup>5</sup>.Jalisco, Michoacán, Zacatecas.  
*Microtus mexicanus mexicanus*<sup>4</sup>.Puebla, Veracruz, Tlaxcala, Hidalgo, Morelos, México.  
*Microtus mexicanus phaeus*<sup>7</sup> ...Jalisco, Michoacán, Durango.  
*Microtus fulviventer*  
*fulviventer*<sup>1</sup> .....Oaxaca.  
*Sylvilagus floridanus orizabae*<sup>4</sup>..High mountains and high plateau region Coahuila to Puebla.

<i>Sylvilagus cucularius</i>	
<i>cucularius</i> <sup>6</sup> .....	Michoacán, Guerrero, México, Distrito Federal, Morelos, Hidalgo, Puebla, Veracruz, Oaxaca.
<i>Romcrolagus diazi</i> .....	Mount Popocatepetl and Mount Ixtacihuatl, México.
<i>Odocoileus virginianus</i>	
<i>oaxacensis</i> .....	Oaxaca.

<sup>1</sup> Also in Transition Zone.

<sup>2</sup> Also in Humid Upper Tropical Subzone.

<sup>3</sup> Also in Arctic-Alpine and Hudsonian Zones.

<sup>4</sup> Also in Hudsonian Zone and down through Transition to Upper Sonoran Zone.

<sup>5</sup> Also down through Transition and Upper Sonoran to Lower Sonoran Zone.

<sup>6</sup> Also in Hudsonian Zone and down through intervening zones to Arid Upper Tropical Subzone.

<sup>7</sup> Also ranging up into Hudsonian and down to Upper Sonoran Zone.

<sup>8</sup> Also in Hudsonian and Transition Zones.

### Birds of Canadian Zone:

<i>Dendrortyx macroura macroura</i> ..	México, Veracruz.
<i>Dendrortyx macroura</i>	
<i>griseipectus</i> .....	Morelos.
<i>Dendrortyx macroura striatus</i> <sup>1</sup> ..	Guerrero, Michoacán.
<i>Dendrortyx macroura</i>	
<i>oaxacae</i> <sup>1, 2</sup> .....	Mountain forests of eastern Oaxaca.
<i>Dactylortyx thoracicus</i>	
<i>chiapensis</i> .....	Central Chiapas to Guatemala.
<i>Cyrtonyx montezumae merriami</i> ..	Eastern slope of Mount Orizaba (between 11,000 and 12,000 feet).
<i>Glaucidium gnoma gnoma</i> <sup>1</sup> .....	Chihuahua, Nuevo León, Tamaulipas, to México, Morelos, Guerrero, and Chiapas.
<i>Caprimulgus vociferus</i>	
<i>oaxacae</i> <sup>1</sup> .....	Sonora, Chihuahua, Coahuila and Tamaulipas, and south to Guerrero and México.
<i>Hylocharis leucotis leucotis</i> <sup>5</sup> .....	Sonora, Chihuahua and Tamaulipas to Oaxaca and Chiapas.
<i>Lamprolaima amethystinus</i>	
<i>margaritae</i> .....	Oaxaca, Guerrero.
<i>Scelaphorus platycercus</i> <sup>5</sup> .....	Sonora, Chihuahua and Tamaulipas to Oaxaca.
<i>Trogon mexicanus mexicanus</i> <sup>6</sup> ..	Chihuahua and Tamaulipas to Oaxaca and Chiapas.
<i>Dendrocopos villosus jardinii</i> <sup>1</sup> ..	Veracruz, Puebla, México, Guerrero, Michoacán, Jalisco, Oaxaca.
<i>Dendrocopos villosus sanctorum</i> <sup>1</sup> ..	Highlands of Chiapas.
<i>Dendrocopos stricklandi</i>	
<i>stricklandi</i> <sup>4</sup> .....	High mountains in Veracruz, Puebla, México, Morelos.
<i>Tachycineta thalassina</i>	
<i>thalassina</i> <sup>1</sup> .....	In mountains, Chihuahua south to Veracruz, México and Oaxaca.
<i>Nucifraga columbiana</i> .....	San Pedro Mártir Mountains, Baja California.
<i>Cyanocitta stelleri azteca</i> <sup>1</sup> .....	Veracruz, Puebla, Morelos, México, Michoacán.
<i>Cyanocitta stelleri coronata</i> .....	Chiapas, Oaxaca, Puebla, Querétaro.

- Psaltriparus minimus melanotis*<sup>5</sup> .....Guanajuato and Hidalgo to Oaxaca and Chiapas.
- Sitta carolinensis mexicana*<sup>1</sup> ....Southern Chihuahua south to Oaxaca.
- Sitta pygmaea pygmaea*<sup>3</sup> .....Sonora and Chihuahua south to México and Puebla.
- Certhia familiaris alticola*<sup>1</sup>.....Hidalgo and Puebla to Chiapas.
- Troglodytes brunneicollis brunneicollis*<sup>1</sup> .....Mountains of San Luis Potosí and Hidalgo, and south to Guerrero and Oaxaca.
- Catharus occidentalis occidentalis*<sup>1</sup> .....Veracruz, Puebla, Oaxaca.
- Turdus rufitorques*<sup>1</sup> .....Chiapas.
- Turdus migratorius propinquus*<sup>1</sup> .....Jalisco, Nayarit, Guerrero, Oaxaca, Veracruz.
- Vermivora crissalis* .....Jalisco, Coahuila, Michoacán.
- Peucedramus olivaceus olivaceus*<sup>1</sup>.Chihuahua and Coahuila to Oaxaca and Chiapas.
- Myioborus miniatus miniatus*<sup>3</sup>...Chihuahua and Sinaloa to Veracruz and Oaxaca.
- Ergaticus ruber ruber*<sup>4</sup>.....Veracruz, Oaxaca, Puebla, México, Michoacán, Jalisco.
- Ergaticus ruber versicolor*.....Chiapas.
- Loxia curvirostra stricklandi*.....Mountains of México.
- Spinus pinus macropterus* .....Veracruz, Puebla, México, Zacatecas, Michoacán.
- Spinus atriceps* .....Chiapas, Guatemala.
- Junco phaeonotus phaeonotus*<sup>1</sup>...High mountains of the plateau region.
- Pipilo torquatus torquatus*<sup>1</sup> .....Puebla, Veracruz, Oaxaca.
- Pipilo macronyx macronyx*<sup>1</sup> ....México, Morelos, Hidalgo, Puebla.
- Pipilo macronyx virescens*<sup>1</sup> ....México, Morelos, Hidalgo, Puebla.
- Pipilo maculatus maculatus*<sup>1</sup> ....Central and southern portions of plateau and south to highlands of Chiapas.
- Atlapetes brunnei-nucha brunnei-nucha*<sup>2</sup> .....Veracruz, México, Oaxaca, Guerrero, Chiapas.

<sup>1</sup> Also in Transition Zone.

<sup>2</sup> Also in Humid Upper Tropical Subzone.

<sup>3</sup> Also in Hudsonian and Transition Zones.

<sup>4</sup> Also in Hudsonian Zone.

<sup>5</sup> Also in Transition Zone and Upper Sonoran Zones.

<sup>6</sup> Also in Transition Zone and Humid Upper Tropical Subzone.

#### HUDSONIAN ZONE

A narrow belt near timber line on several of the higher mountains of México differs markedly in flora, but apparently little in fauna, from the Canadian Zone below. This belt was not studied in detail by us but appears to have much in common with the corresponding zone on the mountains of the United States. At about 11,000 feet on north slopes the firs (*Abies religiosa*) and at least most of the pines of the Canadian Zone cease abruptly, a pine not observed lower down appears, and the forest becomes more open with less shrubby under-

growth and more grass as ground cover. On southerly slopes this change in the character of the vegetation takes place at 11,500 to 12,000 feet and extends to timber line at about 13,500 feet. The 11,000-foot contour line on northerly slopes was observed to mark the lower limit of snow that remained for a considerable time longer than at the lower levels. The mammals and birds that occur are probably all found also in the Canadian or Transition Zones below.

#### Plants of Hudsonian Zone:

- Pinus hartwegii* ..... Puebla, Veracruz.  
*Juniperus mexicana*<sup>1</sup> ..... Veracruz.

<sup>1</sup> Also in Canadian Zone.

#### Mammals of Hudsonian Zone:

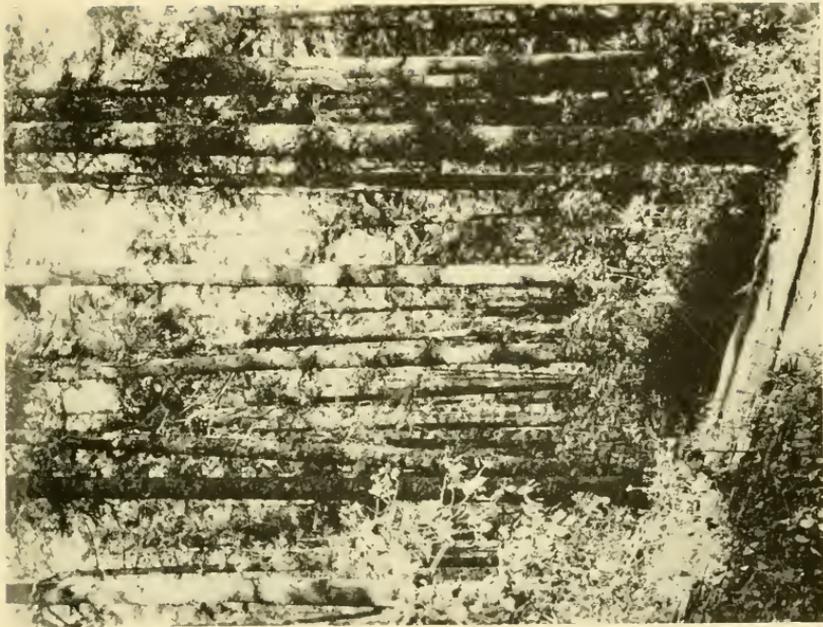
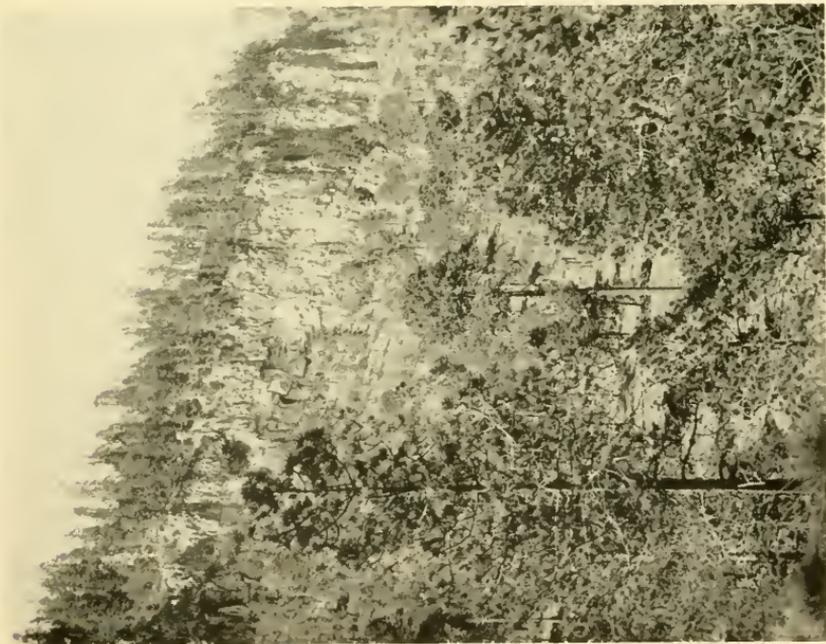
- Sorex saussurei saussurei*<sup>3</sup> ..... Coahuila to Oaxaca.  
*Sorex vagrans orizabae*<sup>1</sup> ..... Puebla, Michoacán, Tlaxcala, Veracruz.  
*Mustela frenata perotae* ..... Cofre de Perote, Veracruz.  
*Sciurus nelsoni hirtus*<sup>2</sup> ..... Puebla, México, Morelos.  
*Sciurus oculatus oculatus*<sup>3</sup> ..... Puebla, Hidalgo, San Luis Potosí, Querétaro, Veracruz.  
*Thomomys umbrinus vulcanius*... Volcán de Popocatepetl, México (12,900 feet).  
*Cratogeomys perotensis*  
*perotensis* ..... Cofre de Perote (12,500 feet).  
*Cratogeomys perotensis peraltus*.. Volcán de Orizaba, Veracruz.  
*Reithrodontomys colimae*  
*colimae* ..... Sierra Nevada de Colima, Jalisco (12,000 feet).  
*Reithrodontomys chrysopsis*  
*chrysopsis*<sup>1</sup> ..... México, Morelos, Michoacán.  
*Reithrodontomys chrysopsis*  
*tolucae* ..... North slope, Volcán de Toluca, México (11,500 feet).  
*Peromyscus melanotis*<sup>2</sup> ..... High mountains, Chihuahua and Tamaulipas to México (Mount Ixtacihuatl, 13,500 feet).  
*Neotomodon alstoni alstoni*<sup>2</sup> ... Michoacán, México, Morelos.  
*Neotoma torquata*<sup>3</sup> ..... Morelos, Distrito Federal, Hidalgo, México, Puebla, Tlaxcala, Veracruz.  
*Sylvilagus floridanus orizabae*<sup>3</sup> .. High mountains and high plateau region Coahuila to Puebla.  
*Sylvilagus cunicularius*  
*cunicularius*<sup>4</sup> ..... Michoacán, Guerrero, México, Distrito Federal, Morelos, Hidalgo, Puebla, Veracruz, Oaxaca.  
*Microtus mexicanus mexicanus*<sup>3</sup>.. Puebla, Veracruz, Tlaxcala, Hidalgo, Morelos, México.  
*Microtus mexicanus phaeus*<sup>2</sup> .... Michoacán, Durango.

<sup>1</sup> Also in Canadian Zone.

<sup>2</sup> Also in Arctic-Alpine, Canadian, and Transition Zones.

<sup>3</sup> Also down through Canadian and Transition to Upper Sonoran Zone.

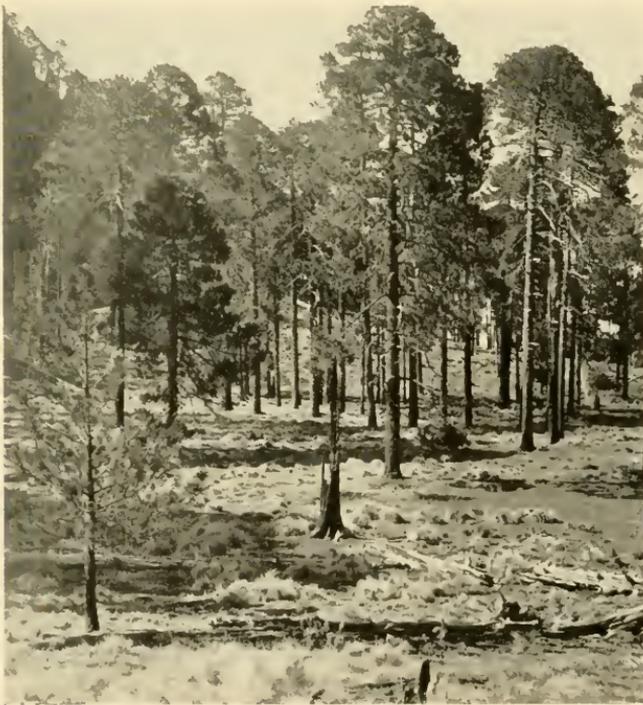
<sup>4</sup> Also down through intervening zones to Arid Upper Tropical Subzone.



Forest at about 10,000 feet altitude, on north slope of Cerro de Tancitaro, Michoacán. The oyamel (*Abies religiosa*) is the dominant tree, with pines, oaks, and alders intermixed. Canadian Zone.



1. Highest point of Cerro de Tancitaro, Michoacán. Note wooded south slope on right and nearly bare north slope on left, indicating approach of timber line at about 12,200 feet. Hudsonian Zone.



