Forest sustainability in the state of Alabama, USA

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Project No.: 130373

July 2014

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1. Introduction

The combustion of wood for energy purpose is not considered to contribute to the augmentation of greenhouse gases concentration in the atmosphere, as long as the CO2 emissions released during the combustion of wood are balanced by the growth of new trees. It is therefore essential to investigate if the forests in the region where the wood used for energy purpose are managed in a sustainable way, avoiding resources associated with overexploitation of forests, land use change, depletion of carbon stocks, etc...

In this framework, literature research was carried out to produce a summary of forest management in Alabama, including general condition, management and sustainability assessment.

2. Alabama forests overview

2.1. Location and distribution

Alabama is located in the South East of the USA and covers a total surface area of 135 765 km². The State of Alabama has 67 counties. Alabama is bordered by four other states: Mississippi to the west, Tennessee to the north, Georgia to the east and Florida to the south.

Figure 1: General maps of Alabama

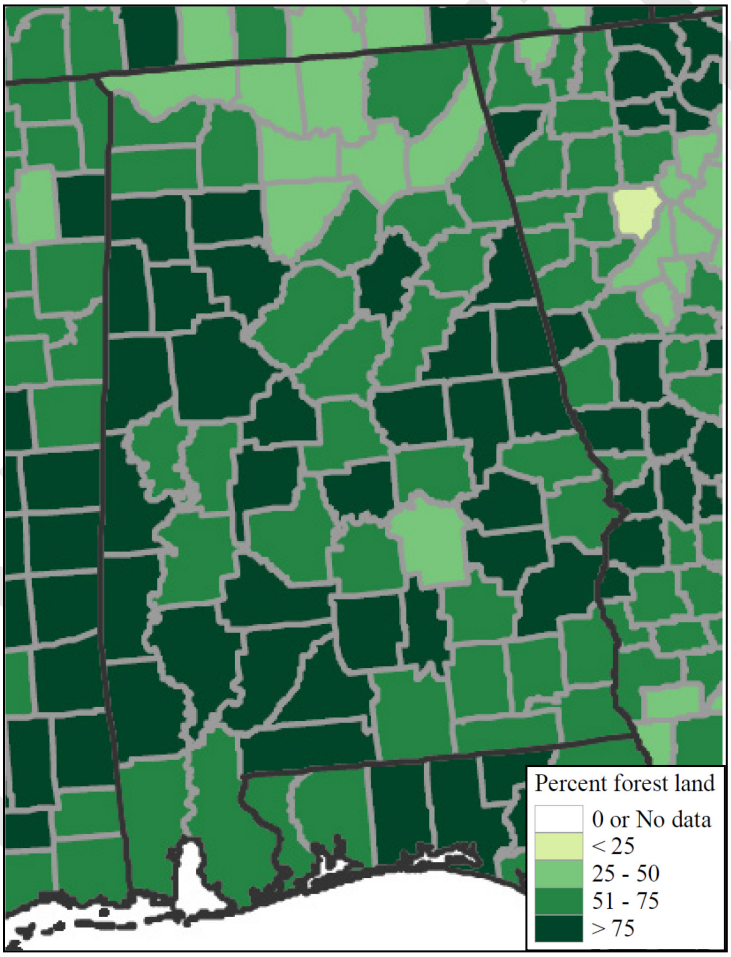
Source: NETSTATE – Alabama
(http://www.netstate.com/states/geography/mapcom/al_mapscom.htm)

The Alabama forests are part of the large forest area of the East coast of the United States of America. Nowadays, Alabama's woodlands cover about 68% of the State's land area with 9.27 million ha[1] (including 9.24 million ha timberland, i.e. forests in commercial production).

Alabama has the third largest timberland acreage in the 48 contiguous states, behind only Georgia and Oregon. As far as private timberland acreage is concerned, Alabama ranks second behind Georgia.

As shown on the figure below, the forests are rather homogenously distributed throughout the State and 59 counties (out of the 67) are more than half covered with forests.

