

DIRECTIONS FOR STUDYING VEGETATION AND FLORA

by F. R. Fosberg

I. Vegetation

Basically, atoll vegetation is relatively simple in structure, composition, and arrangement. The several types may conveniently be arranged in a series from halo-xerophytic to mesophytic. This series does not represent a single succession, though its members must certainly, in various combinations, form parts of a number of successions in different situations. Observations are not yet available over a sufficient period or in enough detail to enable one to more than guess at what developmental relations actually exist, or how nearly in equilibrium are the main types of vegetation.

The gross arrangement of types from atoll to atoll corresponds very well with the general climates of the atolls, and the more detailed arrangement on an atoll seems to be correlated with variations in salinity of ground-water. Other factors being equal, the more halophytic communities will probably be peripheral, especially on the seaward edges of the islets, while the mesophytic ones will be central, and better developed on wider islets.

Climatically, the driest atolls are those in the equatorial belt of calms and those near the tropic of cancer. They have vegetation approaching true desert, in the most extreme cases with no trees at all. The wettest atolls are those few degrees north of the equator or some degrees south of it. Some of them have lush jungle, sometimes of enormous trees with a dense canopy, with a good development of epiphytes.

Composition varies both with climate and with distance from larger land masses. Generally, the wetter islands have the larger floras, and the floras decrease from west to east, culminating in the barren Clipperton, which perhaps had no indigenous land plants. This seems to be, more than anything else, a matter of distance from sources of colonists. At best, the composition of atoll vegetation is very poor in species.

Briefly characterized, the commoner plant communities, arranged from driest to wettest, are:

1. Open stand of Sesuvium portulacastrum on saline flats.
2. Grassland of Lepturus repens, Thuarea involuta, and Fimbristylis cymosa, often pure stands of one or the other, rarely extensive, rarely with scattered trees. (Christmas I., Pökak, etc.)
3. Open beach or sand flat communities of Triumfetta procumbens, Boerhavia, Ipomoea pes-caprae, Portulaca lutea, etc.
4. Weed communities on cleared or disturbed ground, mostly resulting from human activity and composed of both introduced and native species.

5. Dwarf scrub of Sida fallax, Heliotropium anomalum, etc.
6. Mat of Vigna marina or Ipomoea pes-caprae on flat ground, successional after disturbance.
7. Thick mat of Wedelia biflora or of Wedelia and Ipomoea pes-caprae, on flat cleared ground, successional after disturbance.
8. Scaevola frutescens fringe at top of seaward beaches, merging into dense Scaevola or mixed scrub on narrower islets and sand-spits.
9. Scrubby forest of Messerschmidia argentea, Pandanus tectorius, Guettarda speciosa, Cordia subcordata, etc., behind Scaevola fringe.
10. Sonneratia caseolaris stands on tidally submerged lagoon beaches or reef-rock flats.
11. Mangrove swamps of Rhizophora with openings to lagoon or occupying shallow edges of lagoons.
12. Pemphis acidula thickets on dry reef-rock flats.
13. Mangrove depressions, rock-lined, with clear brackish water.
14. Mixed forest with Messerschmidia argentea, Guettarda speciosa, Intsia bijuga, Pipturus argenteus, Pisonia grandis, Ochrosia oppositifolia, Soulamea amara, Ficus, Eugenia, Pandanus, etc., richer in composition in the western atolls, attenuated toward the east, merging gradually, on the one hand with the scrub forest (#9) and on the other with the Pisonia forest (#16). Any of the components may assume dominance or even occur locally in pure stands.
15. Coconut plantations, with sparse understory of Pandanus, Guettarda, Premna obtusifolia, Morinda citrifolia, etc., the luxuriance depending upon the rainfall, the stature upon how recently the undergrowth was cleared out of the plantation.
16. Pisonia forest, originally of huge trees with dense closed canopy, perhaps the most mesophytic of natural types.
17. Ochrosia oppositifolia forest, usually pure stand.
18. Coconut-breadfruit forest, a tall dense forest with closed canopy, perhaps the most mesophytic man-induced type. Either component may occur alone locally.
19. Mesophytic swamp, with Intsia bijuga, Pemphis acidula, Ochrosia oppositifolia, and various other trees, growing in wet depressions, either muddy or with clear water.
20. Open fresh or brackish marsh, with Cyperus javanicus, etc.