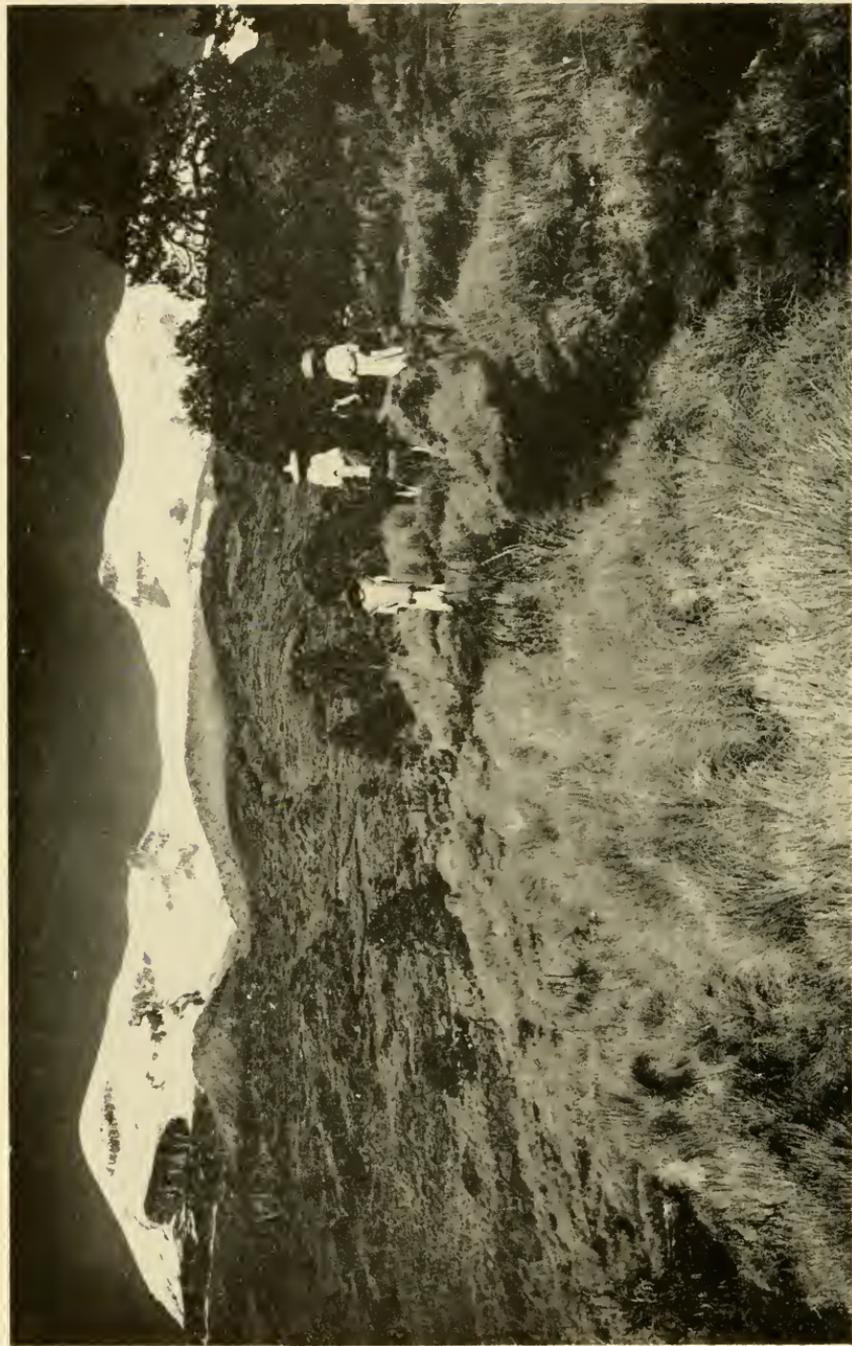
2. *Pinus montezumae* var. *lindleyi*, the dominant tree above 11,000 feet altitude on Cerro de Tancitaro, Michoacán. Ground thinly covered with short grass. Hudsonian Zone.



1. Crest of Cerro de Tancitaro, Michoacán, showing wooded south slope on right and more open, snow-covered north slope on left. Hudsonian Zone.



2. Neveros, or snow gatherers, at about 12,000 feet altitude on Cerro de Tancitaro, Michoacán, March 1, 1903. Snow was packed down on burros and mules to be used for making ice cream in Los Reyes and other towns. Hudsonian Zone.



Cerro Ixtachautl. Western side from near timber line at about 13,000 feet, showing open grassy areas. Hudsonian Zone.



Southern end of Cerro Ixtachihautl, looking across high pass from well up on slope of the Volcán de Popocatepetl, México.



Volcán de Popocatepetl from near summit of Cerro Ixtacilhuatl, México, Arctic Zone.

**Birds of Hudsonian Zone:**

- Dendrocopos stricklandi* .....High mountains in Veracruz, Puebla, México, Morelos.  
*Sitta pygmaea pygmaea*<sup>1</sup>.....Sonora and Chihuahua south to México and Puebla.  
*Myioborus miniatus miniatus*<sup>1</sup>...Chihuahua and Sinaloa to Veracruz and Oaxaca.  
*Ergaticus ruber*<sup>2</sup> .....Veracruz, Oaxaca, Puebla, México, Michoacán, Jalisco.  
*Plagiospiza superciliosa*<sup>1</sup> .....High mountains of plateau region.  
*Junco phaeonotus phaeonotus*<sup>1</sup>...High mountains of plateau region.

<sup>1</sup> Also in Canadian and Transition Zones.

<sup>2</sup> Also in Canadian Zone.

ARCTIC-ALPINE ZONE

This zone includes the areas above timber line on the tops of a few of the highest mountains of México, which exceed 13,000 feet in elevation. These are Mount Orizaba, Mount Popocatepetl, Mount Ixtacihuatl, Cofre de Perote, Volcán de Toluca, and Cerro Malinche. Grass and small herbaceous vegetation extends above timber line to various elevations, depending on slope exposure. At about 15,000 feet on the south slope of Mount Orizaba the last straggling tufts of grass were noted, but beyond this several species of mosses and lichens hold their own in sheltered crevices among the rocks up to 16,500 feet. On Mount Popocatepetl sacatón grass ranges up the soft sandy slope to about 13,700 feet. In this belt above the upper limit of pines, Gros and Gerolt, in 1833, found growing *Chelone gentianoides*, *Amaryllis minuta*, *Lupinus vaginatus*, *Ribes odoratum*, *Arenaria bryoides*, a *Phacelia*, and a *Castilleja*. The only mammal the presence of which was detected above timber line is *Peromyscus melanotis*, which ranges up on Mount Orizaba to 15,200 feet. This is probably the highest elevation reached by any mammal in North America.

BIOTIC PROVINCES

The following treatment of the biotic provinces of México is drawn in part from the delineation of these areas by Goldman and Moore (1945, pp. 347-360). The emphasis is in most cases more on the mammals, and the rather full lists of birds contributed by Moore are reduced.

The biotic provinces are major units or centers of distribution embracing general groupings as shown by the analysis of species and considerations that may include biotic relationships and geologic history. In this concept a biotic province may be similar in topography

throughout its extent and restricted to a single life zone, or it may be composed of both mountains and plains, and several life zones may be represented within the borders. The northern and southern slopes of mountains may differ widely in floral and faunal characteristics as a result of the extreme diversity of local environmental conditions, especially the variations in temperature and the amount and seasonal distribution of moisture received in parts of México. The varying local environmental conditions thus favor the development of many minor plant and animal associations, which are recognizable as subdivisions of the larger, more comprehensive units.

As the geographic distribution, and even the relationships, of many species and subspecies are imperfectly known and their assignment to biotic provinces is subject to later revision, species listed are regarded as members of a characteristic assemblage but are not necessarily confined to a single province or biotic district in all cases. The states or parts of states mentioned are for general location and do not necessarily indicate complete geographic ranges.

#### I. CALIFORNIA BIOTIC PROVINCE

The California Biotic Province extends from southwestern California across the international boundary to include the Sierra Juárez and Sierra San Pedro Mártir and the western slopes of these mountains down to the Pacific coast in northwestern Baja California. The southern limit is near latitude  $30^{\circ}30'$  N. It is an area of moderate rainfall, the lower slopes along the coast in the Upper Austral and the higher levels extending into the Transition Zone. The province is subdivisible, as outlined by Nelson (1921, p. 117), into two subordinate biotic districts: (1) San Pedro Mártir Biotic District occupying the upper slopes of the mountains, and (2) the San Diegan Biotic District including the coastal region and coastal islands. A few species of plants and animals that occur in the heads of northerly-facing canyons near the summit of the Sierra San Pedro Mártir indicate the approach to Canadian Zone.

The higher parts of the mountains are covered with a forest largely of yellow pine and sugar pine, with small stands of *Abies concolor*, *Pinus contorta*, *Populus tremuloides*, and *Symphoricarpos parishii* appearing as representatives of Canadian Zone affiliation in the colder spots. The lower slopes of the mountains are clothed with a dense growth of manzanita (*Arctostaphylos glauca*), chamiso (*Adenostoma fasciculatum*), palo amarillo (*A. sparsifolium*), and California holly (*Heteromeles arbutifolia*).

Mammals assignable to the California Biotic Province are distributed by biotic districts as follows:

## SAN DIEGAN BIOTIC DISTRICT

<i>Sorex ornatus ornatus</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Procyon lotor psora</i> .....	Northwestern Baja California.
<i>Vulpes macrotis tenuirostris</i> .....	Northwestern Baja California.
<i>Urocyon cinereoargenteus</i>	
<i>californicus</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Canis latrans clepticus</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Microtus californicus sanctidiegi</i> ..	Northwestern Baja California.
<i>Microtus californicus</i>	
<i>acquivocatus</i> .....	Northwestern Baja California.
<i>Sylvilagus audubonii sanctidiegi</i> ..	Northwestern Baja California.
<i>Sylvilagus bachmani cinerascens</i> <sup>1</sup> ..	Northwestern Baja California.
<i>Odocoileus hemionus</i>	
<i>californicus</i> <sup>1</sup> .....	Northwestern Baja California.

<sup>1</sup> Also in San Pedro Mártir Biotic District.

## SAN PEDRO MÁRTIR BIOTIC DISTRICT

<i>Scapanus latimanus anthonyi</i> ....	Northwestern Baja California.
<i>Sorex ornatus ornatus</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Urocyon cinereoargenteus</i>	
<i>californicus</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Canis latrans clepticus</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Felis concolor californica</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Spilogale arizonae martirensis</i> <sup>2</sup> ..	Northwestern Baja California.
<i>Citellus beecheyi nudipes</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Sciurus douglasii mearnsi</i> .....	Northwestern Baja California.
<i>Eutamias merriami obscurus</i> ....	Northwestern Baja California.
<i>Thomomys bottae martirensis</i> ....	Northwestern Baja California.
<i>Peromyscus maniculatus</i>	
<i>gambelii</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Peromyscus boylii rowleyi</i> .....	Northwestern Baja California.
<i>Peromyscus truei martirensis</i> ....	Northwestern Baja California.
<i>Microtus californicus huperuthrus</i> ..	Northwestern Baja California.
<i>Sylvilagus bachmani</i>	
<i>cinerascens</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Lepus californicus martirensis</i> <sup>2</sup> ..	Northwestern Baja California.
<i>Odocoileus hemionus</i>	
<i>californicus</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Ovis canadensis cremnobates</i> <sup>2</sup> ....	Northwestern Baja California.
<i>Felis concolor californica</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Mephitis mephitis holzneri</i> .....	Northwestern Baja California.
<i>Citellus beecheyi nudipes</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Citellus leucurus peninsulae</i> .....	Northwestern Baja California.
<i>Thomomys bottae nigricans</i> .....	Northwestern Baja California.
<i>Perognathus fallax fallax</i> .....	Northwestern Baja California.
<i>Perognathus femoralis</i>	
<i>femoralis</i> .....	Northwestern Baja California.
<i>Perognathus femoralis</i>	
<i>mesopolius</i> .....	Northwestern Baja California.

<i>Perognathus longimembris</i>	
<i>pacificus</i> .....	Northwestern Baja California.
<i>Perognathus longimembris</i>	
<i>aestivus</i> .....	Northwestern Baja California.
<i>Perognathus arenarius helleri</i> ...	Northwestern Baja California.
<i>Dipodomys gravipes</i> .....	Northwestern Baja California.
<i>Dipodomys merriami parvus</i> ...	Northwestern Baja California.
<i>Dipodomys agilis simulans</i> .....	Northwestern Baja California.
<i>Onychomys torridus ramona</i> ...	Northwestern Baja California.
<i>Onychomys torridus macrotis</i> ...	Northwestern Baja California.
<i>Reithrodontomys megalotis</i>	
<i>longicaudus</i> .....	Northwestern Baja California.
<i>Reithrodontomys megalotis</i>	
<i>peninsulæ</i> .....	Northwestern Baja California.
<i>Peromyscus eremicus</i>	
<i>fraterculus</i> .....	Northwestern Baja California.
<i>Peromyscus californicus</i>	
<i>insignis</i> .....	Northwestern Baja California.
<i>Peromyscus maniculatus</i>	
<i>gambelii</i> <sup>1</sup> .....	Northwestern Baja California.
<i>Peromyscus maniculatus dubius</i> ..	Todos Santos Island, northwestern Baja California.
<i>Neotoma lepida intermedia</i> .....	Northwestern Baja California.
<i>Neotoma fuscipes macrotis</i> .....	Northwestern Baja California.
<i>Neotoma anthonyi</i> .....	Todos Santos Island, northwestern Baja California.
<i>Neotoma martinensis</i> .....	San Martín Island, northwestern Baja California.

<sup>1</sup> Also in San Diegan Biotic District.

<sup>2</sup> Also in Vizcaino Desert Biotic Province.

The birds that are apparently confined to this province are: *Anas platyrhynchos platyrhynchos*, *Gymnogyps californianus* (possibly extirpated), *Buteo lineatus elegans*, *Circus cyaneus hudsonius*, *Oreortyx picta confinis*, *Lophortyx californica plumbea*, *Rallus longirostris levipes*, *Colaptes chrysoides brunnescens*, *Dendrocopos scalaris eremicus*, *Sayornis saya quiescens*, *Nucifraga columbiana*, *Aphelocoma coerulescens obscura*, *Parus gambelii atratus*, *Parus inornatus murinus*, *Psaltriparus minimus melanurus*, *Sitta pygmaea leuconucha*, *Heleodytes brunneicapillus bryanti*, *Toxostoma cinereum mearnsi*, *Sialia mexicana anabelae*, *Lanius ludovicianus grinnelli*, *Pipilo maculatus umbraticola*, and *Junco oreganus townsendi*.

## 2. GUADALUPE ISLAND BIOTIC PROVINCE

Guadalupe Island is located about 175 miles west of the northern third of Baja California. It is nearly 22 miles long and 3 to 6 miles wide, in the form of an unbroken volcanic ridge reaching to more than 4,500 feet above the sea. The island is surrounded by very deep

water; between it and the mainland the depth is more than 2,000 fathoms. The ocean depths indicate that the island is the exposed crest of a mountain mass rising more than 16,500 feet above its base level on the sea bottom. The climate is similar to that of the California coast.

The flora is more nearly related to that of California than to that of Baja California. The trees include a pine (*Pinus radiata*) and a cypress (*Cupressus guadalupensis*), and oaks have been reported. A cabbage palm (*Erythea edulis*) occurs in small groves at low elevations.

No indigenous land mammals are known. Introduced goats and house mice have ravaged the vegetation to the point of extinction of some species. Introduced domestic cats led to the extinction of some of the native birds. The shores of the island were once favorite resorts for great numbers of the Guadalupe fur seal (*Arctocephalus townsendi*) and the sea otter (*Enhydra lutris nereis*), the former, at least, now believed to be extinct. Elephant seals (*Mirounga angustirostris*), sea lions (*Zalophus californianus*), and harbor seals (*Phoca richardii geronimensis*) still frequent its shores.

Some of its birds, such as *Colymbus nigricollis californicus*, also appear in the California Biotic Province, as well as in States of the west coast of the United States. Some, like *Sitta canadensis canadensis*, appear elsewhere only in the United States and Canada. Some are oceanic forms, which are not found in any of the other provinces of México, but do appear elsewhere in the Pacific Ocean. The following seem to be confined to the island, or in the case of some extinct ones, to have been confined there in the past: *Polyborus lutosus* (now extinct), *Oceanodroma macrodactyla* (probably extinct), *Colaptes cafer rufipileus*, *Thryomanes bewickii brevicauda* (probably extinct), *Salpinctes obsoletus guadeloupeensis*, *Regulus calendula obscurus*, *Carpodacus mexicanus amplus*, *Pipilo maculatus consobrinus* (probably extinct), and *Junco oreganus insularis*.

### 3. VIZCAÍNO DESERT BIOTIC PROVINCE

The Vizcaíno Desert Biotic Province occupies the central desert section of Baja California, along with a desert strip extending north between the Gulf of California and the Sierra San Pedro Mártir into southeastern California. Included are islands along both the western and eastern coasts. With few exceptions it embraces a region of low, desert mountains and plains, and one of the most extremely arid in America. Owing to lack of moisture the vegetation is widely spaced.

The area lies wholly in the Lower Austral Zone, with the exception of Isla Cedros, which is nearly 4,000 feet high, and a few elevations along the backbone of the peninsula which extends into the Upper Austral Zone. The fauna and flora are derived mainly from California, but some remarkable species of plants are peculiar to the area. Among the dominant plants are *Larrea tridentata*, *Fouquieria splendens*, *Cercidium torreyanum*, *Simmondsia californica*, *Idria columnaris*, and *Pachycormus discolor*. The two last named, known locally as the cirio and copalquín, respectively, are outstanding for their abundance, large size, and striking appearance. They, together with other strange desert forms, make the central section of Baja California seem a wonderland of plant monstrosities. Pines, junipers, and California holly (*Heteromeles*) are found on Isla Cedros, which should be segregated as the Isla Cedros Biotic District.

The narrow desert strip, already mentioned, lying between the Gulf of California and the Sierra San Pedro Mártir differs appreciably in floral and faunal composition from the remainder of the province, although many species are the same.

The province may be subdivided into three biotic districts: (1) The area separated by Nelson (1921, p. 118) as the Colorado Desert District may be more fully named as the Colorado Desert Biotic District. It is closely allied to the desert section across the Río Colorado in northwestern Sonora, but for some of the mammals the lower course of the river appears to be an effective barrier. (2) The central desert section including the Vizcaíno Desert, from which the province is named, may be denominated the Central Baja California Biotic District; and (3) Cedros Island, which lies somewhat apart and rising to nearly 4,000 feet in altitude is subjected to oceanic influences that have been factors in the development of a minor distribution center.