Figure 2 : Percentage of land in forest by county



Source: USDA Forest Service - Forest Inventory & Analysis (2007)
(http://www.fia.fs.fed.us/tools-data/maps/2007/descr/yfor_land.asp)

[1] Source : situation as per 2012 Forest Inventory and Analysis, USDA – Forest service

2.1. Ecological zones

Alabama has a subtropical humid climate, characterized by hot, humid summers and generally mild to cool winters. The weather in the parts of Alabama that are near the Gulf of Mexico tends to be the warmest in summer and mildest in the winter, while the Northern, inland parts of the state see slightly cooler and drier summers. Summers in Alabama can be brutally hot, with a wicked combination of high temperatures and high humidity.

Depending on the place, the typical high temperatures recorded in July are in the range 33°C to 34°C while the typical low temperatures recorded in January are in the range -1°C to 4°C[2].

Depending on the place, the average precipitations range generally from 1 200 to 1 800 mm per year[3].

Alabama is divided by the 6 following ecoregions[4]:

A. **Piedmont** (n°45 on Figure 3)

Considered the non mountainous portion of the old Appalachians Highland by physiographers, the northeast-southwest trending Piedmont ecoregion is a transitional area between the mostly mountainous ecoregions of the Appalachians (on the northwest) and the flat coastal plain (on the the south). Once largely cultivated, much of this region has reverted to pine and hardwood woodlands.

B. **South-eastern Plains** (n°65 on Figure 3)

These irregular plains have a mosaic of cropland, pasture, woodland, and forest. Natural vegetation is mostly oak-hickory-pine and Southern mixed forest. The Cretaceous or Tertiary-age sands, silts, and clays of the region contrast geologically to the older igneous and metamorphic rocks of the Piedmont, and the older limestone, chert, and shale found in the Interior Plateau. Streams in this area are relatively low-gradient and sandy-bottomed.

C. **Ridge and Valley** (n°67 on Figure 3)

This northeast-southwest trending, relatively low-lying, but diverse ecoregion is sandwiched between generally higher, more rugged mountainous regions with greater forest cover. As a result of extreme folding and faulting events, the region is roughly parallel ridges and valleys have a variety of widths, heights, and geologic materials, including limestone, dolomite, shale, siltstone, sandstone, chert, mudstone, and marble. Springs and caves are relatively numerous. Present-day forests cover about 50% of the region. The ecoregion has a diversity of aquatic habitats and species of fish.

[2] Source : http://www.ustravelweather.com/Alabama/

[3] Source : http://average-rainfall.weatherdb.com/d/d/Alabama

[4] Source: Primary Distinguishing Characteristics of Level III Ecoregions of the Continental United States (http://www.hort.purdue.edu/newcrop/cropmap/ecoreg/descript.html)

D. Southwestern Appalachians (n°68 on Figure 3)

Stretching from Kentucky to Alabama, these open low mountains contain a mosaic of forest and woodland with some cropland and pasture. The eastern boundary of the ecoregion in Tennessee, along the more abrupt escarpment where it meets the Ridge and Valley, is relatively smooth and only slightly notched by small eastward flowing stream drainages. The western boundary, next to the Interior Plateau's Eastern Highland Rim, is more crenulated, with a rougher escarpment that is more deeply incised. The mixed mesophytic forest is restricted mostly to the deeper ravines and escarpment slopes, and the upland forests are dominated by mixed oaks with shortleaf pine.

