Management Plan

For The

Clemson Experimental Forest

2010

Revised 2022

Working Document

FOREWORD

The philosophy of forest management centers on the land and its capacity for production of amenities desired by people. The objective is to supply a never-ending supply of renewable resources. Management can improve the quantity, quality, and sustainability of many of the amenities desired from the forests.

Management of forests for multiple renewable resources has often been called "multiple use management." Timber, recreation, wildlife, esthetics, clean air and clean water are some of the useful products associated with well managed forests.

The production of forest amenities that have no market value is realized because they can be produced in conjunction with commodity products or in conjunction with landowner objectives. These public values can be enhanced by government through tax incentives and through community support for management activities.

In our system of free enterprise and relatively unrestrained rights to use real property, value derived commodity products cannot hold land perpetually in forest. Development pressure in urban or semi-urban settings often results in degrading the amenities that brought the development pressure in the first place. If forests are to survive in such settings, they do so by deliberate choice and commitment to the social values of forests.

INTRODUCTION

The Clemson Experimental Forest (CEF) lies near the southern foothills of the Appalachian Mountains and surrounds the Clemson University Campus in northwestern South Carolina. The forest grows on lands once the domain of the Cherokee and later the farms of early settlers. The area was described in 1776 by William Bartrum as a land covered with majestic forest. "*An interpretive Prospectus for the Clemson Experimental Forest"* by Lynne Beeson provides an excellent early history of the project area (http://www.clemson.edu/cafls/cef/documents/prospectus.pdf). A century and a half of clearing, burning and row cropping turned it into a land of exposed red clay hills and raw gullies as described by Ben Robertson in his classic book Red Hills and Cotton: an Upcountry Memory.

The beginnings of the CEF go back to the years of the "Great Depression" and the federal programs undertaken to offset the economic chaos of that period. Dr. George Aull, a Clemson agricultural economist, proposed a project under the "New Deal" programs to purchase worn out farms around the Clemson campus and manage them in a manner more suited to their inherent land use capabilities, primarily forestry. The project was approved, and work began in 1934 to purchase lands, control erosion, plant trees, control wildfire and protect wildlife. Much of the initial work was done by the Works Progress Administration (WPA) and some by the Civilian Conservation Corps (CCC). Clemson College began supervision of the lands in 1939. After a period of neglect during the war years and utilization of portions of the north forest for practice bombing, Clemson hired a forester, Norbert Goebel, in 1946 to manage the forest lands. In 1954 the project was deeded to Clemson College with the reservation that the property be used for public use and reserving to the federal government certain mineral rights. The depleted farms are now productive forests providing education and research opportunities for future natural resource managers.

This plan outlines the objectives, policies and techniques employed in the administration and management of the Clemson Experimental Forest.

This plan was prepared by compilation of previous plans, and documents generated over the history of management of the property.

GENERAL OBJECTIVES AND GUIDELINES

Fundamental Authorization:

Clemson University is a land-grant, state-supported institution in accordance with the will of Thomas Green Clemson and The Act of Acceptance of the General Assembly of South Carolina.

The Morrill Act that established the land-grant college system and which, incidentally, was strongly supported by Thomas Green Clemson, provided that: In each state at least one college whose main aim would be "without excluding other scientific and classical studies, and including military tactics, to teach such branches or learning as are related to agriculture and mechanical arts, as the legislature of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

It is within this broad mandate that the Clemson Experimental Forest is operated.

Management Policy and Direction:

The Clemson Experimental Forest and associated agricultural lands acquired under the Clemson Land Use Project are held by the University in a legacy of public trust. As public-use lands, the property has been heavily used to fulfill the University's teaching, research and public service "Land Grant" missions.

The letter and intent of all applicable regulations and laws will be followed in the use, preservation, management, development, exchange, and sale of Land Use properties. Under these regulations and laws, the University will protect the Land Use properties from commercial or private development.

The Education, Research and Service missions of the University will always have priority for use of University Land Use property.

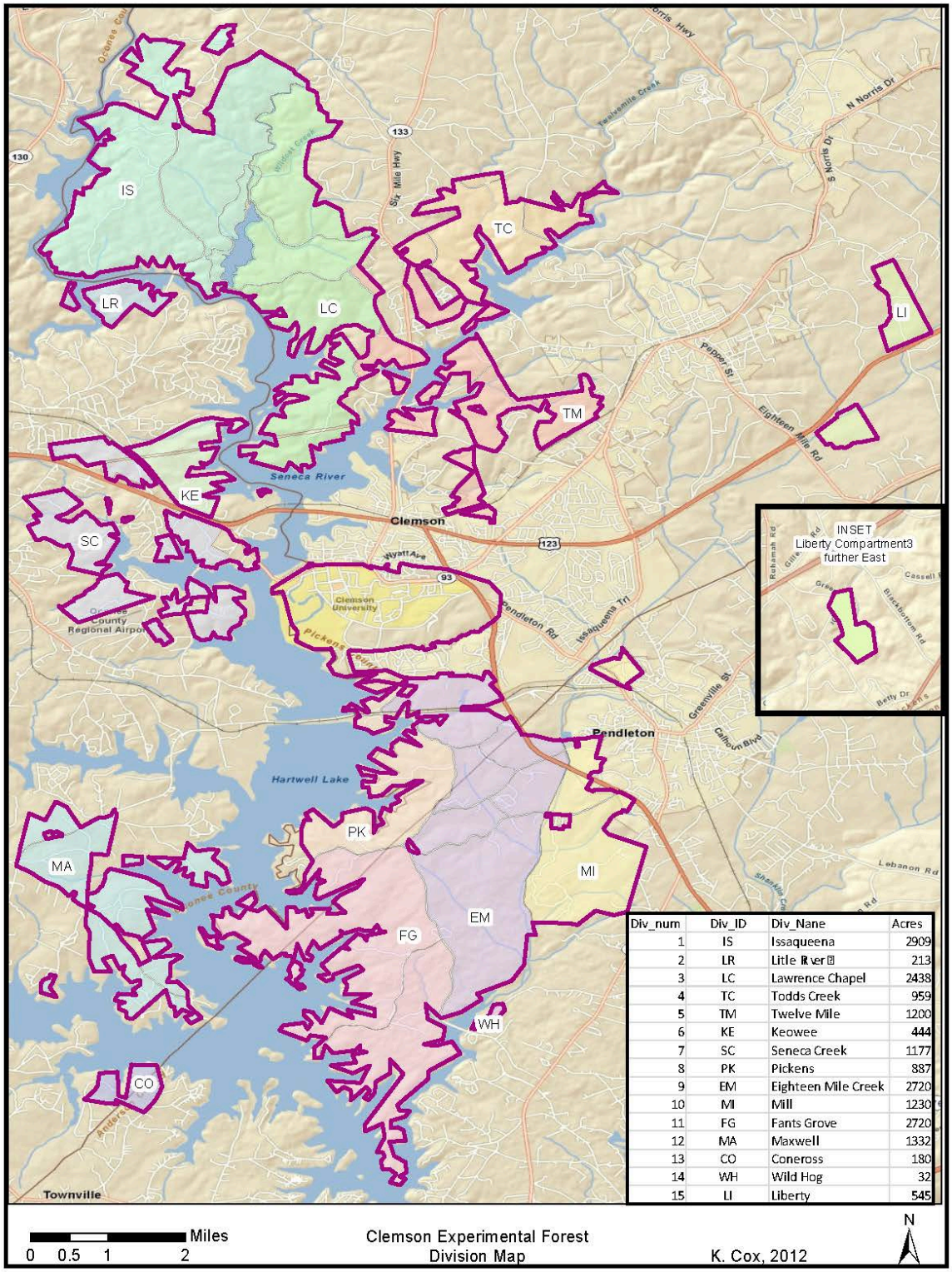
General Information

The stand is the basic forest unit, and its specific management will be guided by prescriptions that take into consideration real and intrinsic values of the forest ecosystem. Silvicultural objectives and prescriptions are to be in conformance with this comprehensive forest management plan with considerations for soil and water quality, wildlife habitat, ecological diversity, as well as improvements in timber production for commodity products and long-term sustainability.

Public use for recreation is allowed and encouraged where it does not conflict with education and research priorities and does not adversely impact the ecology and productivity of the forest. Information and maps are provided on forest signs and on the internet.

For measures of timber and cover type sustainability, a continuous forest inventory (CFI) was established on a 2000-foot grid in 1961. The points are measured at five-year intervals and provide data including growth, natural mortality, harvests and cover type. Stand level inventories are conducted on a routine basis for stand level prescriptions and management planning. A contract inventory was conducted in 2008 to provide additional data for management and to provide an outside vendor measurement of stand volume.

For management purposes, the forest is divided from the top down into fifteen (15) named/numbered divisions delineated by geographical features such as roads, streams, and property boundaries. Each division is further subdivided into numbered compartments. Each compartment is then divided into individual stands. The stand identification code is included in the GIS and other records so the information can be associated with a specific location. The acreage totals within a division or compartment may be greater than the acreage of the associated stands because it will include agricultural areas, streams and rights of way that may not be included in stands summaries.



Div_num	Div_ID	Div_Nane	Acres
1	IS	Issaqueena	2909
2	LR	Litle River	213
3	LC	Lawrence Chapel	2438
4	TC	Todds Creek	959
5	TM	Twelve Mile	1200
6	KE	Keowee	444
7	SC	Seneca Creek	1177
8	PK	Pickens	887
9	EM	Eighteen Mile Creek	2720
10	MI	Mill	1230
11	FG	Fants Grove	2720
12	MA	Maxwell	1332
13	CO	Coneross	180
14	WH	Wild Hog	32
15	LI	Liberty	545

BROAD ECOLOGICAL UNITS

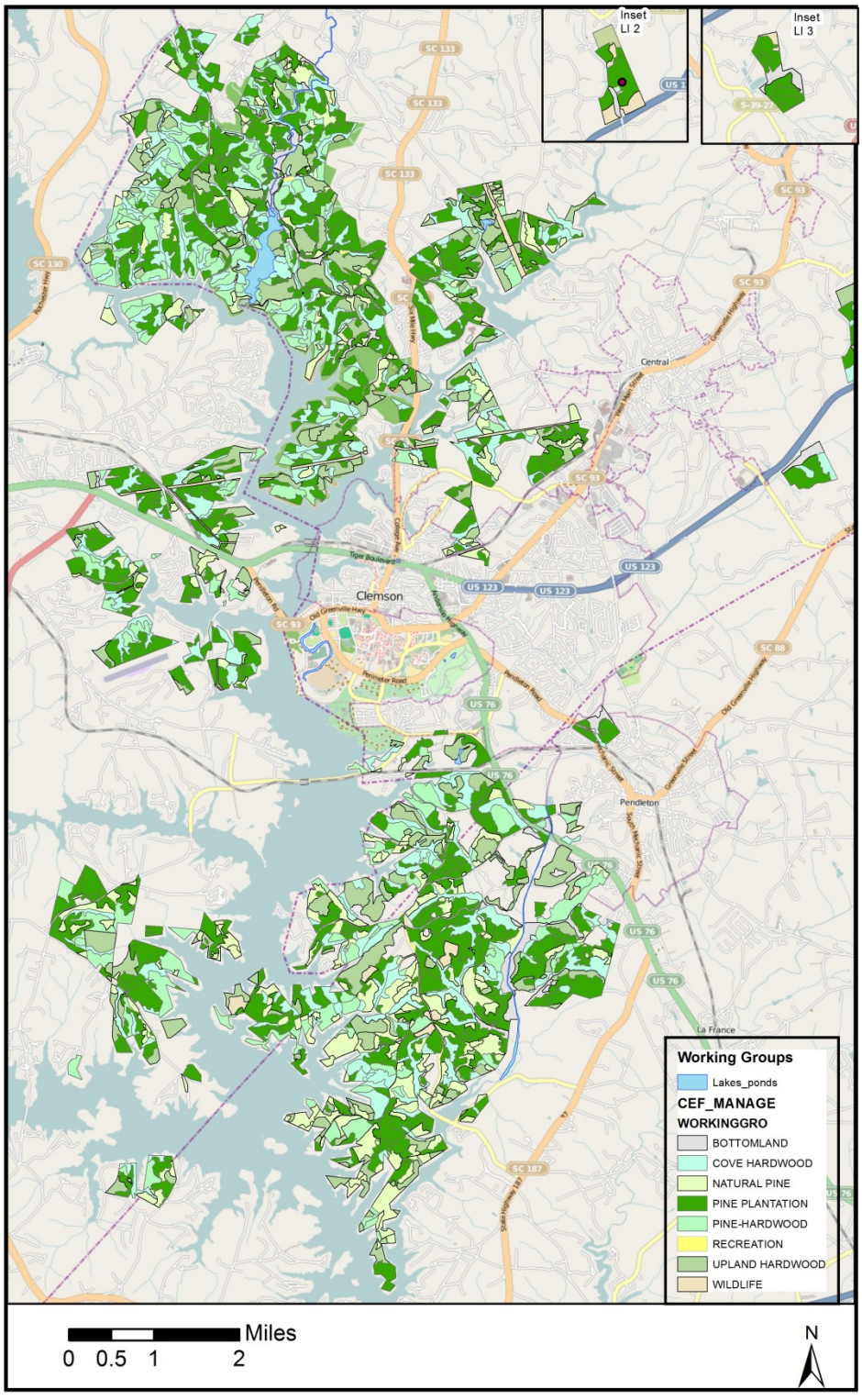
For inventory purposes the Forest is divided into eight (8) broad ecological conditions called working groups:

WORKING GROUP	count	Sum_acres
PINE PLANTATION	688	6646.1
COVE HARDWOOD	282	3133.9
UPLAND HARDWOOD	250	2822.4
PINE-HARDWOOD	222	2270.4
NATURAL PINE	301	2169.3
BOTTOMLAND	40	420.4
WILDLIFE	37	235.5
Water	14	197.6
RECREATION	5	12.5
Total*		17908.1

*Note: The acreage totals are derived from stand acreage and may include agricultural areas, streams, and rights of way that may not be included in stands summaries.

The wildlife, water and recreation working groups may be misleading. The wildlife designation indicated forest openings or linear strips utilized for wildlife food plots. Wildlife management activities occur throughout the forest. The recreation designation is for picnic areas and shelters that are not managed as forest stands. Hiking, biking, horse riding and general nature enjoyment is allowed on designated trails throughout the forest. Hunting is also allowed within the Keowee and Fants Grove Wildlife Management Areas under specific rules developed between Clemson and SC DNR. The water designation includes the 127 acre Issaqueena Lake and acreage from Six Mile, Twelve Mile, and Eighteen Mile Creeks and small ponds in the forest. Acreage in tables and descriptions may vary if roads, rights-of-way or other features are included/excluded in the calculations. Timber management decisions are based on acres delineated and described as forest stands and are typically verified by GPS at the time of activity or treatment.

The remaining types are essential stages of the Oak-Hickory sere considered to be climax for the area. The working groups are further classified by cover type, typically indicating the dominant canopy cover. Stands are generally the basic unit for management planning, but with current GIS and GPS technology, special plants, critical habitats or cultural sites are identified.


