How Far Could a Squirrel Travel in the Treetops? A Prehistory of the Southern Forest

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Introduction

Conservation activities aimed at protecting old-growth forests; at maintaining populations of desired species groups, such as oaks (*Quercus* sp.), wild turkeys (*Meleagris gallopavo*), other game species or Neotropical migratory birds; and at increasing populations of endangered species, such as red-cockaded woodpeckers (*Picoides borealis*), Bachman's warblers (*Vermivora bachmanii*), Louisiana black bears (*Ursus americanus luteolus*) and Tennessee coneflowers (*Echinacea tennesseensis*), require a target environment. This target, often viewed as the environment at some specified past time, becomes the desired future condition. If the target can be considered a stable ecosystem that is self-perpetuating under control of natural processes, the envisioned environment is a defendable "natural" target for land-use planning. If the target is not easily regarded as "natural," but must involve cultural intervention for its appearance or persistence, the planning process must derive a target environment by some other method, one more clearly reflective of the values of the planners themselves.

Our purpose in this paper is to suggest time periods as potential candidates for the "original" or "natural" condition of the southern forest and to evaluate the forest conditions at those times in light of knowledge of past geological and cultural conditions.

The "Original" Southern Forest in 1607

A most useful starting point for characterizing the prehistory of the southern forest is the establishment of permanent English colonies in 1607. We begin there. A frequent vision of the forest, shared by authors too numerous to mention (e.g., Alverson et al. 1994) depicts relatively complete coverage of closed-canopy forest from the Atlantic Coast to the Great Plains. In this view, a squirrel, presumably a gray squirrel (*Sciurus carolinensis*), would have been

able to move almost in a straight line from treetop to treetop across the Carolinas and Tennessee to the Mississippi River.

This view of the southern forest assumes that natural processes, beginning with glacial retreat and continuing to the arrival of European/African colonists, maintained an extensive, relatively unbroken forest canopy over the South. Several distinct implications for forest conservation and management are apparent. First, a preponderance of climax forest cover would be the historically stable, long-existing condition. Second, wildlife species adapted to later successional conditions, such as pine (*Dendroica pinus*) and cerulean warblers (*D. cerulea*), were very numerous and at carrying capacity in stable and extensive habitats. Third, early successional species, such as prairie (*D. pensylvanica*) and Bachman's warblers, were less abundant, occupied habitats ephemeral in time and space, and were selected for dispersal ability and high reproductive rates. This forest is an obvious candidate for the desired future condition (i.e., target) in the conservation planning of the southern landscape.

In reality, the 1607 forest was probably very extensive, as popular writers suggest. However, this view conceals a myth (Denevan 1992b). The myth, that long-continuing natural forces were responsible for that extensive forest, is exposed by the history of the southern forest (Williams 1989, Denevan 1992b). The southern forest was perhaps at its greatest extent in 1607, a result of changing human activity, not continuous forest development. We briefly document forest conditions at the time humans entered the South 12,000 to 15,000 Years Before Present (YBP); in 1492, at the time of contact between southern Europeans and Native Americans; and return later to 1607.

The "Original" Southern Forest in Late Glacial Times

During glacial times, the southern forest ecosystem included boreal species in communities resembling to those recognized as the Canadian spruce-fir (*Picea-Abies*) forests of today (Delcourt and Delcourt 1991). Boreal birds occurred in central Tennessee (Parmalee and Klippel 1982). Proboscideans, principally mastodons (*Mammut americanum*) and mammoths (*Mammuthus columbi*), dominated the fauna. These grazing animals depended primarily on grasses and sedges, and they likely affected the vegetation of their environment as do modern-day elephants (*Loxodonta africana*) (Fox et al. 1992). Humans hunted these large herbivores extensively throughout the Americas and, in conjunction with increasingly warm climates, probably contributed to their extinction 10,000 YBP (Fox et al. 1992). Early humans probably used fire as a part of their hunting repertoire (Buckner and Turrill in press).

By 7,000 YBP, climate amelioration permitted the currently predominant species to occupy the southern forest (Delcourt and Delcourt 1991). The pattern of post-glacial colonization by trees was species-specific, indicating that forest types as we currently recognize them (Buckner 1995, Hamel 1992) were and continue to be transient in time as well as in space on the landscape. The transience of forest communities in geologic time is the first factor creating uncertainty in setting the 1607 forest as a desired future condition.

A second factor that has received intense attention in the literature is the use of fire by people to control and modify vegetation. Records are scanty and interpretations disparate, so our conclusions will not be agreeable to all. Many writers (e.g., Day 1953) conclude that fire was used by Native Americans as a primary management tool for vegetation manipulation (cf. Van Lear and Waldrop 1989). Others (e.g., Russell 1983) conclude that the effects of Native American-caused fires were more limited in extent and confined nearer to their actual villages. A recent summary of palynological and charcoal evidence for a single site in the Southern Appalachians (Delcourt and Delcourt 1997) indicates a continuous human use of fire for the past 5,000 years. The effect of fire in the southern forest was to increase the extent of longleaf (*Pinus palustris*) and other yellow pines, increase the amount of oak in the forest, reduce the amount of hardwood midstory and understory, increase the spacing of the trees, increase forage grasses used by game animals, and maintain cleared areas for hunting and farming.