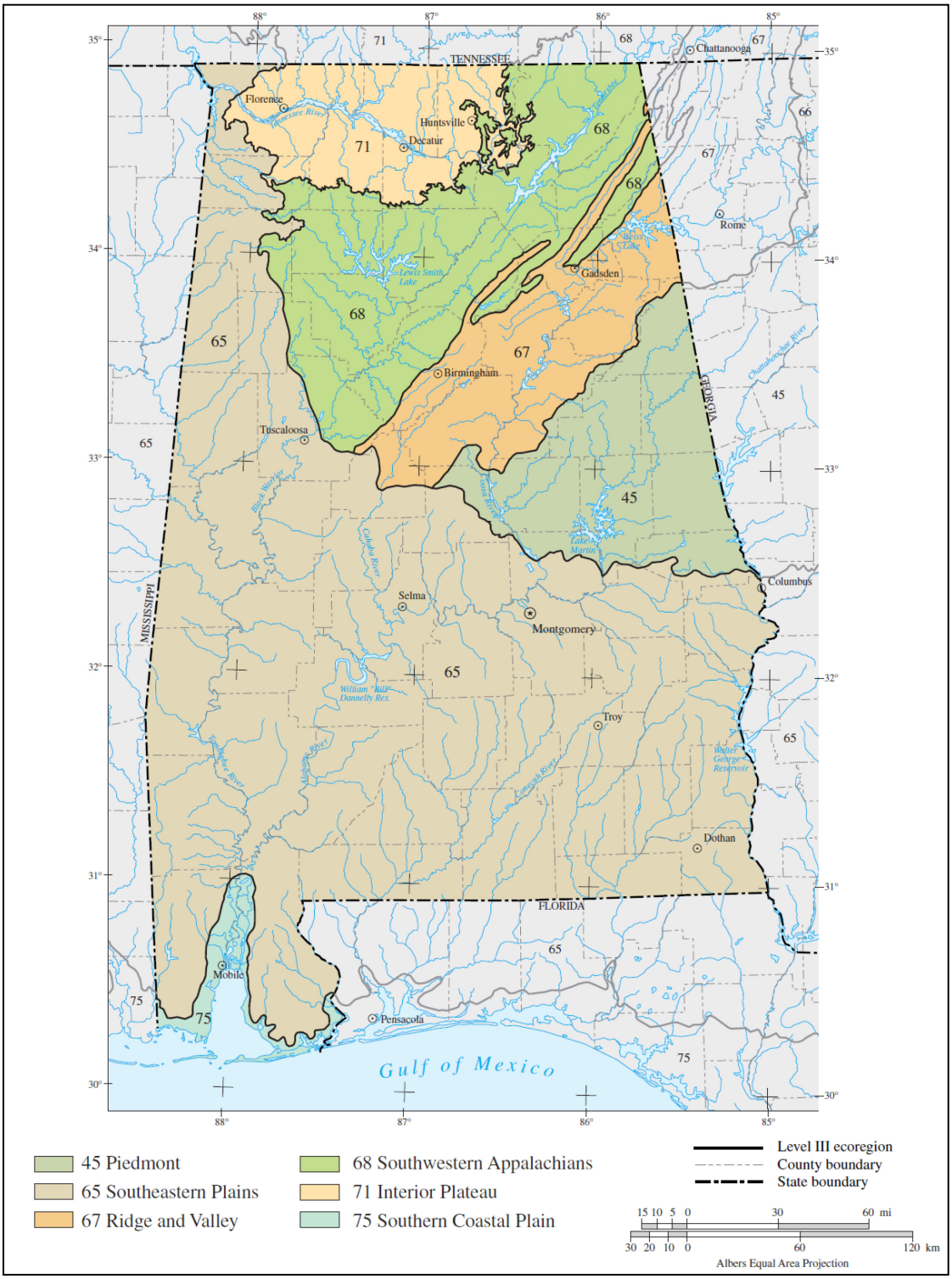
E. Interior Plateau (n°71 on Figure 3)

The Interior Plateau is a diverse ecoregion extending from southern Indiana and Ohio to northern Alabama. Rock types are distinctly different from the coastal plain sands and alluvial deposits to the west, and elevations are lower than the Appalachian ecoregions to the east. Mississippian to Ordovician-age limestone, chert, sandstone, siltstone and shale compose the landforms of open hills, irregular plains, and tablelands. The natural vegetation is primarily oak-hickory forest, with some areas of bluestem prairie and cedar glades. The region has a diverse fish fauna.