Inset
LI 2
Inset
LI 3
Clemson
Central
Pendleton
La France
US 123
US 76
SC 93
SC 133
SC 130
SC 187
SC 88
Working Groups
Lakes_ponds
CEF_MANAGE
WORKINGGRO
BOTTOMLAND
COVE HARDWOOD
NATURAL PINE
PINE PLANTATION
PINE-HARDWOOD
RECREATION
UPLAND HARDWOOD
WILDLIFE
Miles
0 0.5 1 2
N

Forest Management Role in Teaching and Research

The forest is highly utilized by academic classes in forest management, wildlife, natural resources and biological sciences programs. It is also utilized by students in architecture, planning and design and by ROTC programs at Clemson and other area institutions. Continuing education field trips for professionals in natural resource management are frequently conducted on the CEF.

Cooperative programs such as the SC Master Naturalists and other civic groups provide projects in return for habitat management work and species inventory information. The benefits of these programs combat invasive species, foster native species, and create demonstration areas for extension and outreach activities.

Research compatible with the University mission and not conflicting with other priorities is encouraged. Cooperative research with the USFS, DOE, NSF and others are regularly conducted on the CEF by Clemson faculty and scientist from other institutions and agencies. All research must be approved by appropriate oversight committees within the respective college, department, and the University Division of Research. All research on the forest must be registered with the Forest Managers office to ensure it is properly located, avoids overlap with other projects, and to ensure it is protected during forest management and other activities.

FOREST RESOURCE MANAGEMENT

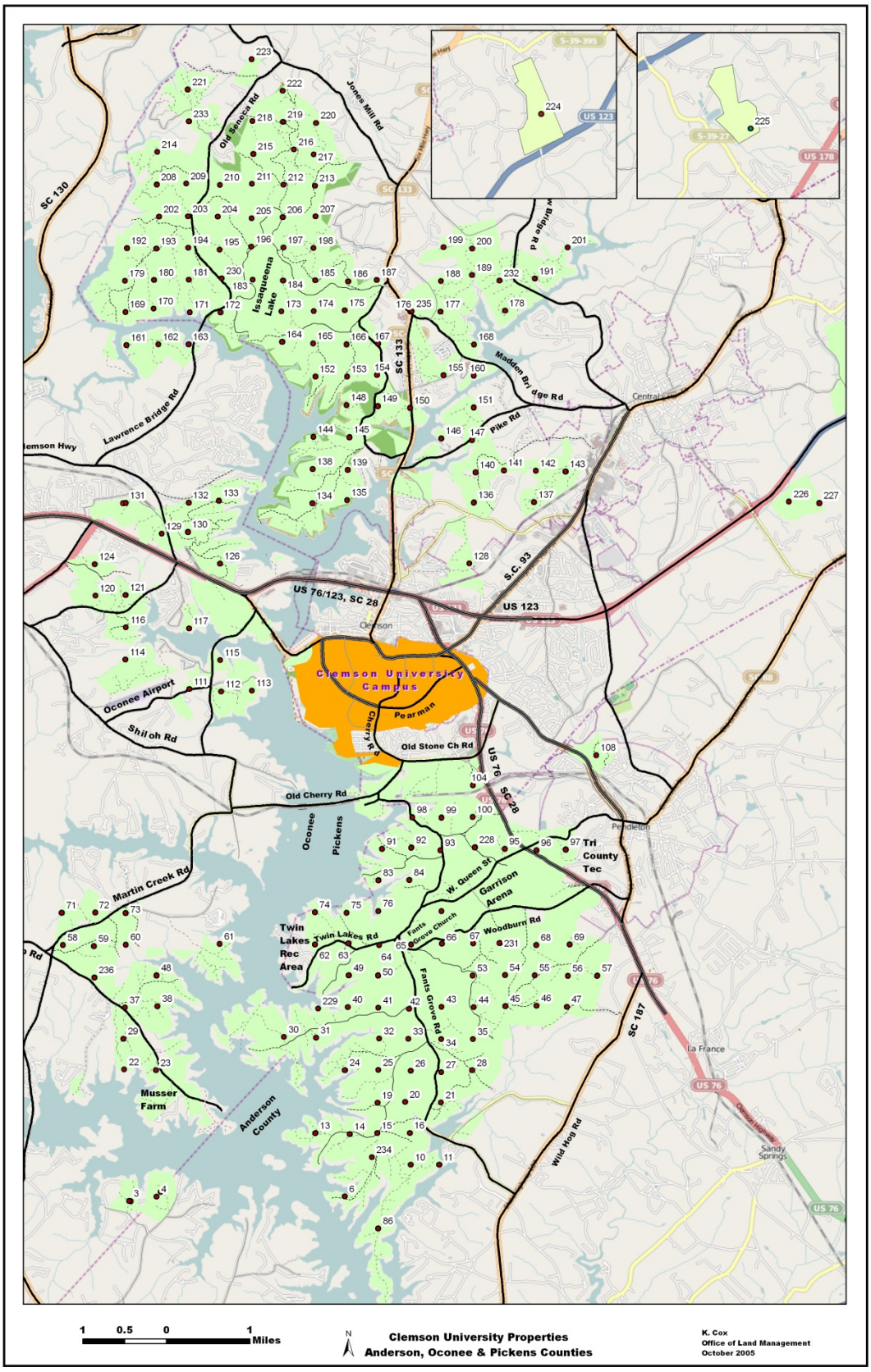
An excellent review of the land use project is available in The First 50 Years of The Clemson Experimental Forest by Sorrells, 1984 http://www.clemson.edu/cafls/cef/documents/50_years_cef.pdf .

Given the condition of the land at the time of acquisition, remarkable progress has been made in developing a forest cover that protects the land from erosion, provides habitat for abundant wildlife and plant communities and provides a stream of revenue from timber sales to pay for it all. An early inventory of timber resources is reported in Agricultural Economic Report NO. 85, "The Land Utilization Program 1934 to 1964" indicates and average of 2,115 board feet volume per acre in 1936. By 1958, after 24 years of reclamation efforts, 4,500 board feet per acre was reported. The report indicates an allowable cut of 1,500,000 board feet with an additional 5000 cords of pulpwood cutting. An excerpt from the report can be viewed at: http://www.clemson.edu/cafls/cef/documents/excerpt_lu_program_1934_1964.pdf.

The Continuous Forest Inventory (CFI) system established in 1961 has continued with five (5) year measurement intervals. The graphic titled *CFI Inventory Summary Data from 1961 through 2016*, indicates a fairly steady increase in sawtimber volume and total cubic volume (merchantable and un-merchantable) over the period.

Inventory Summary 1961-2021														
	pts	for_type	ave	BA	BN A	SPST	SHST	SPPW	SHPW	SPC_M	SHC_M	ST_BDFT	ST_Cords	T_CUFT
year	#		trees/ac	sqft	sqft	BDFT	BDFT	Cords	Cords	CU FT	CUFT	BOFT	Cord	CU FT
1961	197	all	404.7	5.0	84.8	2148.1	1161.9	6.9	4.6	1265.7	1033.2	3310.0	11.4	2553.0
1967	198	all	354.3	4.9	78.8	2662.4	1332.4	5.2	3.9	1217.9	1019.5	3994.8	9.0	2449.1
1972	199	all	367.0	5.1	77.0	3027.9	1534.5	4.2	3.9	1122.0	1045.7	4562.4	8.1	2415.8
1977	198	all	361.9	5.5	79.2	3144.9	1887.4	3.9	4.5	1098.3	1157.7	5032.3	8.4	2477.1
1982	197	all	340.3	6.0	79.7	3712.4	2410.8	4.1	4.3	1132.7	1169.9	6123.2	8.3	2508.3
1986	190	all	349.5	6.3	78.5	3232.5	2397.2	3.8	4.4	1005.5	1216.4	5629.7	8.2	2436.7
1992	189	all	350 6	62.0	758.0	2488 5	2437.6	4.6	4.5	916.4	1187.7	4926.1	9.2	2329.8
1997	189	all	395 .1	7.9	94 .8	2977. 2	3888 .6	6 .3	5.2	1204.6	1498.7	6865.8	11.5	2946.5
2002	190	all	339.9	8.7	94.0	2773.2	4239.7	5.9	5.1	1171.9	1579.2	7012.9	11.0	2934.1
2006	190	all	347.6	9.1	92.2	2156.1	4353.4	5.3	5.1	1069.5	1651.2	6809.5	10.4	2925.4
2011	190	all	354.8	9.9	94.8	3039.8	4249.2	4.2	4.6	1056.8	1711.3	7289.0	8.8	2972.4
2016	190	all	374.3	11.6	107.5	3901.6	4146.3	5.2	5.7	1336.4	1799.8	8047.9	10.9	3329.5
2021	190	all	410.9	12.3	114.9	5085.6	4566.3	5.2	7.4	1502.2	1941.3	9652.0	12.7	3639.4

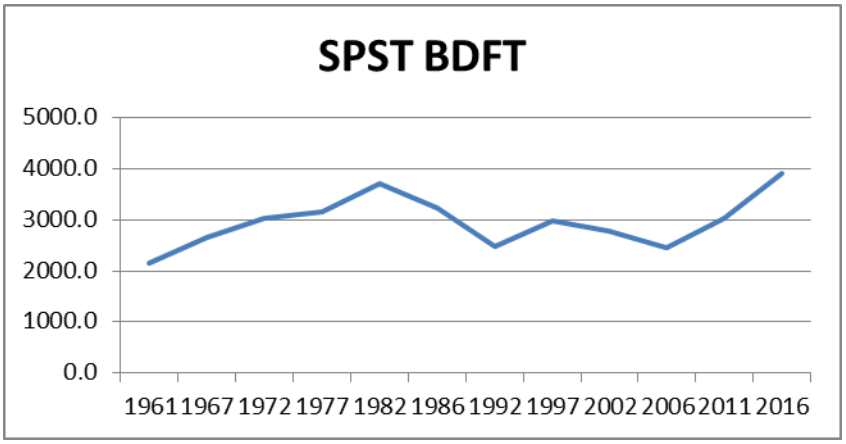
Note: includes trees >= 2” DBH, SPST =Pine sawtimber, SHST= Hardwood sawtimber, SPPW= Pine Pulpwood cords, SHPW= Hardwood pulpwood cords, SPC_M= pine merchantable CUFT, SHC_M= Hardwood merchantable CUFT, ST_BDFT= All sawtimber, ST_Cords= all cords, T_CUFT= All_CUFT


Clemson University Campus
Pearman
Cherry Rd
Old Stone Ch Rd
US 76/123, SC 28
US 123
S.C. 93
Oconee Airport
Shiloh Rd
Old Cherry Rd
Oconee
Pickens
Martin Creek Rd
Twin Lakes Rec Area
Twin Lakes Rd
Fants Grove Church
Fants Grove Rd
Woodburn Rd
W. Queen St
Garrison Arena
Tri County Tec
Musser Farm
Anderson County
Wild Hog Rd
SC 187
La France
Sandy Springs
Pendleton
Central
Clemson
Lawrence Bridge Rd
Pike Rd
Madden Bridge Rd
Jones Mill Rd
Old Seneca Rd
SC 130
SC 133
Issaqueena Lake
US 76
SC 28
1 0.5 0 1 Miles
N
Clemson University Properties
Anderson, Oconee & Pickens Counties
K. Cox
Office of Land Management
October 2005

The number of points inventoried change slightly as land use may convert from forest to agriculture, developed for other University priorities or land is exchanged for consolidation. Zero volume points as found in harvested areas are included in the calculations to generate a representative average volume per acre.

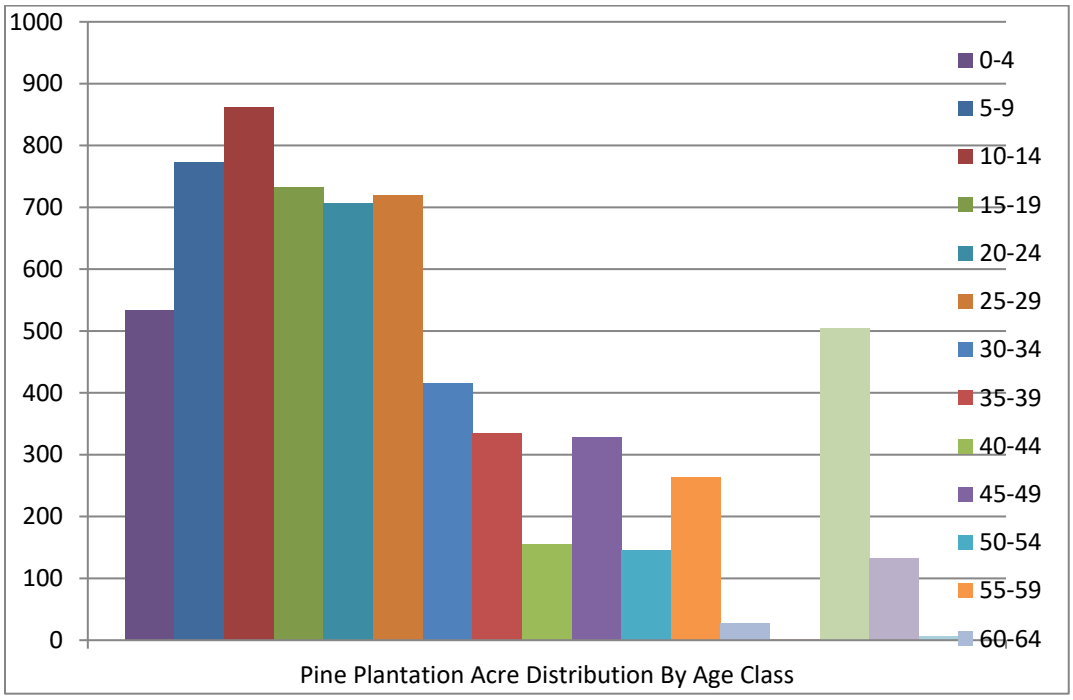
Also note that the number of trees per acre has declined over the years while the basal area per acre has increased. This reflects the foresters desire to put as much volume on as few stems as possible while maintain full stocking. The amount of volume in the pulpwood category, especially in the pine category, has declined in favor of an increase in sawtimber volume. Larger stems have more value because of improved product quality and reduced handling cost, or reduced cost of harvest, and production and reduced waste.

The following graphic shows the trend of pine sawtimber over the inventory period. The pine sawtimber (SPST BDFT) graph shows an increasing volume until the mid-1970 then a decline and more steady state condition for pine sawtimber volume. This clearly represents the accumulation of sawtimber in the thousands of acres of WPA pine plantations established on the property beginning soon after the project was initiated in 1934. These stands were tended and periodically thinned until the mid-1970s. Regeneration harvests were mostly restricted to old field natural stands and low-quality stands. Once these WPA plantations reached maturity, regular regeneration harvests began with growing stock regulation as a goal, a steady state condition of regular harvests while maintaining growing stock. While there are regular outbreaks of southern pine beetle on the CEF, two are memorable. A significant loss occurred in the mid-1970s, and an even more significant loss occurred during 2001 and 2002. These occurrences stress the point of keeping pine density down to a level that encourages tree vigor and general stand health.



