Letter from the Desk of David Challinor
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It is rare for someone to see the last wild animal of a rapidly disappearing population, yet we do know of one such instance. James Green on March 11, 1932, watched a heath hen (*Tympanuchus cupido*) scurry into some low bushes on his farm near West Tisbury on Martha's Vineyard, MA. No wild one was ever seen again. Heath is an old world term for an extended, uncultivated open space covered with herbage and low bushes. The colonial landscape of the early XVIII century from Massachusetts to the Carolinas undoubtedly had heaths large enough to sustain an enormous population of heath hens. This bird was so plentiful that it was a staple food for indentured laborers in coastal New England. In winter, when the birds fed on acorns and acidic berries, their meat tasted bitter; in summer they were somewhat more palatable. The servants actually sought in their labor contracts to limit their having to eat heath hen to only two days a week instead of daily. Heath hen abundance, therefore, enables landscape historians to gain insight into what the coastal scene was like three hundred years ago. (Motzkin *et al*. 2002.) This month's letter will consider the history of landscape in pre-and post-colonial time and how and why it changes.

Today's popular image of pre-settlement New England is of a land covered in hardwood forests. This was only partially true. Indians kept the understory relatively open around their settlements by burning it in the fall to drive game past waiting hunters. Thomas Hooker rode bareback from the Massachusetts Bay Colony to southern Connecticut in the 1640's and described the forest as open enough for his horse to walk free of underbrush; swamps and rivers were his major obstructions, not the understory. Recent research, however, shows there were widespread areas of open heath—far larger and more abundant than we can readily imagine today. (Shuman *et al*. 2004.)

In a recent article in *Ecology*, Faison and colleagues investigated the claim that grazing by large mammals created extensive openlands in both North America and Europe during the Holocene epoch (from the end of the Pleistocene—about 12,000 years ago—to the present). However, did the large herds of grazing and browsing mastodons, camels, horses, bison, ground sloths, *et al*. actually cause the mosaic of grasslands and forest ground on both continents or were such complexes the result of edaphic (soil conditions), climatic, geologic and topographic factors?

Analysis of vegetation patterns prior to human records relies largely on palynology, the study of spores and pollen. Sediment cores from lakes and bogs preserve pollen layers laid down yearly by the surrounding vegetation. Fortunately, virtually all pollen grains are identifiable to species. A downside, however, is that pollen is airborne and allowances must be made for wind direction and strength in determining its source when embedded in a core taken by scientists. For example, about 1970 two

paleoecologists, Wright and Davis, disagreed on whether 9,500-year-old ragweed pollen found in a core from a Connecticut lake bottom came from the surrounding area (as proposed by Davis) or was blown there from Midwest prairies—(Wright's theory). If it was locally derived, the land around the lake must have been open grasslands, because ragweed is a meadow plant and shade-intolerant. The bane of hay fever sufferers, its pollen grains are relatively large and covered with spikes.

By careful analysis, the scientists found that pollen from ragweed and similar open-field plants contributed more than 3 ½ percent of all pollen found in cores that were taken at five sites in southern New England laid down 10,100 to 7,700 years ago. Percentages of this kind of pollen did not increase in cores taken from other sources as far away as the Midwestern prairies. Since the prevailing wind is from west to east, the evidence strongly suggests that the ragweed pollen found in the Connecticut lake bottom was from a local source. We still do not know how extensive these Holocene openlands were, but they must have been relatively common (T. Parshall *et al*. 2002). If that were indeed the case, then grassland birds such as the heath hen were likely to have been present.

The spread of open grasslands during the Holocene extended well beyond New England to as far away as South America. The alteration of the landscape from forest to open meadows and savannahs has recently been confirmed in both the Brazilian Amazon (M.B. de Toledo and M. Bush 2006) and in the Venezuelan Guayana (V. Rull 2006). Both changes were also attributed to a long, warm, dry period about 5,000 years ago.

The next great change in the New England landscape took place with European colonization. Within about 150 years of this population's arrival, the bulk of the hardwood forests had been felled and converted to sheep pasture and agriculture. Large new tracts of open land thus increased the habitat for open grassland fauna such as the heath hen. New England (excluding Maine) was only about 30% forested in the first half of the XIX century; today it is about 60% forested. The important point is that landscape status is dynamic; it changes due to climate and, more recently, from massive human activity. Such changes have a profound effect on the fauna and flora. The heath hen became extinct, but small populations of both openland and forest-dependent plants and animals managed to maintain sufficient propagules (reproducing populations) to exploit newly available habitats.

A remarkable illustration of this ability to occupy rapidly a new prairie is occurring on Maryland's eastern shore. A landowner converted a small portion (230 acres) of his large tract (named Chino Farms) to a grassland reserve in the fall of 1998 when the last crops of corn and soybeans were harvested and the area left fallow. The following spring, warm-season grasses and prairie forbs (small leafy dicotyledonous plants) were planted and researchers marked out experimental plots. Having just finished year eight of a long-term ecological study at this farm, scientists from the University of Maryland have obtained some truly amazing results from this conversion of cropland to prairie.

One of the first birds to occupy this new land was the grasshopper sparrow (*Ammodramus savannarum australis*). This secretive bird nests on the ground and gets its name from its call rather than its penchant for grasshoppers. As soon as the prairie plants sprouted, these sparrows started nesting. Where had they come from? It seemed as though they had just been waiting in isolated patches of meadow for an ideal place to settle. Scientists grabbed the chance to study this elusive species and in the process learned that ideal nest sites always had a tall stem nearby from which the male could sing and thus defend his territory. By scattering artificial perches around the study plots, the number of nesting pairs increased dramatically. For years, landowners along the eastern seaboard have used a similar procedure to attract nesting osprey. They erected nesting platforms atop tall, stout poles but found that one of the pair preferred to perch on an adjacent snag before bringing a fish to the nest. The snag was soon added.

Not only did grasshopper sparrows return to this newly restored open grassland, but when low-lying hollows in the tract filled with rainwater, spadefoot toads (*Scaphiopus spp.*) turned up to breed. These toads spend most of their lives underground and are adept at digging—hence their name. This prairie animal must be ready to breed whenever there is enough rainfall to fill a large puddle. When that occurs, they all emerge on the surface and spawn almost immediately. The eggs hatch after only two days. The tadpoles then feed on their yoke supply for another day when their mouths develop to ingest food, first mostly algae and planktonic organisms, then later dead tadpoles that did not metamorphose quickly enough to survive. I watched these extraordinary amphibians court and spawn on my cotton farm in west Texas within less than an hour after a heavy thunderstorm. I had always thought of them as a central plains prairie and desert animal and was surprised when my colleague Doug Gill of the University of Maryland reported their presence on the recently established eastern shore prairie. Eastern spade-foot toads (*Scaphiopus holbrooki*) still persist in relictual populations in the sandy undisturbed openlands of the Coastal Plains from Long Island to Florida, reminiscent of pre-colonial times.

The main lesson learned from the Chino Farms experiments and the ancient ragweed pollen in the cored lake bottom samples is that well-established perceptions of the pre-settlement east coast as an almost uninterrupted hardwood forest were wrong. Fire and drought, particularly in the early Holocene, created scattered open grasslands where fauna and flora migrated from prairie grassland that was eventually reclaimed by forest to newly created prairies. I am lucky to have lived long enough to witness landscape changes. They occur much more quickly than one realizes, and of all predictions, change is the only one that is guaranteed to happen.

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