F. Southern Coastal Plain (n°75 on Figure 3)

The Southern Coastal Plain consists of mostly flat plains with numerous swamps, marshes and lakes. This ecoregion is warmer, more heterogeneous, and has a longer growing season and coarser textured soils than the Middle Atlantic Coastal Plain. Once covered by a forest of beech, sweetgum, southern magnolia, slash pine, loblolly pine, white oak, and laurel oak, land cover in the region is now mostly longleaf-slash pine forest, oak-gum-cypress forest in some low lying areas, pasture for beef cattle, and urban development.

Figure 3: Ecological zones of Alabama (Level III)



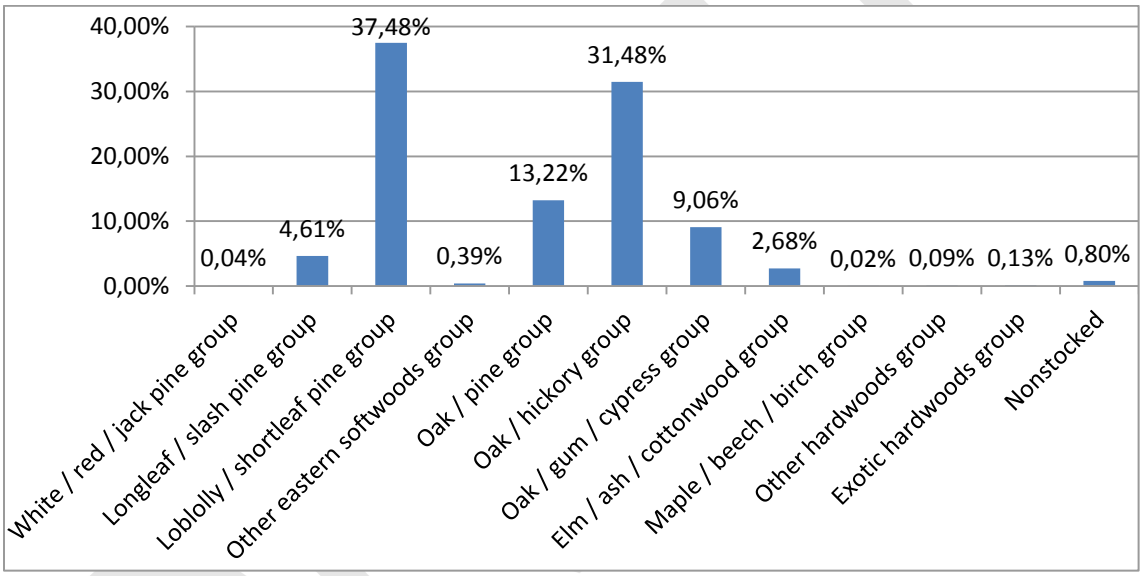
Source: Environmental Protection Agency – Western Ecology Division
(http://www.epa.gov/wed/pages/ecoregions/alga_eco.htm)

2.2. *Forest species*

The main tree species found in Alabama forests are: oak, several species of pine (pine, longleaf, slash, loblolly and shortleaf), several species of nut trees (including hickory), liquidambar (sweetgum) and poplar. The "Loblolly Pine/Shortleaf Pine" association is the predominant forest type occupying approximately 37% of the total forestland area. The "Oak/Hickory" association ranks second in Alabama accounting for approximately 31%.

The area distribution (2012) occupied by the different species is presented on the figure and table below.

Figure 4: Area distribution of forest land by forest-type group



Source: adapted from US Forest service, FIA Program (http://apps.fs.fed.us/fido/standardrpt.html)

Table 1 : Area of forest land by forest-type group

Forest type group	Area (ha)	% of total forest land area
White / red / jack pine group	4071	0.04%
Longleaf / slash pine group	427268	4.61%
Loblolly / shortleaf pine group	3473810	37.48%
Other eastern softwoods group	36446	0.39%
Oak / pine group	1225106	13.22%
Oak / hickory group	2917687	31.48%
Oak / gum / cypress group	839370	9.06%
Elm / ash / cottonwood group	248726	2.68%
Maple / beech / birch group	2254	0.02%
Other hardwoods group	7907	0.09%
Exotic hardwoods group	11809	0.13%
Nonstocked	73905	0.80%
Total	**9268359**	**100.00%**

Source: adapted from US Forest service, FIA Program (http://apps.fs.fed.us/fido/standardrpt.html)

Loblolly pine (also names southern yellow pine) is the most prevalent species in the State. Alabama's population of loblolly pine is almost 1.4 billion trees (Table 2). In fact, one out of every two growingstock trees in Alabama is a loblolly pine. Sweetgum is the second most numerous species, followed by water oak, yellow-poplar, and white oak.