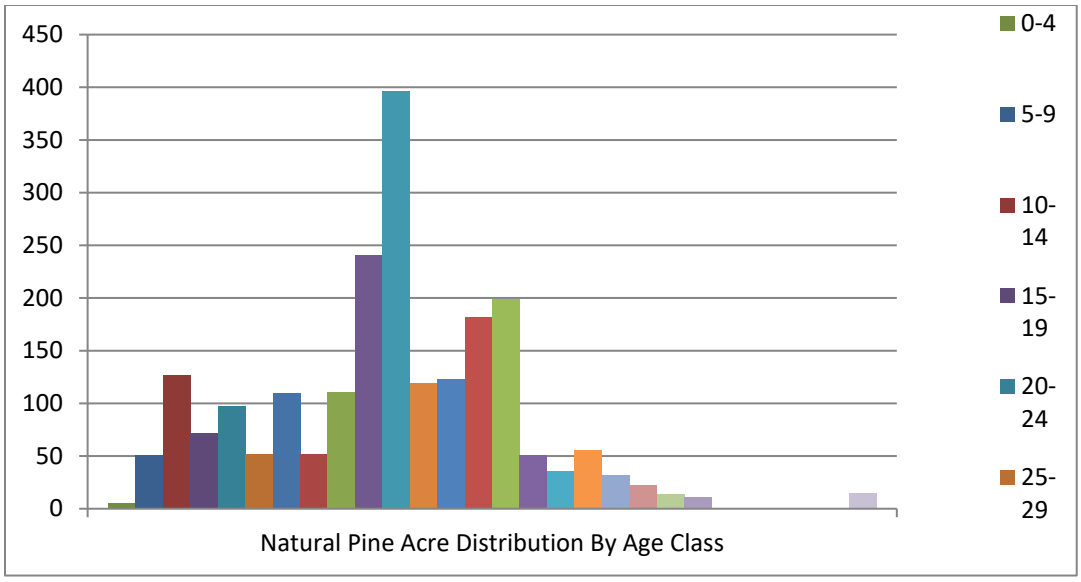
Pine Plantation

The following graphic shows the acres by age class of the pine plantation working group (6,646 acres). We maintain a significant acreage of the 1930s pine plantations to cover gaps in age class during the WWII period. Also, some of these older growth pine plantations are a good visual reminder to the significant impact that was made by the WPA and CCC programs. As shown by the graph below, our pine plantation management is approaching as we utilize some of the remaining WPA stands to fill the gaps.



Natural Pine

The natural pine working group (2,169 acres) age area distribution is listed below. This component consists mostly of loblolly pine regenerated from seed tree or seed-place methods. There are some acres of old field pine mix of shortleaf, Virginia and loblolly. Natural regeneration of loblolly generally results in thousands of trees per acre that require pre commercial thinning to be productive and guard against southern pine beetle problems. Any cost saving of natural regeneration may be lost to pre-commercial thinning, longer time to first thinning and lack of genetic improvement of growing stock. We implement such regeneration methods for education, research and demonstration activities. Also, some landowners want natural regeneration as a cost savings, and sometimes it works well. The primary regeneration method for these stands is clearcut harvest followed by herbicide and or prescribed fire and planting with improved growing stock.

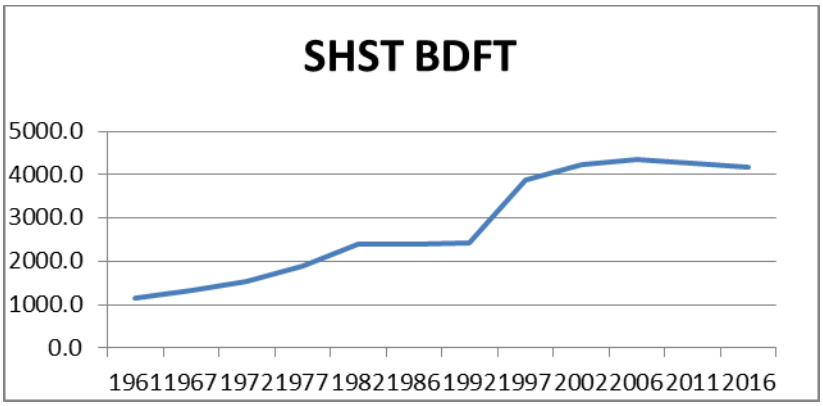


Pine Hardwood

The pine hardwood working group (2,270 acres) age area distribution graphic is below. The pine hardwood working group is a common result of hardwood persistance in old field pine stands and on poor sites where pine can establish in gaps and openings. Also, pine bark beetles create openings and gaps for harwood growth. The southern pine beetle (SPB) kills of 2001 and 2002 resulted in some conversion to pine-hardwood and upland hardwood working group. Frequently these stands are better suited to pine or hardwood. If the forest manager decides on hardwood, the pine will be removed in periodic improvement cuts resulting in a hardwood type.

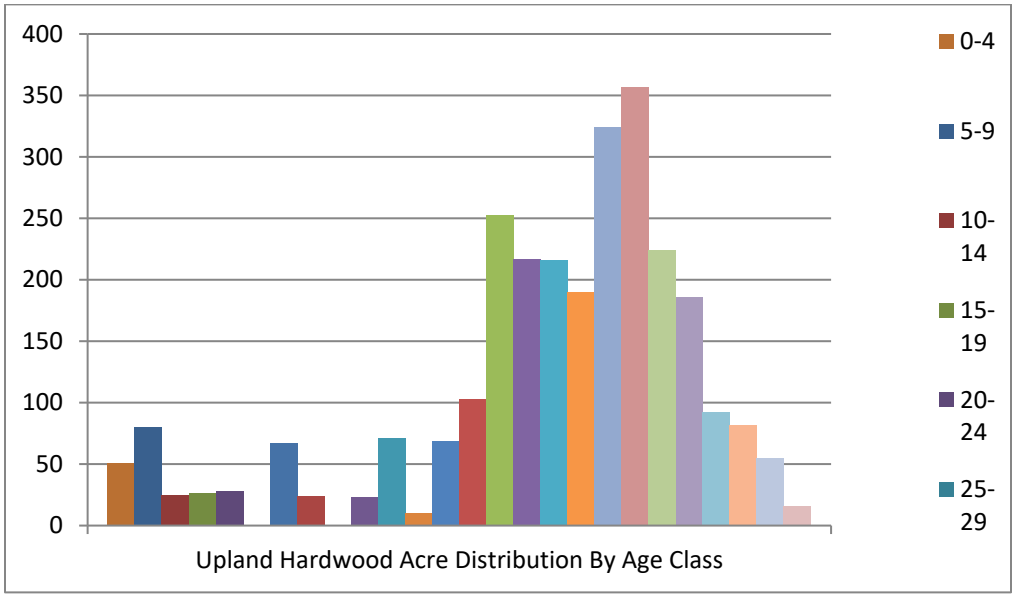
The following graphic shows an increase in hardwood sawtimber over the early inventory periods and a stable volume in more recent inventories. Streamside

management protection zones scenic areas left around special areas, very steep slopes and some other ecologically significant areas are predominately in a hardwood cover type for the CEF. Some of these areas are showing decline in vigor.



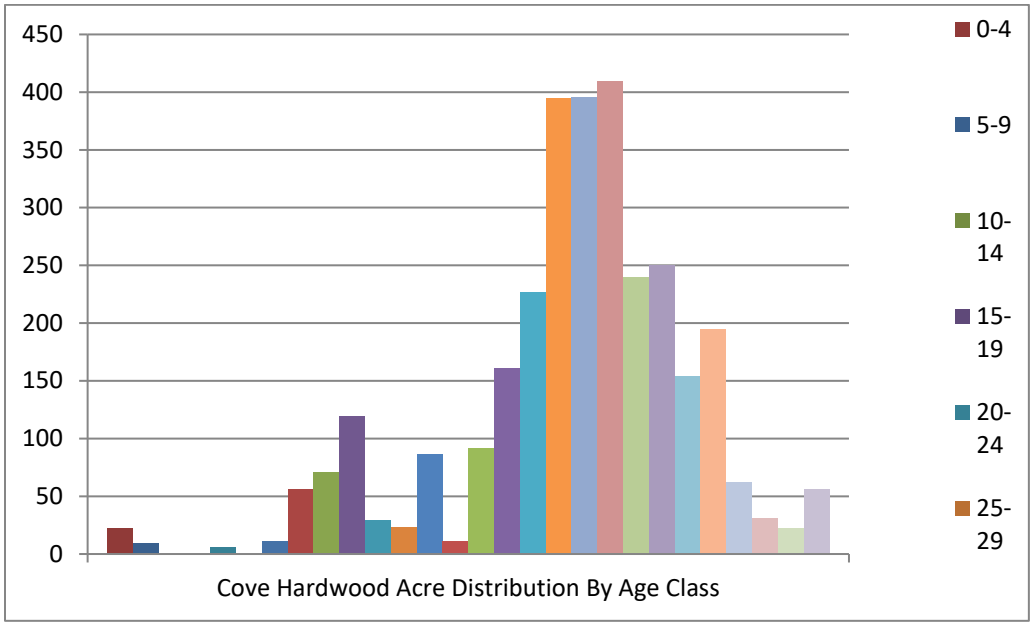
Upland Hardwood

The upland hardwood working group (2,282 acres) age area distribution is below. While we have some good sites for upland hardwood, some old field sites are poor quality and sometimes poor composition (post oak, chestnut oak, hickory) for timber production. These stands do provide other amenities, such as, wildlife habitat, travel corridors and hard mast. Some upland hardwood conversion to pine plantation was done in the 1970s.



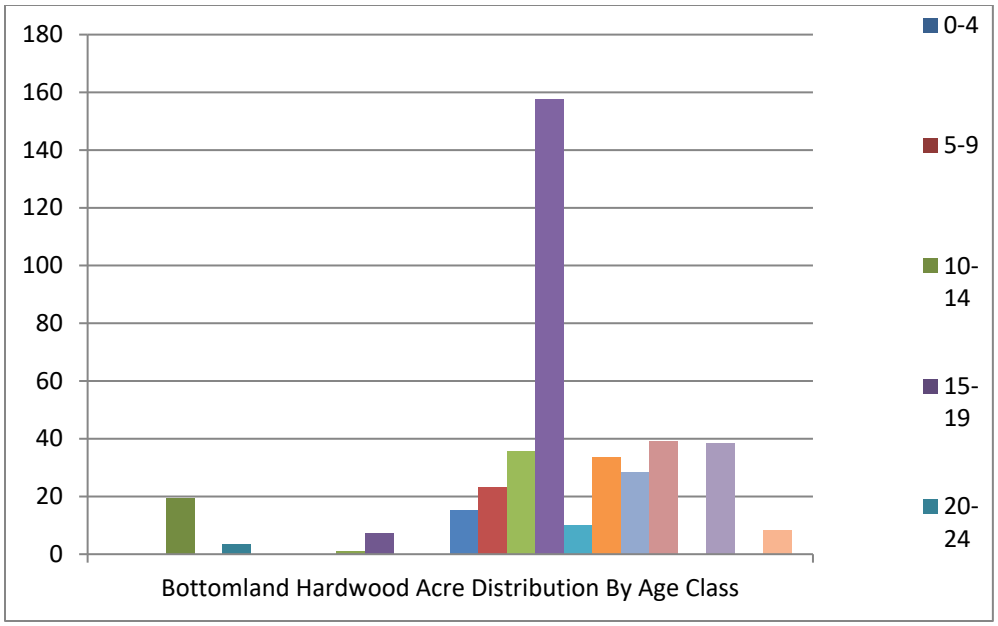
Cove Hardwood

The cove hardwood working group (3,133.9 acres) age area distribution graphic is below. Like hardwoods in general, this class is skewed to older age classes largely because it occurs in relative narrow strips along streams and steeper slopes. It is a very productive class in terms of timber volume and in ecosystem diversity. Some cove stands will be clearcut for regeneration but most of the cutting will be limited to sanitation/salvage improvement cuts.



Bottomland Hardwood

The bottomland hardwood working group (420.4 acres) age area distribution is listed below. It again is skewed to the high end of age class. Most of the bottomland hardwood was lost to Hartwell Lake. While these are quality sites, invasive species like privet are a problem for regeneration after harvest. These areas are important for habitat diversity and wildlife. Numerous beaver ponds provide duck habitat as well as production areas for herptaphauna. The common yellow poplar (and productive) cover type in these areas is giving way to increased component of less desirable sweetgum and river birch.



Harvest estimates from CFI by period are in the following table. The inventory year followed by cubic foot harvest estimate calculated from the volume of the missing harvested tree from the previous inventory period followed by the pulpwood cords estimate and board feet estimate then converted to an annual estimate for pulpwood cords and sawtimber board feet. The 1986 and 1992 estimated are high and other estimated are low compared to the actual harvest records and different than the target allowable harvest of 1,500,000 board feet and 5000 cords established in 1958 and revised to 1,700,000 board feet and 4500 cords in 1974.

Harvest Summary Estimate from CFI

	A_CU_H	A_CD_H	A_BD_H	est annual cds	est annual bf
2016	-84.3	-0.28	-331.4	-980.0	-1,159,900
2011	-202.0	-1.1	-296.1	-3954.7	-1,036,266
2006	-99.0	-0.3	-313.5	-1219.2	-1,097,198
2002	-174.3	-0.7	-507.4	-2562.1	-1,776,040
1997	-112.1	-0.3	-376.7	-1115.6	-1,318,583
1992	-430.9	-1.0	-1373.3	-3624.1	-4,806,690
1986	-434.1	-1.5	-1342.1	-5266.4	-4,697,175
1982	-91.2	-0.2	-330.4	-526.5	-1,156,505
1977	-258.1	-0.7	-699.8	-2453.8	-2,449,143
1972	-291.7	-1.2	-570.1	-4229.8	-1,995,231
1967	-274.3	-1.4	-413.0	-4816.2	-1,445,553
			ave overall	-2976.9	-2,085,298

Allowable Harvest

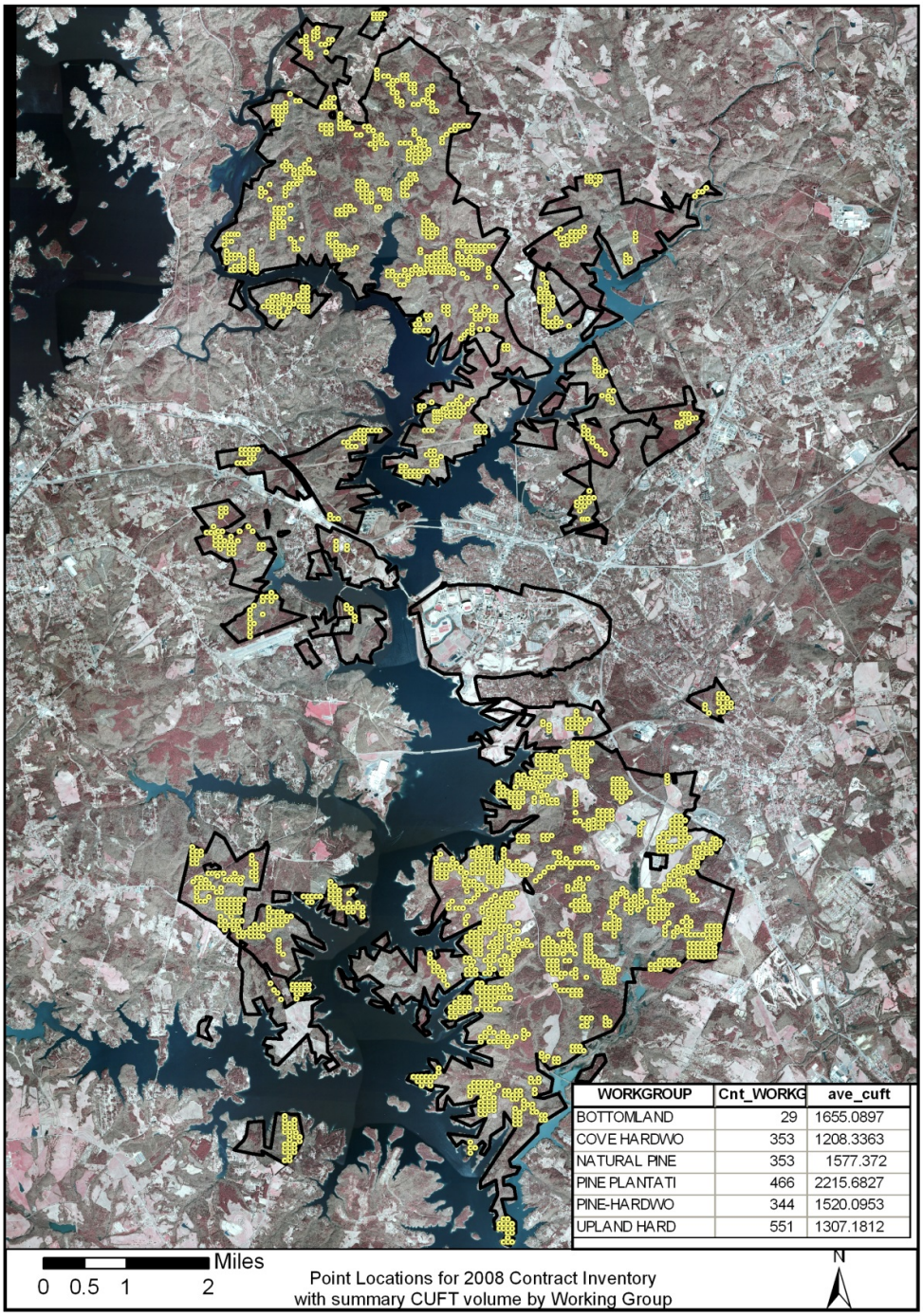
The tables below show the long-term average annual growth exceeds 4.7 MM board feet and 6000 cords. The latest measurement (2021) indicates board foot growth over the previous 5-year average annual growth interval of 5,614,350 board feet and 6,300 cords.

Overall forest cubic feet volume and the sawtimber volume continue to increase. Natural mortality levels have increased indicating a need for more intermediate cut/thinning to improve utilization. The allowable annual cut will be slightly increased from 1,800,000 board feet plus 4500 cords (established 2006) to 2,000,000 board feet plus 4500 cords. Volume of harvest may vary from year to year to take advantage of market conditions, while maintaining the average allowable cut over a five-year period.

New on Point Summary / acre					Survivor Growth				Total Growth		
year	N_BF_AC	N_CD_AC	N_CU_AC		A_BD_S	A_CD_S	A_CU_S		G_BF_AC	G_CD_AC	G_CU_AC
2016	978.8	3.3	607		416.4	-0.1	80.2		1395.2	3.2	687.2
2011	653.5	1.6	421.2		530.1	-0.1	19.9		1183.5	1.5	441.1
2006	906.9	3.2	712.7		211.1	-0.2	47.3		1118.0	3.0	760.0
2002	906.9	3.2	712.7		776.8	-0.2	71.2		1683.6	3.0	783.9
1997	1288.2	3.6	786.0		1198.6	-0.3	66.1		2486.8	3.2	852.1
1992	170.6	1.4	228.4		335.2	0.6	54.4		505.8	2.0	282.8
1986	727.7	1.5	410.4		226.6	0.1	28.4		954.3	1.6	438.8
1982	904.6	1.3	391.2		1077.9	0.0	23.8		1982.5	1.3	415.0
1977	585.4	2.0	460.1		871.9	-0.3	29.3		1457.4	1.7	489.5
1972	532.2	1.3	366.8		793.6	-0.2	59.6		1325.8	1.1	426.5
1967	342.8	1.0	263.2		893.3	-1.4	52.1		1236.0	-0.3	315.3
								ave/period	1393.5	1.9	535.7
								ave/yr	278.7	0.4	107.1
								all CEF	4,877,389.9	6,800.7	1,874,780.0

	Growth Summary per acre			Growth Summary All CEF Annual		
Year	CF	CDS	BF	Annual CF	Annual Cds	annual BF
2021	309.9	1.8	1,604.1	1,084,650	6,300	5,614,350
2016	357.1	2.1	758.9	1,249,850	7,350	2,656,150
2011	441.1	1.0	1,183.5	1,544,000	3,546	4,142,250
2006	760.0	3.0	1,118.0	2,659,989	10,521	3,913,000
2002	783.9	3.0	1,683.6	2,743,750	10,532	5,892,600
1997	852.1	3.2	2,486.8	2,982,275	11,290	8,703,800
1992	282.8	2.0	505.8	989,683	7,059	1,770,300
1986	438.8	1.6	954.3	1,535,892	5,708	3,340,050
1982	415.0	1.3	1,982.5	1,452,491	4,638	6,938,750
1977	489.5	1.7	1,457.4	1,713,135	5,845	5,100,900
1972	426.5	1.1	1,325.8	1,492,671	3,882	4,640,300
1967	315.3	-0.3	1,236.0	1,103,495	-1,185	4,326,000
ave/period	489.3	1.79	1,358.06			
ave/yr	97.9	0.36	271.6			
all CEF	1,712,666.7	6,270.83	4,753,204.2			

An inventory was conducted in 2008 that included selections from stands with merchantable volume distributed across working groups and age classes.



ELEMENTS OF CONCERN

Listed below are plants and animals of record tracked by SC DNR which are located on or near the CEF. One listed plant, Smooth coneflower was discovered along a roadside after thinning and prescribed fire. It was an isolated plant. Prescribed fire and reduction of overstory cover is a prescribed habitat improvement for smooth coneflower. Subsequent surveys of the site in recent years have found no evidence of the plant.

Georgia aster is a candidate species that occurs abundantly on the CEF in disturbed areas such as burned and thinned pine stands, roadsides and rights of way. Soft groovebur, is listed as S1 or critically imperiled in SC, but relatively common otherwise. The global ranking is G5. There is a Candidate Conservation Agreement, May 2014, between Clemson University, US Fish & Wildlife Service, US Forest Service, etal that establishes voluntary management guidelines. Dr. Don Hagan, PhD with Clemson's Department of Forestry and Environmental Conservation provides valuable insight and consultation for areas known to contain this plant.

The Carlson's polycentropus caddisfly with a rank of S1S3 was identified in Wildcat Creek. The stream has a designated riparian zone of 50 feet either side. Also, a bald eagle nesting site is located on Hartwell Lake adjacent to the CEF. Management activities may be restricted within 10 chains of the nest location during nesting if management operations are planned in the area. We will consult with SCDNR or US Fish and Wildlife Service for further input if operations are considered in the area. Nesting may range from September through May.

The *Natural Resources Inventory & Guidelines* was developed during 2006-2007 to identify notable natural resources on the CEF and associated agricultural lands. During the survey, elements such as rock outcrops, waterfalls. special habitats or plant communities were identified. Then special natural resource areas were mapped to include those elements. Management activities in special natural resource areas are subject to additional level of review by the chair of the FNR and Biological Sciences program prior to harvesting. The document is available on the CEF web site http://www.clemson.edu/cafls/cef/nr_plan_revised_october08.pdf. It is a working document, in that it can be changed with proper review by the forest manager, VP PSA and recommendations from chairs of FNR and Biological Sciences.

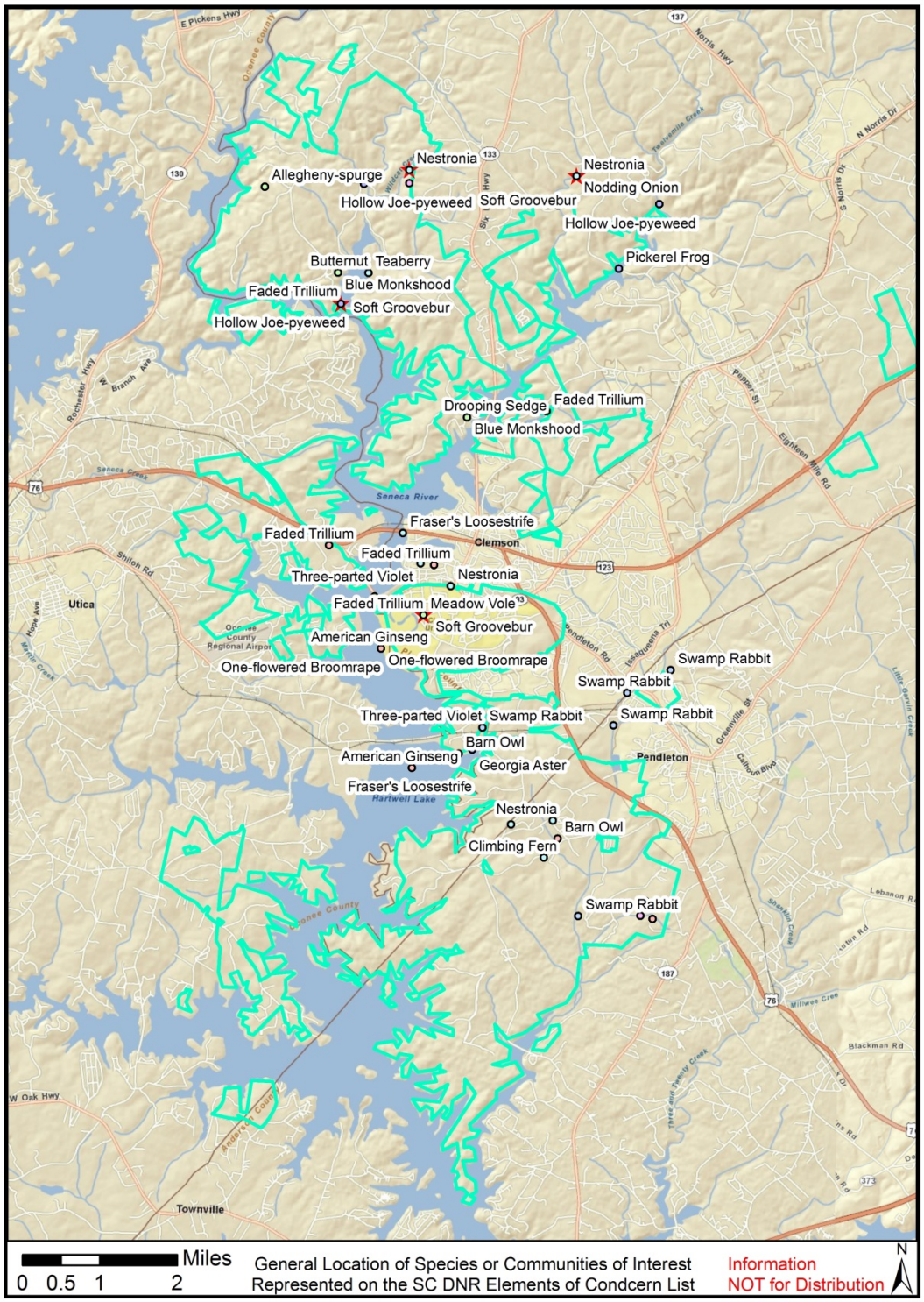
The curator of the Clemson University Herbarium oversees a number of research and student plant inventory projects on the CEF. A copy of the information is maintained with forest management records. Other local sources of information for include the Director of the SC Botanical Garden, and SCDNR.

Control of invasive and exotic plants and animals is essential in maintaining special botanical areas. Prescribed fire is also used where indicated for habitat improvement for certain species.

Invasive species are a hindrance on the Clemson Experimental Forest (CEF). Invasive species can prohibit growth of native plants and cause issues with management and operations. Most of the invasions that occur on the CEF happen where there has been soil disturbance. Other locations where infestations happen tend to start along roadsides, in parking lots and areas adjacent to private lands. Most of these invasions are caused by illegal dumping of yard waste. Invasive species should be controlled as soon as possible after detection to prevent major outbreaks. Various forms of treatment are possible and can be used. Treatments that are utilized include hack and squirt, broadcast spraying and mechanical treatment. Some treatment methods may be combined to insure effective control. For woody tree species the hack and squirt method is the best means for control. For larger areas that may be infested with kudzu mechanical chopping of the vines and then broadcast spraying will be used. For smaller areas, such as small parking lots that may be infested with English ivy, the portion of the vine that is climbing a tree will be severed from the rest of the plant and the remaining plant that is on ground level should be sprayed. When using chemical herbicide for treatment, rates should be applied according to the label and the lowest dosage should be used to effectively control the plant, with follow up treatments used as needed. Careful application of herbicides should be made to make sure that non-targeted plants are not harmed when applying chemicals. Areas that have been treated should be monitored for a couple of years to ensure that full control of the species was achieved.

Common exotic and invasive species on the CEF include:

Callery Pear
Chinaberry
Paulownia
Golden bamboo
Japanese honeysuckle
Mimosa tree
Japanese stiltgrass
Privet (Chinese, Japanese, and European)
Tree of heaven
Vinca vine
Wild olive (autumn, Russian, and thorny)
Chinese wisteria


Nestronia
Allegheny-spurge
Hollow Joe-pyeweed
Soft Groovebur
Nestronia
Nodding Onion
Hollow Joe-pyeweed
Pickerel Frog
Butternut
Teaberry
Blue Monkshood
Faded Trillium
Soft Groovebur
Hollow Joe-pyeweed
Drooping Sedge
Faded Trillium
Blue Monkshood
Fraser's Loosestrife
Faded Trillium
Clemson
Faded Trillium
Three-parted Violet
Nestronia
Faded Trillium
Meadow Vole
Soft Groovebur
American Ginseng
One-flowered Broomrape
One-flowered Broomrape
Swamp Rabbit
Swamp Rabbit
Three-parted Violet
Swamp Rabbit
Swamp Rabbit
Barn Owl
American Ginseng
Georgia Aster
Pendleton
Fraser's Loosestrife
Hartwell Lake
Nestronia
Barn Owl
Climbing Fern
Swamp Rabbit
Utica
Townville
Miles
0 0.5 1 2
General Location of Species or Communities of Interest
Represented on the SC DNR Elements of Condcern List
Information
NOT for Distribution
N

