Down by the Riverside: The Disappearing Bottomland Hardwood Forest of Southeastern North America

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SUMMARY

The rapid expansion of European culture since the fifteenth century has greatly altered the face of the countryside all over the world. Among the most dramatic examples of this are the changes in North American nature wrought by Europeans since the seventeenth century. It has been estimated that between the arrival of the first European colonists in the early seventeenth century and the adoption of sustained-yield forestry in the first decades of the twentieth century, the original forest cover of the United States over that same period was reduced by more than 80 percent.[1] This article traces the history of human impact on bottomland hardwood forests of the southeastern United States, to show how enormous were the alterations brought about by Europeans in the southeastern bottomland hardwood forest ecosystem. Documentation of the different human activities in the area, from prehistoric times to the twentieth century, aims to place the dramatic decline of this forest type in a broader context of human-induced environmental change in North America.

THE SETTING

In 1600 – the approximate date of the arrival of the first European colonists in North America – the eastern half of the continent from the Mississippi River to the Atlantic Ocean, and from the 47th parallel in southern Canada southward to the coastal plains of the Carolinas (except for the northern extension of the Mississippi prairie) was almost entirely covered with forest.[2] The forest types changed from coniferous woods in the north through deciduous woodlands into subtropical forest in Florida. Everywhere there were local variations to add complexity to the scene. Among these were the vast southeastern bottomland hardwood forests that occurred mainly along the major rivers and tributaries of the Southeast.[3]

Environment and History **2** (1996): 77-95

Eastern North America carried and still carries one of the most complicated and variable aggregations of vegetation in the temperate regions of the world. It has literally hundreds of species of trees, most of them deciduous. Hardwoods cover most of the forested area and largely determine the general characteristics of the forest. Not surprisingly, the eastern forest as a whole is usually known as the Eastern Deciduous Forest. The major types of natural forest vegetation found within the Eastern Deciduous Forest have been arranged into many different

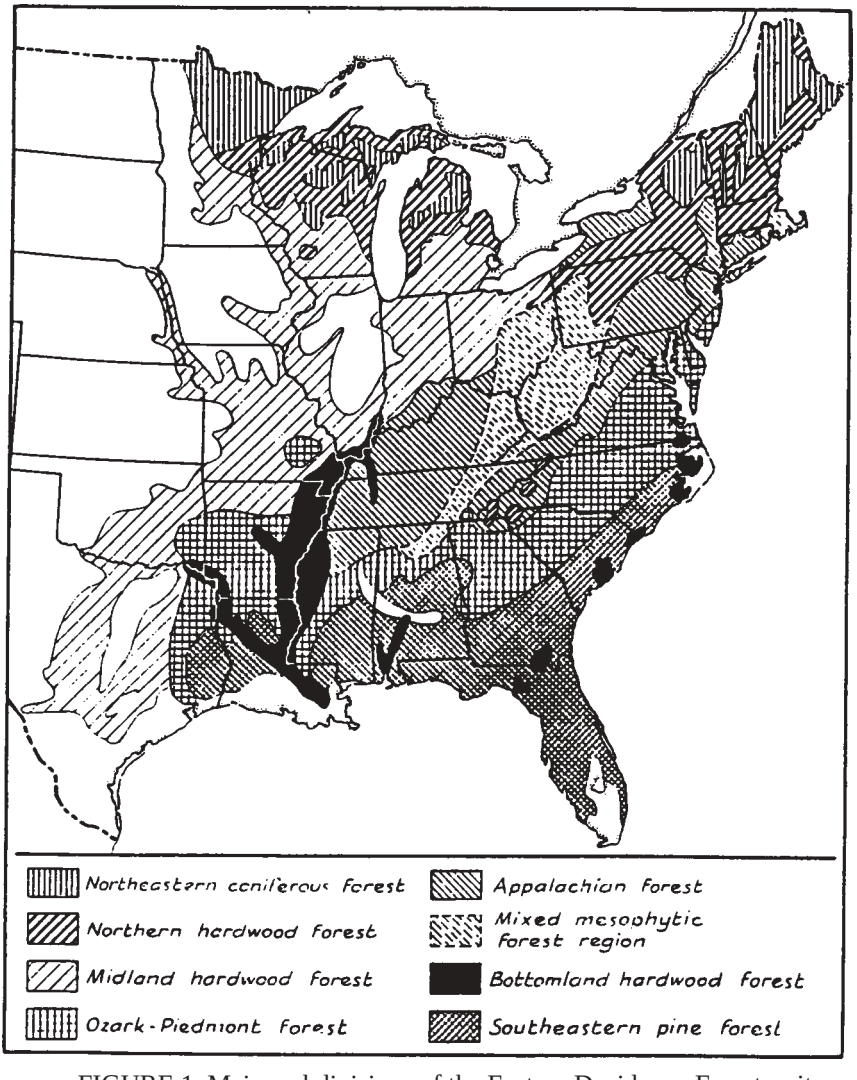

FIGURE 1. Major subdivisions of the Eastern Deciduous Forest as it existed at the time of European conquest. Only the broadest belts of bottomland hardwood forest are shown.[4]

subdivisions. The southeastern bottomland hardwood forest region is among the most distinctive of these because of its unusual site conditions and sharply bounded topography.[5]

The bottomland hardwood forests are found in the general area of 28 to 38 degrees north latitude and 75 to 95 degrees west longitude. The soils of these forests are of alluvial origin, derived from the deposits of sand, silt, clay, and calcareous sediments left by the shifting courses of meandering rivers. The seasonal abundance of water and rich alluvial soil contribute to the formation of lush vegetation which clearly distinguishes the bottomland hardwoods from the pine-dominated upland forests. The bottomland hardwood forests characterise the alluvial swamps of the Mississippi Valley as well as the river valleys of the Coastal Plain from the Mississippi River eastward along the coasts of the Gulf of Mexico, on the peninsula of Florida, and northward through the Carolinas. However, variations of the bottomland hardwood forest type occur to some extent along all the major and minor streams in most states east of the Great Plains.