Table 2 : The 25 most common growing-stock tree species (≥5.0 inches d.b.h) Alabama 2012

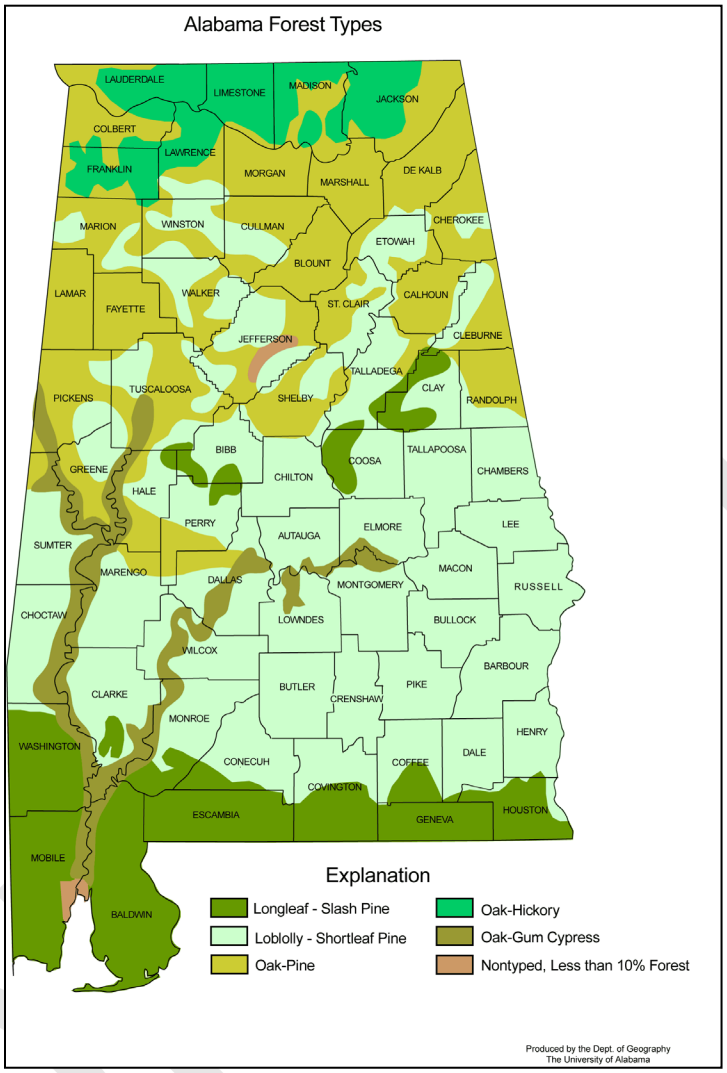
Common name	Scientific name	Total
		number
Loblolly pine	*Pinus taeda*	1,366,068,025
Sweetgum	*Liquidambar styraciflua*	234,211,308
Water oak	*Quercus nigra*	103,792,345
Yellow-poplar	*Liriodendron tulipifera*	100,252,256
White oak	*Quercus alba*	74,386,358
Longleaf pine	*Pinus palustris*	62,647,248
Slash pine	*Pinus elliottii*	58,716,377
Shortleaf pine	*Pinus echinata*	54,083,117
Virginia pine	*Pinus virginiana*	49,422,794
Southern red oak	*Quercus falcata*	44,975,880
Blackgum	*Nyssa sylvatica*	44,062,451
Chestnut oak	*Quercus prinus*	39,953,676
Pignut hickory	*Carya glabra*	38,222,608
Mockernut hickory	*Carya alba*	36,854,511
Red maple	*Acer rubrum*	32,012,002
Laurel oak	*Quercus laurifolia*	29,225,671
Post oak	*Quercus stellata*	29,146,016
Swamp tupelo	*Nyssa biflora*	26,785,100
Eastern redcedar	*Juniperus virginiana*	17,640,192
Green ash	*Fraxinus pennsylvanica*	16,297,270
Black cherry	*Prunus serotina*	15,164,738
Winged elm	*Ulmus alata*	14,368,545
Water tupelo	*Nyssa aquatica*	13,365,438
Black oak	*Quercus velutina*	13,138,217
Northern red oak	*Quercus rubra*	12,440,519