SCOMNAME	NAME_CATEG	G_RANK	S_RANK
Soft Groovebur	Vascular Plant	G5	S1
Soft Groovebur	Vascular Plant	G5	S1
Soft Groovebur	Vascular Plant	G5	S1
Carlson's Polycentropus Caddisfly	Invertebrate Animal	G2G3	S1S3
Blue Monkshood	Vascular Plant	G4	S2
Southern Nodding Trillium	Vascular Plant	G3	S2
Drooping Sedge	Vascular Plant	G4	S2
Nodding Onion	Vascular Plant	G5	S2
One-flowered Broomrape	Vascular Plant	G5	S2
Allegheny-spurge	Vascular Plant	G4G5	S2
One-flowered Broomrape	Vascular Plant	G5	S2
One-flowered Broomrape	Vascular Plant	G5	S2
Southern Nodding Trillium	Vascular Plant	G3	S2
Blue Monkshood	Vascular Plant	G4	S2
Swamp Rabbit	Vertebrate Animal	G5	S2S3
Swamp Rabbit	Vertebrate Animal	G5	S2S3
Swamp Rabbit	Vertebrate Animal	G5	S2S3
Swamp Rabbit	Vertebrate Animal	G5	S2S3
Swamp Rabbit	Vertebrate Animal	G5	S2S3
Teaberry	Vascular Plant	G5	S3
Three-parted Violet	Vascular Plant	G5T3	S3
Fraser Loosestrife	Vascular Plant	G2G3	S3
Nestronia	Vascular Plant	G4	S3
Nestronia	Vascular Plant	G4	S3
Large Yellow Lady's-slipper	Vascular Plant	G5	S3
Single-haired Mountain-mint	Vascular Plant	G3G5	S3
Climbing Fern	Vascular Plant	G4	S3
Nestronia	Vascular Plant	G4	S3
Smooth Coneflower	Vascular Plant	G2G3	S3
Butternut	Vascular Plant	G4	S3
Fraser Loosestrife	Vascular Plant	G2G3	S3
Nestronia	Vascular Plant	G4	S3
Faded Trillium	Vascular Plant	G2G4	S4
	Terrestrial Community - Other Cla	G5	S4
American Ginseng	Vascular Plant	G3G4	S4
	Terrestrial Community - Other Cla	G5	S4
Eastern Spotted Skunk	Vertebrate Animal	G5	S4
Faded Trillium	Vascular Plant	G2G4	S4
American Ginseng	Vascular Plant	G3G4	S4
Faded Trillium	Vascular Plant	G2G4	S4
Faded Trillium	Vascular Plant	G2G4	S4
	Terrestrial Community - Other Cla	G5	S4
Barn-owl	Vertebrate Animal	G5	S4
Barn-owl	Vertebrate Animal	G5	S4
Faded Trillium	Vascular Plant	G2G4	S4
American Ginseng	Vascular Plant	G3G4	S4

	Terrestrial Community - Other Cla	G5	S5
	Terrestrial Community - Other Cla	G5	S5
Meadow Vole	Vertebrate Animal	G5	SNR
Three-parted Violet	Vascular Plant	G5	SNR
Three-parted Violet	Vascular Plant	G5	SNR
Meadow Jumping Mouse	Vertebrate Animal	G5	SNR
Hollow Joe-pye Weed	Vascular Plant	G5?	SNR
Three-parted Violet	Vascular Plant	G5	SNR
Hollow Joe-pye Weed	Vascular Plant	G5?	SNR
Georgia Aster	Vascular Plant	G2G3	SNR
Hollow Joe-pye Weed	Vascular Plant	G5?	SNR
Hollow Joe-pye Weed	Vascular Plant	G5?	SNR
Three-parted Violet	Vascular Plant	G5	SNR
Pickerel Frog	Vertebrate Animal	G5	SNR
Margaret's River Cruiser	Invertebrate Animal	G3	SNR
Three-parted Violet	Vascular Plant	G5	SNR

Management & Protection

The Smooth coneflower was discovered along a roadside after thinning and prescribed fire prior to 2010. It was an isolated plant. Prescribed fire and reduction of overstory cover is a prescribed habitat improvement for smooth coneflower.

In order to protect any existing plants, field surveys will be done on the ground prior to herbicide application, and any ground disturbing activity, including, but not limited to timber harvesting, fire line installation, road building, etc.

If Smooth coneflower plant(s) are found during a preliminary field survey, communication will be made to all CEF staff, faculty, and cooperators (SCDNR) as to its location. Management of those timber stands will be adjusted to help facilitate the recovery and preservation of the plant specimen by the further use of forest thinning, harvesting, and prescribed fire.

FOREST SOILS

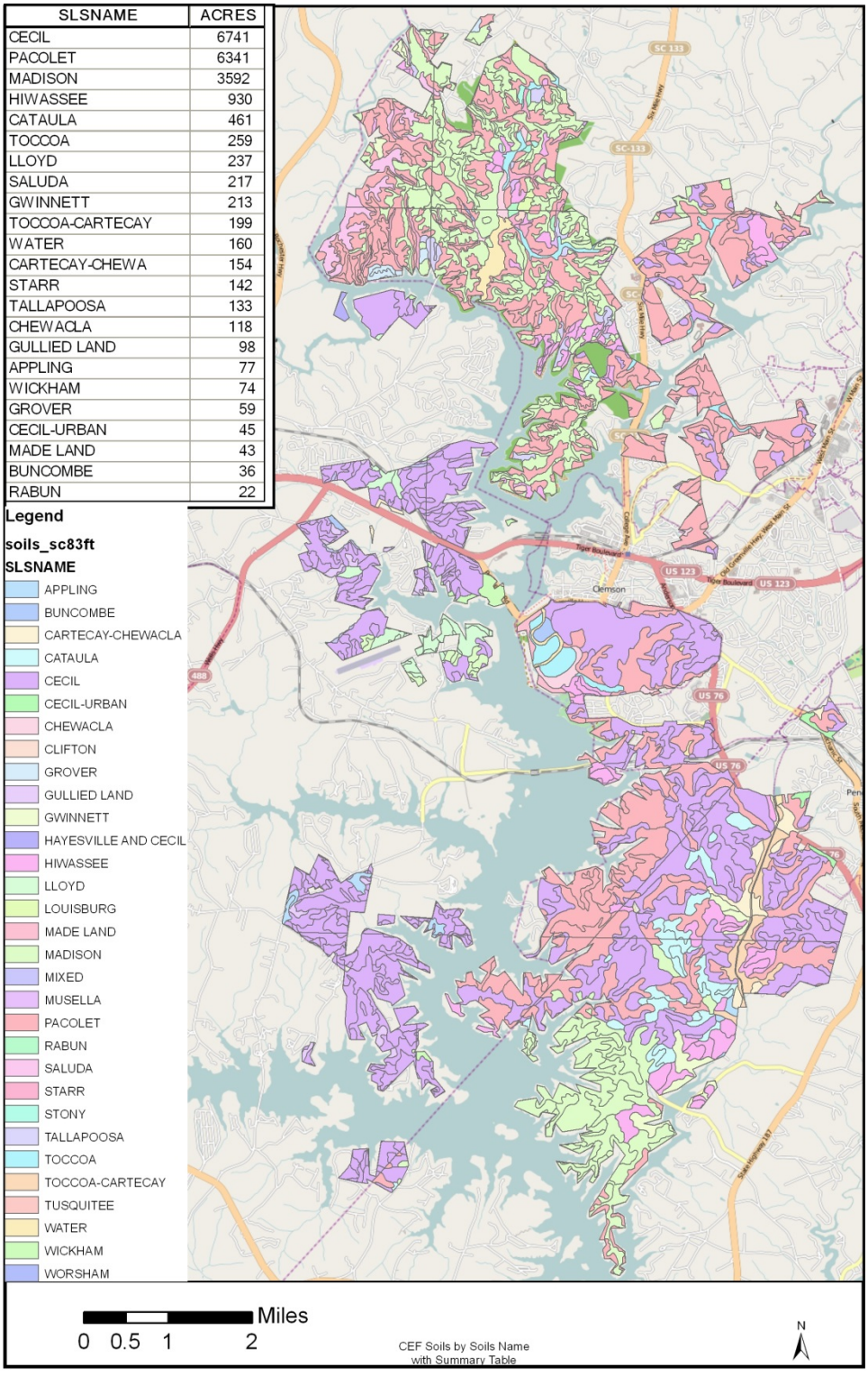
The Clemson Forest lies in the Southern Piedmont Soil Resource Area. Geologically the area is a dissected peneplain with a few remnants of the ancient mountain range. Generally, the area is sloping to moderately steep with broad narrow ridgetops. Elevations range from 650 to 1,000 feet above mean sea level.

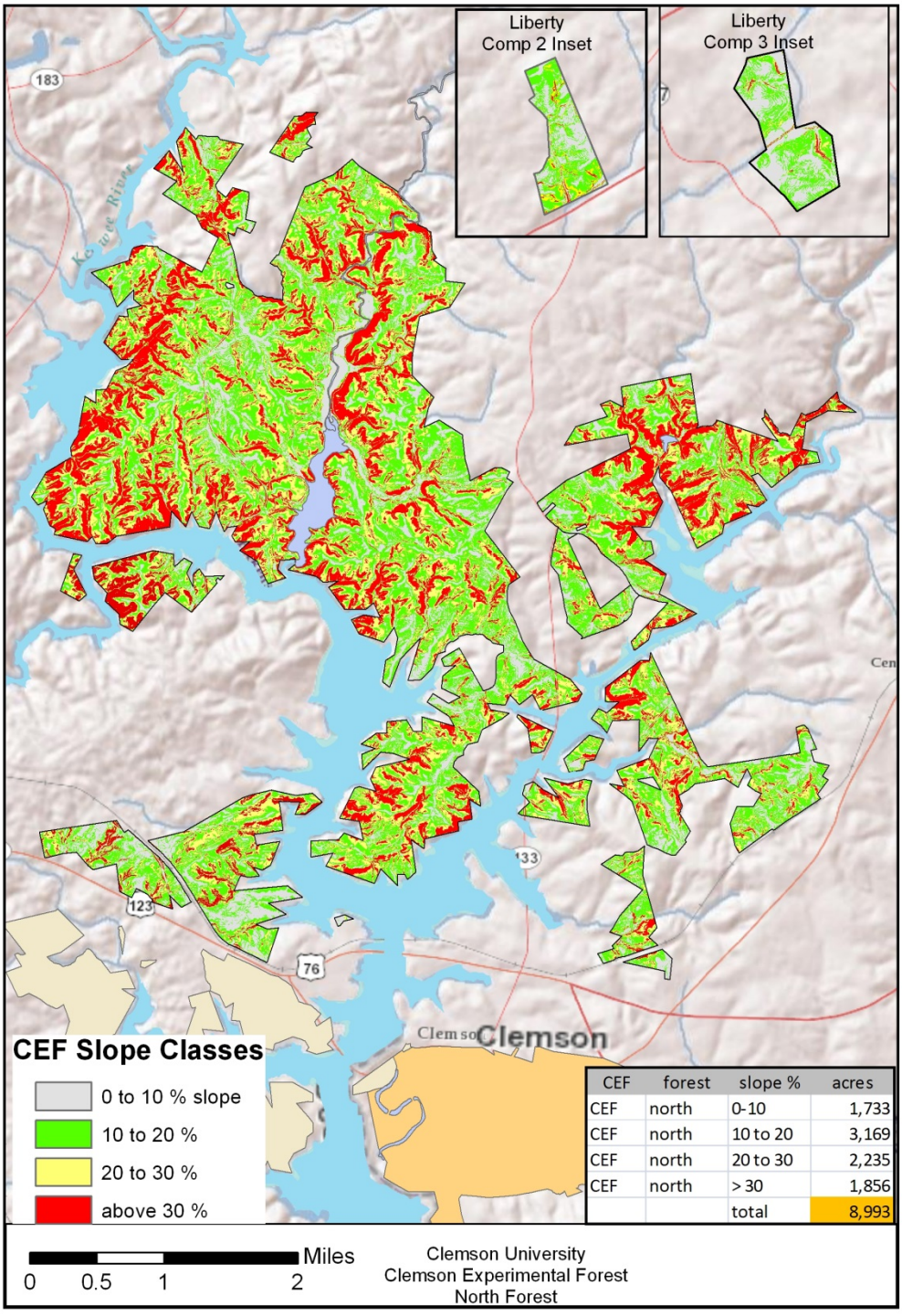
Parent soil material consisted of granites, felsic to mafic schists, phyllites, and granitic and mafic gneisses. This material was formed in the late Precambian to early Paleozoic age. Soils are mostly

Ultisols and have undergone moderate to extremely severe erosion. Entisols occur along the streams, but these areas are not extensive. Inceptisols occur on very steep areas. Soils in the area are classed in a thermic family: warm weather and moderate to heavy rainfall.

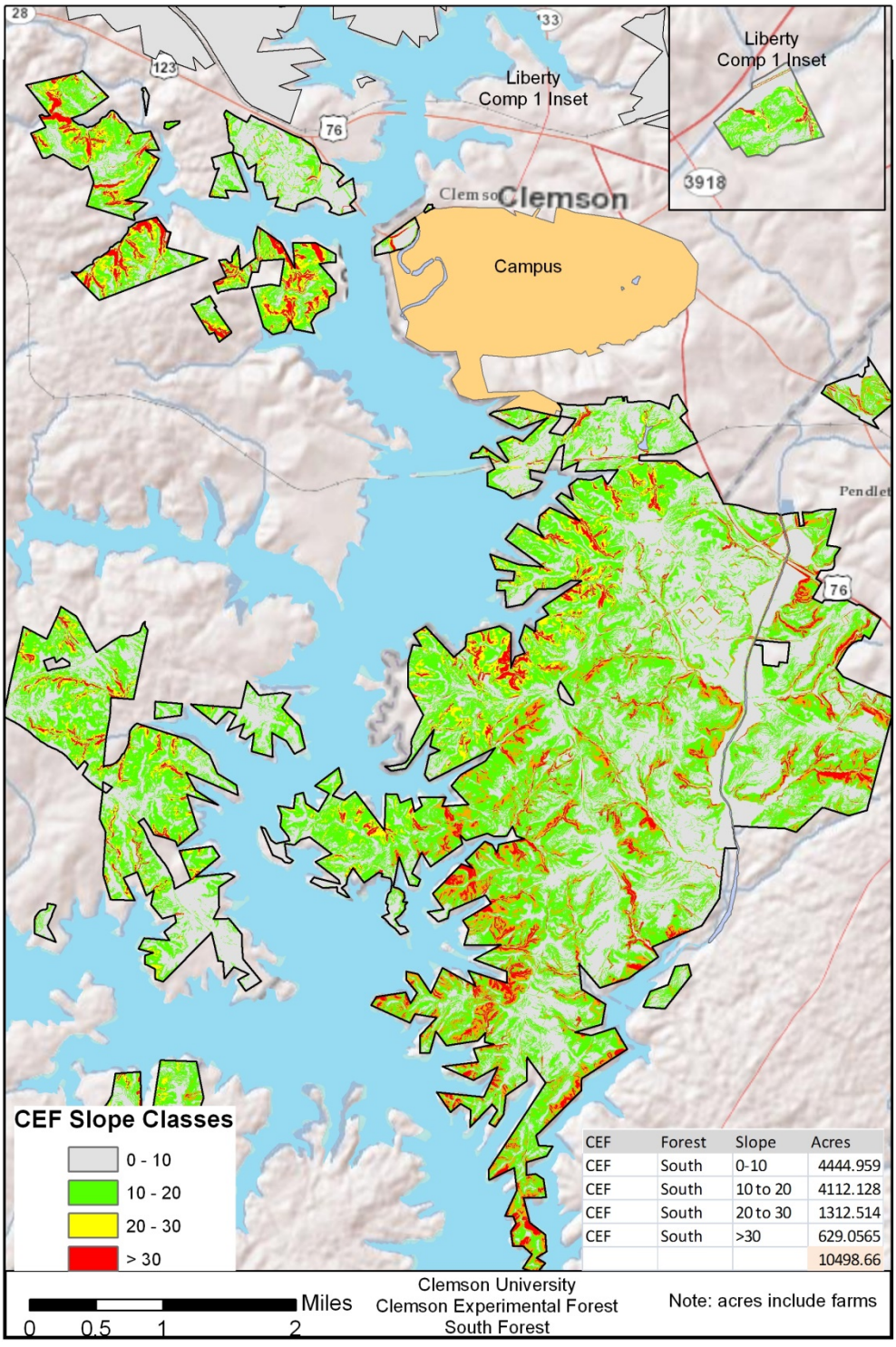
The soils on the forest are generally in the Cecil-Madison-Pacolet association and even split between Cecil and Pacolet followed my Madison as shown on the following map. They are generally well drained strongly sloping to steep soils with more Pacolet in the north area. Soils on steeper slopes that were not cropped are generally in better condition. Detail soil information is available from the GIS layer or online from the USDA web soil survey.