Because the bottomland soils are mostly composed of materials with a particle size small enough to inhibit the leaching of nutrients and to retain moisture, these soils are more fertile and moist than the adjacent upland soils with their predominantly sandy composition. Not surprisingly, the diversity and species richness of plant communities in the southeastern bottomland hardwood forests is immense. In the better drained areas of the floodplain forests are very dense. Trees at these sites reach very large size, often over three feet in diameter. Small trees, shrubs, and lianes are abundant.

> Along the elevated ridges fronting the streams the white oak, the willow oak, the shell-bark and mocker-nut hickories, the black walnut in great numbers, the yellow poplar and the sassafras large enough to furnish canoes of great size, the mulberry, the Spanish oak, the sweet and black gums are the principal forest trees, with an undergrowth in the openings of dogwood, various haws, crab apples, wild grapes, buckthorns, etc. In the forests covering the lower lands, which slope back to the swamps and reservoirs, the cow oak takes the place of the white oak, while the over-cup white oak occurs everywhere in the more or less saturated soil. Here the sweet gum reaches its greatest size, and here grow also in great perfection the bitter-nut, the elms, hornbeams, white ash, box-elder, and red maples of enormous size. The honey locust, water oaks, and red and Spanish oaks are equally common. Here, among the smaller trees, the holly attains its greatest development, with hornbeams and wahoo elms, while papaws, haws, and privets form the mass of the dense undergrowth, which, interspersed with dense cane-brakes, covers the ground under the large trees.[6]

As with other types of forests, tolerant species gradually replace intolerant ones in the process of natural succession. Many plant species of the bottomland hardwood forests typically require or tolerate recurring or long inundation. Extended flooding, however, raises mortality among some species of trees and

consequently snags are abundant in mature bottomland hardwood forests. Because of their proximity to streams, parts of these forests fit within the general definition of riparian vegetation. In addition to natural succession and the differences in soil structure and drainage, the composition of bottomland hardwood stands is furthermore affected by insects, plant diseases, wildlife predation on seed and seedlings, and – without doubt – by the actions of man and his livestock.

The southeastern bottomland hardwood forests present an extremely heterogeneous mixture of tree species with changes so subtle that the classification of specific forest cover types is a difficult task. The US Forest Service today classifies forest land according to the presence or absence of certain species groups, dividing the bottomland hardwoods into oak-gum-cypresses and elm-ash-cottonwood types. Other, more detailed classifications of bottomland hardwood forests have also ben used; the description of eight primary types with several variations, developed by J.A. Putnam in 1951, has been applied widely.[7] However, only the more recent data on the bottomland hardwood forest and its inhabitants separate these different plant communities. Consequently, the term 'bottomland hardwood forest' is used throughout this article, referring to all of the different plant communities found within this major forest type.

THE NATIVE AMERICAN AND THE FOREST

The aboriginal human inhabitants of North America, usually known as Indians,[8] have often been portrayed as 'environmentalists' in their land-use practices. Native Americans, according to such accounts, lived off nature's bounty and had left no mark upon the land at the time of European conquest. This romantic assertion, however, has little to do with the actual life of Indians and greatly underestimates their influence on the environment of pre-Columbian North America. Furthermore, the attempt to portray Native Americans as innocents living on 'virgin land' ultimately makes them a part of the natural world, thus denying both their history and cultural heritage.

The Indian land-use practices, of course, differed significantly from those of European colonists, and were – by our standards – considerably less 'advanced'. The notion that Native Americans had passively adapted to their natural environment must, however, be avoided. Indian uses of regional environments were extremely varying; nature offered not one, but many ways for humans to live in a given area. The natural environment gives no clues as to what an optimum use of land might be; only culture can provide the values for defining this. Consequently, Indian cultures *per se* were not more 'adapted' to their environment or less 'advanced' in their land-use practices than their European counterparts. The Native American use of the environment had greatly influenced certain landscapes of North America at the time of European conquest.

Indians were capable of modifying vegetational assemblages, manipulating animal populations, and creating habitats best suited to human settlements.[9]

There were hundreds of Native American tribes and several distinctive culture areas by the time of European settlement in what is now the contiguous United States. Accordingly, the prehistoric Southeast was inhabited by tens of tribes, each with different cultural adaptations and subsistence economies. Some well-known tribes of the region include the Cherokee and the Catawba of the southern Appalachians, the Creek of interior Alabama and Georgia, and the Choctaw, the Chickasaw, and the Natchez of interior Mississippi and nearby areas.[10]

Given the diversity of Native American cultures, generalisations about their land-use practices should be avoided. Certain common features, however, emerge when these practices are contrasted with those of Europeans. Animal domestication was generally non-existent, and crop-raising aboriginals of North America almost always integrated their horticultural subsistence practices into hunting, fishing, and gathering economies. Usually there was a clear sexual division among these economies: men concentrated on hunting and fishing, and women on horticulture and gathering. The Native American economies typically protected themselves from environmental fluctuations by moving about in ecologically and seasonally defined cycles, seeking to take advantage of the seasonal abundances and rich variety offered by nature. Throughout the continent, security of subsistence was obtained by incorporating a wide variety of environmental resources into these cycles; when one resource failed to appear during a given season, others were available to ensure subsistence.[11]

Traditionally, the archaeologically defined Indian cultures in the Southeast have been discussed in terms of their chronological and stylistical relationships in time and space, with only a very general description of their use of natural resources. During the last decades archaeologists, anthropologists, and ethnohistorians have, however, made significant contributions to our understanding of the relationship between aboriginals and their physical environment in the southeastern North America.[12] For example, Indian agricultural practices in the Southeast do not appear to have been as uniform as they usually have been portrayed.

Most archaeological attention has been paid to the subsistence technology of the last precolonial period, the so-called Mississippi period which began approximately 900 AD and ended with the arrival of the first Europeans in the area during the early sixteenth century. This cultural tradition arose along the Mississippi floodplain between modern-day Vicksburg (Mississippi) and St. Louis (Missouri), and it spread to river valleys throughout much of the Southeast. The Mississippian culture in the interior Southeast was characterised by its sedentary villages on riverine locations and its relatively firm agricultural base. Despite agricultural innovations, gathering and hunting were still important activities for the Mississippian farmers.[13]

The subsistence technology of Mississippian cultures on the coastal areas of the Southeast was based on small-scale corn agriculture as well as on hunting and utilisation of wild plants: especially acorns and nuts of different oaks and hickories were collected. Many tribes of the interior Southeast, such as the Catawba and the Choctaw, typically combined annual cycles of hunting and gathering with a regular horticultural cycle: crops were planted in spring, and other resources sustained communities until the fall harvest.[14] Fields were established by cutting and burning existing vegetation, paying attention to soil quality. To clear the forests, Native Americans first girdled the trunks or scorched the roots until the trees were dead. The stumps and dead trees, as well as brush, were then burned. After the land had been cleared, the soil was broken for cultivation with simple wooden implements and the crops were planted.