The mammals assignable to the Vizcaíno Desert Biotic Province are distributed by biotic districts, as follows:

#### COLORADO DESERT BIOTIC DISTRICT

<i>Pipistrellus hesperus hesperus</i> <sup>1</sup> .....	Northeastern Baja California.
<i>Procyon lotor pallidus</i> .....	Northeastern Baja California.
<i>Canis latrans mearnsi</i> <sup>1</sup> .....	Northeastern Baja California.
<i>Urocyon cinereoargenteus scottii</i> .....	Northeastern Baja California.
<i>Felis concolor browni</i> <sup>1</sup> .....	Northeastern Baja California.
<i>Mephitis mephitis estor</i> .....	Northeastern Baja California.
<i>Citellus leucurus leucurus</i> .....	Northeastern Baja California.
<i>Citellus tereticaudus</i> .....	Northeastern Baja California.
<i>tereticaudus</i> .....	Northeastern Baja California.
<i>Thomomys bottae lucidus</i> .....	Northeastern Baja California.

<i>Perognathus longimembris</i>	
<i>bombycinus</i> .....	Northeastern Baja California.
<i>Perognathus baileyi hueyi</i> .....	Northeastern Baja California.
<i>Perognathus penicillatus</i>	
<i>angustirostris</i> .....	Northeastern Baja California.
<i>Perognathus arenarius albescens</i> .	Northeastern Baja California.
<i>Perognathus spinatus spinatus</i> <sup>2</sup> ..	Northeastern Baja California.
<i>Perognathus formosus</i>	
<i>cinerascens</i> .....	Northeastern Baja California.
<i>Dipodomys merriami arenivagus</i> ..	Northeastern Baja California.
<i>Dipodomys deserti deserti</i> <sup>1</sup> .....	Northeastern Baja California.
<i>Onychomys torridus pulcher</i> .....	Northeastern Baja California.
<i>Reithrodontomys megalotis</i>	
<i>megalotis</i> .....	Northeastern Baja California.
<i>Peromyscus eremicus eremicus</i> <sup>2</sup> ..	Northeastern Baja California.
<i>Peromyscus maniculatus</i>	
<i>sonoriensis</i> <sup>1</sup> .....	Northeastern Baja California.
<i>Peromyscus maniculatus hueyi</i> ..	Northeastern Baja California.
<i>Peromyscus crinitus stephensi</i> ...	Northeastern Baja California.
<i>Peromyscus crinitus</i>	
<i>pallidissimus</i> .....	Northeastern Baja California.
<i>Sigmodon hispidus eremicus</i> <sup>1</sup> ....	Northeastern Baja California.
<i>Neotoma albigula venusta</i> <sup>1</sup> .....	Northeastern Baja California.
<i>Neotoma lepida felipensis</i> .....	Northeastern Baja California.
<i>Neotoma lepida insularis</i> .....	Angel de la Guarda Island, northeastern Baja California.
<i>Ondatra zibethica bernardi</i> <sup>1</sup> ....	Northeastern Baja California.
<i>Castor canadensis repentinus</i> ....	Northeastern Baja California.
<i>Lepus californicus deserticola</i> ....	Northeastern Baja California.
<i>Sylvilagus audubonii arizonae</i> <sup>1</sup> ..	Northeastern Baja California.

<sup>1</sup> Also in Sonora Biotic Province.<sup>2</sup> Also in Central Baja California Biotic District.

## CENTRAL BAJA CALIFORNIA BIOTIC DISTRICT

<i>Canis latrans peninsulae</i> <sup>1</sup> .....	Central Baja California.
<i>Felis concolor improcera</i> <sup>1</sup> .....	Central Baja California.
<i>Spilogale arizonae martirensis</i> <sup>2</sup> ..	Central Baja California.
<i>Citellus atricapillus</i> .....	South-central Baja California.
<i>Citellus beecheyi rupinarum</i> .....	Central Baja California.
<i>Citellus leucurus canfieldae</i> .....	Central Baja California.
<i>Eutamias merriami meridionalis</i> ..	Central Baja California.
<i>Thomomys bottae russeolus</i> .....	Central Baja California.
<i>Perognathus arenarius</i>	
<i>arenarius</i> .....	Central Baja California.
<i>Perognathus arenarius</i>	
<i>ambiguus</i> .....	Central Baja California.
<i>Perognathus fallax inopinus</i> .....	Central Baja California.
<i>Perognathus spinatus spinatus</i> <sup>3</sup> ..	Central Baja California.
<i>Perognathus spinatus guardiaae</i> ..	Angel de la Guarda Island, Baja Cali- fornia.
<i>Perognathus spinatus</i>	
<i>marcosensis</i> .....	San Marcos Island, Baja California.
<i>Perognathus spinatus evermanni</i> ..	Mejía Island, Baja California.

<i>Dipodomys merriami</i>	
<i>platycephalus</i> .....	Central Baja California.
<i>Dipodomys agilis peninsularis</i> ...	Central Baja California.
<i>Peromyscus eremicus eremicus</i> ...	Central Baja California.
<i>Peromyscus guardia</i> .....	Angel de la Guardia Island, Central Baja California.
<i>Peromyscus guardia mejiae</i> .....	Mejía Island, central Baja California.
<i>Peromyscus guardia interparietalis</i> .....	San Lorenzo Island, central Baja California.
<i>Peromyscus stephani</i> .....	San Esteban Island, central Baja California.
<i>Peromyscus dickeyi</i> .....	Tortuga Island, central Baja California.
<i>Sylvilagus bachmani exiguus</i> <sup>1</sup> ...	Central Baja California.
<i>Antilocapra americana</i>	
<i>peninsularis</i> .....	Central Baja California.
<i>Ovis canadensis cremnobates</i> <sup>2</sup> ...	Central Baja California.

<sup>1</sup> Also in Southern Baja California Biotic District.

<sup>2</sup> Also in California Biotic Province.

<sup>3</sup> Also in Colorado Desert Biotic District.

#### CEDROS ISLAND BIOTIC DISTRICT

<i>Perognathus anthonyi</i> .....	Cedros Island, Baja California.
<i>Peromyscus eremicus</i>	
<i>cedrosensis</i> .....	Cedros Island, Baja California.
<i>Neotoma lepida bryanti</i> .....	Cedros Island, Baja California.
<i>Sylvilagus bachmani</i>	
<i>cerrosensis</i> .....	Cedros Island, Baja California.
<i>Odocoileus cerrosensis</i> .....	Cedros Island, Baja California.

Some of the birds apparently confined to this province are *Endomychura h. craveri* (breeds on islands of the Gulf of California), *Otus asio cardonensis*, *Phalaenoptilus nuttallii hueyi* (occurs also in southeastern California), *Eremophila alpestris enerterus*, *Heleodytes brunneicapillus purus*, *Toxostoma lecontei arenicola*, *Geothlypis beldingi goldmani*, *Carpodacus mexicanus mcgregori* (confined to San Benito Island, casual on Cedros Island), *Pipilo fuscus aripolius*, *Passerculus sandwichensis anulus*, *Passerculus sandwichensis sanctorum* (confined to San Benito Islands), *Amphispiza belli cinerea*, and *Melospiza melodia rivularis*. The following occur also in the next province: *Hylacharis xantusi*, *Toxostoma cinereum cinereum*, and *Lanius ludovicianus nelsoni*.

#### 4. SOUTHERN BAJA CALIFORNIA BIOTIC PROVINCE

To the Southern Baja California Biotic Province is assigned the southern section of the peninsula of Baja California from near latitude 27° N. to Cabo San Lucas and islands along the eastern and

western coasts. Included within its scope are lowland plains mainly along the Pacific coast and a narrow, lava-covered plateau fronting abruptly on the Gulf coast is evidence of tremendous former volcanic activity in the northern part of the province. In marked contrast, south of La Paz granite mountains rising islandlike somewhat resemble the mountains of southern California. This diversified region lies in the arid Upper Tropical Subzone at the lower elevations, but includes a belt of the Lower Austral Zone and extends into the Upper Austral Zone on the upper slopes of the mountains between La Paz and Cabo San Lucas, and on a few summits along the backbone of the peninsula. The region is arid in general character but has moderate rainfall during the winter and in the Cape Biotic District in summer produces a much denser stand of vegetation than in the Vizcaíno Desert Biotic Province, to which it is nearly related. The mammals and birds are closely allied to those of southern California but many have become differentiated within the area.

The tropical character of the area at the lower levels is shown by the presence along the coasts of the mangrove *Rhizophora mangle*, *Avicennia nitida*, *Conocarpus erecta*, and more generally distributed *Ficus palmeri*, *Lysiloma candida*, *Albizia occidentalis*, *Haematoxylum brasiletto*, *Esenbeckia flava*, several species of *Bursera*, several of *Jatropha*, two species of *Lantana*, and many others. Lower Austral plants are represented on the plains as far south as the vicinity of La Paz by such species as the creosotebush, *Larrea tridentata*, and the goatnut, *Simmondsia californica*. The Upper Austral affinities of the mountains south of La Paz are shown by the occurrence of *Pinus cembroides*, *Quercus devia*, *Ribes brandegei*, *Heteromeles arbutifolia*, *Garrya salicifolia*, *Arbutus peninsularis*, *Nolina beldingi*, and *Thalictrum peninsulare*. *Quercus devia* and the giant beargrass, *Nolina beldingi*, are also found sparingly in the Sierra de la Giganta.

The province may be subdivided into two biotic districts: (1) A northern section may be named the Sierra de la Giganta Biotic District in reference to the Sierra de la Giganta, the outstanding physical feature of the region. This extended and extremely rugged mountain range bears the name of the highest peak, the Cerro de la Giganta, about 5,800 feet in altitude at the northern end. Elsewhere, however, the crest varies from 3,000 to 5,000 feet in elevation. (2) The area south of La Paz, and neighboring islands, commonly referred to by authors as the "Cape Region," may be known as the Cape Biotic District. The Cape District was extended by Nelson (1921, p. 119) to include the entire present province, but his application of the name

to a diversified area extending so far north is regarded as too comprehensive. The principal physical feature is the Sierra Victoria which attains elevations of 6,000 to 8,000 feet.

The mammals assignable to the Southern Baja California Biotic Province are distributed by biotic districts as follows:

SIERRA DE LA GIGANTA BIOTIC DISTRICT

- Pipistrellus hesperus australis*<sup>1</sup>..Sierra de la Giganta Region, Baja California.
- Antrozous pallidus minor*<sup>1</sup>.....Sierra de la Giganta Region, Baja California.
- Procyon lotor grinnelli*<sup>1</sup>.....Sierra de la Giganta Region, Baja California.
- Bassariscus astutus palmarius*<sup>1</sup>..Sierra de la Giganta Region, Baja California.
- Bassariscus astutus insulicola*....Sierra de la Giganta Region, Baja California.
- Spilogale microdon* .....Sierra de la Giganta Region, Baja California.
- Vulpes macrotis devia*.....Sierra de la Giganta Region, Baja California.
- Urocyon cinereoargenteus peninsularis*<sup>1</sup> .....Sierra de la Giganta Region, Baja California.
- Felis concolor improcera*<sup>1</sup>.....Sierra de la Giganta Region, Baja California.
- Citellus leucurus extimus*<sup>1</sup>.....Sierra de la Giganta Region, Baja California.
- Thomomys bottae russeolus*....Sierra de la Giganta Region, Baja California.
- Perognathus baileyi extimus*<sup>1</sup> ...Sierra de la Giganta Region, Baja California.
- Perognathus arenarius arenarius*..Sierra de la Giganta Region, Baja California.
- Perognathus arenarius ambiguus*.Sierra de la Giganta Region, Baja California.
- Perognathus arenarius albulus*...Sierra de la Giganta Region, Baja California.
- Perognathus arenarius amnophilus* .....Sierra de la Giganta Region, Baja California.
- Perognathus spinatus magdalenae* .....Magdalena Island, Baja California.
- Perognathus spinatus margaritae* .....Margarita Island, Baja California.
- Perognathus spinatus bryanti* ...San José Island, Baja California.
- Perognathus spinatus occultus* ...Carmen Island, Baja California.
- Perognathus spinatus pullus* ....Coronados Island, Baja California.
- Perognathus spinatus seorsus* ....Danzante Island, Baja California.
- Perognathus merriami margaritae* .....Margarita Island, Baja California.
- Perognathus merriami insularis* .....San José Island, Baja California.

- Peromyscus pseudocrinitis* ..... Coronados Island, Baja California.  
*Peromyscus caniceps* ..... Monserrate Island, Baja California.  
*Peromyscus eremicus polypoliis*.. Margarita Island, Baja California.  
*Peromyscus eremicus carmenii* ... Carmen Island, Baja California.  
*Peromyscus maniculatus margaritae* ..... Margarita Island, Baja California.  
*Peromyscus maniculatus magdalenae* ..... Magdalena Island, Baja California.  
*Neotoma lepida ravidae*..... Sierra de la Giganta Region, Baja California.  
*Neotoma lepida pretiosa* ..... Sierra de la Giganta Region, Baja California.  
*Neotoma lepida perballida* ..... San José Island, Baja California.  
*Neotoma lepida marcosensis* ... San Marcos Island, Baja California.  
*Neotoma lepida latirostra* ..... Danzante Island, Baja California.  
*Neotoma abbreviata* ..... San Francisco Island, Baja California.  
*Neotoma nudicauda* ..... Carmen Island, Baja California.  
*Lepus californicus magdalenae*... Magdalena Island, Baja California.  
*Sylvilagus mansuetus* ..... San José Island, Baja California.  
*Sylvilagus bachmani exiguus* ... Sierra de la Giganta Region, Baja California.  
*Ovis canadensis wecmisi*..... Sierra de la Giganta Region, Baja California.  
*Odocoileus hemionus peninsulæ*<sup>1</sup>. Sierra de la Giganta Region, Baja California.

<sup>1</sup> In both the Sierra de la Giganta and Cape Biotic Districts.

#### CAPE BIOTIC DISTRICT

- Sorex ornatus lagunae*.....Cape Region of Baja California.  
*Notiosorex crawfordi* .....Cape Region of Baja California.  
*Balantiopteryx plicata* .....Cape Region of Baja California.  
*Dasypterus ega xanthinus*.....Cape Region of Baja California.  
*Mormoops megalophylla senicula*.Cape Region of Baja California.  
*Natalus mexicanus* .....Cape Region of Baja California.  
*Pipistrellus hesperus australis*<sup>1</sup>...Cape Region of Baja California.  
*Antrozous pallidus minor*<sup>1</sup>.....Cape Region of Baja California.  
*Procyon lotor grinnelli*<sup>1</sup>.....Cape Region of Baja California.  
*Bassariscus astutus palmarius*<sup>1</sup>..Cape Region of Baja California.  
*Bassariscus astutus saxicola*....Espíritu Santo Island, Baja California.  
*Spilogale lucasana* .....Cape Region of Baja California.  
*Taxidea taxus infusca*.....Cape Region of Baja California.  
*Urocyon cinereoargenteus peninsularis*<sup>1</sup> .....Cape Region of Baja California.  
*Felis concolor improcera*<sup>1</sup>.....Cape Region of Baja California.  
*Lynx rufus peninsularis*.....Cape Region of Baja California.  
*Citellus leucurus extimus*<sup>1</sup>.....Cape Region of Baja California.  
*Citellus insularis* .....Cape Region of Baja California.  
*Thomomys bottae anitae* .....Cape Region of Baja California.  
*Thomomys bottae alticola* .....Cape Region of Baja California.  
*Perognathus baileyi extimus*<sup>1</sup> ...Cape Region of Baja California.  
*Perognathus baileyi fornicatus* ...Monserrate Island, Baja California.  
*Perognathus arcnarius subluclidus* .....Cape Region of Baja California.

<i>Perognathus arenarius siccus</i> . . .	Cerralvo Island, Baja California.
<i>Perognathus spinatus</i>	
<i>peninsulæ</i> . . . . .	Cape Region of Baja California.
<i>Perognathus spinatus lambi</i> . . . .	Espíritu Santo Island, Baja California.
<i>Dipodomys merriami melanurus</i> . .	Cape Region of Baja California.
<i>Peromyscus eremicus eva</i> . . . . .	Cape Region of Baja California.
<i>Peromyscus eremicus avius</i> . . . .	Cerralvo Island, Baja California.
<i>Peromyscus eremicus insulicola</i> .	Espíritu Santo Island, Baja California.
<i>Peromyscus maniculatus</i>	
<i>coolidgei</i> . . . . .	Cape Region of Baja California.
<i>Peromyscus truei lagunae</i> . . . . .	Cape Region of Baja California.
<i>Oryzomys peninsulæ</i> . . . . .	Cape Region of Baja California.
<i>Neotoma lepida arenacea</i> . . . . .	Cape Region of Baja California.
<i>Neotoma lepida notia</i> . . . . .	Cape Region of Baja California.
<i>Neotoma lepida vicina</i> . . . . .	Espíritu Santo Island, Baja California.
<i>Lepus californicus xanti</i> . . . . .	Cape Region of Baja California.
<i>Lepus insularis</i> . . . . .	Espíritu Santo Island, Baja California.
<i>Sylvilagus bachmani peninsularis</i> .	Cape Region of Baja California.
<i>Odocoileus hemionus</i>	
<i>peninsulæ</i> <sup>1</sup> . . . . .	Cape Region of Baja California.

<sup>1</sup> In both the Sierra de la Giganta and Cape Biotic Districts.