d.b.h. = diameter at breast height.

Source: Forest inventory & Analysis Factsheet (Alabama, 2012 – USDA) (http://www.srs.fs.usda.gov/pubs/43622)

The distribution of forest type groups in Alabama is shown in Figure 4. We can see that oak and hickory forest and oak-pine mixes are located in the north, whereas the rest of the state is mainly covered by different species of pine.

Figure 5 : Alabama Forest Types



Source: (http://www.forestry.state.al.us/)
& (http://mapsof.net/map/alabama-forest-types)

2.3. Forest ownership

Approximately 94% (8.65 million hectares) of Alabama's timberland is privately-owned and the 6% remaining is publicly-owned (federal, state and local public owners). Of the privately-owned land, about 11% is owned by forest industries (companies that own a wood processing plant) and 83% is owned by non-industrial private sector.

Alabama's timberland and forestland ownership pattern is given in the following table.

Table 3 : Area of forest land and timberland by ownership groups

Forest land / Ownership groups	Area (ha)	% of total forestland area
Forest Service	301 494	3.3%
Other federal	113 372	1.2%
State and local gov't	202 278	2.2%
Private	8 651 216	93.3%
Total	9 268 360	100.0%
Timberland / Owner ship groups	**Area (ha)**	**% of total timberland area**
Forest Service	284 960	3.1%
Other federal	106 449	1.2%
State and local gov't	199 724	2.2%
Private	8 651 216	93.6%
Total	9 242 349	100.0%

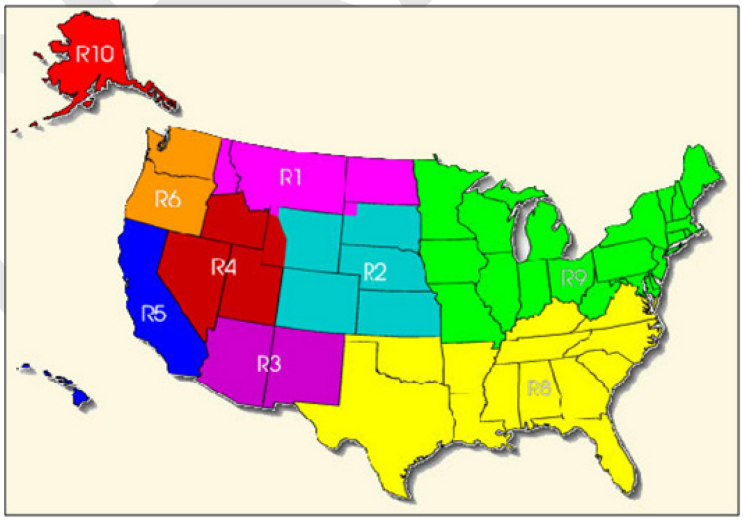
Source: adapted from US Forest service, FIA Program (http://apps.fs.fed.us/fido/standardrpt.html)

2.4. Competent authorities

Forest management in the United States of America, at the federal level is under the authority of the US Department of Agriculture and more specifically it's agency of the US Forest Service whose mission is to: *"Sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generation"* [5]

Forest management on the territory of the United States is shared in 10 different parts belonging to regional divisions of the Forest Service. As shown on the figure below, Florida and other States like Alabama and Georgia belongs to the R8 region: Southern Region.