Tillage as practiced by Indians differed significantly from the contemporary European practices: broadcast seeding was virtually non-existent, and crops were planted in rows with each stalk or plant hoed to keep down the weeds. Native Americans commonly used the method of hill planting: as an individual plant grew, loose dirt was scraped around it in order to suppress the weeds. The hills, which were from twelve to twenty inches (30 to 50 cm) in diameter and circa three feet (90 cm) apart, were used over and over again in successive seasons and could grow to sizable mounds of earth. As the soil between the hills remained unbroken, there was little danger of soil erosion in the Indian fields, and this contributed to the sustenance of soil fertility.

Mississippian farmers were probably the first eastern Indians to cultivate beans, and the horticulture of most southeastern tribes was built up around the small-scale cultivation of corn and beans, but also squash and tobacco were grown. All of these American products were unknown to Europeans until the conquest of the New World. In order to achieve maximum yields from their fields, Indian farmers of the Southeast used two agricultural methods: intercropping and multiple cropping. By intercropping (planting several cultigens together in the same fields) Native Americans efficiently utilised the limited area of productive land and enabled the crops to complement each other. The long growing season of the Southeast, on the other hand, made several plantings possible: early and late varieties of corn often yielded two annual crops from the same fields.

The Native American crops complemented each other in a number of ways. The cornstalks, for example, provided a place for the beans to climb on, while the squash vines covered the ground and efficiently suppressed the growth of competing weeds. Beans, on the other hand, largely replaced nitrogen in the soil which corn depleted; this partly enabled Native Americans to cultivate the same fields over long periods of time without the use of fertiliser. Only after the fields had markedly declined in fertility, were they abandoned and new areas were cleared.

Indian farmers of the interior Southeast often preferred floodplain locations because of their need to grow corn without use of fertilisers; silt deposited by floodwaters enriched the soil and made continuous cultivation – and thus sedentary populations – possible. The bottomland soils furthermore held enough moisture even during droughts to sustain agriculture without the use of irrigation. Occasional severe floods were therefore endured for the sake of this naturally productive alluvial soil. Besides, the bottomland soils were (unlike the hard upland soils) easy to till with Indians' flint and wooden tools. Some bottomland sites furthermore presented seasonal opportunities for fishing and hunting.

The Native American agriculture in the interior Southeast was often very productive and, combined with hunting, fishing, and gathering, usually provided the tribes in the region with a secure subsistence. Agriculture may have contributed from 25 to over 50 percent of their food needs.[15] However, it must be emphasised that this pattern of agriculture in the Southeast was confined to the broad natural levees of major rivers on the lower elevations of the Piedmont, the Cumberland Plateau, and the Mississippi Valley. The narrow levees of rivers and the constant threat of flooding on the Coastal Plain made it unattractive for agriculture. Thus the floodplain areas of the inner Coastal Plain were generally unoccupied by any permanent populations during the Mississippi period. This assertion is supported by all the maps made of the area prior to the early nineteenth century: Native American towns on these maps are always situated on or above the Fall Line or on the coast while the intervening area is shown without any occupation.[16]

Estimates of precolonial Native American population in the Atlantic seaboard area run from 350,000 to over 2,200,000.[17] Thus the total number of aboriginal people in North America at the time of the European conquest can only be a matter of speculation. Accordingly, the estimates on percentage of land under cultivation within the range of the southeastern bottomland hardwood forest vary considerably, and no one can state with certainty how much acreage was cultivated in the region by Indian agriculturalists.

It is interesting to note that John Lawson, writing in 1714, remarked that the agricultural Indians of North Carolina did not necessarily clear and cultivate the most fertile lands along the rivers as the removal of huge trees in the bottomlands presented too great an inconvenience.[18] Accounts such as Lawson's make it tempting to speculate that because of this, mature bottomland hardwood forests were often excluded from conversion to cornfields by Native Americans, even when agriculture was being practiced. In any case, transformation of land from forests to agricultural fields seems to have been quite localised, and vast areas of the bottomland hardwood forest remained untouched by human activity, especially on the Coastal Plain.

In southeastern North America, Indian settlements and agricultural fields concentrated in the proximity of major rivers, surrounded by hunting areas of

early successional stages. Fields in the vicinity of permanent villages could become quite extensive and this, combined with other land use practices, resulted in localised deforestation. However, the typical Native American use of the bottomland hardwood forest did little to endanger the natural variety of the land or its capacity for self-renewal. It was mostly the vicinity of scattered Indian villages that became a patchy landscape of mixed grasslands and young woods, and even the most far-reaching actions by the Indian resulted in local modification of the bottomland hardwood forest rather than its eradication.

The Native American populations of southeastern North America were relatively small, their commercial intercourse restricted, and their technology adapted to the needs of personal and communal rather than market-oriented production. The Indian had neither the need nor the means to remake the landscape as thoroughly as the European colonists were to do. For example, the colonists were to use fire as a tool to clear the way for introduced plants and animals, whereas the aborigines had used it to encourage certain wild native species favored over others. The Native American use of timber was furthermore relatively insignificant in relation to deforestation in the bottomlands. Most southeastern Indians lived in shelters built of reeds, bark and a few saplings, and they gathered dead or fallen branches for firewood. Besides, before the emergence of European trade, there was no reason to attack the forest in the European way; Native Americans neither saw wilderness as something that needed to be conquered to ensure prosperity nor considered the forest in its natural state something to be feared.

The early European accounts agreed that the eastern Indians were well-adapted to their natural surroundings. Whether this were true or not, the extensive clearing of forest for timber harvest and cultivation by the colonists was to represent a great shift in the degree to which human populations affected their natural environment, including the bottomland hardwood forest ecosystem.