Grinnell has shown that only three of the bird forms are of southern origin: "*Crotophaga sulcirostris pallidula*, *Hylocharis xantusi*, and *Dendroica erithachorides castaneiceps*." Some of the other bird forms apparently confined to this biotic province are: *Butorides virescens frazari*, *Otus asio xantusi*, *Bubo virginianus elachistus*, *Glaucidium gnoma hoskinsii*, *Chordeiles acutipennis inferior*, *Colaptes chrysoides chrysoides*, *Melanerpes formicivorus angustifrons*, *Dendrocopos scalaris lucasani* (also on San Esteban Island), *Parus inornatus cineraceus*, *Sitta carolinensis lagunae*, *Heleodytes brunneicapillus affinis*, *Turdus migratorius confinus*, *Polioptila caerulea obscura* (also on San Esteban Island), *Lanius ludovicianus nelsoni* (also in the Vizcaino Desert Province), *Vireo huttoni cognatus*, *Geothlypis beldingi beldingi*, *Richmondia cardinalis igneus*, *Pipilo maculatus magnirostris*, *Pipilo fuscus albigula*, *Aimophila ruficeps sororia*, and *Junco oreganus bairdi*.

##### 5. REVILLAGIGEDO BIOTIC PROVINCE

The Revillagigedo Islands, approximately 325 miles west of Cape Corrientes and approximately 250 miles south of Cape San Lucas in Baja California and comprising many islands much farther away, are so isolated that tentatively we have considered them as a biotic province until the ecology of the islands is more completely known. Some of the ornithological forms, not found elsewhere in México, are here-with given: *Puffinus pacificus cuncatus* (breeds on San Benedicto Is-

land and also on other islands of the central and eastern Pacific Ocean), *Puffinus auricularis* (also occurs from Cape San Lucas to Clipperton Island), *Sula dactylatra californica* (may breed on other islands), and *Gygis alba* subsp. (colony on O'Neal Rock near Socorro Island; found also on various islands of the Pacific Ocean). Apparently confined to Socorro Island are *Nyctanassa violacea gravirostris*, *Buteo jamaicensis socorroensis*, *Aratinga holochlora brevipes*, *Micrathene whitneyi graysoni*, and *Pipilo maculatus carmani*. *Speotyto cunicularia rostrata* and *Troglodytes tanneri* seem to be confined to Clarion Island.

## 6. SONORA BIOTIC PROVINCE

The Sonora Biotic Province is the name applied by various authors to the desert plains region extending from southwestern Arizona south through western Sonora with indefinite southern limits. It merges imperceptibly at any particular point with the Sinaloa Biotic Province but is here treated as narrowing to a point on the coast in central western Sinaloa. It is very arid in climate and typifies an arid western division of the Lower Austral Zone (Lower Sonoran Zone) of wide extent in northern México and adjoining parts of the southwestern United States. In desert aspect it is similar to the Vizcaíno Desert Biotic Province of central and northeastern Baja California (another section of the same life zone), many of the plants being the same. The fauna, however, differs widely in species composition and is largely derived from different sources. Some of the characteristic plants are *Ephedra trifurca*, *Nolina bigelovii*, *Agave yaquiana*, *Krameria palmeri*, *Acacia constricta*, *Caesalpinia gracilis*, *Cercidium torreyanum*, *Dalea spinosa*, *Olneya tesota*, *Koeberlinia spinosa*, *Bursera microphylla*, *Simmondsia californica*, *Zizyphus sonorensis*, *Thurberia thespesioides*, *Fouquieria splendens*, *Opuntia basilaris*, *Pachycereus pringlei*, *Carnegiea gigantea*, *Lophocereus schottii*, *Pluchea sericea*, *Hymenoclea monogyra*, *Flourensia cernua*, *Encelia farinosa*, and *Larrea tridentata*.

The Sonora Biotic Province may be subdivided into four biotic districts: (1) The section extending southward from the Yuma Desert of southwestern Arizona through adjoining parts of northwestern Sonora to the coast of the Gulf of California. This may be known as the Yuma Desert Biotic District. It is an area of extreme aridity, closely allied to the neighboring section across the Colorado River delta and assigned to the Colorado Desert Biotic District of the Vizcaíno Desert Biotic Province. Both sections are blanketed from

humid Pacific coastal influences by high mountains, and distance from the Sierra Madre to the east leaves these sections in one of the driest regions in America. Though the two sections are closely allied, many plants being identical, the fauna differs so markedly, the general evidence for a number of species indicating different sources, that it seems convenient to recognize the Colorado River as a barrier and assign them to separate biotic provinces. Much of the Yuma Desert Biotic District is very sandy and the mammals are characterized by very pale coloration. (2) The desert plains region extending from southwestern Arizona, east of the Yuma Desert Biotic District south along the western side of the Sierra Madre, to the Yaqui River valley. This region may be denominated the Yaqui Biotic District in reference to the Yaqui tribe of Indians and the Yaqui River, the largest stream flowing through it. The section as a whole has a very dry climate, but does not represent the extreme aridity of the Yuma Desert Biotic District. Extensive lava beds, especially in the Pinnacle Mountain vicinity, have favored the development of various dark-colored regional races of mammals. (3) Mountainous Tiburón Island and neighboring islands, lying in shallow water in the Gulf of California off the west coast of Sonora, are closely related to the mainland, but primarily because of isolation carry so many locally differentiated forms that the group seems worthy of recognition as the Tiburón Island Biotic District. (4) Low plains and mountains of southern Sonora from the lower Mayo River valley southward, gradually narrowing to a point on the coast in central western Sinaloa may be known as the Mayo Biotic District. In this region the Sierra Madre lies nearer the Pacific coast than farther north and the rainfall is more copious. Because of the heavier rainfall the vegetation is more abundant and partakes of the character of the flora of the adjoining Sinaloa Biotic Province.

Mammals assignable to the Sonora Biotic Province are distributed by biotic districts as follows:

#### YUMA DESERT BIOTIC DISTRICT

<i>Myotis yumanensis yumanensis</i> ...	Northwestern Sonora.
<i>Myotis californicus pallidus</i> .....	Northwestern Sonora.
<i>Pipistrellus hesperus hesperus</i> ....	Northwestern Sonora.
<i>Tadarida mexicana</i> <sup>1</sup> .....	Sonora in general.
<i>Procyon lotor pallidus</i> .....	Northwestern Sonora.
<i>Vulpes macrotis arizonensis</i> .....	Northwestern Sonora.
<i>Canis latrans mearnsi</i> <sup>1</sup> .....	Northwestern Sonora.
<i>Lynx rufus baileyi</i> .....	Northwestern Sonora.
<i>Citellus tereticaudus neglectus</i> <sup>1</sup> ..	Northwestern Sonora.

- Citellus harrisii saxicola*.....Northwestern Sonora.  
*Thomomys bottae phasma* .....Northwestern Sonora.  
*Thomomys bottae vaurosseni* ...Northwestern Sonora.  
*Perognathus longimembris*  
*kinoensis* .....Northwestern Sonora.  
*Perognathus amplus rotundus* ...Northwestern Sonora.  
*Perognathus intermedius phasma*. (Not recorded but doubtless occurs).  
*Dipodomys merriami regillus* ...Northwestern Sonora.  
*Dipodomys deserti deserti* .....Northwestern Sonora.  
*Castor canadensis repentinus*....Northwestern Sonora.  
*Onychomys torridus perpallidus*..Northwestern Sonora.  
*Reithrodontomys megalotis*  
*megalotis*<sup>1</sup> .....Northern and western Sonora.  
*Peromyscus eremicus eremicus* ...Northwestern Sonora.  
*Peromyscus maniculatus*  
*sonoriensis* .....Northwestern and northern Sonora.  
*Sigmodon hispidus eremicus*....Northwestern Sonora.  
*Neotoma albigula venusta* .....Northwestern Sonora.  
*Neotoma albigula mearnsi* ..... (Not recorded but doubtless occurs).  
*Neotoma lepida aureotunicata* ...Northwestern Sonora.  
*Lepus californicus deserticola*....Northwestern Sonora.  
*Sylvilagus audubonii arizonae*<sup>1</sup>...Northern and western Sonora.  
*Odocoileus hemionus eremicus*<sup>1</sup>..Northern and western Sonora.  
*Ovis canadensis gaillardi*<sup>1</sup> .....Western Sonora.

<sup>1</sup> Also in Yaqui Biotic District.

YAQUI BIOTIC DISTRICT

- Pizonyx vivesi* .....Central western Sonora.  
*Pipistrellus hesperus merriami*..Central Sonora.  
*Eptesicus fuscus pallidus*.....Central Sonora.  
*Tadarida mexicana*<sup>1</sup> .....Sonora in general.  
*Mephitis macroura milleri*.....Central Sonora.  
*Canis latrans mearnsi*.....Sonora in general.  
*Lynx rufus baileyi*.....Northern and central Sonora.  
*Citellus variegatus grammurus* ..Central and eastern Sonora.  
*Citellus tereticaudus neglectus* ...Northwestern and central western Sonora.  
*Citellus harrisii harrisii* .....Central Sonora.  
*Thomomys bottae modicus* .....Northern Sonora.  
*Thomomys bottae winthropi* ....Central Sonora.  
*Thomomys bottae convergens* ...Central Sonora.  
*Perognathus flavus sonoriensis* ...Central Sonora.  
*Perognathus baileyi baileyi* ....Central Sonora.  
*Perognathus penicillatus pricei* ..Northern and central Sonora.  
*Perognathus intermedius*  
*intermedius* .....Northern Sonora.  
*Perognathus intermedius*  
*pinacate* .....Northern Sonora.  
*Dipodomys spectabilis perblandus*.Northern Sonora.  
*Dipodomys merriami merriami* ..Northern Sonora.  
*Dipodomys ordii ordii* .....Northern Sonora.  
*Dipodomys deserti sonoriensis* ...Northwestern Sonora.  
*Castor canadensis frondator*....Northern Sonora.  
*Onychomys torridus torridus*....Northern Sonora.

- Reithrodontomys megalotis*  
*megalotis*<sup>1</sup> ..... Northern and western Sonora.  
*Reithrodontomys fulvescens*  
*fulvescens* ..... Central and southern Sonora.  
*Peromyscus eremicus papagensis*. Northwestern Sonora.  
*Peromyscus eremicus anthonyi* .. Southern Sonora.  
*Peromyscus pembertoni* ..... San Pedro Nolasco Island, southern Sonora.  
*Peromyscus boylii glasselli* ..... San Pedro Nolasco Island, southern Sonora.  
*Sigmodon hispidus cienegae*..... Northern and central Sonora.  
*Neotoma albigula sheldoni* ..... Northern Sonora.  
*Neotoma lepida bensoni* ..... Northern Sonora.  
*Lepus alleni alleni* ..... Northern and central Sonora.  
*Lepus californicus eremicus* .... Northwestern Sonora.  
*Sylvilagus audubonii arizonae*<sup>1</sup>.. Northern and western Sonora.  
*Odocoileus hemionus eremicus*<sup>1</sup>... Northern and western Sonora.  
*Antilocapra americana*  
*sonoriensis* ..... Northern and central Sonora.  
*Ovis canadensis gaillardi*<sup>1</sup>..... Western Sonora.

<sup>1</sup> Also in Yuma Desert Biotic District.

#### TIBURÓN ISLAND BIOTIC DISTRICT

- Canis latrans jamesi*..... Tiburón Island, Sonora.  
*Perognathus baileyi insularis* .... Tiburón Island, Sonora.  
*Perognathus penicillatus seri* .... Tiburón Island, Sonora.  
*Perognathus penicillatus minimus*. Turner Island, Sonora.  
*Dipodomys merriami mitchelli* ... Tiburón Island, Sonora.  
*Peromyscus eremicus*  
*tiburoniensis* ..... Tiburón Island, Sonora.  
*Peromyscus stephani* ..... San Esteban Island, Sonora.  
*Peromyscus collatus* ..... Turner Island, Sonora.  
*Neotoma albigula seri* ..... Tiburón Island, Sonora.  
*Neotoma varia* ..... Turner Island, Sonora.  
*Lepus alleni tiburoniensis* ..... Tiburón Island, Sonora.  
*Odocoileus hemionus sheldoni* ... Tiburón Island, Sonora.

#### MAYO BIOTIC DISTRICT

- Onychomys sonoriensis* ..... Southern Sonora.  
*Taxidea taxus sonoriensis*..... Southern Sonora.  
*Lynx rufus escuinapae*..... Southern Sonora.  
*Thomomys simulus simulus* .... Southern Sonora.  
*Thomomys bottae camoae* ..... Southern Sonora.  
*Lionys pictus sonoranus*..... Southern Sonora.  
*Perognathus pernix rostratus* .... Southern Sonora.  
*Perognathus goldmani* ..... Southern Sonora.  
*Perognathus artus* ..... Southeastern Sonora.  
*Dipodomys merriami mayensis*... Southern Sonora.  
*Onychomys torridus yakiensis*... Southern Sonora.  
*Reithrodontomys fulvescens*  
*tenuis* ..... Southern Sonora.  
*Oryzomys couesi lambi*..... Southern Sonora.

<i>Sigmodon hispidus major</i> <sup>1</sup> .....	Southern Sonora to northern Nayarit.
<i>Teanopus phenax</i> .....	Southern Sonora.
<i>Neotoma albigula melanura</i> .....	Southern Sonora.
<i>Lepus alleni palitans</i> <sup>1</sup> .....	Southern Sonora to northern Nayarit.
<i>Sylvilagus audubonii goldmani</i> ...	Southern Sonora to central Sinaloa.

<sup>1</sup> Also in Sinaloa Biotic Province.

Some of the birds apparently confined to this province are: *Lophortyx gambelli fulvipectus*, *Lophortyx gambelii pembertoni* (apparently confined to Tiburón Island), *Lophortyx douglasii bensoni* (also in Alamos District), *Eremophila alpestris leucansiptila*, *Auriparus flaviceps fraterculus*, *Helodytes brunneicapillus brunneicapillus*, *Pipilo fuscus jamesi* (confined to Tiburón Island), *Aimophila carpalis carpalis* (rediscovered in Arizona), and *Richmondia cardinalis superba*.

#### 7. SIERRA MADRE OCCIDENTAL BIOTIC PROVINCE

The Sierra Madre Occidental Biotic Province occupies the massive area of the Sierra Madre Occidental, which forms the continental backbone, extending from the international border southeasterly along the boundary lines between the states of Sonora and Chihuahua, Sinaloa and Durango, to eastern Nayarit, western Zacatecas, and northern Jalisco. General conditions are fairly uniform throughout this lengthy area, which takes the form of a rolling plateau at 7,000 to 8,000 feet altitude, with the western side deeply cut by canyons bearing drainage out to the Pacific coast. Here and there a few peaks, including Cerro Mohinora in extreme southwestern Chihuahua, rise above the general level. The higher part lies chiefly in the Transition Zone, flanked by a broad belt of Upper Austral Zone. The climate is rather dry, although heavy rains are frequent during the summer and some snow falls on the upper slopes in winter and as late as May. The province has been subdivided by authors into three biotic districts, but these are not very clearly indicated in an analysis dealing primarily with the mammals alone.

The upper slopes of the mountains are covered mainly with forests of pine, oak, and madroño, with the "pinabete" (*Abies religiosa*), Douglas fir (*Pseudotsuga mucronata*), and quaking aspen (*Populus tremuloides*), appearing here and there in the colder places, as Canadian Zone elements. At somewhat lower levels in the Upper Austral Zone oaks and many shrubs, including the manzanita (*Arctostaphylos pungens*), and several species of mountain-mahogany (*Cercocarpus*) and of *Ceanothus* become dominant.

Among the mammals of the province are the following :

- Sorex vagrans monticola* ..... Southwestern Chihuahua.  
*Sorex durangae* ..... Western Durango.  
*Euarctos americanus machetes* ... Western Chihuahua.  
*Ursus nelsoni* ..... Western Chihuahua.  
*Procyon lotor mexicanus* ..... Western Chihuahua and western Durango.  
*Spilogale gracilis gracilis* ..... Western Chihuahua.  
*Mephitis mephitis estor* ..... Western Chihuahua.  
*Urocyon cinereoargenteus scottii* .. Western Chihuahua.  
*Canis latrans impavidus* ..... Western Durango.  
*Canis lupus baileyi* ..... Western Chihuahua and western Durango.  
*Felis concolor azteca* ..... Chihuahua.  
*Citellus variegatus grammurus* .. Eastern Sonora, western Chihuahua.  
*Citellus variegatus rupestris* .... Southwestern Chihuahua, western Durango, northeastern Sinaloa.  
*Citellus madrensis* ..... Southwestern Chihuahua, northwestern Durango.  
*Eutamias dorsalis dorsalis* ..... Western Chihuahua, northwestern Durango.  
*Eutamias bulleri bulleri* ..... Western Zacatecas.  
*Sciurus aberti durangi* ..... Western Chihuahua, western Durango.  
*Sciurus apache apache* ..... Eastern Sonora, western Chihuahua, western Durango.  
*Glaucomyus volans madrensis* .... Western Chihuahua.  
*Thomomys umbrinus emixus* .... Southwestern Zacatecas.  
*Thomomys umbrinus crassidens* . Western Zacatecas.  
*Thomomys umbrinus sheldoni* .. Northeastern Nayarit.  
*Thomomys umbrinus chihuahuae* . Southwestern Chihuahua.  
*Thomomys umbrinus evexus* .... Northwestern Durango.  
*Thomomys umbrinus madrensis* . Northwestern Chihuahua.  
*Thomomys umbrinus caliginosus* ..... Northwestern Chihuahua.  
*Peromyscus melanotis* ..... Western Chihuahua and western Durango.  
*Peromyscus boylii rowleyi* ..... Western Chihuahua, central Durango, northern Zacatecas.  
*Peromyscus boylii spicilegus* .... Southern Sonora to southern Jalisco.  
*Peromyscus truci truci* ..... Northwestern Chihuahua.  
*Peromyscus truci gentilis* ..... Southwestern Chihuahua, western Durango, western Zacatecas.  
*Peromyscus difficilis difficilis* .... Southwestern Chihuahua, western Zacatecas.  
*Sigmodon hispidus baileyi* ..... Northwestern Durango.  
*Sigmodon leucotis* ..... Western Zacatecas.  
*Neotoma albigula durangae* .... Northwestern Durango.  
*Neotoma mexicana madrensis* ... Northeastern Sonora, western Chihuahua south to western Zacatecas.  
*Nelsonia neotomodon* ..... Western Zacatecas.  
*Microtus mexicanus madrensis* ... Western Chihuahua.  
*Sylvilagus floridanus holzneri* ... Eastern Sonora and western Chihuahua to northern Nayarit and northwestern Jalisco.  
*Odocoileus virginianus couesi* ... Eastern Sonora and western Chihuahua to northern Nayarit and northwestern Jalisco.