SLSNAME	ACRES
CECIL	6741
PACOLET	6341
MADISON	3592
HIWASSEE	930
CATAULA	461
TOCCOA	259
LLOYD	237
SALUDA	217
GWINNETT	213
TOCCOA-CARTECAY	199
WATER	160
CARTECAY-CHEWA	154
STARR	142
TALLAPOOSA	133
CHEWACLA	118
GULLIED LAND	98
APPLING	77
WICKHAM	74
GROVER	59
CECIL-URBAN	45
MADE LAND	43
BUNCOMBE	36
RABUN	22





CEF	forest	slope %	acres
CEF	north	0-10	1,733
CEF	north	10 to 20	3,169
CEF	north	20 to 30	2,235
CEF	north	> 30	1,856
		total	8,993


Liberty
Comp 1 Inset
Liberty
Comp 1 Inset
Clemson
Campus
Pendlet
28
123
76
133
3918
CEF Slope Classes
0 - 10
10 - 20
20 - 30
> 30
CEF Forest Slope Acres
CEF South 0-10 4444.959
CEF South 10 to 20 4112.128
CEF South 20 to 30 1312.514
CEF South >30 629.0565
10498.66
Miles
0 0.5 1 2
Clemson University
Clemson Experimental Forest
South Forest
Note: acres include farms

The terrain is generally operable. Protection of the soil resource is essential in forest operations. Limitations occur with wheeled equipment on slopes greater that 35% for distances over 500 feet. The maps above highlight areas of slope greater that 30 percent. In many cases these areas are operable from access areas and ledge roads created many years ago. Areas above 35 percent slope with skid distances greater than 500 feet will be avoided for conventional wheeled feller buncher and skidder. Operation on these slopes will be considered with a track feller buncher and skidder. Very little terrain is suitable for cable logging because of convex slopes.

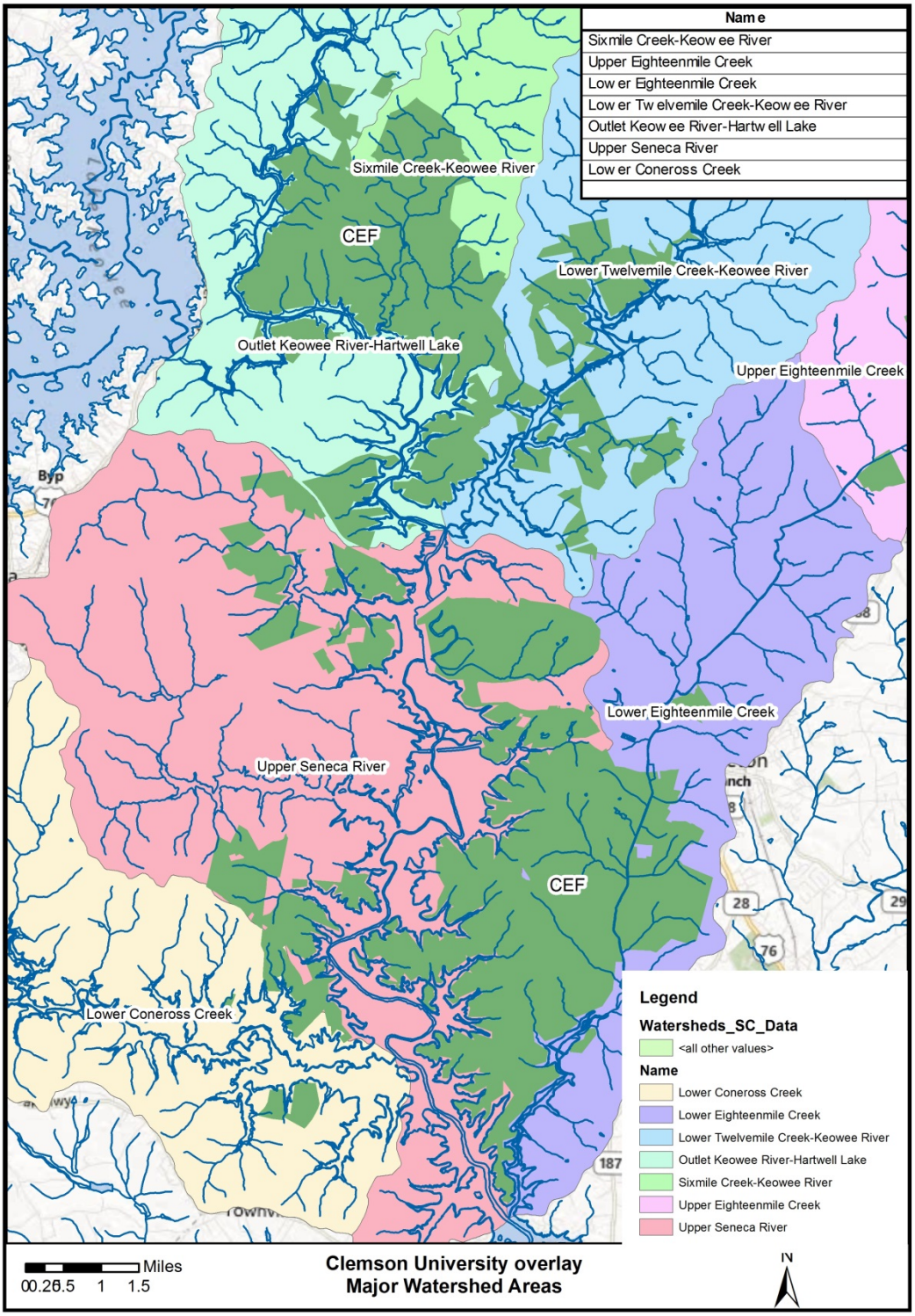
THE WATER RESOURCE

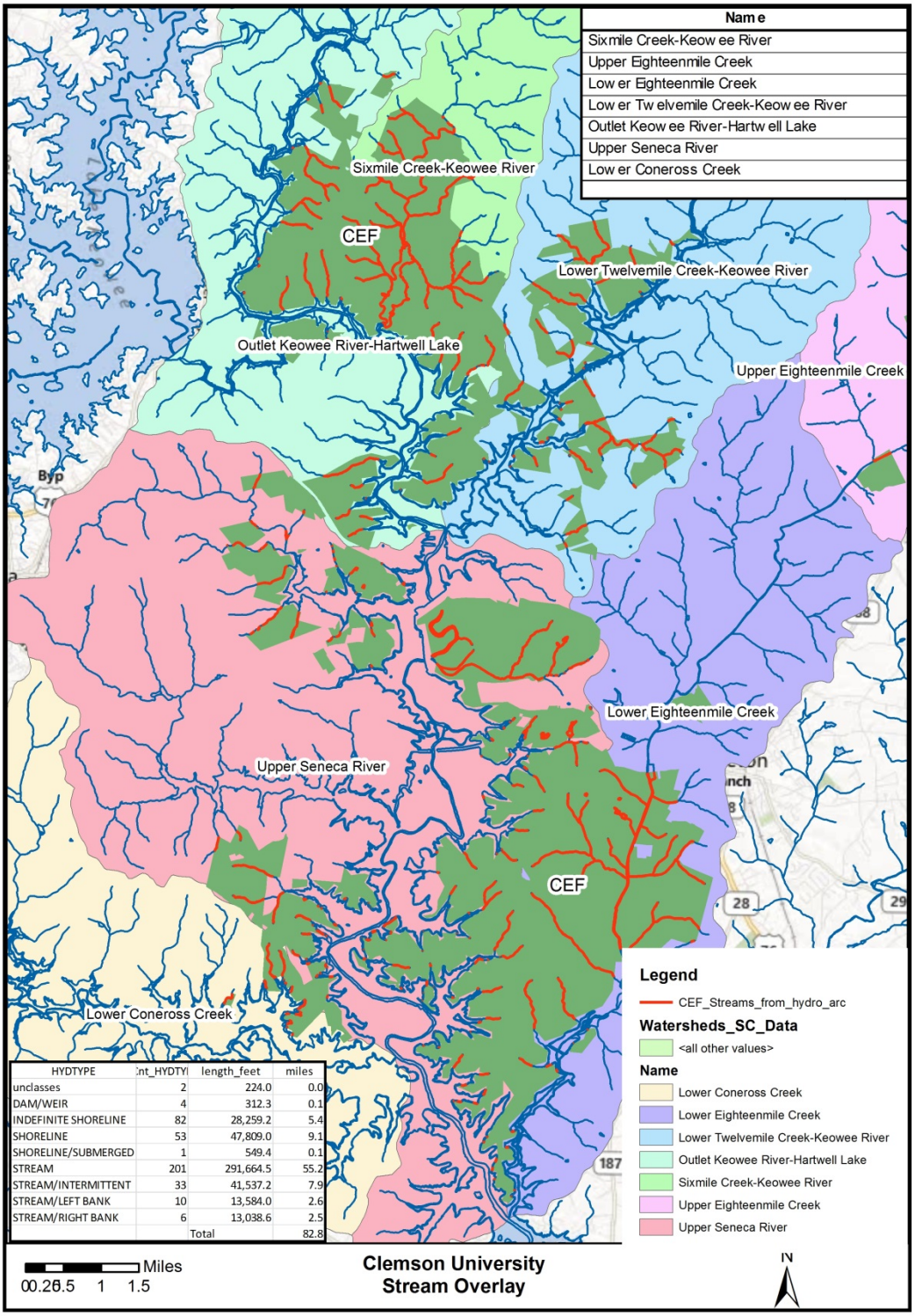
Forests are notably effective dispensing precipitation and resisting erosion. The water storage capacity and rate of soil development in them generally exceeds that of non-forest areas. The average normal rainfall of 51 inches per year is well distributed over the year and is not a limiting factor for forest growth unless drought situations occur.

The following map shows the major watersheds areas for the forest and the perennial streams flowing from the area followed by a map showing the stream classification and length on the CEF and other Clemson properties. The data does not include major portions of the 100-mile Hartwell Lake shoreline that is immediately adjacent to the CEF. Protection of the water resource is a major objective of forest management and is a cornerstone of the objectives for acquisition of the property.

Harvesting, road maintenance and any soil disturbing activities are conducted so as to minimize impact to the water resource. South Carolina Best Management Practices for Forestry are considered the minimum compliance guidelines. A fifty (50) feet riparian buffer is assigned on all perennial streams and 100 feet riparian buffers are assigned for larger streams including, Six Mile, Twelve Mile and Eighteen Mile Creeks. Also 100 feet riparian buffers are maintained on the Hartwell Lake shoreline. Exceptions to these buffer distances may be made very specific and limited basis by CEF staff on site. Harvesting of specific marked trees within these buffers may be allowed on a limited basis, such as cases where harvesting of these trees may protect the buffer from windthrow and soil disturbance. These buffers are considered special natural resource areas are mapped and used for planning in the GIS system. They are also shown in the Natural Resource Inventory available on the CEF web site.

Research on stream and water quality is regularly conducted on the CEF. The effectiveness of SC BMPs for Forestry has been verified by research of forest streams. Biological sciences, forestry and natural resource classes are regularly conducted on stream quality and quantifying aspects utilizing forest streams. Clemson forest streams were also highlighted in a Stream Team Article in the South Carolina Wildlife Magazine and available by permission on the CEF website http://www.clemson.edu/cafls/cef/documents/streamteamarticle_small.pdf.


Name
Sixmile Creek-Keowee River
Upper Eighteenmile Creek
Lower Eighteenmile Creek
Lower Twelvemile Creek-Keowee River
Outlet Keowee River-Hartwell Lake
Upper Seneca River
Lower Coneross Creek
Sixmile Creek-Keowee River
CEF
Lower Twelvemile Creek-Keowee River
Outlet Keowee River-Hartwell Lake
Upper Eighteenmile Creek
Lower Eighteenmile Creek
Upper Seneca River
CEF
Lower Coneross Creek
Legend
Watersheds_SC_Data
<all other values>
Name
Lower Coneross Creek
Lower Eighteenmile Creek
Lower Twelvemile Creek-Keowee River
Outlet Keowee River-Hartwell Lake
Sixmile Creek-Keowee River
Upper Eighteenmile Creek
Upper Seneca River
Miles
0 0.25 0.5 1 1.5
Clemson University overlay
Major Watershed Areas
N


Name
Sixmile Creek-Keowee River
Upper Eighteenmile Creek
Lower Eighteenmile Creek
Lower Twelvemile Creek-Keowee River
Outlet Keowee River-Hartwell Lake
Upper Seneca River
Lower Coneross Creek
Sixmile Creek-Keowee River
CEF
Lower Twelvemile Creek-Keowee River
Outlet Keowee River-Hartwell Lake
Upper Eighteenmile Creek
Lower Eighteenmile Creek
Upper Seneca River
CEF
Lower Coneross Creek
HYDTYPE | nt_HYDTY | length_feet | miles
unclasses | 2 | 224.0 | 0.0
DAM/WEIR | 4 | 312.3 | 0.1
INDEFINITE SHORELINE | 82 | 28,259.2 | 5.4
SHORELINE | 53 | 47,809.0 | 9.1
SHORELINE/SUBMERGED | 1 | 549.4 | 0.1
STREAM | 201 | 291,664.5 | 55.2
STREAM/INTERMITTENT | 33 | 41,537.2 | 7.9
STREAM/LEFT BANK | 10 | 13,584.0 | 2.6
STREAM/RIGHT BANK | 6 | 13,038.6 | 2.5
Total | | | 82.8
Legend
CEF_Streams_from_hydro_arc
Watersheds_SC_Data
<all other values>
Name
Lower Coneross Creek
Lower Eighteenmile Creek
Lower Twelvemile Creek-Keowee River
Outlet Keowee River-Hartwell Lake
Sixmile Creek-Keowee River
Upper Eighteenmile Creek
Upper Seneca River
Miles
0 0.25 0.5 1 1.5
Clemson University
Stream Overlay
N

The CEF forest management practices have been developed over time to protect the natural resources of the project lands. These natural resources are all interrelated to water quality. Soil and water management practices are designed to slow runoff from all management and use activities and to take into considerations of the natural features of the land and the corrections and misuse of past farming practices. Water resource quality and volume is considered in all phases of management.

Managing the water resource provides numerous benefits to the greater environment. Beaver ponds and wetland areas provide aquatic areas that serve beneficial habitat and serve as outdoor classrooms and research areas. These areas also improve flood and stream regulation in the local watersheds through temporary storage during increased rainfall and other wet weather events.

The CEF is in the upper end of the Savannah River Basin and is a recognized land base of undeveloped forest within the river basin. With approximately 100 miles of shoreline along Lake Hartwell, the source of several local municipalities drinking water, the CEF serves as a resource and an example and assists locally in protecting this resource.

The CEF has served as a local site for forest hydrology research. These studies have served to monitor water quality and volume and the factors that affect them. Volume of runoff can be attributed to many factors such as precipitation amount, duration, geology, slope, and forest cover and can be affected by forest management practices and natural disturbances and can vary over time. Timber harvest size has been shown to be a factor in the amount of runoff volume within a watershed. The CEF has voluntarily limited clearcut size to 50 acres to help minimize some of the negative effects, including water flow quantity from the harvest sites.

Managing the water resource requires an understanding of the natural features and land use activities, and recognizing the important role vegetation cover types, riparian areas, and wetlands toward protecting the water resource. Forest management practices can assist in managing overall water quality, volume, and minimize negative effects.

Forest management activities, including road construction, maintenance, timber harvesting, site preparation, etc. can have an impact on water runoff and volume. Recreation areas and trail development and maintenance can also become factors and must be taken into consideration to protect the resource. Local factors, such as slope and harvest area size can contribute to increased streamflow, erosion potential, and diminished water quality benefits.

Roads, skid trails, and hiking trails are built with sustainability, longevity, soil protection, and BMP compliance in mind. Site location is determined in a way to follow the natural drainage of the landscapes, which makes the feature sustainable for a longer period with minimal impact on the land. Some areas occasionally require minor engineering or construction of manmade features, such as culverts or French drains, to overcome certain landscape features. In areas of increased slope characteristics, water bars and turnouts are installed more often to remove the

water volume and quantity from the road as soon and as often as necessary to minimize water speed, velocity, and erosion potential.

Nonmerchantable vegetation and logging slash/debris on forest sites, specifically high traffic areas like skid trails help slow runoff and prevent increased flow from harvest sites while minimizing soil compaction and erosion. Timely reforestation and green up can minimize improve soil moisture and water retention while mitigating the negative effects of increased runoff due to natural disturbance or timber harvest operations.

The CEF is part of the Public Service and Agriculture agency within the College of Agriculture, Forestry, and Life Sciences. Our Water Resources Department serves as the coordinating agency for the State and regional river basin planning council efforts including the Savannah River Basin Council, which we are a part of. https://www.clemson.edu/public/water-assessment/index.html The management and protection of the CEF serves to support he general mission of the basin council and its goals. In addition, the CEF serves as part of the Shoreline Management Plan for the US Army Corp Engineers Hartwell Project. https://www.clemson.edu/public/water-assessment/index.html

CULTURAL RESOURCES

Significant old home sites, graves and other cultural features have long been mapped and used in forest management planning. Much of the data has been consolidated and included in the CEF Cultural and Historic Inventory available on the CEF web site http://www.clemson.edu/cafls/cef/documents/cef_cultural_inv.pdf.

If new elements of areas of interest are identified, they shall be reported to the forest office for evaluation and addition to the resource database. If a new cultural element, such as a grave, grave yard, or artifacts are discovered during a management operation, all activities will stop or avoid the area until an evaluation can be made by appropriate personnel.

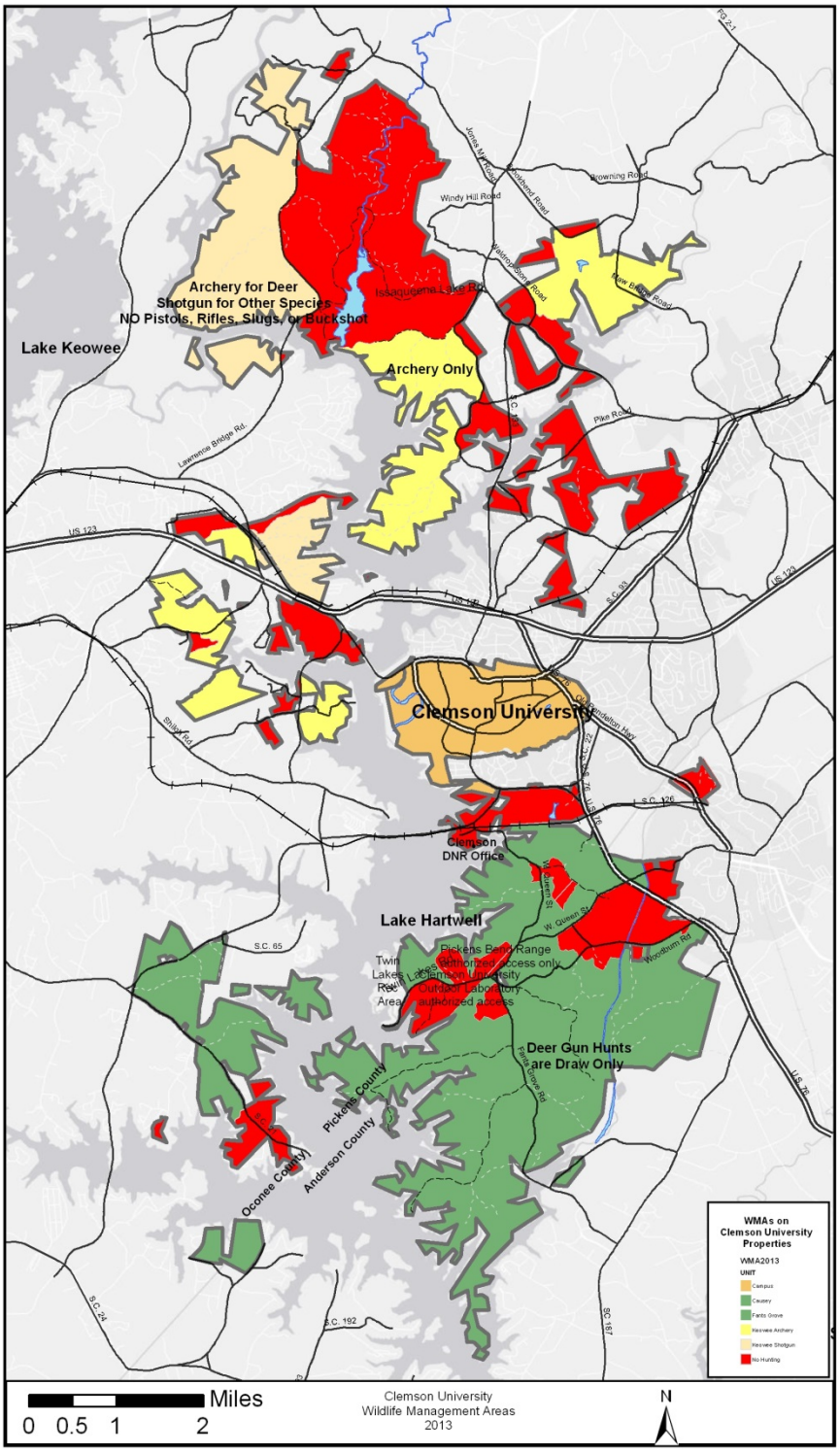
It is a management objective to protect significant cultural resources on the CEF.

WILDLIFE MANAGEMENT

Wildlife has always been an integral part of the management program. Major wildlife species including deer and turkey were essentially extirpated from the area during the 1930s due to habitat destruction and over-hunting. Habitat improvement through forest management, wildlife law enforcement and restocking efforts have restored abundant populations of deer and turkey and also provided excellent habitat for a variety of species. Audubon has recognized the CEF as part of a global network of places recognized for their outstanding value to bird conservation.

Good wildlife habitat is maintained by forest management practices that provide a diversity of habitat suitable to many species of wildlife all stages of development. A variety of forest age classes and cover types interspersed with planted openings and the use of prescribed fire are components of our wildlife management strategy. Protection of den trees, snags, wildlife corridors and streamside protection zones are components of wildlife habitat management.

South Carolina Department of Natural Resources partners with Clemson University in the management of two Wildlife Management Areas on the CEF through a Cooperative Agreement. The Keowee Wildlife Management Area north of Highway 123 and the Fant's Grove Wildlife Management Area South of Highway 123 as shown on the following map. Regulations for hunting on these areas are published in the SC DNR Rules and Regulations. With the establishment of these WMA's, a new "No Hunting WMA" designation was established so that SCDNR law enforcement could enforce rules and regulations in no hunting areas.


Archery for Deer
Shotgun for Other Species
NO Pistols, Rifles, Slugs, or Buckshot
Lake Keowee
Archery Only
Issaqueena Lake Rd.
Jones Mill Road
Shortcut Road
Browning Road
Windy Hill Road
Waterdog Bottom Road
New Bridge Road
Pike Road
Lawrence Bridge Rd.
US 123
Shiloh Rd
Clemson University
Clemson DNR Office
Lake Hartwell
Twin Lakes Rec Area
Pickens Range authorized access only
Clemson University Outdoor Laboratory authorized access
Deer Gun Hunts are Draw Only
Pickens County
Anderson County
Oconee County
S.C. 65
S.C. 126
S.C. 24
S.C. 192
SC 187
Woodburn Rd
W. Queen St
Fants Grove Rd
WMAs on Clemson University Properties
WMA2013
UNIT
Campus
Causey
Fants Grove
Keowee Archery
Keowee Shotgun
No Hunting
Miles
0 0.5 1 2
Clemson University
Wildlife Management Areas
2013
N

OTHER RECREATION

In addition to hunting, the CEF is extensively used by students, area residents and tourist for recreation that ranges from equestrian use, bicycle riding, hiking birding and general enjoyment of nature. The use of off road vehicles is prohibited as is public use of vehicles behind gated, signed or otherwise barricaded roads. Faculty, students, scientist and others needing legitimate access to forest roads may obtain a key from the forest management office.

Trail maps are located on the CEF web under the recreation tab. There are about 32 miles of trail in the Fant's Grove area and some 41 miles in the north area primarily around the Issaqueena Lake area. A Collaborative Adaptive Management Plan for the Clemson Experimental Forest Trail System was completed in 2000 with the assistance and support of area stakeholders. A focus of the plan is to provide reasonable recreational trail access while maintaining the ecological integrity of the trail areas, stream crossings and impact areas. A copy of the plan is available in the forest management office.

CEF trails are maintained by various volunteer groups and are designated as multiple use. The Greater Clemson Mountain Biking Club and the South Carolina Upstate Equine Council are instrumental in providing labor and materials for trail maintenance. In addition to their maintenance and daily trail riding, they organize events to bring trail users to the CEF for enjoyment and competition.

The rules and regulations for public use of the CEF are posted at recreation areas and on the CEF website. SCDNR Law Enforcement assists in patrolling and enforcement.

CLEMSON EXPERIMENTAL FOREST - USER GROUP PLOICIES

The Clemson Experimental Forest's 17,500 acres are dedicated to education, research and demonstration in order to better understand and manage forest resources for the benefit of society. These essential resources include clean air, clean water, pleasing aesthetic qualities, abundant wildlife, protection of species and habitat diversity, recreation opportunities, along with commodity products from the forest. The forest is managed strictly for perpetual sustained or improved yield of these products. The Clemson Experimental Forest personnel, equipment, supplies, roads, recreation facilities and maintenance are solely supported by revenue generated by the Forest.

Clemson Experimental Forest (CEF) requires the following:

- All trails and related activities shall comply with South Carolina's Best Management Practices (BMPs) for Forestry and the Sustainable Forestry Initiative
- Trail marking/posting penetrating the bark of trees must use aluminum nails
- New trails must be approved by CEF Management

- Minimize or eliminate treated wood, plastic, manmade, or other combustible materials in trail construction
- All organized user group activities require a permit from CEF Management. Fees may be required.
- Motorized vehicles and equipment are prohibited except on established roadways open for vehicle travel
- All trails are to be Multiple Use. Exclusive use is prohibited without CEF Management approval

All users are responsible for the safety of their person and property while on the Forest. Entry onto Clemson University properties constitutes consent to an inspection and search of the person and any vehicle, trailer, conveyance or container. Persons apprehended for acts of arson, vandalism, littering, cutting or removing trees, shrubs, or other natural or man-made objects will be prosecuted.

SPECIAL AREAS

As mentioned previously, a special areas inventory was conducted resulting in identification and mapping of elements of interest and special natural resources areas on the CEF and is available on the CEF web page. Summary maps for the north and south sections of the forest are below. Forest operations may be subject to provisions in the Special Natural Resources document.

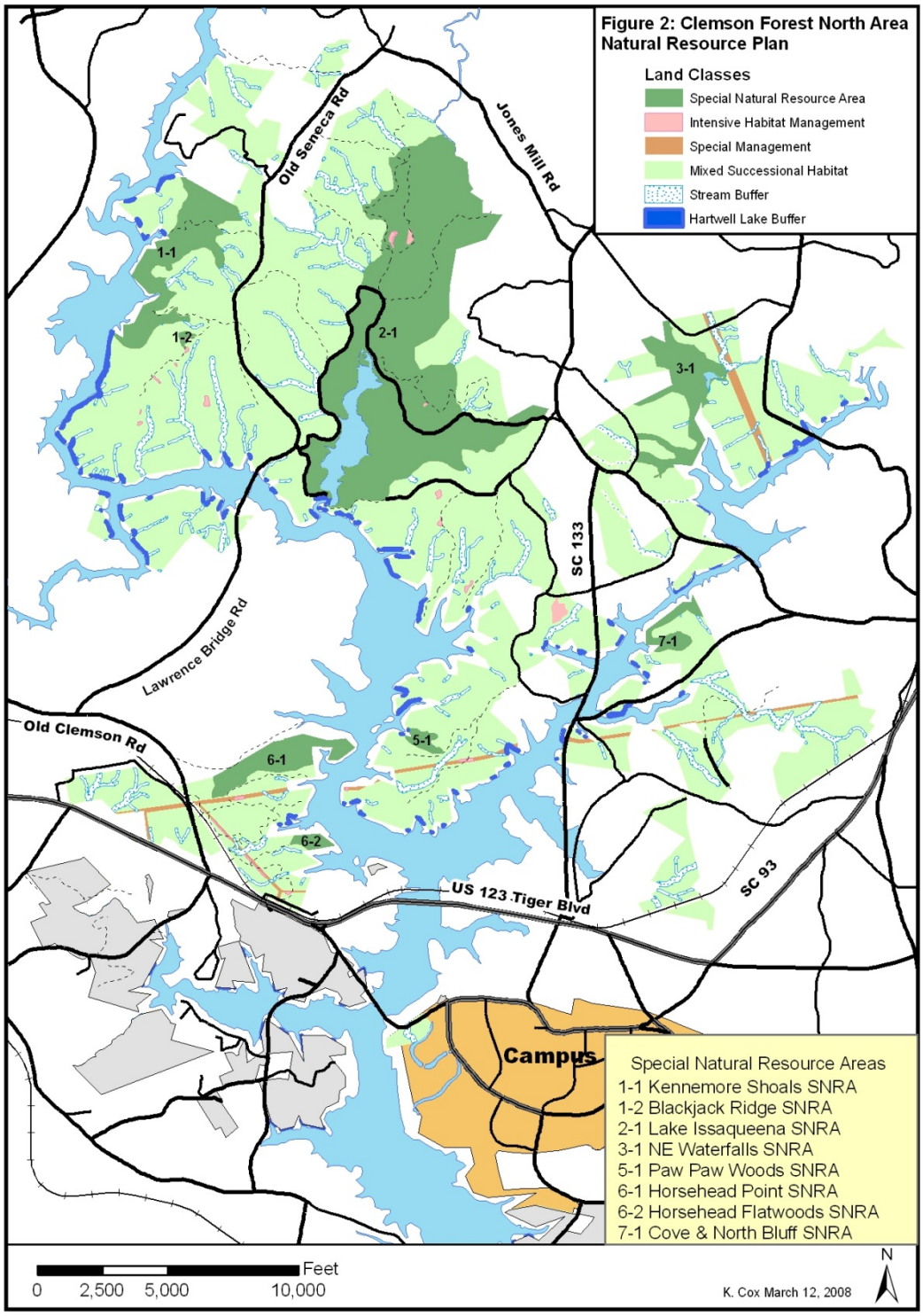


Figure 2: Clemson Forest North Area
Natural Resource Plan
Land Classes
Special Natural Resource Area
Intensive Habitat Management
Special Management
Mixed Successional Habitat
Stream Buffer
Hartwell Lake Buffer
Old Seneca Rd
Jones Mill Rd
SC 133
Lawrence Bridge Rd
Old Clemson Rd
US 123 Tiger Blvd
SC 93
Campus
1-1
1-2
2-1
3-1
5-1
6-1
6-2
7-1
Special Natural Resource Areas
1-1 Kennemore Shoals SNRA
1-2 Blackjack Ridge SNRA
2-1 Lake Issaqueena SNRA
3-1 NE Waterfalls SNRA
5-1 Paw Paw Woods SNRA
6-1 Horsehead Point SNRA
6-2 Horsehead Flatwoods SNRA
7-1 Cove & North Bluff SNRA
Feet
0 2,500 5,000 10,000
K. Cox March 12, 2008
N