The importance of fire to the ecology of longleaf pine is well established. Because both the late successional pine warbler and early successional prairie warbler depend on pine forest habitats, both likely benefitted from persistent use of fire in the southern ecosystem (cf. Hamel 1992). Another plant that is fostered by moderate burning regimes is cane (*Arundinaria gigantea*) (Platt and Brantley 1997). Primarily a species of river floodplains of the South, cane played a prominent role in the ecology of Bachman's warbler (Hamel 1986, Remsen 1986), as well as in the economy of Native American people (Hamel and Chiltoskey 1975). Noss et al. (1995) list canebrakes as one of the endangered ecosystems of the United States. This plant is another key to understanding the prehistory of the southern forest.

The "Original" Southern Forest in 1492

Canebrakes were a common feature of the river floodplains of the South in 1607 (Platt and Brantley 1997), while pine forests were the predominant

forest cover on the uplands across the South. Both plants benefit from disturbance, especially fire. Numerous early explorers noted the low population density in the southern forest in 1607 (cf. Clark 1984, Williams 1989, and especially Silver 1990). Until recently, however, the importance of events that occurred between 1492 and 1607 was not widely recognized. These events, however, shaped the forest conditions that support the myth of an unbroken forest extending from the Chesapeake Bay to the Great Plains in 1607.

The final ingredient that shaped the prehistory of the southern forest was the isolation of the Americas from Europe, Africa and Asia. That isolation created a "virgin soil" condition, not of extensive undisturbed forest, but of human populations isolated from disease pathogens (Whitmore 1991). Contact in 1492 between the Old and New Worlds injected diseases endemic in the Old World (e.g., smallpox, measles, typhus and malaria) as epidemics into the New World. The result was horrific loss of human life.

Population estimates of the Americas in 1492 vary greatly, reflecting different demographic perspectives and methods of calculation. North American estimates range from a relatively low 3.7 to 4.4 million (Denevan 1992a) to a much higher 18 million (Dobyns 1983). Fierce debates rage among demographers about the actual numbers; little debate occurs concerning events between 1492 and 1607. An anthropological consensus is that the population of the Americas was reduced by roughly 90 percent in the 1500s (Whitmore 1991, Lovell 1992). Implications of this depopulation for the 1607 forest are extensive.

Human population collapse following epidemic disease outbreaks led to abandonment of Native American agricultural fields no longer needed to produce food crops and reduction of fires set to maintain those fields. Huge, open agricultural areas, measured in thousands of acres, were noted by earliest Spanish explorers, particularly the members of DeSoto's expedition in 1540 (Dobyns 1983, Cowan 1985, Doolittle 1992). Even then, depopulated villages were described. Subsequent to initial Spanish exploration, these abandoned fields, occupying vast areas in the bottomlands of the rivers of the South, reverted to forest. Probably they were colonized first by the cane that the people maintained for use as a construction material (Platt and Brantley 1997). Subsequently, these cane patches were colonized by other woody species, which in time shaded out the canebrakes. The range of Native American peoples who maintained canebrakes as sources of construction materials is a close approximation of the distribution of Bachman's warbler.

Woody encroachment onto Native American old fields may reflect the initiation of some of the old-growth bottomland forests of today. Enormous sweetgum (*Liquidambar styraciflua*) trees dominate the canopy of the spectacular forests of Congaree Swamp, Richland County, South Carolina, and the Sweetgum Natural Area on the Delta National Forest, Sharkey County, Mississippi. However, smaller individuals of the species are scarce or absent (Jones

1997, P. B. Hamel personal observation: 1981). Dense stands of sweetgum, a shade-intolerant species (Fowells 1965), develop only in full sun on old fields and roadsides. Without some extensive disturbance, these enormous trees will in time be replaced by more shade-tolerant species. Jones' (1997) finding that 95 percent of champion trees in Congaree Swamp have died in the past 15 years suggests that this successional process is happening now. Human population collapse following epidemic disease outbreaks, abandonment of Native American agricultural fields and reduction of fires set to maintain those fields set the stage for colonization of extensive areas by forests.

Cerulean warbler populations were high throughout the Ohio and middle Mississippi River valleys in the extensive floodplain forests encountered by early settlers (e.g., Wilson 1810-1811, Widmann 1907). Had the forests there developed continuously, the species' dependence upon vast unbroken expanses of forest would be unquestionable. The existence of large Native American populations with extensive agricultural fields in those very river bottoms well into the 16th century offers a ray of hope for the future of this currently embattled species. If cerulean warblers were the most common warblers in Mississippi Alluvial Valley forests in central Illinois in the 19th century, they were occupying lands on which the Native Americans in the 13th century constructed a metropolis, Cahokia, more populous than London at the same period (Kennedy 1994).

Conclusion

We conclude that no specific past time can be said to represent the true "original" condition of the southern forest, that human activity has shaped that forest for millennia and that the desired future condition of the southern forest has more to do with societal values than with some ideal past condition. We did not arrive at this conclusion easily. Our examination of the historical record of human inhabitation and forest development does provide an indication of the resilience of southern biota and offers hope to conservation planners and policy makers that desired future conditions can in fact be specified and achieved.

Probably, a squirrel could no more have traveled through unbroken forest from Norfolk, Virginia to Greenville, Mississippi in 1492 than it can in 1998.

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