21. Artificial marshes for taro-culture, with Cyrtosperma chamissonis, Colocasia esculenta, Saccharum officinarum and other planted species.

These are the most noticeable groups of communities on the average run of Pacific atolls. There are many variations of these, intermediate stages, and seemingly distinct local types. Toward the west, in the Melanesian and East Indian regions, the vegetation is certainly much richer, but there seems to be almost no recorded information on it.

The problems presented by atoll vegetation are many. Good descriptions of the structure and composition of atoll communities are practically lacking. Nothing is known of its relationship with atoll soils. Actual patterns need to be mapped. An attempt must be made to reconstruct the original forest of present day coconut plantations. Correlations with ground-water conditions, with the several soil series, phosphate hard-pan, with sand, rubble, beach rock, and reef-rock must be made. Developmental or successional relations between the communities must be worked out. Effects of hurricanes and typhoons must be clarified.

The basic tasks that must be accomplished first, and that are best tackled first by the Atoll Program expeditions are the description of the gross structure and physiognomy, the recording of composition, and the mapping of the local distribution of the communities. Any further observations are all to the good, but these basic tasks must be done before any more detailed work can be of much significance.

If any correspondence can be established between patterns, incidence of salt spray, ground-water salinity, and soil patterns, it should be regarded as an important accomplishment.

If the communities listed above can be established as recurrent and sufficiently homogeneous to be of significance by the observations of several independent observers, a standard scheme for mapping them can be worked out. Eventually their distribution through the Pacific can be plotted and the present impression of a correlation with major climatic belts can be placed on a firmer and more objective basis.

Specific observations should be made on selected sites representative of the communities listed above, and of any others discovered, as follows: average height of dominant layer, slope of canopy surface toward sea and correlation of this with wind direction, number of layers and their definiteness, composition of each, relative abundance and evenness of distribution of commoner species, density of canopy and of other layers, substratum amount of disturbance by humans, abundance of sea-birds, presence of guano, presence of a raw-humus layer on ground, underlain or not by a hard-pan, presence or absence of weeds, indications of chlorosis of any species, either native or introduced, which species seem to be reproducing themselves in the vegetation, which not, which only in openings, any obvious invaders, presence and abundance of epiphytes, lianas.

Plenty of photographs should be made, and accompanied by notes on their exact locations and the nature of the subject matter.

One of the most intriguing sets of problems on which observations may readily be made is that concerning the colonization, by plants, of newly formed land--sand spits, gravel bars, etc. Which plants are the pioneers, how their seeds reach these habitats, conditions under which germination takes place, the order in which species are added to the communities, percentage composition at different stages in the development of the communities, and many related facts can be observed by anyone, and will contribute to an understanding of this process of colonization by plants. Collection should be made of seeds found on beach-drift, with accurate data on localities, abundance and whether or not similar seeds were seen germinating.

The basic tasks that must be accomplished first, and that are best tackled first by the field program, are the description of the gross structure and composition, the recording of composition, and the mapping of the local distribution of the communities. Any further observations are all to the good, but these basic tasks must be done before any more detailed work can be of such significance.

If correspondence can be established between patterns, relationships of soil types, ground-water salinity, and soil patterns, it should be regarded as an important accomplishment.

If the communities listed above can be established as recurrent and sufficiently homogeneous to be of significance by the observations of several independent observers, a standard scheme for mapping them can be worked out. Eventually their distribution through the field can be plotted and the present interpretation of a correlation with water climatic belts can be placed on a larger and more objective basis.

Specific observations should be made on selected areas representative of the communities listed above, and of any others discovered, as follows: average height of dominant layer, slope of canopy surface toward sea and correlation of this with wind direction, number of layers and their definition, composition of each, relative abundance and evenness of distribution of commoner species, density of canopy and of other layers, abundance of disturbance by insects, abundance of sea-birds, presence of fungi, presence of a low-humus layer on ground, waterlain or not by a thin pan, presence or absence of weeds, indications of chorionia of any species, other native or introduced, which species seem to be reproducing themselves in the vegetation, which are, which only in open areas, any obvious structure, presence and abundance of epiphytes, lianas.

The plants of photographs should be made, and accompanied by notes on their exact localities and the nature of the subject matter.