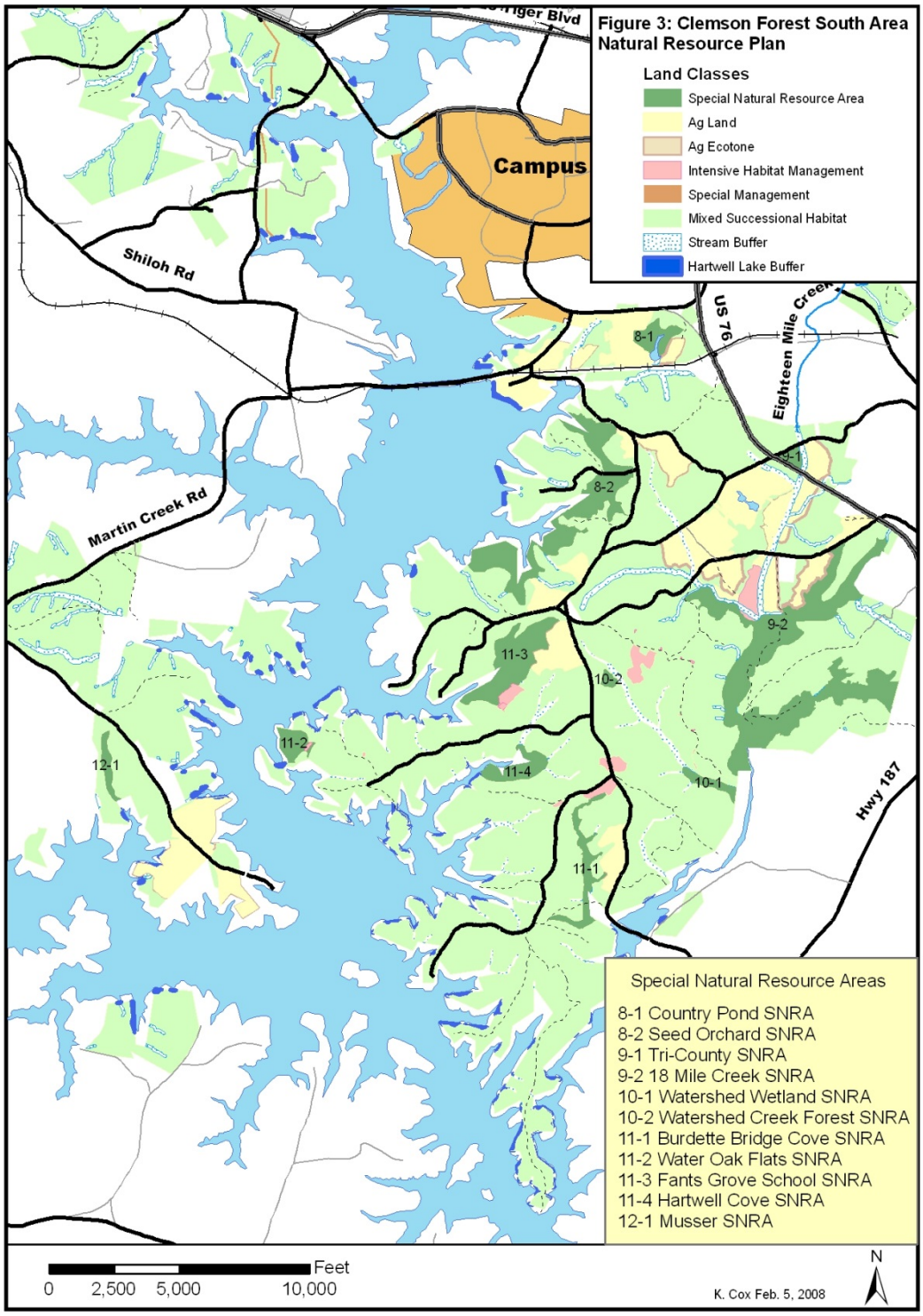


Figure 3: Clemson Forest South Area Natural Resource Plan
Land Classes
Special Natural Resource Area
Ag Land
Ag Ecotone
Intensive Habitat Management
Special Management
Mixed Successional Habitat
Stream Buffer
Hartwell Lake Buffer
Campus
Shiloh Rd
Martin Creek Rd
US 76
Eighteen Mile Creek
Hwy 187
8-1
8-2
9-1
9-2
10-1
10-2
11-1
11-2
11-3
11-4
12-1
Special Natural Resource Areas
8-1 Country Pond SNRA
8-2 Seed Orchard SNRA
9-1 Tri-County SNRA
9-2 18 Mile Creek SNRA
10-1 Watershed Wetland SNRA
10-2 Watershed Creek Forest SNRA
11-1 Burdette Bridge Cove SNRA
11-2 Water Oak Flats SNRA
11-3 Fants Grove School SNRA
11-4 Hartwell Cove SNRA
12-1 Musser SNRA
Feet
0 2,500 5,000 10,000
K. Cox Feb. 5, 2008
N

GENERAL FOREST OPERATIONS

Stand Delineation and Records

Our management procedure, which uses the stand as the basic unit, first divides the forest into 14 divisions. These divisions are then divided into 141 compartments, averaging 135.5 acres in size. Compartment boundaries are formed by topographical features and roads. The forest is comprised of 1,825 stands averaging 9.7 acres in size. A stand is recognized as an area occupied by trees of similar character based on age, composition and site; or it may be a grassed or open area used as a wildlife plot or otherwise unproductive for trees.

Stands were delineated in the past using aerial photographs and were later digitized to create ArcGIS shapefiles containing pertinent stand information. As land is not converted to other uses, stand boundaries are updated following timber harvests, using GPS data collected during the harvest, and following beetle infestations. At the time of regeneration stand information will be updated with regards to establishment year and cover type.

To track volume growth and accuracy of stand information stands are to be inventoried on a compartment-by-compartment basis. The inventory will be conducted using a BAF10 prism and tree and spatial data collected and recorded using TCruise and SoloForest. Merchantable tree heights will be measured as if one was cruising to sell the stand. It is the goal to re-inventory each stand on a 10-year basis to note any changes to composition. To meet this target 1,750 acres a year must be inventoried. During the inventory process, technicians will also note any obvious errors in stand data (i.e., the stand description indicates an 85-year-old pine plantation, but on the ground the trees are of pulpwood size). As compartments are completed, the data is to be ran using TCruise, point data compiled and mapped using ArcMap. Accomplishment of these activities is dependent on adequate personnel.

Records System

To ensure that electronic records are not lost due to computer failure, all important records will be uploaded onto the H: drive in the CEF folder. This drive is maintained by CCIT and backed frequently. Updates to shapefiles shall also be stored on the H: drive and labeled in a manner that identifies when that file was updated. Important records will include stand, CEF boundary, compartments, road, sale and division shapefiles, as well as inventory data and other forest management information.

Pesticides Used on the CEF

Site preparation often includes herbicide when the site is to be regenerated with planted pine. A tank mix designed to provide a state in which seedlings are free to grow and obtain a manufacturer's guarantee is desired. Commonly used forestry herbicides include Arsenal AC, Chopper, Garlon, Milestone, Accord, and others. Specific herbicide and rates may be altered as

conditions change for specific jobs. Below is a list of other pesticides used for non-site preparation activities; mainly these chemicals are used in food plots, recreation areas and around forest gates. **Herbicides and insecticides are used in the minimum quantity necessary to accomplish the operation and always under label direction.** Certified contract herbicide applicators are used for stand level application primarily for vegetation control prior to pine regeneration. Department personnel use targeted spray herbicide for vegetation control around gates, picnic areas, wildlife plots and small areas of invasive species. Occasional control of fire ants around facilities and picnic areas is necessary. The current insecticide utilized is listed below. The only other insecticide utilized by on the forest is for control of Hemlock Wooley Adelgid, and is only used on a few trees on a three-year cycle.

Other Pesticides Used on the CEF		
Herbicide	**Active Ingredient**	**Use**
Eraser	Glyphosate	Weeds, Grass, and Trees
Eraser A/P	Glyphosate	Weeds, Grass, and Trees
Weedar 65	2,4-D	Broadleaf Weeds
Tordon 101	2,4-D and Picloram	Broadleaf Weeds and Brush
Reward	Diquat dibromide	Aquatic Weeds
Insecticide	**Active Ingredient**	**Use**
Zenith 75 WSP	Imidacloprid	Hemlock Wooley Adelgid
Ground Assault	Permethrin	Ants

Forest Roads

An adequate system of forest roads exists on the CEF for management operations, teaching and research requirements exist on the forest. Forest roads are generally closed to public vehicle traffic. The Issaqueena Lake road is opened from March 15 until November 1 for public access to the lake and picnic shelters. Any road may be closed at the forest manager's discretion in order to protect the resource during periods of wet weather, high fire danger or other incidents that may occur. The roads are maintained in three class: ***Class I***, Roads wide enough to accommodate two-way traffic in most places. These roads are maintained with gravel surface with ditches and culverts as needed and generally accessible in most weather conditions. The road grade does not exceed 8 percent. ***Class 2*** roads are not designed for two-way traffic but have turnouts to allow for passing vehicles. The roads are stabilized with vegetation and short sections may be graveled. ***Class 3*** roads are product removal roads or access to specific teaching or research sites not used on a regular basis. An objective is to limit grading and shaping roads in

favor of using vegetation for road stabilization. Closing forest roads to public vehicle traffic has greatly reduce maintenance costs, reduced erosion, and generally improved habitat.

Harvest

Timber harvests are an essential component of maintaining a healthy forest and providing a variety of education and research areas. Objectives of timber harvest include wildlife habitat improvement, maintain special habitats for selected species, and improve stand quality and vigor and commodity production for revenue. Periodic thinning is conducted to maintain health and vigor by controlling stocking at a level sustainable for the site. Regeneration harvest (clearcut, shelterwood, group selection) are conducted when stands reach physical or financial maturity.

The forest manager, with input from staff, will select stands for cultural treatments based on the stand condition (stocking, age, vigor), research and education requirements and subject to any limitations of terrain, riparian zones, cultural features, adjacency to prior cuts and other factors that may influence harvesting decisions. Harvest areas will be in operable units (two or more harvest areas within the general area) to improve sale price. Clearcut stands will not exceed 50 acres in size, except as necessary to control southern pine beetle, salvage storm damage, research requirements, or to solve or prevent logistical issues with stand management. Adjacent stands must be at least 3 years old, established and stocked with a canopy height exceeding 5 feet.

The objective for harvest will be to improve some component of management objectives, such as forest health, productivity, wildlife and ecological values, education and research requirements.

Regeneration will be established, either natural or planted, within two years of harvest. Pine plantations will require a summer cycle for passive control of pitch eating weevil prior to planting. Pine harvest areas will generally be replaced with pine plantation using second generation or better seedlings, predominately loblolly. Longleaf, slash, shortleaf pines may be planted as research or demonstration areas. The use or clonal or transgenic is not planned except to accommodate education or research activities. The use of transgenic seedlings will require approval by the appropriate University oversight committee.

Public Involvement & Transparency

The Clemson Experimental Forest is highly visible. With nearly 100 miles adjacent to Hartwell Lake, many miles of public road and surrounding a major public university campus with lots of recreational users, forest operations are readily visible. Frequent tours, fieldtrips and education programs are conducted on the CEF.

We maintain a good relationship with conservation groups, cycling and equestrian clubs and the general public. Our management activities are intended to reflect the best available knowledge of

natural resource management. Questions about management practices allow us to provide that knowledge to a variety of audiences from local garden clubs to visiting scientists.

Our goal is to continue to develop and improve the science and practice of natural resource management.

The following notice is to be posted at various locations and entry locations to the CEF:

PUBLIC INQUIRY AND RESPONSE

The public is invited to comment on the management and operation of the Clemson Experimental Forest. The primary contact for the Clemson Experimental Forest is Russell Hardee, Forest Manager, 266B Lehotsky Hall, Clemson, SC 29634-0334, telephone 864-656-4833, email rhardee@clemson.edu.

The Forest Manager or his designee will respond to your inquiry with an initial response as quickly as possible (within 10 days of receipt). Some inquiries may require consultation and response by others in the University administration.

We appreciate your interest and thank you for your support.

Russell A. Hardee

Russell A. Hardee, CF
Forest Manager
Clemson Experimental Forest

Responsibility to Recognize and Respect the Rights of Indigenous People

CEF shall recognize and respect Indigenous Peoples' rights as required by state and federal law. Currently no state or federally recognized indigenous peoples have claims relating to CEF lands. As inventories and management activities are conducted, should possible sites of interest be discovered, the Forest Manager is to be notified. The University Historian, State Historic Preservation Office, State Commission of Minority Affairs, and/or State Archaeologist may be consulted as needed.

If state or federally recognized indigenous peoples were to have claims relating to CEF lands, the CEF Manager would confer with the affected Indigenous Peoples with respect to sustainable forest management practices. CEF would seek to understand and respect traditional forest-related knowledge; identify and protect spiritually, historically, or culturally important sites; address the use of non-timber forest products of value to Indigenous Peoples; and respond to Indigenous Peoples' inquiries and concerns received.

University personnel, including CEF management, are encouraged to communicate with and respond to Indigenous Peoples' in regards to known cultural heritage sites such as the historic Treaty Oak, site of the signing of the Treaty of Hopewell in 1785.

Sustainable Forestry Commitment

The Clemson Experimental Forest (CEF) is committed to continually achieving independent certification to the Sustainable Forestry Initiative® (SFI) Requirements for the (2022) Program Standard of Sustainability for Forest Certification.

The CEF is committed to promoting and achieving the Principles of Sustainable Forest Management including practicing sustainable forestry, employing responsible practices, regenerating the forest and maintaining productive capacity, protecting and maintaining long term forest and soil productivity, protecting water resources, protecting special sites and biological diversity, complying with legal requirements, and continually improving forest practices.

The CEF is committed to complying with applicable laws and regulations, including social laws. The CEF strives to involve interested and affected parties in its sustainable forest management programs and to consider their comments and inputs in making management decisions.

To help implement and achieve the Sustainable Forestry Initiative Standard, the CEF has developed and adopted appropriate programs, plans and procedures to guide its land management activities. These programs and plans are contained in the SFI Manual, the SFI Program and other written documents.

The CEF is committed to comply with applicable laws and regulations and takes appropriate steps to comply. The CEF is also committed to annually review the effectiveness of its management programs to continually improve the practice of sustainable forestry.