THE EUROPEAN AND THE FOREST

The first Europeans to enter the bottomland hardwood forests of North America were Spanish conquistadors who explored parts of the Southeast during the early sixteenth century. However, their visits to the region were brief and did not seem to leave any mark of lasting consequence. The English were more tenacious in their attempts to conquer the New World, and with them the European colonisation of North America became a rapid process: the first permanent British settlement, Jamestown, was founded in Virginia in 1607, and by the middle of the eighteenth century there were already thirteen British colonies on the Atlantic coast.[19] After the Revolution the expansion of the new nation, the United States, accelerated and vast areas of land were acquired from Britain, France, and Spain between 1783 and 1819.

By 1800 the settlers had crossed the Appalachians and the frontier (technically a region of more than two and less than six people per square mile) had already advanced to modern-day Ohio (admitted to the Union as a state in 1803), Kentucky (1792), Tennessee (1796), and westernmost Georgia. Only thirty years later, by 1830, the frontier line cut across northern Missouri (1821) to its western boundary and similarly had advanced in Arkansas (1836) and Louisiana (1812) to their western bounds.

By the 1850s, the westward-moving frontier ran from Minnesota (admitted 1858) south through Iowa (1846), Nebraska (1867) and Kansas (1861) and then through Arkansas to Texas (annexed 1845). Areas of settlement, however, had appeared on the West Coast, and the intervening territory was occupied during the next three decades. Officially the frontier came to an end in 1890; the unsettled area had been so broken up by isolated bodies of settlement that there could hardly be said to be a frontier line anymore. This meant also that by the late nineteenth century the last remaining patches of 'virgin' bottomland hardwood forest in the Southeast were within the area of intense human settlement.

The economic life of the European colonists was heavily based on agriculture; approximately 90 percent of the population in all the colonies earned their living on farms.[20] Agriculture differed somewhat in the various colonies as it was influenced by soil, climate, and English trade regulations. But everywhere the use of the land was primitive, resulting in early soil exhaustion; the rotation of crops and use of fertilisers were hardly known. Rich virgin soil with seemingly limitless reserves did not encourage scientific farming. It has been said that the colonial farmer seemed to have but one object: the ploughing up of fresh land. New land for agriculture could be obtained by clearing the forested areas. The colonists had soon adopted from Indians the use of fire and girdling as a means to transform forest to fields. Combined with the settlers' modern technology, this soon resulted in a phenomenal alteration of the southeastern forest.

Southern agriculture in the colonial period was extensively based on plantations. The plantations in South Carolina and Georgia were given over to the large-scale production of rice and indigo. Rice became the leading crop in these colonies. Rice was grown on cut-over, marshy, or flooded lands, especially on clear-cut cypress swamps. By the mid-eighteenth century most land suitable for profitable rice growing in colonised South Carolina was under cultivation.[21] With new techniques adopted in the late 1700s, production continued to increase during the next century, more than tripling between 1820 and 1850. Only after the Civil War (1861-65) did the centre of rice production move from South Carolina to Louisiana; at the same time the cultivation of this crop was also taken up in the lowlands of Texas and Arkansas.

The settlers in Virginia had discovered in tobacco a staple crop. Tobacco cultivation was a profitable business, but it quickly exhausted even the richest alluvial soil; the optimal age of a tobacco field was three years after which it was turned over to other crops and land for a new tobacco field had to be cleared.

Since tobacco was an export product, it was necessary for plantations to be located on the riverbanks in order that the transportation of the yield by ships would be possible. Consequently the land along rivers was rapidly taken up in Virginia and North Carolina. Only after the lands near the rivers had been entirely occupied did the settlers move inland; this meant that the better drained sections of bottomland hardwood forests were among the first areas to be cleared for agricultural interests. By 1750 the soils of the old tobacco regions had been exhausted and production moved into the Piedmont. By the 1820s Kentucky and Tennessee were expanding their production rapidly; later, tobacco gained importance also in Ohio and Missouri.

The scarcity of labour in North America – a problem partly resolved by using African slave labour – demanded utmost efficiency in its use. Combined with other elements of tobacco cultivation, such as the biology of the plant and the ever-growing demands of the market, this requirement ensured that few people would have the maximum impact on soil and forest. Tobacco cultivation consequently resulted in ceaseless breaking in of new land and vast deforestation in much of the Southeast.

After the invention of the cotton gin in 1793, cotton became an important cash crop for the southern farmers. Production centered first in South Carolina and Georgia. After 1815, however, the cotton belt expanded quickly through Alabama and Mississippi and – as the soils in the older areas were exhausted – into Tennessee, Louisiana, Arkansas, and Texas. Another profitable crop for some southern farmers was sugarcane, a plant introduced to Louisiana during the eighteenth century by the French. Since the sugarcane plant depletes potassium rapidly and requires fertile land, its cultivation was confined to the areas of recent alluvium along the lower Mississippi and its tributaries.

In comparison with tobacco, cotton and sugarcane, the other crops cultivated in the eighteenth and nineteenth century Southeast did not deplete the soil as extensively. Their cultivation, therefore, did not increase the need for landclearing along the rivers as much as did the farming of the former three crops; nor were they grown on the swampy areas of the bottomland hardwood forests like rice.

Because of incomplete statistics it is difficult to estimate how much land was cleared before 1850, but it is probable that some 113,740,000 acres (45,416,000 ha) of land had been improved (term used by U.S. Bureau of the Census) in the United States before that date.[22] The overwhelming part of this land was carved out of the eastern forests, with only a small amount coming from natural clearings. All the evidence points to a big upswing in the rate of clearing after 1840; and in any case between 1850 and 1860 the amount cleared rose by a total of 39,705,000 acres (15,882,000 ha), equivalent to approximately one-third of all clearing carried out during the preceding two centuries. During the 1860s the amount of forest land newly cleared and settled fell by almost 50 percent, but during the next decade the settlement of the Midwest raised it again to its highest total in any inter-censal period with almost 50 million acres (20 million ha).[23]

The shift in the centre of activity of pioneer endeavour from the east to the central and non-forested parts of the continent after the 1860s did not meant a diminution of the human impact on the eastern forests. Non-cleared areas in the Southeast were largely brought under cultivation. For example, in Florida the acreage of land in farms almost doubled between 1870 and 1900.[24] Accordingly, the amount of improved land rose steadily (Tables 1 and 2). The scarcity of wood in the central prairies furthermore acted as a stimulus for lumbering in the Southeast and led to the emergence of a continental system of timber transportation.[25]