The Sierra Madre Occidental Biotic Province is rather rich in bird life. Not only many races are confined to it, but even the genus *Xenospiza*. Another, *Cyanocorax*, occurs nowhere else in México and of a third, *Otophanes*, only a few specimens have been taken elsewhere. Some of the birds confined to this province are *Meleagris gallopavo onusta*, *Aratinga holochlora brewsteri*, *Amazona finschi woodi*, *Otus vinaceus vinaceus*, *Otus trichopsis aspersus*, *Asio stygius lambi*, *Otophanes mcleodii* (also in the Transverse Volcanic Province), *Atthis heloisa margarethae*, *Lampornis clemenciae bessophilus*, *Trogonurus mexicanus clarus*, *Melanerpes formicivorus aculeatus*, *Campephilus imperialis* (also in the Transverse Volcanic Province), *Dendrocopos villosus icastus*, *Dendrocopos arizonae arizonae*, *Empidonax affinis pulverius*, *Empidonax difficilis inmodulatus*, *Empidonax albigularis timidus*, *Progne dominicensis sinaloae*, *Cyanocorax dickeyi*, *Aphelocoma coerulescens grisca*, *Cyanocitta stelleri diademata*, *Parus sclateri eidos*, *Parus wollweberi annexus*, *Myadestes townsendi calophonus*, *Turdus assimilis calliphthongus*, *Catharus aurantirostris aenopennis*, *Catharus occidentalis olivascens*, *Sialia mexicana bairdi*, *Sialia mexicana amabile*, *Ptilogonys cinereus otofuscus*, *Vireo solitarius pinicolus*, *Vireo gilvus brewsteri*, *Dendroica auduboni nigrifrons*, *Ergaticus ruber melanauris*, *Hesperiphona abeillei pallida*, *Carpodacus mexicanus altitudinis*, *Atlapetes torquatus verecundus*, *Pipilo maculatus griscipygius*, *Melospiza kieneri grisior*, *Plagiospiza superciliosa palliata*, *Xenospiza baileyi*, *Aimophila quinquestriata quinquestriata*, *Aimophila rufescens mcleodi*, *Aimophila ruficeps simulans*, *Junco phaeonotus palliatus*, *Spizella atrogularis evvura* (also in the United States), and *Melospiza melodia goldmani*.

#### 8. CHIHUAHUA—ZACATECAS BIOTIC PROVINCE

The Chihuahua-Zacatecas Biotic Province covers the northern interior plains in Chihuahua, western Coahuila, Durango, Zacatecas, San Luis Potosí, and Aguascalientes, passing on the south into the Transverse Volcanic Biotic Province, and toward the northeast into the Tamaulipas Biotic Province to which the northern part is closely allied. On the west the province is bounded by the more elevated Sierra Madre Occidental Biotic Province and a part of the eastern border is formed by the Sierra Madre Oriental Biotic Province. It is an arid interior desert region consisting mainly of rolling plains, increasing gradually from 1,000 to 3,000 feet along the northern border to about 5,000 feet in altitude along the southern and western sides. Short ranges of desert mountains rise islandlike above the gen-

eral surface, and higher mountain groups, including the Sierra del Carmen, just south of the Big Bend of the Río Grande, reach 10,000 feet in altitude. The general drainage is toward the Río Grande, but a number of interior basins have no outlets.

The province lies mainly in the Lower Austral Zone, where open grassland plains are interrupted by areas overgrown with mesquite (*Prosopis juliflora*), acacias of various species, ocotillo (*Fouquieria splendens*), creosotebush (*Larrea tridentata*), and many other desert shrubs, yuccas, agaves, and cactuses, the latter including the large, conspicuous species *Myrtillocactus geometrizans*. At the higher elevations the land surface, especially on the slopes of the mountains, rises into the Upper Austral Zone, and oaks, junipers, and pinyon pines are characteristic vegetation. The higher parts of the Sierra del Carmen, with forest cover largely of oaks and yellow pines, reach into the Transition Zone.

Because of diversification the Chihuahua-Zacatecas Biotic Province may conveniently be subdivided into three biotic districts: (1) The lower-lying northern section extending from the international boundary south to the 25th parallel may be known as the Chihuahua-Coahuila Desert Biotic District. (2) To the southward of the 25th parallel the general land surface increases more rapidly and irregularly in altitude with groups of rather sterile mountains rising from a base level at 5,500-7,000 feet to 8,000-9,000 feet on the higher summits. Because of location this elevated section may be denominated the Central Tableland Biotic District. On the north it passes gradually into the Chihuahua-Coahuila Desert Biotic District and on the south partakes of the character of some of the units of the Transverse Volcanic Biotic Province. (3) The Sierra del Carmen, rising to more than 9,000 feet south of the Big Bend of the Río Grande, because of elevation and isolation forms a minor center of distribution, extending across the river to include the Chisos Mountains in Texas. This area rising islandlike above the general level of the surrounding country may be denominated the Sierra del Carmen Biotic District.

Mammals assignable to the Chihuahua-Zacatecas Biotic Province are distributed by biotic districts as follows:

#### CHIHUAHUA-COAHUILA BIOTIC DISTRICT

<i>Procyon lotor fuscipes</i> .....	Northern Coahuila.
<i>Bassariscus astutus flavus</i> .....	Coahuila.
<i>Spilogale ambigua</i> .....	Chihuahua.
<i>Taxidea taxus berlandieri</i> .....	Chihuahua, Coahuila.
<i>Vulpes macrotis zinseri</i> .....	Southeastern Coahuila.

- Urocyon cinereoargenteus*  
*scottii*<sup>1</sup> ..... Chihuahua, Coahuila, San Luis Potosí.
- Canis latrans microdon* ..... Coahuila, Tamaulipas, San Luis Potosí.
- Canis latrans mearnsi* ..... Chihuahua.
- Lynx rufus texensis*<sup>1</sup> ..... Coahuila, Tamaulipas.
- Citellus variegatus rupestris*<sup>1</sup> ... Southern Chihuahua, Durango.
- Citellus spilosoma canescens* ... Northern Chihuahua.
- Citellus interpres* ..... Coahuila.
- Thomomys bottae toltecus* ..... Northern Chihuahua.
- Thomomys baileyi mearnsi* ..... Northern Chihuahua.
- Thomomys baileyi nelsoni* ..... Chihuahua, Durango.
- Thomomys umbrinus goldmani* .. Northeastern Durango.
- Cratogeomys castanops consitus*.. Chihuahua.
- Cratogeomys castanops excelsus*.. Coahuila.
- Cratogeomys castanops subsimus*. Coahuila.
- Liomys irroratus canus*<sup>1</sup> ..... Chihuahua south to Zacatecas.
- Perognathus flavus flavus* ..... Chihuahua.
- Perognathus apache melanotis* ... Chihuahua south to Zacatecas.
- Perognathus penicillatus*  
*eremicus*<sup>1</sup> ..... Chihuahua, Coahuila, Durango.
- Perognathus nelsoni canescens* ... Southern Coahuila.
- Dipodomys spectabilis baileyi* ... Northern Chihuahua.
- Dipodomys spectabilis*  
*spectabilis* ..... Northern Chihuahua.
- Dipodomys spectabilis*  
*zygomatus* ..... Southern Chihuahua.
- Dipodomys nelsoni*<sup>1</sup> ..... Chihuahua, Coahuila, Nuevo León.
- Dipodomys merriami merriami* .. Chihuahua.
- Dipodomys ordii ordii* ..... Chihuahua.
- Dipodomys ordii obscurus* ..... Northwestern Durango.
- Onychomys leucogaster albescens*. Chihuahua.
- Onychomys torridus torridus* ... Chihuahua.
- Reithrodontomys megalotis*  
*megalotis*<sup>1</sup> ..... Chihuahua to Zacatecas.
- Peromyscus maniculatus*  
*blandus*<sup>1</sup> ..... Chihuahua and Coahuila to Zacatecas and  
San Luis Potosí.
- Peromyscus leucopus tornillo* ... Chihuahua, Durango.
- Peromyscus pectoralis*  
*eremicoides* ..... Chihuahua, Coahuila, Durango.
- Sigmodon hispidus berlandieri*<sup>1</sup>.. Chihuahua, Coahuila.
- Neotoma albigula albigula* ..... Chihuahua, Coahuila.
- Neotoma mexicana mexicana* ... Chihuahua.
- Lepus gaillardi gaillardi* ..... Northern Chihuahua.
- Lepus gaillardi battyi* ..... Southern Chihuahua, northwestern Du-  
rango.
- Lepus californicus texianus* .... Chihuahua, Coahuila.
- Sylvilagus audubonii minor*..... Chihuahua.
- Odocoileus hemionus cana*..... Chihuahua.
- Antilocapra americana mexicana*.. Chihuahua.
- Ovis canadensis mexicana*..... Chihuahua.

<sup>1</sup> Also in Central Tableland Biotic District.

## CENTRAL TABLELAND BIOTIC DISTRICT

- Procyon lotor hernandezii*.....Southwestern San Luis Potosí.  
*Mephitis macroura macroura*....San Luis Potosí.  
*Urocyon cinereoargenteus*  
*scottii*<sup>1</sup> .....Chihuahua, Coahuila, San Luis Potosí.  
*Canis latrans microdon*<sup>1</sup>.....Chihuahua, Coahuila, San Luis Potosí.  
*Citellus variegatus rupestris*<sup>1</sup> ..Southern Chihuahua, Durango.  
*Citellus variegatus variegatus*<sup>2</sup> ..Southern Zacatecas to México.  
*Citellus spilosoma pallescens* ...Southern Chihuahua, southern Coahuila,  
eastern Durango, northern Zacatecas,  
western San Luis Potosí.  
*Citellus spilosoma spilosoma* ....Southern Durango south to Aguascal-  
ientes, east to San Luis Potosí.  
*Cynomys mexicanus* .....Southern Coahuila, northern San Luis Po-  
tosi.  
*Thomomys umbrinus potosinus* ..San Luis Potosí.  
*Thomomys umbrinus*  
*atrodorsalis* .....San Luis Potosí.  
*Thomomys umbrinus zacatecae* ..Zacatecas.  
*Cratogeomys castanops*  
*goldmani* .....Zacatecas.  
*Cratogeomys castanops*  
*rubellus* .....San Luis Potosí.  
*Liomys irroratus canus*<sup>1</sup>.....Chihuahua south to Zacatecas.  
*Perognathus hispidus zacatecae* ..Zacatecas.  
*Perognathus penicillatus*  
*crenicus*<sup>1</sup> .....Chihuahua, Coahuila, Durango.  
*Perognathus nelsoni nelsoni* ....Southern Coahuila south to Jalisco.  
*Dipodomys spectabilis cratodon* ..Aguascalientes.  
*Dipodomys phillipsii ornatus* ....Zacatecas.  
*Dipodomys nelsoni*<sup>1</sup> .....Chihuahua, Coahuila, Nuevo León.  
*Dipodomys merriami atronasus* ..San Luis Potosí.  
*Dipodomys ordii palmeri* .....San Luis Potosí.  
*Onychomys torridus canus* .....Zacatecas, San Luis Potosí, Aguascal-  
ientes.  
*Onychomys torridus surrufus* ....Coahuila, Nuevo León, Tamaulipas.  
*Reithrodontomys megalotis*  
*megalotis*<sup>1</sup> .....Chihuahua to Zacatecas.  
*Peromyscus maniculatus*  
*blandus*<sup>1</sup> .....Chihuahua and Coahuila to Zacatecas and  
San Luis Potosí.  
*Peromyscus xenurus* .....Durango.  
*Peromyscus melanophrys*  
*consobrinus*<sup>2</sup> .....Zacatecas, San Luis Potosí, Jalisco.  
*Oryzomys coeasi peragrus*.....San Luis Potosí.  
*Sigmodon hispidus berlandieri*<sup>2</sup> .Chihuahua and Coahuila south to Jalisco.  
*Sigmodon fulviventer* .....Zacatecas.  
*Neotoma albigula durangae* ....Chihuahua, Durango.  
*Neotoma albigula zacatecae* ....Zacatecas.  
*Lepus californicus asellus*.....Southern Coahuila south to Zacatecas and  
Aguascalientes.  
*Sylvilagus audubonii parvulus*<sup>2</sup>..Coahuila south to Puebla.

<sup>1</sup> Also in Chihuahua-Coahuila Biotic District.<sup>2</sup> Also in Transverse Volcanic Biotic Province.

## SIERRA DEL CARMEN BIOTIC DISTRICT

<i>Sorex milleri</i> .....	Northern Coahuila.
<i>Ursus americanus eremicus</i> .....	Northern Coahuila.
<i>Bassariscus astutus flavus</i> <sup>1</sup> .....	Coahuila.
<i>Canis latrans microdon</i> .....	Coahuila, Tamaulipas, San Luis Potosí.
<i>Lynx rufus texensis</i> <sup>1</sup> .....	Coahuila, Tamaulipas.
<i>Eutamias dorsalis carminis</i> .....	Northern Coahuila.
<i>Thomomys sturgisi</i> .....	Northern Coahuila.
<i>Peromyscus pectoralis lacuanus</i> ..	Northern Coahuila.
<i>Sigmodon ochrognathus</i> .....	Northern Coahuila.
<i>Neotoma mexicana inornata</i> .....	Northern Coahuila.

<sup>1</sup> Also in Chihuahua-Coahuila Biotic District.

The bird forms apparently confined to this province are: *Anas diazi novimexicana*, *Mergus merganser americanus*, *Colaptes cafer collaris*, *Eremophila alpestris aphyrastus*, *Vireo belli medius*, *Toxostoma dorsale dumosum* (also in Transverse Biotic Province), *Chondestes grammacus strigatus*, *Amphispiza bilineata confinis*.

## 9. TAMAULIPAS BIOTIC PROVINCE

The Tamaulipas Biotic Province comprises the lowland plains and a few isolated ranges of low mountains in eastern Coahuila, northern Nuevo León and Tamaulipas, except the southwestern part. The southern boundary is the line between the Nearctic and Neotropical regions. Along the southern side of the Río Grande Valley this province passes toward the west with increasing altitude, imperceptibly at any particular point, into the Chihuahua-Zacatecas Biotic Province, and it is allied to the Sonora Biotic Province, but it should be noted that the indigenous bird life does not indicate this as clearly as do the mammals and plants. From the low Gulf coastal plains of Tamaulipas the altitude within the area increases gradually to about 2,000 feet along the eastern flank of the Sierra Madre Oriental. Arid conditions prevail, as the moderate rainfall is absorbed by limestone closely underlying much of the surface, and there are few streams. The province lies mainly in the Lower Austral Zone, invaded to some extent by tropical elements, a few of which reach as far north as the Río Grande. Mixed conditions are due to nearly uniform low terrain and to frosts of killing severity to cold-sensitive plants and animals. The upper slopes of some of the mountains enter the lower part of the Upper Austral Zone.

The area is semiarid and the vegetation is made up mainly of thorny shrubs and small trees with a liberal admixture of yuccas, agaves, and

cactuses. Among the plants are *Yucca australis*, *Atriplex matamorenensis*, *Acacia wrightii*, *Pithecolobium flexicaule*, *Cercidium floridum*, *Eysenhardtia polystachya*, and *Covillea tridentata*.