Figure 6: Regional areas of the Forest Service



Source : http://www.fs.fed.us/

[5] Forest Service Agency Financial report- Fiscal Year 2008

The authority responsible for forest management in Alabama is split into two levels: federal and state. The Forest Service – an agency of the Department of Agriculture – is responsible at federal level for the coordination of forest policies and the management of federal forests. At state level, the Division of the Alabama Forestry Commission (AFC) is in charge of forest management. Established as a state agency in 1924, the mission of the Alabama Forestry Commission is three-fold:

- to protect the forests from all harmful agents,
- to service and help landowners to carry out responsible forest management on their property, using professional technical assistance so as to benefit themselves, their land and society,
- to educate the general public about the value of the forests in insuring both a healthy economy and environment.

The Forestry Commission is governed by a seven member Board of Commissioners appointed by the Governor of Alabama.

Alabama's territory is divided in 6 regions as shown on the figure below:

Figure 7 : Alabama Forestry Commission's regions

Source: Alabama Forestry Commission (http://www.forestry.alabama.gov/)

2.5. Overview of wood-related industry

Alabama forests generate over $21 billion in timber production and processing revenue[6]. Alabama forests provide over 122 thousand jobs in timber production and processing.

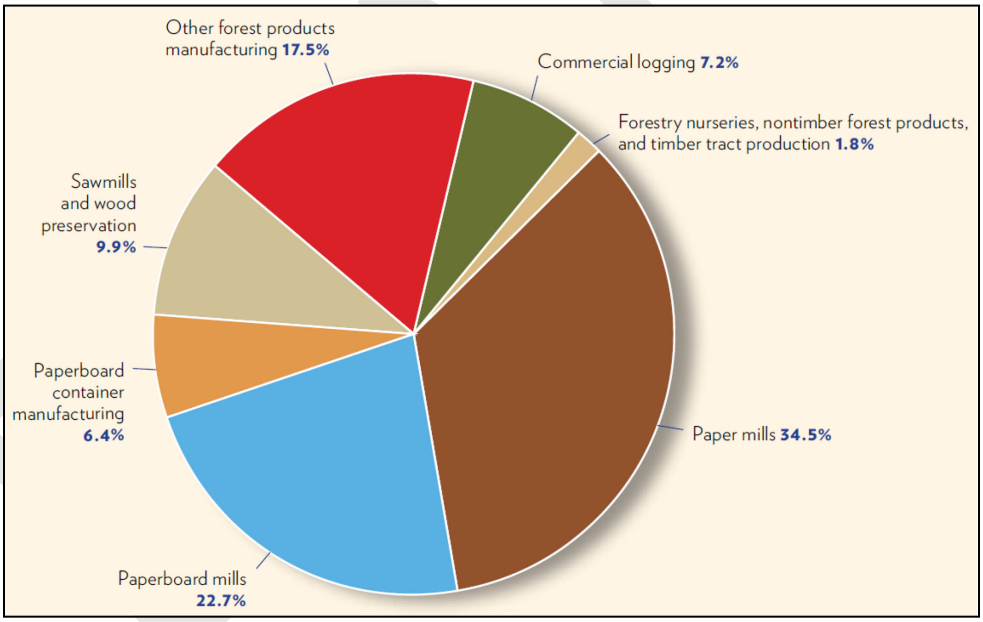
The sales of forest products and related sectors totalled $11.2 billion in 2010 (Figure 8). This includes the following:

- $10.2 billion for forest products manufacturing
- $805.8 million for commercial logging
- $204 million for forestry nurseries, non-timber forest products and timber tract production

Forest products manufacturing made up 91% of all forestry-related sales of which these are the largest sectors:

- $3.8 billion for paper mills
- $2.5 billion for paperboard mills

Figure 8 : Sales of forest products and related sectors[7]



The direct output and output impacts for the forest products manufacturing sector are presented in Table 4. The direct employment and employment impacts for the forest products manufacturing sector are presented in Table 5[8].

[6] Source : Economic Impacts of Alabama's Agricultural, Forestry, and related Industries (Dpt of Agricultural, Economic and Rural Sociology) & Alabama Forestry Commission

[7] