

Chapter 2

Extent and Location

Mary Byrd Davis

Many of the writers in *Eastern Old-Growth Forests* describe specific old-growth sites, and some discuss the extent of old growth across a region. This chapter presents an overview of the extent and location of known primary or original forest across the entire East to provide a framework into which readers can fit later accounts.

A survey I carried out in 1993 identifies approximately 1.5 million acres "of forest, woodland, and savanna that look largely as they would appear had not Europeans settled North America." As my Introduction noted, the report does not list all existing primary forest. In particular, it undervalues old growth on what chapter author David Stahle characterizes as noncommercial sites. Statistics on primary forest in the northern Great Lake states illustrate the extent to which noncommercial forest can alter old-growth estimates. My 1993 inventory pointed out sites in Michigan, Minnesota, and Wisconsin that I estimated totaled around 550,000 acres. Chapter co-author Lee Frelich, using data from the North Central Forest Experiment Station, Natural Heritage Programs, and scientific articles, now estimates that these states include 912,000 acres of primary forest (1995). The discrepancy lies mainly in swamp conifers (black spruce-tamarack and northern white-cedar), which Frelich estimates at 465,000 acres. The conifers were seldom logged, because the trees were small and their northern locations too wet for building sites. Many of the sites that I listed in 1993 have not been confirmed in the field as primary forest by experts; some, when subject to close analysis, will probably prove to have been logged or grazed. However, the total known acreage of primary forest can be expected to increase in the future, because new sites are being discovered.

Recent finds range from sites of a few acres to blocks of 1,000 acres or more. For example, in the summer of 1994 J. L. Bogler of the Missouri Native Plant

Society and Sierra Club volunteers discovered more than 25 acres of old growth, possibly unlogged, on a steep bluff in St. Louis County's Creve Coeur Park. They were studying the area because they feared that the Environmental Impact Statement for a proposed highway extension through the park was incomplete. At this writing the future of the stand is still in doubt (Kaufmann 1995; Caroline Pufalt, personal communication). In the spring of 1995, Paul Carlson announced that he and other researchers, working under a contract with the U.S. Forest Service (USFS) as part of ecosystem planning for the Chattooga Watershed in Georgia, North Carolina, and South Carolina, had discovered a total of approximately 4,500 acres of old growth on three national forests. Most of the old growth is upland oak that is apparently unlogged or has undergone only selective logging. Canopies are old but even-aged, suggesting origin after a fire (Paul Carlson, personal communication). These acreages are noncommercial, the category of old growth likely to be the most frequently discovered in the future.

However, finds of marketable species are not precluded. In 1994 Bill Moorehead, working for the Virginia Division of Natural Heritage on a joint vegetation community and land mapping project with USFS, discovered a 3,600-acre block of old growth in the James River Ranger District of George Washington National Forest. Chestnut oak is the dominant or codominant species; 15 percent of the site is mesic oak forest. USFS has proposed cuts in the area, a proof that the old growth includes marketable timber (Moorehead, personal communication).

My overview here is based on my 1993 report, updated to reflect such major discoveries and reevaluations as Paul Carlson's report, Lee Frelich's investigation of the upper Midwest, and Barbara McMartin's study of records of human disturbance in the Adirondacks. I cite in the chapter my new sources of information. For sources cited in the 1993 report and for further information on the sites briefly described here, see the 1993 report.

Here I limit my descriptions to blocks of 1,000 or more acres and to patches of old growth that total 1,000 acres within a forested matrix. For designated areas with both large blocks and scattered patches, I describe only the former. However, I include in my state and regional statistics smaller known sites. Apart from size, my criteria for site descriptions are those of the 1993 report; I use *old growth* in the broad sense of *primary* or *original*, while including some sites that have had light logging or grazing in the past. The geographic area I cover is that of this book and of the 1993 report. The western boundary is a line from western Minnesota through eastern Texas to the Gulf of Mexico. Unfortunately, Canada is largely omitted, because of limitations of space and resources. Acreage figures for specific sites may differ from those in other chapters as a result of differences in old-growth definitions.

Some states do not appear in my descriptions of individual sites, but every state in the East has some known or potential primary forest, as a brief look at

a few of the less likely states illustrates. To mention only one site per state, Connecticut has Sage's Ravine, 100 or more acres of old growth including hemlock; Rhode Island, possible unlogged acreage within the Great Swamp Management Area; Delaware, Mudstone Branch, approximately 80 acres of old-growth bottomland and upland hardwoods (Bill McAvoy, personal communication); and Iowa, Bluffton Fir Stand, 94 acres of uncut woodland dominated by balsam fir.

I emphasize ownership as a reminder that in the United States a variety of entities protect old-growth forests. Much is said in this book about the national forests, and rightly so, as the U.S. Forest Service owns considerable old growth and can be influenced by the public. However, we should not forget that certain states have strong records of land acquisition for protection—New York in the past and Florida in recent years, for example—and that in the immediate future states may have more interest in and more money for acquisition of natural areas than the federal government. Furthermore, some federal lands other than national forests include old growth in need of protection.

I group sites in this chapter according to the four eastern regions into which the USFS divides its periodic *Forest Statistics of the United States*: Northeast, Southeast, North-Central, and South-Central. USFS's regions are based more on administrative areas than on biology, but any division of forests along state lines is arbitrary, and following the USFS's groups facilitates comparison of old-growth statistics with USFS forest resources figures.

Northeast

The Northeast Assessment Region encompasses 12 states (the New England states plus New York, New Jersey, Pennsylvania, Maryland, Delaware, and West Virginia) containing at least 346,000 acres of primary forest, 0.4% of the region's forest land (see Table 2-1 for regional statistics). The state with the most old growth is clearly New York (at least 262,000 acres), followed by Maine (36,000), Pennsylvania (27,000), and New Hampshire (15,000).

Most of Maine's known old growth is fir forest. Baxter State Park in north-central Maine is the site of 23,094 acres of uncut subalpine forest comprised almost entirely of balsam fir. The largest area is 5,470 acres on Mount Katahdin. Loggers did not generally cut above 2,500 feet in the park, but because of natural conditions, the trees are usually not more than 100 years old. The park also has uncut stands of black spruce and of red spruce, bringing its total old growth to around 24,500 acres. The Mahoosuc Mountains on the border with New Hampshire have 2,444 acres of uncut subalpine balsam fir; Bigelow Mountain has 1,300 acres.

By far the largest known area of mid- to low-elevation old growth in Maine is The Nature Conservancy's 5,000-acre Big Reed Forest Preserve, also in the

Table 2-1. Forest land^a and known primary forest

	Northeast		North-central	
	Forest land	Known primary forest	Forest land	Known primary forest
Acreage	85,381,000	346,000 ^b	83,109,000	950,000 ^c
Ownership	% of forest land	% of primary	% of forest land	% of primary
USFS	3%	3.3%	10.3%	[71.2%] ^f
Other federal	0.6%	0.6%	1.7%	[15.7%] ^f
State & local governments	12.2%	79.8%	18.7%	[10.2%] ^f
Forest industry	14.0%	0.2%	5.3%	[0.2%] ^f
Other private	70.1%	16.1% ^d	64.0%	[2.5%] ^f
	Southeast		South-central	
	Forest land	Known primary forest	Forest land	Known primary forest
Acreage	88,079,000	482,000 ^e	123,760,000	194,000 ^f
Ownership	% of forest land	% of primary	% of forest land	% of primary
USFS	6.0%	27.6%	5.7%	32.0%
Other federal	4.4%	60.6%	2.3%	50.5%
State & local governments	3.0%	6.6%	2.1%	8.5%
Forest industry	18.5%	0.4%	18.4%	negligible
Other private	68.1%	4.7% ^e	71.6%	8.6%

^aForest land statistics are from data supplied by Joanne L. Faulkner, Forest Inventory and Analysis, Southern Forest Experiment Station, U.S. Forest Service (USFS). For the basis of statistics on known primary forest, see the text.

^bOld growth in Adirondack State Park is estimated at 200,000 acres (165,000 on public land; 35,000 on private land). Figures do not include peatlands or, except for Pennsylvania, barrens.

^cAcreage total is from Frelich (1995). Primary forest sites for which I have information total only 567,334 acres. Since Frelich does not specify ownership, I base the ownership percentages on my figure, which makes them particularly uncertain.

^dConservation organizations and academic institutions own 3% of the primary forest.

^eThe acreage figure does not include any areas of mangroves or, except where mapped or estimated for a precise location, dry ridge forest. I have assigned 175,000 acres to old growth in Great Smoky Mountains National Park and divided it equally between Tennessee and North Carolina.

^fThe acreage figure includes David Stahle's calculation of 70 square miles for the Boston Mountain portion of the Ozarks (see Stahle, this volume), but does not attempt to extrapolate from his studies figures for other parts of Arkansas or for Oklahoma.

^gConservation organizations and academic institutions own 2.8% of the known primary forest.

north-central part of the state. The reserve is a natural mixed mosaic of the state's forest types, including northern hardwoods, spruce-fir, rich woods, and cedar swamps. The only known logging was the occasional cutting of cedar and pine 110 to 70 years ago (see Cogbill, this volume). Maine's half-million acres of peatland may include considerable primary forest and savanna, but its extent has not been estimated.

In New Hampshire, as in Maine, subalpine forest is prominent. The 40,000-acre Nash Stream Forest includes about 8,000 acres of high-elevation spruce-fir forest, the bulk of which was never logged, and several hundred acres of old-growth northern hardwoods. Because the purchase of the land was a joint project in which the federal government, the state, and the Trust for New Hampshire Lands participated, the state now owns the forest, but the federal government holds a conservation easement on it.

New Hampshire's White Mountain National Forest, with at least 6,000 acres of old growth, includes the 5,552-acre Great Gulf Wilderness at an elevation of 1,700 to 5,800 feet, supporting extensive undisturbed subalpine fir forest. Other large sites are Crawford Notch, with a 1,650-acre old-growth forest that encompasses in whole or in part four watersheds, including the much-studied Gibbs Brook; the Bowl, well over 500 acres of old growth covering the western side of a mountain valley; and Nancy Brook, 1,000 or more acres of unlogged forest dominated by red spruce and balsam fir and including a virgin red spruce swamp flat.

New York boasts the largest area of contiguous uncut forest in the Northeast, roughly 50,000 acres of old growth in Adirondack State Park's Five Ponds Wilderness. The Wilderness is comprised of poor fen, rich fen, upland conifer, and upland mixed forest. Estimates of the total old growth in the six-million-acre park, which is a mixture of public and private land in northeastern New York, range as high as 500,000 acres, a figure recently proposed by Barbara McMartin on the basis of historical records (1994). Published inventories based on field investigations have not yet exceeded 100,000 acres, partly because researchers have concentrated on searching out the most outstanding examples. Known sites include state-owned lands in the vicinity of Lewey Lake and Piseco Lake, each site with several thousand acres of old growth (Robert Leverett, personal communication); and the Ausable Club's 1,150 acres of old-growth hemlock-hardwoods on which the state has a conservation easement. The extent of uncut subalpine forest has not been determined, but reportedly the mountains were not generally logged above 4,000 feet.

In New York's Catskill State Park, Michael Kudish has identified some 54,000 acres of old growth in 38 separate parcels, the largest of which is 25 square miles. The total acreage may be as high as 64,000 acres. Most of the old growth is what Kudish calls ridge forest, above 3,000 feet (1994). In the Catskills' eastern ridge forest, red spruce, balsam fir, and mountain paper birch dominate; in the Catskills' central and western ridge forest, where these species are rare or

absent, yellow birch, red maple, black cherry, and American beech dominate. Catskill Park is a mixture of public and private land, but most of the old growth is on public land.

Outside the parks, New York's largest known site is the 5,000-acre Shawangunk Mountains Dwarf Pine Plains in the southeast. The Plains are a fire climax community—dwarf pitch pine and pine barren shrubs on bedrock. Most of the plains are in Minnewaska State Park or in the private Mohonk Preserve. The Big Basin Tract (threatened by logging) in southwestern New York's Allegheny State Park encompasses 770 acres believed by park officials to be unlogged and 1,030 acres only selectively cut and damaged by construction of a ski run.

In Pennsylvania the largest old-growth tract is the Allegheny National Forest's Tionesta Scenic and Research Natural Areas with a total of some 4,000 acres of unlogged hemlock-beech forest in the northwestern part of the state. The federal government purchased this site and the small Hearts Content Scenic Area as the only uncut vestiges of a six-million-acre hemlock-beech forest that once covered the Allegheny Plateau. Unfortunately, Tionesta now has oil wells and an artificially inflated deer population that prevents regeneration of trees except for the less palatable beech.

Pitch pine-scrub oak barrens in eastern Pennsylvania include considerable old growth, according to the Pennsylvania Natural Diversity Inventory—East. The status of the barrens is controversial, but the Inventory believes that at least some parts have not been cut, though they have burned in fires that may or may not have been of natural origin. The largest of the barrens are Arbutus Peak Oak Barren Macrosite (some 5,000 acres), Long Pond Macrosite (6,000 acres of barrens interspersed with bogs, vernal pools, and wetland forests), and Buck Run Oak Barren (4,000 acres on a xeric ridge top).

Many of Pennsylvania's state forests and parks include old growth, the most notable among them Cook Forest State Park with 1,500 acres of unlogged white pine and hemlock (see Leverett, this volume; and Cook, this volume). The acreage of most of the other sites, often hemlock or hemlock-hardwoods on steep slopes and in gorges, is controversial, but a few may be over 1,000 acres. Lehigh Gorge State Park and adjacent Glen Onoko Cove in eastern Pennsylvania are reported to support at least 900 acres of unlogged hemlock-hardwoods. Ricketts Glen State Park and McConnells Mill State Park in eastern and western Pennsylvania respectively also have extensive old growth.

North-Central

Within the Forest Service's North-Central Region are Michigan, Wisconsin, Minnesota, Ohio, Indiana, Illinois, Iowa, and Missouri, with a total of 950,000 acres of known primary forest, 1.1% of the region's forest land. Minnesota has

far and away the most primary forest (652,000 acres). Next is Michigan (203,000 acres), followed by Wisconsin (57,000 acres) (Frelch 1995). Missouri, Indiana, and Illinois have 16,000, 12,000, and 8,000 acres, respectively.

Michigan would have an impressive list of old-growth sites even if the minimum size were set at 5,000 instead of 1,000 acres. Old growth on Isle Royale National Park in Lake Superior has not been inventoried, but Jack Oelfke estimated it to be at least 10 to 15% of the Park's 571,790 acres—57,000 to 86,000 acres. Around 40% of the park has burned, much of it as a result of the activities of Euro-Americans, but only 1 to 2% of the island has been logged. Aspen accounts for 42% of the cover, but communities include swamp conifer, birch-fir, and northern hardwoods.

Except for Isle Royale, the extensive old-growth areas in Michigan are in the state's Upper Peninsula. Porcupine Mountain Wilderness State Park preserves 35,000 acres of unlogged forest (Frelch, this volume), most of it in one large block. Sugar maple, American basswood, eastern hemlock, and yellow birch dominate. The forest may have been lightly culled for white pine. The 17,950-acre Sylvania Wilderness in Ottawa National Forest supports 15,000 acres of unlogged hemlock-hardwoods (Frelch, this volume; Margaret Davis, this volume). The McCormick Tract, managed by Ottawa National Forest, includes 2,590 acres of old-growth mesic northern hardwoods from which white pine has been cut. The Huron Mountain Reserve Area, owned and protected by the Huron Mountain Club, encompasses 6,500 acres of old-growth forest, only some 20% of which was selectively cut for white pine. Forest communities include several hemlock-northern hardwood types (49.6%); lichen-juniper, pine-oak, and white pine-hemlock-hardwood types (30%); and pine forests of jack pine (5.5%), red pine (0.7%), and white pine (1.1%). In addition, the Mulligan Creek area, with varied private owners, includes some 2,000 to 3,000 acres of virgin forest, according to Doug Cornett (personal communication). Northern hardwood communities, interspersed with hemlock stands, dominate.

Wisconsin has numerous old-growth sites, but most with which I am familiar are small. Two of the larger are barrens or savanna. The 7,000-acre Namekagon Barrens include 4,000 unlogged acres. Jack pine, intermixed with scrub oak and in some areas red pine, dominates. The Fort McCoy Military Reservation in west-central Wisconsin includes 60,000 acres of sand savanna, dominated by black oak, and of sand prairie, with the quality of specific sites varying from excellent to poor. A contrast to the dry sites is Apostle Islands National Lakeshore in Lake Superior, at the northwestern limit of the hemlock-hardwood forest and on the southern edge of the boreal forest. The Lakeshore protects 1,500 acres of old growth on five islands that have never been commercially logged and on portions of five other islands. Some of the islands have never been browsed by ungulates. The 230,000 forested acres of the Menominee Indian Reservation in east-central Wisconsin may include a portion of the

51,000 acres of primary swamp-conifer forest that Frelch estimates remain in Wisconsin (1995). Most of the Reservation's forest has a long history of selective cutting, but some of the wet forest, which includes northern white-cedar swamps, may never have been logged.

Because of a single area—the Boundary Waters Canoe Area Wilderness in Superior National Forest—Minnesota is estimated to have more primary forest than any other state in the East. The Boundary Waters in northeastern Minnesota support 376,000 acres (Frelch 1995). Heinselman listed the various virgin plant communities as of 1973. The most widespread were fir-birch (16.0% of total area); jack pine-black spruce (11.2%); black spruce bog forest (7.3%); and maple-aspen-birch (7.1%). Additional old-growth areas in Superior National Forest include the Keeley Creek Research Natural Area, a 1,280-acre tract that is 30% bog and 70% upland forest. Itasca State Park in northwestern Minnesota preserves 3,000 to 3,500 acres of mostly unlogged old-growth white pine and red pine forest (Rusterholz, this volume). Minnesota has an estimated 274,587 acres of primary swamp conifers, many of these acres in peatlands (Frelch 1995). The state has protected the 146,000 acres in the core areas of 16 of its ecologically significant peatlands, but 58% of the acreage of primary swamp conifers across the Great Lakes states unprotected (Frelch 1995). Minnesota also has an estimated 87,363 acres of primary birch-aspen (Frelch 1995). Presumably, a portion of these acres is in the aspen parklands in about six core areas in Kitten County.

In three of the five southern states of the North-Central Assessment Region, most large old-growth areas are on dry forest. According to the USFS, Indiana's Hoosier National Forest in the southern part of the state has an estimated 10,000 acres of patches of dry upland forest and 400 acres of barrens, both of which have had some selective cutting for personal use but no commercial logging. The dry upland forest is usually found on ridge tops and south- or west-facing slopes, and is often dominated by post oak. Both the dry upland forest and the barrens were subject to fire every 5 to 10 years until this century. Subsequently fire was suppressed, and the understorey suffered. The Forest Service is now using prescribed burns to restore the natural vegetation.

Illinois' Shawnee National Forest supports about 2,800 acres of patches of unlogged post oak-blackjack oak on dry upland sites—generally on ridge tops and in association with glades (Larry Stritch, personal communication). Illinois is also the site of extensive old growth in wetlands—the Cache River Project. Within the project are the 3,200-acre Lower Cache River State Natural Area, approximately half of which is mature to old growth; Cypress Creek National Wildlife Refuge, protecting 500 acres of old growth; and Little Black Slough, with some 4,000 acres of mature to old growth, including more than 1,000 contiguous acres of old growth. The 30,000 acres in the project are variously owned by the Illinois Department of Conservation, the U.S. Fish and

Wildlife Service, The Nature Conservancy, and Ducks Unlimited (Max Hutchison, personal communication). Both the Shawnee Forest and the Cache Project are in southern Illinois.

Mark Twain National Forest in Missouri supports 30,000 acres of savanna and flatwoods, a substantial portion of which have not been logged. The savannas, in central and southwest Missouri, are high, dry forest dominated by post oak and chinquapin oak. Unfortunately, because logging took place in patches to create maximum edge, there are now no big unlogged areas. Most of the savannas are overgrown because of lack of fire, but the Forest Service is using prescribed burns here on a landscape scale. The flatwoods, located in central Missouri, support scattered post oak on upland plateaus. Many of them were once fields and thus are not old growth (Linda Richards, personal communication). South-central Missouri's Caney Mountain Wildlife Area, owned by the Missouri Department of Conservation, has a more favorable history. It includes some 4,000 acres of unlogged post oak savanna, segments of which are now burned periodically, and, in the midst of the savanna, dry-mesic old growth on a rocky and steep slope. The dry upland post oak forests in Missouri and nearby states do not meet the definition of old growth held by many researchers within the region.

Though Kansas is in the Great Plains rather than the North-Central Forest Service region, it includes some Eastern old growth worth mentioning here. The Fort Leavenworth Military Reservation, bordering the Mississippi River, is the site of 1,000 or more acres of old-growth Eastern floodplain forest. The dominant trees are sycamore, cottonwood, elm, and pecan. Also on the reservation but on steep bluffs are 125 acres of old growth dominated by red and black oaks, basswood, walnut, and sugar maple.

Southeast

The Southeast Assessment Region encompasses only Virginia, North Carolina, South Carolina, Georgia, and Florida, but known primary forest totals at least 482,000 acres, 0.5% of the area's forest land. The state with the most identified primary forest is Florida (at least 213,000 acres), slightly ahead of North Carolina (197,000 acres).

Virginia's only identified locations with more than 1,000 acres of old growth are three sites in George Washington National Forest on the western edge of the state. Ramsey's Draft Wilderness, occupying a steep ravine, has 3,000 to 6,000 acres of unlogged forest with white pine, oaks, tulip trees, and hemlock (Leverett, personal communication). Little Laurel Run contains at least 1,000 unlogged acres. The newly found old growth in James River Ranger District encompasses 3,600 acres broken by a single road and scarcely logged except for some chestnut salvaging. About 25 to 33% is fire ridge pine-oak, 15% mesic

oak, and 50% dry to mesic or dry oak (Bill Moorehead, personal communication). According to the USFS's Tentative Old Growth Inventory for the George Washington, the Forest includes 88,000 acres of dry-mesic oak old growth, 130 years or older, and 78,000 acres of xeric pine and pine-oak, 80 years or older. However, the Inventory was based on a computer database, and Virginia researchers tend to consider a lack of fire on ridges as an anthropogenic disturbance disqualifying as old growth the sites on which pine is being overtaken by oak. Arbitrarily assigning a total of 35,000 acres to these two types of forest in the George Washington gives Virginia a total of 42,000 acres of primary forest.

North Carolina's most extensive old growth exists in its portion of Great Smoky Mountains National Park, which straddles the border with Tennessee. Nobody knows the amount of old growth in the 520,000-acre Park, but researcher Will Blozan estimates that "very roughly one third" of the Park (some 175,000 acres) is old growth. As much as 60,000 acres could be contiguous, because ridges covered with old growth connect with one another (Will Blozan, personal communication; Albert Meier, personal communication). The National Park Service (NPS) produced an old-growth map by overlaying satellite data on data from written records of human activity. The map indicated that 35.9% of the Park is uncut, with uncut acreage divided into cove hardwoods (38.7%); northern hardwoods (15.3%); mixed mesic hardwoods (13.3%); and other types ranked at below 10% each. A project to identify old-growth oak and eastern hemlock has since cast doubt on the reliability of the infrared aerial photo interpretation and of records of human disruption, as far as specific sites are concerned. During the project, researchers delineated 2,368 acres of old-growth oak and eastern hemlock sites (Yost, Johnson, and Blozan 1994).

The extent of old growth in western North Carolina's Pisgah and Nantahala National Forests is also still undetermined, but identified sites total at least 18,000 acres. Pisgah boasts Linville Gorge Wilderness Area, 10,195 acres with 4,000 to 7,000 acres of old growth (Leverett, personal communication), and Big Ivy, a 14,000-acre area with undetermined old-growth acreage not protected from logging. The star of Nantahala National Forest is Joyce Kilmer Memorial Forest in the Joyce Kilmer-Slickrock Wilderness, with 3,800 unlogged acres including a cove-hemlock forest with trees believed to be close to 500 years in age. The Wilderness also has some 3,000 unlogged acres in the upper Slickrock Creek watershed (Kirk Johnson, personal communication). Almost 2,000 acres of old growth are on Nantahala's Standing Indian Mountain (Robert Leverett, personal communication).

To the east in North Carolina's Croatan National Forest are 63,000 acres of unlogged pocosin, a form of peatland (see Lynch, this volume). About two-thirds of the acreage is high pocosin with sizable pond pine and bay trees. Scattered through the pocosin are sand ridges bearing longleaf pine-wiregrass communities, an undetermined number of them uncut. Pond pine woodland, a form of pocosin, can be found in Pender County's 15,000-acre Holly Shelter

Cameland and in the Air Force-Navy Bombing Range in Dare County, where possibly thousands of acres are unlogged or only lightly logged.

South Carolina, with some 14,000 identified acres of old growth, has two of the East's highest quality, lowland old-growth sites—Congaree Swamp National Monument and Beidler Sanctuary (Four Holes Swamp). Only about 17% of the 15,135-acre Congaree in central South Carolina has been selectively cut or clearcut, leaving about 11,000 acres of old-growth bottomland hardwoods. Further south the 5,800-acre Beidler Sanctuary, owned by The Nature Conservancy and Audubon Society, has 1,700 virgin acres of mixed hardwoods and cypress-tupelo swamp. Sumter National Forest boasts most of an old-growth tract of more than 1,000 contiguous acres that straddles the South Carolina-North Carolina border. The old growth, protected in Ellicott Rock Wilderness in the Chattooga watershed, includes patches of cove forest, but is more than 90% upland oak (Paul Carlson, personal communication). Loose definitions of old growth would encompass other large areas such as the Greenville Watershed Property, not included in my statistics. The property encompasses 28,000 acres of varied forest communities that had at least selective cutting 50 or more years ago.

Georgia's 14,000 acres of old growth represent a variety of ecosystems. Upland oak is prominent in north Georgia's Chattahoochee National Forest's 5,000 or so identified acres. The Forest's Cohutta Ranger District is the site of 2,000 to 4,000 acres of unlogged upland oak and pine forests (Leverett, personal communication). Furthermore, the Forest has a share of the old growth in the Chattooga watershed. Patches of old-growth oak totaling 1,136 acres are found along the watershed's Blue Ridge escarpment from Clayton, Georgia, to Highlands, North Carolina; and the Georgia portion of Ellicott Rock Wilderness has 875 or more acres of contiguous upland oak old growth. Old-growth cypress-gum forest occurs in the privately owned 1,350-acre Ebenezer Creek Swamp in east-central Georgia. The longleaf pine ecosystem is represented by 2,500 privately owned acres with some 1,000 acres of old-growth longleaf in sandhills beside the Altamaha River (see Means, this volume). Maritime forest that reportedly has not been logged for "many, many years," if ever, covers the 2,000-acre Wassaw Island National Wildlife Refuge, a coastal island. Other coastal islands off Georgia, as well as north to Virginia and south to Florida, support at least patches of unlogged hardwoods (Wilson Baker, personal communication), but the islands have generally been little studied for old growth.

In Florida, turning first to the Panhandle and the northern portion of the peninsula, Eglin Air Force Base preserves up to 5,000 acres of fine quality old-growth longleaf pine-turkey oak-grasses within 460,000 forested acres. In Apalachicola National Forest are tupelo swamps that are probably uncut and thousands of acres of virgin pondcypress growing in patches that may be several hundred acres in size. The 30,784-acre Waccassassa Bay State Preserve on the Gulf Coast near Cedar Key includes a coastal hydric hammock that is

mostly intact from an ecological standpoint, although it was selectively logged around 1900. Tosohatchee State Reserve protects about 2,000 acres of cabbage palm hammocks, of which at least half are virgin except for past cattle grazing and a somewhat lowered water table; plus a 2,000-acre floodplain cypress swamp, also half uncut.

The Nature Conservancy's Apalachicola Bluffs and Ravines Preserve includes hundreds of acres of selectively cut patches of old-growth mixed hardwoods and pine on steep slopes and in ravines; and San Felasco Hammock State Preserve contains mature mesic hammock of more than 3,000 acres as well as selectively cut old-growth patches. Whether either of these sites holds 1,000 acres of old growth is uncertain, but they represent a widespread ecosystem that never existed in thousand-acre blocks—temperate hardwood hammock confined to steep slopes and other areas naturally protected from fire (Bruce Means, personal communication; Bob Simons, personal communication).

In the south of the Florida peninsula, the site with the most old growth is Big Cypress National Preserve. Here are 23,000 unlogged acres of Florida slash pine and 158,000 acres of scattered, uncut "hat rack" pond cypress, the cypress no more than 33 feet in height and with diameters at breast height of under six inches. Southern Charlotte County is the site of some 30,000 acres of cypress slash pine flatwoods, up to 10% of which are old growth (James Beaver III, personal communication). At the 46,000-acre Pakahatchee Strand State Preserve, something less than 4,000 acres of swamp forest with tropical hardwoods, bald-cypress, and pond apple may never have been logged. Everglades National Park preserves an unknown number of uncut acres of slash pine, hardwood hammocks, and mangrove swamps. The mangroves here form an enormous belt along the seaward side. Florida as a whole has an estimated 500,000 acres of mangrove swamps, extensive areas of which have never been cut (Beever, personal communication). Unfortunately, in 1995 Florida enacted a law (Chapter Law 95-299) that allows limited cutting of mangroves on state as well as private land.

South-Central

In the South-Central Assessment Region, Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas share at least 194,000 acres of primary forest, 1.6% of overall forest land. At present Tennessee leads the way (approximately 92,000 acres), followed by Arkansas (61,000 acres) and Oklahoma (23,000 acres), but further research is likely to change this order (see Stahle, this volume). The fourth in line is Kentucky with 4,000 acres.

The mountains of eastern Kentucky and eastern Tennessee support their states' only large old-growth areas. Kentucky's Blanton Forest, with 2,350 acres, mostly old growth, encompasses an entire side of Pine Mountain. Com-

munities include oak-pine, hemlock-mixed mesophytic, Appalachian oak, cliffs, and mountain bogs. Marc Evans of the Kentucky Heritage Program discovered the site in 1992, and the state is now trying to buy it from its private owners. Tennessee can claim at least half of the old growth in Great Smoky Mountains National Park, and its Cherokee National Forest has patches of old growth totaling more than 2,000 acres.

Arkansas has sizable upland as well as wetland old-growth areas. According to the Arkansas Natural Heritage Commission, wetland sites include Bayou DeView in east-central Arkansas, encompassing several thousand acres of small to medium-sized tupelo with scattered very large and very old cypress, primarily in back swamps; and Little River Swamp, a several-thousand-acre "virgin stand of baldcypress type" in southwestern Arkansas. Ownership of Bayou DeView is divided among the U.S. Army Corps of Engineers, the state of Arkansas, and private parties; Little River Swamp is privately owned (Tom Foti, personal communication). The USFWS manages two wetland sites: more than 1,500 acres of uncut baldcypress in the 11,000-acre Big Lake National Wildlife Refuge, and, in White River National Wildlife Refuge, the possibly slightly logged 973-acre Sugarberry Natural Area, which has been partially flooded by beavers, plus the 30-acre unlogged Striplin Tract.

On dry sites over 2,500 feet in elevation, Ouachita National Forest in west-central Arkansas has thousands of acres of stunted oak that have never been logged, Bill Pell believes. The best known of these areas are on Blackfork Mountain. Ozark National Forest to the north also has old-growth oak on dry sites. David Stahle and Phil Chaney estimated that in the Boston Mountain portion of the Ozarks alone, scattered old growth on one type of site totals 70 square miles (see Stahle, this volume). Specific sites with old growth in the national forests include the Ozark National Forest's 1,655-acre Clifty Canyons Special Interest Area, a complex of forest communities where the extent of old growth has not yet been determined. In the Lower Buffalo Wilderness of Buffalo National River, Turkey Mountain and adjacent slopes support 1,000 acres of apparently unlogged post oak and chinquapin oak savanna. The Cossatot River State Park Natural Area, not yet inventoried, has up to 2,000 acres of old growth, in the form of eastern red-cedar glades and xeric pine or pine-hardwood forests on steep slopes (Tom Foti, personal communication).

Louisiana does not appear to have any 1,000-acre areas of contiguous old growth, but the four of the six districts of Kisatchie National Forest for which an inventory has been completed—the Winn, Kisatchie, Evangeline, and Catahoula Districts—have many 50- to 100-acre sites, usually buffered by regenerating forest and mostly along streams and rivers.

In eastern Oklahoma, Cross Timbers ancient post oak-blackjack oak is the leading old-growth community. The post oak-blackjack is not suitable for timber and is generally cut only when land is cleared for another reason. Therefore, many thousands of acres remain, often under attack by developers (see Stahle, this volume). Most of the ancient forest has not been mapped, but

David Stahle tested a predictive model in Osage County and through it has found at least 15 square miles of ancient Cross Timbers post oak-blackjack oak, including four areas of more than one square mile each (Stahle, this volume). Steep slopes in the West Arbuckle Mountains hold more than 1,000 acres of privately owned post oak-blackjack oak that have not been logged but probably have experienced some grazing (Ian Butler, personal communication). The McCurtain County Wilderness area in the Ouachita Mountains supports post oak and blackjack oak along with shortleaf pine, hickory, and dogwood. The area protects 8,700 unlogged acres, access to which is restricted by the Oklahoma Department of Wildlife Conservation. In Ouachita National Forest itself, stunted white oak, blackjack oak, post oak, and black hickory top ridges on Black Fork and Rich Mountains. Winding Stair Mountain, also in the National Forest, supports well over 1,000 acres of post oak, blackjack oak, and northern red oak along a scenic highway (Patricia Seay, personal communication).

In eastern Texas, old-growth Cross Timbers post oak-blackjack oak has largely disappeared, but the state may have some 1,000 acres of old-growth longleaf pine in patches embedded in Angelina National Forest (David Diamond, personal communication). Furthermore, according to the U.S. Army, 960 acres of bottomland hardwoods along Harrison Bayou at the Longhorn Army Ammunition Plant have not been logged.

The total area of forest land in the Eastern United States is 380,330,000 acres. If we include Frelich's figures for the northern Great Lakes states, the area known to be in primary forest amounts to approximately 1,970,000 acres or 0.5% of the forested land. These figures represent more primary forest than virtually anyone 10 years ago would have estimated remain in the East. Several notes of caution are in order, however. First, primary forest includes much acreage that is not old growth according to definitions followed by most researchers. Second, until a great deal of additional field research is carried out, any acreage figure for primary forest in the East cannot be more than a tentative, preliminary estimate—a way of looking at what we know, not at what exists. Field searches for old growth are an urgent need. Third, the acreage included in my estimate is by no means all protected. Much is still in private hands or under the control of agencies that may open it up to logging. Fourth, a total of 1,971,180 acres of old growth is only a fraction of what the East requires for healthy ecosystems.

References

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