STATE County/Parish	1860	1870	1880	1890	1900
FLORIDA					
Alachua County	373	459	562	748	1016
Levy County	77	56	181	285	285
Wakulla County	153	118	137	114	227
LOUISIANA					
Avoyelles Parish	581	385	882	991	1171
MISSOURI					
Butler County	90	148	219	374	557
Dunklin County	158	209	437	1017	1012

TABLE 1. Improved (= cleared) land in some southeastern counties and parishes, originally dominated by the bottomland hardwood forest, 1860 to 1900 (100 acres).[26]

STATE/YEAR	1850	1880	1900	1920	1940
Alabama	12.1	18.9	20.7	19.6	19.1
Arkansas	2.6	12.1	16.6	17.5	18.0
Florida	1.6	3.3	4.4	6.0	8.3
Georgia	22.8	26.0	26.4	25.4	23.7
Louisiana	5.0	8.3	11.1	10.0	10.0
Mississippi	10.5	15.9	18.2	18.2	19.2

TABLE 2. Land in farms in some southeastern states, 1850 to 1940 (1,000,000 acres).[27]

The clearing of southeastern forests for agriculture continued after the turn of the century, peaking again in the 1930s. New drainage techniques became crucial in the transformation of lowlands from swampy forests to agricultural

fields. After the Second World War bigger farms, commercial fertilisers, pesticides, and an expanding market for agricultural commodities resulted in increased profits, and new land for agriculture was in high demand. Soybeans became a major crop in many areas of the Southeast, and the desire to convert the remaining areas of bottomland hardwood forest into productive rowcrop fields resulted largely from the cultivation of this new, profitable crop. Especially bottomland areas along the lower Mississippi have continued to suffer losses because of the increased soybean cultivation.[28]

There had been other than agricultural reasons to attack the seemingly limitless forest since the time of the first colonists. European settlement brought sweeping changes in land use; in addition to the clearing for crops and pastures, there were the harvesting of trees for housing, fencing, lumber and fuel, and the manufacturing of naval stores and charcoal iron, all of which accelerated the destruction of the original forest. The introduction of the steam engine, which consumed wood for fuel and was often used for sawing machines, also assisted this attack on the forests from the early nineteenth century on.

Wood was the basic fuel in the United States until the late nineteenth century; coal hardly entered into domestic fuel consumption before that. Of all timber cut in gross volume, the amount cut for fuel exceeded the amount cut for lumber still in the late nineteenth century.[29] Ever since the colonial period, southeastern woodlots and sawmills had concentrated in the proximity of streams and rivers where the transportation of lumber was easy and the dominant trees were hardwoods that constituted cordwood of superior quality. In order to save labour and expense, cutting was customarily restricted to riverbanks and adjacent slopes so the logs could easily be rolled into the streams.[30]

The lumber industry in the United States expanded enormously during the nineteenth century; the lumber cut increased from less than 0.5 billion board feet in 1800 to more than 35 billion board feet by 1899.[31] This expansion was made possible by three technical changes: improved saws and the use of steam engines, the improvement of local transport with the development of the log drive, and the evolution of a continental transport system that linked the areas of timber surplus and deficiency. The large-scale lumbering industry started in the Northeast, extended to the Central and Lake states at mid-century and reached the Southeast during the last decades of the 1800s.

Lumbering had been widespread on southern plantations and along coastal waterways from colonial times on, and there had always been a market for the durable baldcypress, a tree characteristic of the bottomland swamps. Cypress was highly valued for shipbuilding and roofing purposes as the wood efficiently resisted damp.[32] Cypress swamps were usually logged at high water because of easier transportation, and thus the cutting was extremely wasteful as the trees could be sawn off up to some fifteen feet (6 to 7 m) above root level and the stumps left to rot. Severe floods offered remarkable opportunities to obtain this valuable wood:

> The river was extraordinarily high, the lowlands being overflowed to a depth of more than 10 feet...No idle man was to be found on shore; everybody who could swing an ax, paddle a boat, or pilot a log was in the swamp engaged in felling and floating cypress timber. All the mill-hands worked in the swamps; fields and gardens were left untouched, and even clerks from the stores were sent to swamps as overseers.[33]

Following the federal Swamp Lands Act of 1849-50, vast areas of mature cypress forests on public lands along the Mississippi, Red, and Atchafalya rivers passed via corrupt officials to lumbermen. The major assault on the southern cypress stands, however, was delayed until after the Civil War because of the inaccessibility of many swamp areas.[34]

The adaptation of steam-powered sawmills combined with the spread of the railroads during the nineteenth century revolutionised the southern lumber industry, and in the 1850s production more than doubled.[35] The Civil War ended the boom, but by the 1880s the South was again on its way to become the nation's leading lumber-producer, a status won by the turn of the century.

Following the Civil War, many southern states had been economically strapped as no taxes were paid on federal lands, and soon the sale of these lands – in order to put them back on the tax rolls – had become inevitable. Thus the economic situation in the post-war South enabled northern lumber companies and speculators to take over vast areas of southern forest: between 1876 and 1888 millions of acres of forested public land were sold to ruthless northern buyers, often with minimal prices.[36]

> The cutting of these cypress forests is not wisely regulated under the ownership of the state. These lands have been thrown into the market at 50 cents an acre with the condition of settlement. Beneficial as such a law might prove in the disposal of lands fit for cultivation, it results, in the case of timber-land unfit for the plow, in the reckless destruction of one of the surest sources of public revenue. The state thus sells for 50 cents what on its face is worth to the purchaser hundreds of dollars, and which, when deprived of its value and rendered forever worthless, will be turned back to the state again.[37]

The new owners were usually absentees who looked for a quick profit and missed the fact that trees were both a valuable crop and an essential protection to the soil; no efforts were made to replant the clear-cut forests.

In the late nineteenth century Gulf States region, methods characteristic of the old lumber industry were used: enormous mills, huge log drives and aggressive pursuit of timberlands combined with 'cut out and get out' policies resulting in a vast deforestation. Construction of railroads significantly spurred the timber economy and made it possible to harvest formerly inaccessible stands of virgin timber.

> The large number of [cypress] logs harvested shows clearly with what activity the destruction of these treasures of the forest is being pushed; and the reports, as of heavy

> thunder, caused by the fall of the mighty trees, resounding at short intervals from near and far, speak of its rapid progress.[38]

'Logtowns' sprang up across the region, and logging drove the local economy until the supplies were depleted. The settlements and the cut-over lands were then abandoned – and dropped from the tax rolls once again.

During the late nineteenth century, the northern lumber companies were primarily interested in the virgin pine forests of the southeastern uplands, but also the vast timber stands of bottomland areas offered opportunities for quick gains:

> In 1831 Mr. Vaughn found these cypress swamps untouched by the ax. At present their resources are so diminished by the inroads made upon them during the last twelve years that, with a prospect of a rapidly-increasing demand for cypress lumber in the near future, he judges that they will be completely exhausted during the next ten years. This opinion is shared by all mill-owners here, who believe that in less than that time their business must come to an end.[39]

In 1909 the all-time peak of lumber production in the United States was reached; over 44.5 billion board feet of lumber was sawed that year, with almost 20 billion board feet of it coming from the South and South Atlantic regions.[40] Because of cheap labour, tax incentives, and depletion of old-growth stands in the western and northern parts of the United States, the southern forest industry has remained strong in the twentieth century (Table 3). At the same time technical innovations, such as the development of lightweight chainsaws in the late 1940s, have made logging in the southeastern forests easier than ever before.

YEAR	AMOUNT			
1869	1,287		1919	16,078
1879	2,504		1929	16,335
1889	5,082		1939	11,395
1899	11,116		1949	10,926
1909	19,973		1959	10,269
			1969	10,501

TABLE 3. Lumber production in the Southeast, 1869 to 1969 (1,000,000 board feet).[41]

THE DISAPPEARING FOREST

During the nineteenth century, a growing number of Americans had recognised the forest as the basis of industrialisation, agricultural expansion, and material advancement. This soon resulted in a significant diminution in the area occupied

by forests in North America. At the most conservative estimate, some 153,000,000 acres (61,000,000 ha) of forest had been cleared for agriculture by 1860, and at least another 11,000,000 (4,400,000) by the lumbering industry, mining, and urban spread; a couple of hundred years after the colonists' arrival about one-quarter of the original forests of the eastern United States had disappeared.[42]

Toward the end of the century, the quickening destruction of the southeastern forests due to the booming lumber industry resulted in vast deforestation and erosion that ultimately led to the adaptation of sustained-yield forestry in the twentieth century. By 1919 the onslaught across southern timber stands had reduced the primeval forest by approximately 40 percent: only some 178,000,000 acres (71,000,000 ha) from the original 300,000,000 acres (120,000,000 ha) remained. Of the southern woodland left, 39,000,000 acres (15,500,000 ha) was classified as virgin forest.[43] Lumbering had played the greatest part in this reduction and had left a permanent imprint on the southeastern landscape. In addition to its massive assault on the southeastern pine forests, the logging industry had concentrated much of its cutting efforts on hardwood stands of high commercial value, and thus especially mature bottomland forests had been affected by lumbering.

Since the 1930s almost a third of all the cleared land in the Southeast has reverted to forest, though fragmented and immature. Large areas of hardwood forest in the Southeast have been converted to even-aged pine plantations, and these ecological deserts today dominate the landscape of many southeastern states. Much of the increase in forested area has come from the abandonment of marginal farmland, a process largely restricted to upland regions. Consequently, most of the mature bottomland hardwood forest seems to have been permanently lost. Conservation of the remaining sites versus economic development has been a controversial issue since the 1970s, but only the relatively small areas of bottomland hardwood forest in public ownership seem today secure from economic exploitation.[44]

The natural environment of the American Southeast altered rapidly after the colonists' arrival. By modifying and destroying the original habitats, the European colonisation of North America caused enormous changes in the landscape of the continent. The changes themselves were essentially the same as those that had been brought about in Europe earlier, but the tempo was much faster. Numerous endemic plant and animal species became increasingly rare or extinct; similarly the culture of indigenous human inhabitants of North America was destroyed. Many native species soon lost most of their natural habitat as the European settlers altered the continent. Judging from all evidence, the destruction of mature bottomland hardwood forests in the Southeast played a significant part in the demise of many species, causing irreversible changes in the ecosystem.[45]

The immense transformation of the bottomland hardwood forests of southeastern North America was largely driven by economic interests. Along with the

industrialisation and commercial development in Europe and North America came burgeoning markets for products which could be obtained by utilising the bottomland hardwood forest, and agriculture and forestry expanded enormously compared with the Native American practice. Economic gain was the basis for the extensive alteration of the southeastern bottomland hardwood forest, and the demands for economic growth continue to impel human-induced environmental change all over the world.

NOTES

[1] Michael Williams, *Americans and Their Forests: A Historical Geography*, Studies in Environment and History (Cambridge: Cambridge University Press, 1989), 3-4.
[2] Ibid.; and Thomas R. Cox, Robert S. Maxwell, Philip Drennon Thomas, and Joseph J. Malone, *This Well-Wooded Land: Americans and Their Forests from Colonial Times to the Present* (Lincoln: University of Nebraska Press, 1985), 2. However, see Stephen J. Pyne, *Fire in America* (Princeton, NJ: Princeton University Press, 1982), 75-76, 79-80.
[3] The geographical region 'Southeast', as used in this paper, consists of the modern-day states of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee, and of southern Virginia and Kentucky, southeastern Missouri, and eastern Oklahoma and Texas.
[4] Illustration from David M. Smith, 'The Forests of the United States', in *Regional Silviculture of the United States*, ed. John W. Barret, 2nd ed. (New York: John Wiley and Sons, 1980), 15 (Figure 1-5).
[5] David M. Smith, 'Forests of the United States', 9-19. See also Lucy E. Braun, *Deciduous Forests of Eastern North America* (Philadelphia: Blakiston, 1950), 31-38, 290-91; and C. Frank Brockman, *Trees of North America: A Guide to Field Identification*, rev. ed. (New York: Golden, 1986), 18-19.
[6] Dr. Charles Mohr's report upon the forests of the Yazoo Delta, Mississippi, in 1880. Published in Charles S. Sargent, *Report on the Forests of North America (Exclusive of Mexico)*, Vol. 9 of *The Tenth Census of the United States (1880)*, U.S. Department of Interior, Census Office (Washington, D.C.: Government Printing Office, 1884), 535.
[7] J.A. Putnam, *Management of Bottomland Hardwoods*, Occasional Papers, no. 116 (Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station, 1951). In Putnam's classification, the bottomland flora is divided into eight different categories. According to Putnam, the widely distributed sweetgum-water oak type is usually found on terrace flats and in first bottoms. The white oak-red oak-other hardwoods type occurs mainly on first bottom and terrace ridges. The overcup oak-bitter pecan type is characteristic of low, poorly drained flats, sloughs, and backwater basins. The cottonwood type pioneers fronts and well-drained flats, while hackberry-elm-ash is normally a successional type following cottonwood on low ridges, flats, and sloughs in first bottoms and on terrace flats and sloughs. The willow type invades fronts in sloughs and low flats. The river front hardwoods type is transitional between cottonwood or willow and the sweetgum-water oak type, and occurs on all front lands except deep sloughs and swamps. Finally, the cypress-tupelo-gum type characterises low and poorly drained flats, deep sloughs, and swamps.

[8] In this article, I use the terms 'Indian' and 'Native American' interchangeably. 'Native American' in U.S. Census usage includes Aleuts and Eskimos as well as Indians. As the geographical area of my study comprises only southeastern North America, no misunderstandings should arise.

[9] Richard White and William Cronon, 'Ecological Change and Indian-White Relations', in *History of Indian-White Relations*, ed. Wilcom E. Washburn, *Handbook of North American Indians*, vol. 4 (Washington, D.C.: Smithsonian Institution, 1984), 417.

[10] On major cultural areas of the prehistoric North America, see Donald J. Ballas, 'Historical Geography and American Indian Development', in *A Cultural Geography of North American Indians*, ed. Thomas E. Ross and Tyrel G. Moore (Boulder, CO: Westview, 1987), 15-20.

On Indian tribes of the Southeast, see Pentti Virrankoski, *Pohjois-Amerikan intiaanit: Rio Granden pohjoispuolella asuneiden intiaanien kulttuuri ja historia*, Suomen Antropologisen Seuran toimituksia, no. 3, 3rd ed. (Helsinki: Suomen Antropologinen Seura, 1980), 16-50.

[11] White and Cronon, 'Ecological Change and Indian-White Relations', 417.

[12] Lewis H. Larson, *Aboriginal Subsistence Technology on the Southeastern Coastal Plain during the Late Prehistoric Period*, Ripley P. Bullen Monographs in Anthropology and History, No.2 (Gainesville: University Presses of Florida, 1980) is a good example of this new, interdisciplinary approach to the prehistory of North America. It has largely served as a model for the following discussion on Native American subsistence technology in relation to the bottomland hardwood forest ecosystem.

[13] Albert E. Cowdrey, *This Land, This South* (Lexington: University Press of Kentucky, 1983), 13-14; and R. Douglas Hurt, *Indian Agriculture in America* (Lawrence: University Press of Kansas, 1987), 13-16.

[14] The following account on the general characteristics of Native American agriculture in southeastern North America is based on Cowdrey, *This Land, This South*, 14-15; Cox et al., *This Well-Wooded Land*, 39-40; G. Melvin Herndon, 'Indian Agriculture in the Southern Colonies', *North Carolina Historical Review* 44 (Summer 1967): 283-97; Hurt, *Indian Agriculture in America*, 13-16, 27-41; Harry N. Scheiber and Harold G. Vatter, *American Economic History*, 9th ed. (New York: Harper and Row, 1976), 45; and White and Cronon, 'Ecological Change and Indian-White Relations', 419-20.

[15] Hurt, *Indian Agriculture in America*, 29-31; and Larson, *Aboriginal Subsistence Technology*, 222.

[16] Larson, *Aboriginal Subsistence Technology*, 56, 58-59, 65, 221-22.

[17] Cf. A. L. Kroeber, *Cultural and Natural Areas of Native North America* (Berkeley: University of California Press, 1963), 147; and Henry F. Dobyns, *Their Number Become Thinned: Native American Population Dynamics in Eastern North America*, Native American Historic Demography Series (Knoxville: University of Tennessee Press, 1983), 41.

[18] Herndon, 'Indian Agriculture', 284.

[19] Four of the colonies (Virginia, North Carolina, South Carolina, and Georgia) had extensive areas of bottomland hardwood forest.

[20] The following account on European agriculture in North America is largely based on Cowdrey, *This Land, This South*, 28-41, 67-80, 107-11; Cox et al., *This Well-Wooded Land*, 9, 38-39; Scheiber and Vatter, *American Economic History*, 43-44, 52-53, 133-34; and Timothy Silver, *A New Face on the Countryside: Indians, Colonists, and Slaves in South Atlantic Forests, 1500-1800*, Studies in Environment and History (Cambridge: Cambridge University Press, 1990), 104-10, 139-88.

[21] Robert M. Weir, *Colonial South Carolina - A History* (Millwood, NY: KTO Press, 1983), 38.
[22] Michael Williams, 'Clearing the United States Forests: Pivotal Years 1810-1860', *Journal of Historical Geography* 8 (January 1982): 14-15.
[23] Ibid.
[24] U.S. Bureau of the Census (U.S. Census Office), *Historical Statistics of the United States, Colonial Times to 1970*, Part 1 (Washington, D.C.: Government Printing Office, 1975), 460 (table K 55). The area of land in farms in Florida increased from 2,374,000 to 4,364,000 acres (949,600 to 1,745,600 ha).
[25] Williams, 'Clearing the United States Forests', 16, 24-25.
[26] U.S. Bureau of the Census, agricultural statistics from the 8th, 9th,10th, 11th, and 12th Censuses (1860-1900).
[27] U.S. Bureau of the Census, *Historical Statistics*, 460, (tables K 54, 55, 59, 60, 62, and 63).
[28]The annual return for soybeans is manyfold higher than that the landowner receives from natural or planted stands of hardwoods, or even from cultivation of corn. See R. Eugene Turner, Stephen W. Forsythe, and Nancy J. Craig, 'Bottomland Hardwood Forest Land Resources of the Southeastern United States', in *Wetlands of Bottomland Hardwood Forests*, ed. J. R. Clark and J. Benforado, *Developments in Agricultural and Managed-Forest Ecology*, no. 11 (New York: Elsevier Scientific Publishing, 1981), 24.