Among the mammals are the following:

<i>Scalopus inflatus</i> .....	Tamaulipas.
<i>Cryptotis berlandieri</i> .....	Tamaulipas.
<i>Dasypterus intermedius</i> .....	Tamaulipas.
<i>Bassariscus astutus flavus</i> .....	Nuevo León, Tamaulipas.
<i>Conepatus leuconotus texensis</i> ...	Tamaulipas.
<i>Conepatus mesoleucus mearnsi</i> ...	Coahuila, Nuevo León.
<i>Canis latrans microdon</i> .....	Tamaulipas.
<i>Felis pardalis albescens</i> .....	Tamaulipas.
<i>Felis cacomitli</i> .....	Tamaulipas.
<i>Lynx rufus texensis</i> .....	Nuevo León, Tamaulipas.
<i>Citellus mexicanus parvidens</i> ...	Coahuila, Nuevo León, Tamaulipas.
<i>Citellus variegatus couchii</i> .....	Coahuila, Nuevo León, Tamaulipas.
<i>Sciurus negligens</i> .....	Southern Tamaulipas.
<i>Sciurus niger limitis</i> .....	Northern Tamaulipas.
<i>Sciurus alleni</i> .....	Nuevo León, Tamaulipas.
<i>Geomys personatus tropicalis</i> ....	Tamaulipas.
<i>Thomomys umbrinus perditus</i> ....	Coahuila, Nuevo León.
<i>Cratogeomys castanops</i>	
<i>tamaulipensis</i> .....	Tamaulipas.
<i>Cratogeomys castanops</i>	
<i>convexus</i> .....	Coahuila.
<i>Liomys irroratus texensis</i> .....	Nuevo León, Tamaulipas.
<i>Perognathus merriami merriami</i> .	Tamaulipas.
<i>Perognathus hispidus hispidus</i> ..	Tamaulipas.
<i>Onychomys leucogaster longipes</i> ..	Nuevo León, Tamaulipas.
<i>Reithrodontomys fulvescens</i>	
<i>intermedius</i> .....	Tamaulipas.
<i>Baiomys taylori taylori</i> .....	Nuevo León, Tamaulipas.
<i>Peromyscus leucopus texanus</i> ...	Nuevo León, Tamaulipas.
<i>Peromyscus pictoralis laceianus</i> ...	Coahuila, Nuevo León, Tamaulipas.
<i>Oryzomys couesi aquaticus</i> .....	Tamaulipas.
<i>Neotoma micropus micropus</i> ...	Tamaulipas.
<i>Neotoma micropus littoralis</i> ...	Southern Tamaulipas.
<i>Lepus altamirae</i> .....	Tamaulipas.
<i>Lepus californicus merriami</i> ....	Coahuila, Nuevo León, Tamaulipas.
<i>Sylvilagus floridanus chapmani</i> ...	Coahuila, Nuevo León, Tamaulipas.
<i>Pecari angulatus angulatus</i> .....	Coahuila, Tamaulipas.
<i>Dasyfus novemcinctus texanus</i> ...	Tamaulipas.

#### 10. SINALOA BIOTIC PROVINCE

The Sinaloa Biotic Province occupies a northern extension of the Arid Tropical Zone from Sinaloa northward to the Yaqui River Valley along the lower western slopes of the Sierra Madre Occidental, but many of the tropical forms do not range north of the Río del Fuerte in northern Sinaloa. From central western Sinaloa northward

it is separated from the coast by a narrow, southern extension of the Sonora Biotic Province in the Lower Austral Zone. Rains are fairly frequent in summer and light showers occur irregularly in winter, with frosts so slight as to be almost imperceptible. The area is semi-arid in general character, the rainfall sufficient to produce a low forest of moderate density made up of trees 15 to 25 feet high.

Many of the plants, associated with distinctive forms of mammals and birds, are also found in tropical provinces to the southward, but do not occur regularly in the adjoining Sonora Province. Among the plants are *Ipomoea arborescens*, *Randia echinocarpa*, *Guazuma ulmifolia*, *Ceiba acuminata*, *Acacia cymbispina*, *Lysiloma divaricata*, and several species of wild fig.

Among the mammals are the following:

<i>Notiosorex crawfordi evotis</i> .....	Sinaloa.
<i>Nasua narica pallida</i> .....	Chihuahua.
<i>Spilogale pygmaea pygmaea</i> .....	Sinaloa.
<i>Felis pardalis sonoriensis</i> .....	Eastern Sonora.
<i>Felis yagouaroundi tolteca</i> .....	Sinaloa.
<i>Lynx rufus escuinapae</i> .....	Sinaloa.
<i>Sciurus sinaloensis</i> .....	Sinaloa.
<i>Sciurus truei</i> .....	Sinaloa, Sonora.
<i>Thomomys umbrinus eximius</i> ...	Northern Sonora.
<i>Thomomys umbrinus atrovarius</i> ..	Southern Sinaloa, central Nayarit.
<i>Thomomys umbrinus musculus</i> ..	Southern Sinaloa, northern Nayarit.
<i>Thomomys umbrinus extimus</i> ...	Southern Nayarit.
<i>Thomomys simulus simulus</i> ....	Southeastern Sonora.
<i>Liomys pictus sonoranus</i> .....	Sinaloa, Sonora.
<i>Perognathus pernix pernix</i> .....	Jalisco, Sinaloa.
<i>Perognathus pernix rostratus</i> ...	Sinaloa, Sonora.
<i>Perognathus goldmani</i> .....	Northern Sinaloa, southern Sonora.
<i>Perognathus ortus</i> .....	Eastern Sinaloa, eastern Sonora.
<i>Peromyscus goldmani</i> .....	Sonora.
<i>Teanopus phenax</i> .....	Sonora.
<i>Neotoma albigula melanura</i> ....	Southern Sonora.
<i>Neotoma mexicana sinaloae</i> ....	Sinaloa, Sonora.
<i>Lepus alleni palitans</i> .....	Sinaloa, Sonora.
<i>Sylvilagus audubonii goldmani</i> ..	Sinaloa, Sonora.
<i>Pecari angulatus sonoriensis</i> ....	Sonora.
<i>Odocoileus virginianus sinaloae</i> ..	Sinaloa.

Among the forms of bird life apparently confined to this province are *Geranoospiza nigra livens*, *Ortalis wagleri griseiceps*, *Lophortyx douglasii douglasii*, *Forpus cyanopygius pallidus*, *Otus guatemalae tomlini*, *Glaucidium minutissimum oberholseri*, *Momotus mexicanus vanrossemi*, *Dryocopus lineatus obsoletus*, *Empidonax difficilis culiacani*, *Empidonax albigularis subtilis*, *Thryothorus felix sonorae*, *Toxostoma curvirostre maculatum*, *Turdus rufo-palliatu*s *grisor*, *Polioptila*

*nigriceps restricta*, *Vireo pallens paluster* (one record from Sonora), *Carpodacus mexicanus rhodoptus*, and *Aimophila carpalis bangsi* (breeds).

## II. NAYARIT-GUERRERO BIOTIC PROVINCE

The Nayarit-Guerrero Biotic Province occupies the coastal region within the Arid Tropical Zone from southern Sinaloa, south through Nayarit, western Jalisco, Colima, southwestern Michoacán, and southern Guerrero. It also includes the bottom of the valley of the Río Balsas in southern Michoacán and northern Guerrero, and the Islas Tres Marias off the coast of Nayarit, which form a well-marked biotic district. Irregular rolling plains with interspersed low ridges make up the mainland surface. Within this tropical area the year is divided into a wet and dry season. Frequent and abundant rains begin in May or June and end in November or December. The arid general character is due to the length of the rainless season from December to May when most of the vegetation becomes leafless, except where there are underground water supplies.

Belts of more or less closed forest, especially on north slopes of hills and along stream valleys, alternate with savanna areas. Many of the dominant plants of this province are of wide distribution, but are associated with mammals and birds of more limited geographic range.

Among the many prominent plants are several species of wild figs (*Ficus*) and of *Bursera*, *Cedrela occidentalis*, *Ceiba parvifolia*, *Hæmatoxylum brasiletto*, *Erythrina occidentalis*, *Ipomoea wolcottiana*, *Randia blepharophylla*, *Acacia hindsii*, and *Mimosa colimensis*.

Among the mammals are the following:

<i>Marmosa canescens insularis</i> ....	Isla María Madre, Jalisco.
<i>Noctilio leporinus mexicanus</i> ....	Guerrero.
<i>Glossophaga soricina mutica</i> ....	Jalisco.
<i>Procyon lotor insularis</i> .....	Isla María Madre, Jalisco.
<i>Nasua narica molaris</i> .....	Colima.
<i>Potos flavus guerrerensis</i> .....	Guerrero.
<i>Conchatus mesoleucus nelsoni</i> ....	Colima.
<i>Canis latrans vigilis</i> .....	Colima.
<i>Felis pardalis nelsoni</i> .....	Colima, Guerrero, Jalisco, Nayarit.
<i>Citellus annulatus annulatus</i> ....	Colima, Guerrero.
<i>Citellus annulatus goldmani</i> ....	Nayarit.
<i>Citellus adocetus</i> .....	Guerrero, Michoacán.
<i>Sciurus polioptus peregrinator</i> ...	Northern Guerrero.
<i>Sciurus polioptus senex</i> .....	Michoacán.
<i>Sciurus polioptus colimensis</i> ....	Colima.
<i>Sciurus polioptus tepicanus</i> .....	Nayarit.
<i>Sciurus colliaci colliaci</i> .....	Nayarit.
<i>Sciurus colliaci nuchalis</i> .....	Jalisco.

<i>Platygeomys fumosus</i> .....	Colima.
<i>Pappogeomys bulleri</i>	
<i>nayaritensis</i> .....	Nayarit.
<i>Pappogeomys bulleri flammeus</i> ..	Jalisco.
<i>Orthogeomys grandis</i>	
<i>guerrerensis</i> .....	Guerrero.
<i>Liomys pictus pictus</i> .....	Colima, Jalisco.
<i>Liomys pictus escuinapae</i> .....	Jalisco, Nayarit.
<i>Liomys pictus parviceps</i> .....	Northern Guerrero, southern Michoacán.
<i>Reithrodontomys fulvescens</i>	
<i>nelsoni</i> .....	Colima.
<i>Reithrodontomys levipes</i> .....	Jalisco.
<i>Peromyscus boylii simulus</i> .....	Nayarit.
<i>Peromyscus boylii madrensis</i> ...	Isla María Madre, Jalisco.
<i>Oryzomys couesi aztecus</i> .....	Guerrero, Morelos.
<i>Oryzomys nelsoni</i> .....	Isla María Madre, Jalisco.
<i>Oryzomys melanotis melanotis</i> ..	Jalisco, Nayarit.
<i>Oryzomys melanotis colimensis</i> ..	Colima.
<i>Sigmodon alleni</i> .....	Jalisco.
<i>Hodomys alleni alleni</i> .....	Colima.
<i>Xenomys nelsoni</i> .....	Colima.
<i>Sylvilagus cunicularius insolitus</i> ..	Colima, Michoacán, Nayarit.
<i>Sylvilagus graysoni</i> .....	Isla María Madre, Jalisco.
<i>Pecari angulatus humeralis</i> .....	Colima.

Some of the bird forms apparently confined to the mainland of this province are *Lophortyx douglasii impedita*, *Cissilopha san-blasiana nelsoni*, and *Habia rubica rosea*. By far the largest number of forms confined to the province appear in the Tres Mariás Islands Biotic District, of which some are *Buteo jamaicensis fumosus*, *Polyborus cheriway pallidus*, *Rallus longirostris nayaritensis*, *Forpus cyanopygius insularis*, *Amazona ochrocephala tresmariae*, *Nyctidromus albicollis insularis*, *Cyananthus latirostris lawrencei*, *Dendrocopos scalaris graysoni*, *Platypsaris aglaiae insularis*, *Thryothorus felix lawrencii*, *Melanotis caerulescens longirostris*, *Turdus rufopalliatus graysoni*, *Myadestes obscurus insularis*, *Vireo virescens forreri*, *Granatellus venustus francescae*, *Icterus pustulatus graysonii*, *Piranga bidentata flammea*, *Richmondia cardinalis mariae*, and *Aimophila humeralis asticta*.

## 12. SIERRA MADRE ORIENTAL BIOTIC PROVINCE

The Sierra Madre Oriental Biotic Province is named for the outstanding feature, the northern section of the Sierra Madre Oriental, which forms a general range in southeastern Coahuila, southern Nuevo León, southwestern Tamaulipas, and eastern San Luis Potosí. Some of the higher mountains are disposed in irregular groups that rise abruptly from the plains to more than 9,000 feet. One prominent peak, the Cerro Potosí, in western Nuevo León reaches to more than 12,000 feet.

The province occupies an intermediate position and is allied to neighboring provinces on all sides. The Sierra Madre Oriental receives a moderate amount of rainfall from moisture-laden winds from over the Gulf, but is much drier than the mountains of Veracruz. Occasional winter storms leave some snow for a short time on the upper slopes of the mountains. The plains at the lower levels lie in the Lower Austral Zone but slope up into Upper Austral Zone, both zones reaching to relatively high elevations due to the high base level. The plains along the basal slopes of the mountains consist in part of open grasslands, interspersed with thickets of thorny shrubs and small trees, including *Prosopis juliflora*, acacias of various kinds, yuccas, agaves, and cactuses. Oaks, nut pines (*Pinus cembroides* and *P. nelsoni*) and manzanita (*Arctostaphylos pungens*) on the middle slopes of the mountains are indicators of the Upper Austral Zone. Higher on the slopes are limited stands of *Pinus leiophylla* and madroño (*Arbutus*), assigned to the Transition Zone, and near the higher summits a few firs (*Abies religiosa*), pines (*Pinus flexilis*), and aspens (*Populus tremuloides*) occur as Canadian Zone elements.

Among the mammals of the province are the following:

<i>Corynorhinus phyllotis</i> .....	San Luis Potosí.
<i>Idionycteris mexicanus</i> .....	Tamaulipas.
<i>Euarctos americanus eremicus</i> ....	Coahuila.
<i>Spilogale leucoparia</i> .....	Coahuila, Nuevo León, Tamaulipas.
<i>Conepatus pediculus</i> .....	Coahuila.
<i>Eutamias bulleri solivagus</i> .....	Coahuila.
<i>Thomomys umbrinus analogus</i> ....	Coahuila.
<i>Cratogeomys castanops</i> <i>  subnubilus</i> .....	Coahuila.
<i>Cratogeomys castanops</i> <i>  planifrons</i> .....	Tamaulipas.
<i>Neotoma navus</i> .....	Coahuila.
<i>Microtus mexicanus subsimus</i> ....	Coahuila.
<i>Odocoileus virginianus</i> <i>  miquihuanensis</i> .....	Tamaulipas.

Among the birds confined to this province are *Colinus virginianus aridus* and *Dendrocopos villosus intermedius*.

### 13. TRANSVERSE VOLCANIC BIOTIC PROVINCE

The dominant geographic position of the Transverse Volcanic Biotic Province has already been pointed out. It occupies a transverse volcanic area extending across the southern and highest part of the interior plateau. The new volcano, Parícutin, that began to rise suddenly from the level of a cornfield in Michoacán, in February 1942, is

the latest manifestation of a mountain-building process that has been in progress here and there for ages within the restricted region. Parts of 11 states may conveniently be included, but the heart of the province is a belt about 400 miles in length and some 60 miles in width. As indicated by Merriam (North American Fauna No. 8, p. 30, 1895), in discussing the remarkable distribution of the pocket gophers of the region, this belt contains 13 of the highest peaks of México, all of which attain an altitude of 12,000 feet or more. Three of these rise to more than 17,000 feet and are capped by small areas representing the Arctic Zone. The only 12,000-foot peaks that stand outside the limits of the belt are Cerro Potosí in Nuevo León and Cerro Zempoaltepec in Oaxaca, the latter regarded by us as a southeastern outpost of the province. In this area of titanic sculpture, all the life zones of North America are represented and the full play of natural forces has favored the evolution or survival of a remarkable number of genera, species, and regional races that find congenial habitats often in close proximity but under widely varying local environmental conditions. Receding glaciers on Cerro Ixtacihuatl and the glacier-eroded top of the Cofre de Perote, Veracruz, are evidence that the area has been colder than at present. Fossil remains of the mastodon, mammoth, and other extinct animals of Pleistocene time indicate that the high valleys of México and Toluca once supported a more luxuriant growth of vegetation than at the present time. Rains and snow are frequent during the summer in the mountains, but the winters are dry and on the interior plateau arid general conditions prevail. Along the eastern slope of the mountains forming the eastern border of the province prevailing winds from over the Gulf discharge their moisture in a heavily forested section, probably the wettest in México. In addition to the regular summer rainy season, when heavy showers are of almost daily occurrence, periodical winter storms known as nortes or northers, bring steady, drizzling rains that usually continue for three days or longer at a time. Fog, often having the effect of light rain, enshrouds the slopes between 5,000 and 7,000 feet altitude nearly throughout the year. This cloud-forest belt forms a section of the Humid Upper Tropical Zone which, owing to its coolness, partakes of the biotic character of the upper slopes of the mountains, a condition that has probably endured as a result of changing climate during Pleistocene time. Along the lower eastern slopes of the mountains the cloud-forest belt passes gradually into the tropical lowlands of the Veracruz Biotic Province. Toward the north the transition is mainly into the Sierra Madre Oriental Biotic Province,

which, north of the valley of the Río Pánuco, also embraces high mountains.

Owing to the wide range in altitude and climatic conditions, the vegetation of the different areas within the province is extremely varied. The cloud forest mentioned contains many oaks, but includes three ferns and many other divergent components. The high interior plains are made up largely of grasslands, intermixed with patches of small trees, shrubs, yuccas, agaves, and cactuses. On the slopes of the mountains are belts of oaks and pines, giving way to firs at about 9,000 feet, and these in turn to other pines and alders, forming a timber-line zone on the highest mountains. The longest river system (the Lerma) wholly within México crosses from east to west along two-thirds of the northern half of the province and with the marshes and the largest lakes of México creates a biotic district within the province.

Some genera and a number of species of mammals are restricted to the Transverse Volcanic Biotic Province. Among the species characteristic of this province are the following:

- Sorex vagrans orizabae* .....México, Michoacán, Puebla, Tlaxcala.  
*Sorex saussurei veraecrucis* .....Puebla.  
*Sorex ventralis* .....Puebla.  
*Sorex oreophilus* .....Jalisco.  
*Cryptotis pergracilis*  
*pergracilis* .....Jalisco.  
*Cryptotis pergracilis macra* .....Guanajuato.  
*Cryptotis soricina* .....México.  
*Cryptotis obscura* .....Hidalgo.  
*Cryptotis alticola* .....México.  
*Cryptotis fossor* .....Northeastern Oaxaca.  
*Cryptotis magna* .....Northeastern Oaxaca.  
*Notiosorex gigas* .....Jalisco.  
*Bassariscus astutus astutus*.....México, Puebla.  
*Spilogale angustifrons*  
*angustifrons* .....Guanajuato, México, Puebla.  
*Conepatus mesoleucus*  
*mesoleucus* .....Hidalgo.  
*Conepatus filipensis* .....Northeastern Oaxaca.  
*Canis latrans cagottis*.....México, Puebla.  
*Citellus mexicanus mexicanus* ..Guanajuato, Jalisco, México, Puebla,  
 Querétaro, Tlaxcala.  
*Citellus perotensis* .....Veracruz.  
*Citellus variegatus variegatus* ..Guanajuato, Hidalgo, Jalisco, México,  
 Michoacán, Morelos, Puebla, Querétaro.  
*Sciurus aurrogaster frumentor* ..Veracruz.  
*Sciurus poliopus poliopus* .....Oaxaca.  
*Sciurus poliopus hernandezii* ....Oaxaca, Puebla.  
*Sciurus poliopus nemoralis* .....México, Michoacán.

- Sciurus polioptus cervicalis* ..... Jalisco, Michoacán.  
*Sciurus nelsoni nelsoni* ..... Morelos.  
*Sciurus nelsoni hirtus* ..... México, Morelos, Puebla.  
*Sciurus oculatus oculatus* ..... Hidalgo, Puebla, Querétaro, Veracruz.  
*Sciurus oculatus tolucae* ..... Guanajuato, México, Michoacán, Querétaro.  
*Glaucomys volans herreranus*... Veracruz.  
*Thomomys umbrinus umbrinus* .. Veracruz.  
*Thomomys umbrinus orizabae* ... Puebla.  
*Thomomys umbrinus albigularis*.. Hidalgo.  
*Thomomys umbrinus peregrinus*.. México.  
*Thomomys umbrinus martinensis*. Western Puebla.  
*Thomomys umbrinus tolucae* ... México.  
*Thomomys umbrinus vulcanius* .. México.  
*Thomomys umbrinus supernus* .. Guanajuato.  
*Cratogeomys merriami merriami*. México.  
*Cratogeomys merriami oreocetes* ..... México.  
*Cratogeomys merriami peregrinus* ..... México.  
*Cratogeomys merriami saccharalis* ..... Puebla.  
*Cratogeomys merriami irolonis* .. Hidalgo, Tlaxcala.  
*Cratogeomys perotensis perotensis* ..... Puebla, Veracruz.  
*Cratogeomys perotensis estor* ... Western Veracruz.  
*Cratogeomys perotensis peraltus* ..... Western Veracruz.  
*Cratogeomys fulvescens fulvescens* ..... Eastern Puebla.  
*Cratogeomys fulvescens subluteus* ..... Western Veracruz.  
*Platygeomys gymnurur gymnurur* ..... Jalisco.  
*Platygeomys gymnurur inclarus* ..... Jalisco.  
*Platygeomys gymnurur imparilis* ..... Michoacán.  
*Platygeomys angustirostris* .... Michoacán.  
*Platygeomys varius* ..... Michoacán.  
*Platygeomys tylorhinus* ..... Hidalgo.  
*Platygeomys planiceps* ..... México.  
*Platygeomys zinseri* ..... Jalisco.  
*Platygeomys neglectus* ..... Querétaro.  
*Pappogeomys bulleri bulleri* .... Jalisco.  
*Pappogeomys bulleri nelsoni* ... Jalisco.  
*Pappogeomys bulleri albinus* .. Jalisco.  
*Pappogeomys bulleri lagunensis*.. Jalisco.  
*Pappogeomys bulleri amecensis* .. Jalisco.  
*Orthogeomys grandis nelsoni*.... Oaxaca.  
*Heterogeomys hispidus concavus*.. Querétaro.  
*Zygogeomys trichopus trichopus*.. Michoacán.  
*Zygogeomys trichopus tarascensis* ..... Michoacán.  
*Perognathus flavus mexicanus*... México.

- Dipodomys phillipsii phillipsii* ... México.  
*Dipodomys phillipsii perotensis* .. Veracruz.  
*Reithrodontomys megalotis*  
*cinereus* ..... Hidalgo, Tlaxcala, Veracruz.  
*Reithrodontomys amoles* ..... Querétaro.  
*Reithrodontomys otus* ..... Jalisco.  
*Reithrodontomys rufescens*  
*rufescens* ..... Hidalgo, Oaxaca, Puebla, Querétaro,  
Veracruz.  
*Reithrodontomys colimae*  
*colimae* ..... Jalisco.  
*Reithrodontomys colimae*  
*nerterus* ..... Jalisco.  
*Reithrodontomys hirsutus* ..... Jalisco.  
*Reithrodontomys chrysopsis*  
*chrysopsis* ..... Michoacán.  
*Reithrodontomys chrysopsis*  
*tolucae* ..... México.  
*Reithrodontomys chrysopsis*  
*orizabae* ..... Puebla.  
*Reithrodontomys chrysopsis*  
*perotensis* ..... Veracruz.  
*Peromyscus maniculatus*  
*labecula* ..... Jalisco.  
*Peromyscus hylocetes* ..... Southern Jalisco, Michoacán.  
*Peromyscus difficilis amplus* ... Hidalgo, Oaxaca, Puebla, southern Vera-  
cruz.  
*Peromyscus difficilis felipensis* ... México.  
*Peromyscus bullatus* ..... Veracruz.  
*Peromyscus melanophrys*  
*zamorae* ..... Hidalgo, Michoacán.  
*Peromyscus mekisturus* ..... Puebla.  
*Peromyscus lepturus* ..... Oaxaca.  
*Peromyscus simulatus* ..... Veracruz.  
*Peromyscus furvus* ..... Puebla, northern Veracruz.  
*Peromyscus melanocarpus* ..... Oaxaca.  
*Peromyscus nelsoni* ..... Veracruz.  
*Oryzomys couesi crinitus* ..... México.  
*Oryzomys couesi regillus* ..... Michoacán.  
*Oryzomys couesi albiventer* .... Jalisco.  
*Oryzomys fulgens* ..... México.  
*Oryzomys alfaroi caudatus* ..... Oaxaca.  
*Oryzomys alfaroi chapmani* .... Veracruz.  
*Oryzomys alfaroi dilutior* ..... Puebla.

## SIERRA DE ANAHUAC BIOTIC DISTRICT

- Sigmodon melanotis* ..... Michoacán.  
*Sigmodon alticola alticola* ..... Oaxaca.  
*Sigmodon alticola amoles* ..... Querétaro.  
*Neotomodon alstoni alstoni* .... Michoacán.  
*Neotomodon alstoni orizabae* .... Puebla.  
*Nelsonia goldmani* ..... Michoacán.  
*Neotoma latifrons* ..... Michoacán.  
*Neotoma nelsoni* ..... Veracruz.

<i>Neotoma montezumae</i> .....	Hidalgo.
<i>Neotoma torquata</i> .....	Hidalgo, Morelos, Puebla.
<i>Neotoma tropicalis</i> .....	Northeastern Oaxaca.
<i>Neotoma ferruginca ochracea</i> ...	Jalisco.
<i>Microtus mexicanus mexicanus</i> ..	Puebla.
<i>Microtus mexicanus phaeus</i> .....	Jalisco.
<i>Microtus umbrosus</i> .....	Oaxaca.
<i>Pitymys quasiater</i> .....	Puebla, Veracruz.
<i>Lepus californicus festinus</i> .....	Guanajuato, Hidalgo, México, Puebla, Tlaxcala.
<i>Sylvilagus floridanus</i>	
<i>subcinctus</i> .....	Guanajuato, Jalisco.
<i>Sylvilagus cunicularius</i>	
<i>cunicularius</i> .....	Hidalgo, Michoacán, Morelos, Oaxaca, Puebla, Tlaxcala.
<i>Romerolagus diazi</i> .....	Puebla.
<i>Odocoileus virginianus</i>	
<i>mexicanus</i> .....	México.
<i>Odocoileus virginianus</i>	
<i>toltecus</i> .....	Veracruz.

Of all the provinces this one has the largest number of bird forms which are confined to it, numbering at least 80. Of these, 8 are full species and 1 is a genus. The following are some of the characteristic forms: *Dendrortyx barbatus*, *Dendrortyx macroura macroura*, *Dendrortyx m. oaxacae*, *Colinus virginianus nigripectus*, *Meleagris gallopavo gallopavo*, *Rallus longirostris tenuirostris*, *Coturnicops noveboracensis goldmani*, *Geococcyx velox velox*, *Otus asio sortilegus*, *Cyananthus latirostris propinquus*, *Thalurania furcata ridgwayi*, *Lampornis amethystinus amethystinus*, *Xiphocolaptes promeropirhynchus sclateri*, *Sittasomus griseicapillus jaliscensis*, *Empidonax difficilis immemoratus*, *Empidonax albigularis axillaris*, *Aechmolphus mexicanus*, *Eremophila alpestris chrysolaeama*, *Cyanolyca nana*, *Aphelocoma coeruleascens sunichrasti*, *Aphelocoma sordida sieberii*, *Certhia familiaris jaliscensis*, *Cistothorus platensis tinnulus*, *Heleodytes megalopterus megalopterus*, *Heleodytes jocosus gularis*, *Thryothorus felix grandis*, *Thryomanes bewickii bairdi*, *Henicorhina leucophrys mexicana*, *Catherpes mexicanus mexicanus*, *Toxostoma ocellatum*, *Toxostoma curvirostre curvirostre*, *Catharus occidentalis occidentalis*, *Sialia mexicana australis*, *Vireolanius melitophrys goldmani*, *Vireo nanus*, *Neochloe brevipennis*, *Dendroica petechia dugesi*, *Geothlypis trichas melanops*, *Geothlypis chapalensis*, *Geothlypis speciosa*, *Geothlypis nelsoni nelsoni*, *Cassidix palustris*, *Carpodacus mexicanus centralis*, *Atlapetes torquatus virenticeps*, *Pipilo torquatus alticola*, *Pipilo fuscus fuscus*, *Pipilo fuscus toroi*, *Aimophila ruficauda acuminata*, *Melospiza melodia pectoralis*, *Melospiza melodia adusta*, and *Toxostoma dorsale dumosum* (also in Chihuahua-Zacatecas Biotic Province).

## 14. VERACRUZ BIOTIC PROVINCE

The Veracruz Biotic Province embraces the tropical lowlands from eastern San Luis Potosí, southern Tamaulipas, and northeastern Puebla, southeasterly through Veracruz and Tabasco and small portions of northern Oaxaca and Chiapas. It is dominated by tropical rain forest, but arid sections, especially near the coast in Veracruz, are included in its scope. The tropical evergreen rain forest resulting from a combination of high temperature, abundant moisture, and fertile soil, represents the optimum type of vegetative vigor and luxuriance. The climax areas in this type contain the largest trees, and rapid growth characterizes plant species of infinite number and form. Much of the original forest cover has been removed or logged over by man, however, and the areas that remain are those least accessible along the lower basal slopes of the mountains. Nearer the coast the rainfall is much less and there are lengthy dry periods during which many trees lose their leaves. Among the trees only a few can be mentioned here. These include the wild figs of various species, *Castilla elastica*, *Cecropia mexicana*, *Bursera pannonia*, *Swietenia macrophylla*, *Cedrela mexicana*, *Pachira aquatica*, *Theobroma cacao*, and *Calocarpum mammosum*. Associated with the flora is a dependent avifauna of extraordinary richness and variety. Many of the mammals are characteristic and mark northern extensions of the ranges of tropical species of wide distribution. In the tropical rain forest, however, with its coarse vegetation and heavy canopy, conditions are less favorable for mammals and fewer species are present than in more open areas where the admission of more light produces denser ground cover and more food. A number of the mammals are arboreal.

A few characteristic mammals are:

- Didelphis marsupialis tabascensis*. Tabasco.  
*Metachirops opossum pallidus*....Veracruz.  
*Philander laniger aztecus*.....Veracruz.  
*Vampyrum spectrum nelsoni*.....Veracruz.  
*Artibeus turpis* .....Tabasco.  
*Pipistrellus cinnamomeus* .....Tabasco.  
*Nasua narica narica*.....Veracruz, eastern Puebla, Tabasco, northern Chiapas.  
*Potos flavus aztecus*.....Veracruz.  
*Jentinkia sumichrasti sumichrasti*. Veracruz.  
*Tayra barbara senex*.....Veracruz.  
*Conepatus leuconotus leuconotus*..Veracruz.  
*Conepatus tropicalis tropicalis* ..Veracruz.  
*Felis onca veracrucis*.....Chiapas, Tabasco, Veracruz.  
*Felis pardalis pardalis* .....Oaxaca, Tabasco, Veracruz.

- Alouatta palliata mexicana*.....Tabasco, Veracruz, northern Chiapas.  
*Ateles geoffroyi vellerosus*.....Veracruz, Tabasco, Oaxaca.  
*Sciurus deppei deppei*.....Veracruz, Tabasco, Oaxaca, Chiapas.  
*Sciurus aureogaster*  
*aureogaster*.....Veracruz, eastern San Luis Potosí,  
eastern Puebla, northern Oaxaca.  
*Sciurus aureogaster*  
*hypopyrrhus*.....Southern Veracruz, eastern Oaxaca, Ta-  
basco, northern Chiapas.  
*Heterogeomys hispidus*  
*isthmicus*.....Veracruz.  
*Heterogeomys hispidus*  
*teapensis*.....Tabasco.  
*Heterogeomys lanius*.....Veracruz.  
*Heteromys desmarestianus*.....Chiapas, Tabasco.  
*Heteromys longicaudatus*.....Tabasco.  
*Heteromys lepturus*.....Oaxaca, Veracruz.  
*Heteromys temporalis*.....Veracruz.  
*Liomys pictus veraecrucis*.....Veracruz.  
*Liomys pictus obscurus*.....Veracruz.  
*Reithrodontomys mexicana*  
*goldmani*.....Northern Puebla.  
*Baiomys musculus brunneus*...Veracruz.  
*Peromyscus leucopus*  
*mesomelas*.....Puebla, Veracruz.  
*Peromyscus boylii aztecus*.....Puebla, Veracruz.  
*Peromyscus mexicanus teapensis*.Tabasco.  
*Oryzomys rostratus rostratus*...Puebla, Veracruz.  
*Nyctomys sumichrasti*  
*sumichrasti*.....Veracruz.  
*Sigmodon hispidus saturatus*....Tabasco, Veracruz.  
*Dasyprocta mexicana*.....Veracruz.  
*Cuniculus paca nelsoni*.....Veracruz.  
*Sylvilagus floridanus russatus*....Tabasco, Veracruz.  
*Pecari angulatus crassus*.....Puebla.  
*Odocoileus virginianus*  
*veraecrucis*.....Veracruz.  
*Mazama sartorii sartorii*.....Veracruz.

Some of the birds apparently confined to this province are *Tinamus major percautus*, *Crypturellus soui meserythrus*, *Rostrhamus sociabilis major*, *Paphosia helenae*, *Colinus virginianus godmani*, *Heliornis fulica*, *Pionopsitta haematotis*, *Amazona farinosa guatemalae*, *Otus guatemalae fuscus*, *Lophostrix cristata stricklandi*, *Campylopterus curvipennis excellens*, *Galbula melanogenia*, *Grallaria guatimalensis guatimalensis*, *Leptopogon amaurocephalus pilcatus*, *Myioborus miniatulus molochinus*, *Habia rubica holobrunnea*, *Richmondia cardinalis coccinea*, *Cyanocompsa cyanoides concreta*, *Sporophila aurita corvina*, *Sicalis luteola chrysoptis*, and *Arremonops rufivirgatus crassirostris*.

## 15. SIERRA MADRE DEL SUR BIOTIC PROVINCE

The Sierra Madre del Sur Biotic Province embraces high mountain areas extending from west to east through central Guerrero and the mountains and interior valleys of central and western Oaxaca. It is allied to the Transverse Volcanic Biotic Province, with which it is closely connected in northern Oaxaca. The higher mountains rise to more than 10,000 feet altitude. The northern and southern slopes in Guerrero and the interior valleys of Oaxaca dip down into the Arid Tropical Zone. The middle slopes of the mountains near the Pacific coast lend variety by bearing patches of Humid Upper Tropical Zone, marked by the presence of tree ferns and other moisture-loving plants associated with mammals and birds of restricted distribution. The climate is similar to that of the plateau to the north. The summer rains are copious and the winters are dry.

Belts of oaks, pines, and firs clothe the upper slopes of the high mountains. The interior valley of Oaxaca is a nearly level plain with trees or bushes irregularly distributed over its surface. Among the trees on the plain are the mesquite (*Prosopis juliflora*), several species of *Acacia*, *Cassia*, and tree *Ipomoea*, and along streams grow thickets of *Baccharis* bushes and scattered bald cypress trees (*Taxodium mucronatum*). A bald cypress at Mitla in the Valley of Oaxaca, with a trunk circumference of 51.8 meters, is believed to be the largest tree in México. A few cactuses, yuccas, and agaves also occur.

Among the mammals are:

<i>Sorex veraepacis mutabilis</i> .....	Oaxaca.
<i>Sorex saussurei oaxacae</i> .....	Oaxaca.
<i>Sorex ventralis</i> .....	Oaxaca.
<i>Cryptotis mexicana peregrina</i> ...	Oaxaca.
<i>Cryptotis mexicana goldmani</i> ...	Guerrero.
<i>Cryptotis mexicana machetes</i> ...	Oaxaca.
<i>Sciurus poliopus effugius</i> .....	Southwestern Guerrero.
<i>Orthogeomys grandis felipensis</i> ...	Oaxaca.
<i>Liomys annectens</i> .....	Oaxaca.
<i>Liomys guerrerensis</i> .....	Guerrero.
<i>Reithrodontomys fulvescens</i>	
<i>helvolus</i> .....	Guerrero, Oaxaca.
<i>Reithrodontomys rufescens</i>	
<i>luteolus</i> .....	Oaxaca.
<i>Reithrodontomys alleni</i> .....	Oaxaca.
<i>Reithrodontomys microdon</i>	
<i>albilabris</i> .....	Oaxaca.
<i>Peromyscus megalops megalops</i> ..	Oaxaca.
<i>Peromyscus megalops auritus</i> ...	Southeastern Guerrero, western Oaxaca.
<i>Peromyscus megalops</i>	
<i>melanurus</i> .....	Oaxaca.

<i>Peromyscus thomasi</i> .....	Guerrero.
<i>Oryzomys guerrerensis</i> .....	Guerrero, Oaxaca.
<i>Neotoma parvidens</i> .....	Oaxaca.
<i>Neotoma ferruginea picta</i> .....	Guerrero, Oaxaca.
<i>Microtus fulviventris</i> .....	Central Oaxaca.
<i>Sylvilagus insonus</i> .....	Guerrero.
<i>Odocoileus virginianus</i> <i>oaxacensis</i> .....	Oaxaca.

Among the forms of bird life apparently confined to this province are *Colinus virginianus atriceps*, *Phaethornis superciliosus mexicanus*, *Lampornis amethystinus margaritae*, *Aulacorhynchus wagleri*, *Xiphocolaptes promeropirhynchus omiltemensis*, *Xiphorhynchus flavigaster megarhynchus*, *Automolus rubiginosus guerrerensis*, *Thryothorus sinaloa russeus*, *Turdus migratorius permixtus*, *Ptilogonys cinereus pallescens*, *Chlorospingus ophthalmicus albifrons*, *Carpodacus mexicanus griscomi*, *Amaurospizopsis relictus*, and *Aimophila rufescens subvespera*.

#### 16. TEHUANTEPEC BIOTIC PROVINCE

The Tehuantepec Biotic Province occupies the arid Pacific coastal strip of Oaxaca, the southern side of the Isthmus of Tehuantepec, and is continued southeastward along the coast of the state of Chiapas to beyond the Guatemalan border. It also includes the arid area extending eastward from the Isthmus along the valley of the Río Grande de Chiapas, in the interior of the state of the same name. In marked contrast, the province thus interdigitates with the Chiapas Highlands Biotic Province. It is allied to the Nayarit-Guerrero Biotic Province toward the west, which is very similar in climate and character of land surface, but differs notably in biotic composition. Farther northwest the province abuts on the eastern end of the Sierra Madre del Sur Biotic Province, with which it has little in common. Across the Isthmus of Tehuantepec there is a tropical connection with the Veracruz Biotic Province, which differs widely in climate and combination of species contained.

Open, nearly level savanna areas occur near the Pacific coast, but the land surface in general is undulating or hilly and covered with a rather thin growth of tropical shrubs and trees 20 to 30 feet in height. Stiff thorny bushes abound and often form thickets difficult to penetrate. The many trees include the mesquite (*Prosopis juliflora*), several species of *Acacia*, *Pithecollobium*, *Ipomoea*, *Annona*, and others of wide distribution. As elsewhere some of the largest trees are wild figs (*Ficus*), which tower above the general top of the low forest.

Among the mammals of the Tehuantepec Biotic Province are:

<i>Cryptotis frontalis</i> .....	Southern Oaxaca.
<i>Spilogale angustifrons tropicalis</i> ..	Southern Oaxaca.
<i>Canis latrans goldmani</i> .....	Chiapas.
<i>Sciurus socialis socialis</i> .....	Chiapas, Oaxaca.
<i>Sciurus socialis littoralis</i> .....	Oaxaca.
<i>Sciurus goldmani</i> .....	Southwestern Chiapas.
<i>Orthogeomys grandis annexus</i> ..	Central Chiapas.
<i>Orthogeomys grandis scalops</i> ...	Oaxaca.
<i>Heterogeomys hispidus</i>	
<i>tehuantepecus</i> .....	Oaxaca.
<i>Liomys pictus isthmius</i> .....	Western Chiapas, southeastern Oaxaca.
<i>Liomys pictus phaeurus</i> .....	Southwestern Oaxaca.
<i>Liomys crispus crispus</i> .....	Western Chiapas.
<i>Liomys crispus setosus</i> .....	Southern Chiapas.
<i>Reithrodontomys fulvescens</i>	
<i>mustelinus</i> .....	Guerrero, Oaxaca.
<i>Reithrodontomys amoenus</i> .....	Oaxaca.
<i>Baiomys musculus nigrescens</i> ....	Chiapas.
<i>Peromyscus allophylus</i> .....	Chiapas.
<i>Oryzomys couesi zygomaticus</i> ....	South-central Chiapas.
<i>Tylomys bullaris</i> .....	Chiapas.
<i>Nyctomys sumichrasti pallidulus</i> ..	Oaxaca.
<i>Neotoma ferruginea isthmica</i> ....	Oaxaca.
<i>Dasyprocta punctata chiapensis</i> ...	Chiapas.
<i>Lepus flavigularis</i> .....	Chiapas, southern Oaxaca.
<i>Pecari angulatus nelsoni</i> .....	Chiapas.

Because of the paucity of our data on this province, where it interdigitates with the next province, it is difficult to determine the proper allocation of the bird forms for either province, which in some cases may be incorrect. Among the birds apparently confined to this province are *Tigrisoma lineatum lineatum*, *Buteo magnirostris petersi*, *Daptrius americanus guatemalensis*, *Ortalis vetula vallicola*, *Ortalis vetula leucogastra*, *Colinus virginianus insignis*, *Colinus virginianus salvini*, *Colinus vrginianus coyolcos*, *Morococcyx erythropygus erythropygus*, *Compsothlypis pitiayumi inornata*, *Notharchus macrorhynchus hyperrhynchus*, *Melanerpes aurifrons frontalis*, *Melanerpes aurifrons polygrammus*, *Calocitta formosa azurea*, *Icterus pectoralis pectoralis*, *Passerina rositae*, *Passerina leclancherii grandior*, *Aimophila ruficauda lawrencii*, *Aimophila sumichrasti*, and *Arremonops rufivirgatus chiapensis*.

#### 17. CHIAPAS HIGHLANDS BIOTIC PROVINCE

The Chiapas Highlands Biotic Province marks the recurrence of a high mountain area east of the tropical gap at the Isthmus of Tehuantepec, obviously allied to, but differing notably in biotic character from,

the mountains west of the Isthmian gap. Embraced in the province are the high mountains of northern Chiapas which extend southeastward into Guatemala, where, around the head of the valley of the Río Grande de Chiapas, they are connected with the range forming the continental backbone between this valley and the tropical lowlands of the Pacific coast of Chiapas. These elevated areas thus represent partially separated extensions into Chiapas of a high mountain mass of much greater height and magnitude in southern Guatemala. The northern unit consists of a broad irregular group of high mountains deeply cut by tropical canyons carrying drainage into the large rivers of Tabasco. The upper slopes of the mountains are covered with oaks and pines, and a few firs (*Abies religiosa*) occur near the tops. Summer rains are heavy and fog is prevalent, especially along the middle northern slopes which are Humid Upper Tropical in zonal position. The southern unit is restricted mainly to the narrow mountain ridge overlooking the coastal strip and facing the Pacific Ocean. Near the Guatemalan border high mountains extending into Guatemala bear firs near the tops. Farther west they are pine-covered but of lesser elevation. Humid tropical areas on the slopes have been found suitable for coffee culture. As elsewhere along the Pacific front of the mountains, the humid areas are less extremely wet than on the Gulf side where fog is more prevalent, and some precipitation may occur during the dry season for the region as a whole.

Among the mammals are the following:

- Sorex veraepacis chiapensis* .....Chiapas.  
*Sorex saussurei cristobalensis* ...Chiapas.  
*Sorex sclateri* .....Chiapas.  
*Sorex stizodon* .....Chiapas.  
*Spilogale angustifrons elata*.....Chiapas.  
*Sciurus griseo flavus*  
*griseo flavus* .....Southeastern Chiapas.  
*Sciurus griseo flavus*  
*chiapensis* .....Central Chiapas.  
*Glaucomys volans goldmani*.....Chiapas.  
*Heterogeomys hispidus chiapensis*.Chiapas.  
*Heteromys desmarestianus*  
*desmarestianus* .....Northern Chiapas, southern Tabasco.  
*Heteromys goldmani* .....Southern Chiapas.  
*Heteromys nelsoni* .....Chiapas.  
*Reithrodontomys dorsalis* .....Chiapas.  
*Peromyscus lophurus* .....Chiapas.  
*Peromyscus guatemalensis* .....Southern Chiapas.  
*Peromyscus zarhynchus* .....Chiapas.  
*Oryzomys alfaroi angusticeps* ...Central and southern Chiapas.  
*Oryzomys alfaroi palatinus* ....Northern Chiapas, southern Tabasco.  
*Oryzomys alfaroi saturatior* ....Northern Chiapas.

<i>Oryzomys hyllocetes</i> .....	Southern Chiapas.
<i>Tylomys tumbalensis</i> .....	Chiapas.
<i>Scotinomys teguina subnubilus</i> ...	Chiapas.
<i>Neotoma ferruginea chamula</i> ....	Central Chiapas.
<i>Sylvilagus floridanus chiapensis</i> ..	Central Chiapas.
<i>Odocoileus virginianus nelsoni</i> ....	Chiapas.

Among the forms of bird life which are apparently confined to this province are the following: *Penelopina nigra nigra*, *Colinus virginianus minor*, *Dactylortyx thoracicus lineolatus*, *Dactylortyx thoracicus chiapensis*, *Caprimulgus vociferus chiapensis*, *Chaetura nubicola*, *Xiphocolaptes promeropirhynchus emigrans*, *Aphelocoma unicolor coelestis*, *Thryothorus rufalbus rufalbus*, *Troglodytes rufociliatus rufociliatus*, *Turdus ignobilis differens*, *Catharus occidentalis alticola*, *Peucedramus olivaceus aurantiacus*, *Ergaticus versicolor*, *Atlapetes gutturalis griseipectus*, and *Junco phaeonotus fulvescens*.

#### 18. YUCATÁN PENINSULA BIOTIC PROVINCE

The Yucatán Peninsula Biotic Province is formed by the low, flat peninsula area that projects far out toward the island of Cuba from the mainland between the Gulf of México and the Caribbean Sea. The state of Yucatán, nearly all of Campeche, Quintana Roo, Cozumel Island, northern Guatemala, and northern British Honduras, are included within its scope. In all this vast territory there are no mountains worthy of the name, and scarcely a hill more than 300 to 500 feet high. A comparatively thin layer of soil covers the underlying limestone which is porous and absorbs moisture so readily that there is little surface stream drainage. Numerous natural sinkholes in the rock, varying from a few feet to more than 100 yards across, contain water of considerable depth at less than 100 feet below the surface of the ground. A few small depressions contain shallow water, the largest and most notable being Lake Petén in northern Guatemala.

The year is divided into two seasons, the rainy season from June to about the end of November, and the dry season from December to June. During the rainy season torrential showers fall mainly in the afternoon. During the dry period occasional showers and some fog maintain moist conditions and an evergreen forest, owing to prevailing winds along the Caribbean coast and throughout the southern part of the peninsula. In Yucatán, however, the dry season is more pronounced and a low, but dense, arid tropical forest becomes nearly leafless. Palms tend to predominate in the heavy forest along the Caribbean coast. The province is, therefore, subdivisible into arid and

moderately humid sections representing biotic districts, with some species dividing into subspecies peculiar to each. Cozumel Island is in itself an important distribution center with various well-marked species peculiar to it, and should be recognized as a biotic district. In general uniformity, however, the province as a whole exhibits a marked departure from the mountainous country forming the continental backbone to the southward.

Among the plants are: *Beaucarnea plibilis*, *Agave sisalana*, *Acacia globulifera*, *Lysiloma sabicu*, *Enterolobium cyclocarpum*, *Haematoxylum campechianum*, *Cacsalpinia gaumeri*, *Esenbeckia pentaphylla*, *Bursera pubescens*, and *Pachycereus gaumeri*.

Among the mammals of the Yucatán Peninsula are the following:

- Didelphis marsupialis cozumelae*. Cozumel Island, Quintana Roo.  
*Didelphis marsupialis*  
*yucatanensis* ..... Yucatán.  
*Cryptotis mayensis* ..... Yucatán.  
*Macrotus pygmaeus* ..... Cozumel Island.  
*Mimon cozumelae* ..... Cozumel Island.  
*Tadarida yucatanica* ..... Yucatán.  
*Procyon pygmaeus* ..... Cozumel Island.  
*Nasua narica yucatanica* ..... Yucatán.  
*Nasua nelsoni* ..... Cozumel Island.  
*Potos flavus campechensis* ..... Campeche.  
*Jentinkia sumichrasti*  
*campechensis* ..... Campeche, Yucatán.  
*Grison canaster* ..... Yucatán.  
*Conepatus tropicalis yucatanicus* .. Yucatán.  
*Felis onca goldmani* ..... Campeche, Yucatán.  
*Felis fossata* ..... Yucatán.  
*Ateles geoffroyi yucatanensis*... Campeche, Quintana Roo, northeastern Guatemala.  
*Sciurus deppei vivax* ..... Campeche.  
*Sciurus yucatanensis*  
*yucatanensis* ..... Yucatán.  
*Sciurus yucatanensis baliolus* ... Campeche.  
*Heterogeomys hispidus*  
*yucatanensis* ..... Yucatán.  
*Heteromys gaumeri* ..... Yucatán.  
*Reithrodontomys gracilis* ..... Campeche, Yucatán.  
*Peromyscus leucopus castancus* .. Campeche.  
*Peromyscus leucopus cozumelae* .. Cozumel Island.  
*Peromyscus yucatanicus*  
*yucatanicus* ..... Yucatán.  
*Peromyscus yucatanicus badius* .. Campeche.  
*Oryzomys cozumelae* ..... Cozumel Island.  
*Oryzomys rostratus*  
*yucatanensis* ..... Yucatán.  
*Oryzomys fulvescens mayensis* .. Campeche.  
*Otodylomys phyllotis phyllotis* ... Yucatán.  
*Otodylomys phyllotis phacus* .... Campeche.

<i>Sigmodon hispidus microdon</i> . . . .	Campeche, Yucatán.
<i>Coendou mexicanum yucataniae</i> . .	Yucatán.
<i>Dasyprocta punctata yucatanica</i> . .	Yucatán.
<i>Sylvilagus floridanus yucatanicus</i> .	Yucatán.
<i>Pecari angulatus yucatanensis</i> . . .	Yucatán.
<i>Pecari nanus</i> . . . . .	Cozumel Island.
<i>Tayassu pecari ringens</i> . . . . .	Campeche.
<i>Odocoileus virginianus</i>	
<i>yucatanensis</i> . . . . .	Yucatán.
<i>Mazama sartorii pandora</i> . . . . .	Yucatán.

This province is very rich in bird life and has the second largest number of forms confined to it of all the provinces. Some of these are *Crypturellus cinnamomeus intermedius*, *Colymbus dominicus dominicus*, *Phoenicopterus ruber*, *Buteo magnirostris gracilis*, *Crax rubra griscomi*, *Ortalis vetula pallidiventris*, *Colinus nigrogularis caboti*, *Dactylortyx thoracicus sharpei*, *Agriocharis ocellata*, *Rallus longirostris pallidus*, *Amazona xantholora*, *Chlorostilbon canivetii forficatus*, *Pteroglossus torquatus erythrozonus*, *Melanerpes rubriventris pygmaeus*, *Dendrocopos scalaris parvus*, *Dendrocincla anabatina typhla*, *Thamnophilus doliatus yucatanensis*, *Attila spadiceus gaumeri*, *Attila spadiceus cozumelae*, *Tityra semifasciata deses*, *Troglodytes musculus beani*, *Nannorchilus leucogaster brachyurus*, *Toxostoma guttatum*, *Mimus gilvus leucophaeus*, *Cyclarhis gujanensis yucatanensis*, *Coereba flaveola caboti*, *Dendroica petechia rufivertex*, *Granatellus sallaei boucardi*, *Icterus auratus*, *Icterus cucullatus igneus*, *Icterus cucullatus cozumelae*, *Spindalis zena benedicti*, *Habia rubica nelsoni*, *Habia gutturalis rooensis*, *Habia gutturalis insularis*, *Richmondia cardinalis yucatanica*, and *Richmondia cardinalis saturata*.

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