On the 20th century land conversion in the Mississippi Delta, see Herbert S. Sternitzke, 'Impact of Changing Land Use on Delta Hardwood Forests', *Journal of Forestry* 74 (January 1976): 25-27.
[29] Marion Clawson, 'Forests in the Long Sweep of American History', *Science* 204 (June 1979): 1172.
[30] Silver, *New Face on the Countryside*, 133-35. The elimination of forest canopy from the drainage basin of a stream is likely to increase evaporation, runoff and erosion, which can cause considerable fluctuations in the water level.
[31] Cox et al., *This Well-Wooded Land*, 266 (Figure 2); and U.S. Bureau of the Census, *Historical Statistics*, 542 (table L 113).

A board foot measures 1 foot x 1 foot x 1 inch, and 12 board feet equal one cubic foot. Throughout this article, 'billion' is the American billion (thousand million).

The following account on forestry in the southeastern United States is based on Cowdrey, *This Land, This South*, 52-55, 89-95, 111-14; Cox et al., *This Well-Wooded Land*, 94-101, 122, 164-65, 188; Jerome A. Jackson, 'The Southeastern Pine Forest Ecosystem and Its Birds: Past, Present, and Future', in *Bird Conservation 3*, ed. Jerome A. Jackson (Madison: University of Wisconsin Press, 1988), 127-34; Robert S. Maxwell, 'The Impact of Forestry on the Gulf South', *Forest History* 17 (April 1973): 31-35; and Williams, 'Clearing the United States Forests', 12-28, and *Americans and Their Forests*, 238-88.
[32] For example, see Cowdrey, *This Land, This South*, 92-93, 97-98; Herndon, 'Forest Products of Colonial Georgia', *Journal of Forest History* 23 (July 1979): 135; and Silver, *New Face on the Countryside*, 119.
[33] Dr. Charles Mohr's report from the Tensas River region of Alabama in 1880. Published in Sargent, *Report on the Forests*, 525.
[34] The Swamp Lands Act of 1849-50, aiming to increase the amount of arable land, donated all federal swamplands to the individual states, under the condition that the money obtained from their sale be used to levee and drain them.

[35] Cox et al., *This Well-Wooded Land*, 122.
[36] Cowdrey, *This Land, This South*, 111-14. Some 5,500,000 acres (2,200,000 ha) of federal land were sold in the five southeastern public land states (Arkansas, Louisiana, Mississippi, Alabama, and Florida) after the Civil War.
[37] Dr. Charles Mohr's report upon the forests of the Yazoo Delta, Mississippi, in 1880. Published in Sargent, *Report on the Forests*, 536.
[38] Dr. Charles Mohr's report from the Tensas River region of Alabama in 1880. Published in Sargent, *Report on the Forests*, 526.
[39] Ibid.
[40] U.S. Bureau of the Census, *Historical Statistics*, 542 (tables L 113, 118, and 119). The states included in the South and South Atlantic regions are Alabama, Arkansas, Florida, Georgia, Louisiana, North Carolina, Mississippi, Oklahoma, South Carolina, Texas, and Virginia.
[41] U.S. Bureau of the Census, *Historical Statistics*, 542, (tables L 118 and 119). Includes data from Alabama, Arkansas, Florida, Georgia, Louisiana, North Carolina, Mississippi, Oklahoma, South Carolina, Texas, and Virginia.
[42] Williams, 'Clearing the United States Forests', 25.
[43] Idem., *Americans and Their Forests*, 238.
[44] In the states of Virginia, North Carolina, South Carolina, Georgia, and Florida, only about 5 percent of the remaining bottomland hardwood forests are in public ownership. See O. Gordon Langdon, Joe P. McClure, Donal D. Hook, Joe M. Crockett, and Ron Hunt, 'Extent, Condition, Management, and Research Needs of Bottomland Hardwood-Cypress Forests in the Southeastern United States', in *Wetlands of Bottomland Hardwood Forests*, ed. J. R. Clark and J. Benforado, *Developments in Agricultural and Managed-Forest Ecology*, no. 11 (New York: Elsevier Scientific Publishing, 1981), 72 (Table 3.1).

Paul A. Korte and Leigh H. Frederickson. 'Loss of Missouri's Lowland Hardwood Ecosystem', in *Transactions of the Forty-second North American Wildlife and Natural Resources Conference*, ed. Kenneth Sabol (Washington, D.C.: Wildlife Management Institute, 1977), convincingly illustrates the demise of the bottomland hardwood forest in southeastern Missouri. They estimate that these forests covered some 2,400,000 acres (972,000 ha) of the region in the late 18th century. By 1870 agricultural development had reduced the forests to 2,100,000 acres (850,000 ha). Lumbering then added to the agricultural clearing, and by 1920 only 1,300,000 acres (526,000 ha) of bottomland forest remained. Since then, loss of forested habitat has accelerated as a result of government assisted drainage, agricultural mechanisation, and increased soybean production. Consequently only 98,000 acres (39,700 ha) of bottomland forest prevailed by 1975, and much of this land was fragmented to blocks of less than 1,000 acres (400 ha).

On the conservation controversy concerning the remaining areas of bottomland hardwood forest, see J. R. Clark and J. Benforado, 'Introduction', in *Wetlands of Bottomland Hardwood Forests*, ed. J. R. Clark and J. Benforado, *Developments in Agricultural and Managed-Forest Ecology*, no. 11 (New York: Elsevier Scientific Publishing, 1981), 2-4.
[45] For example, the extinction of the Ivory-billed Woodpecker (*Campephilus principalis*) is believed to have resulted from the extensive logging of its bottomland hardwood forest habitat. See James C. Greenway, *Extinct and Vanishing Birds of the World*, 2nd rev. ed. (New York: Dover, 1967), 357-60; and James T. Tanner, *The Ivory-billed Woodpecker*, National Audubon Society Research Report no. 1 (New York: National Audubon Society, 1942).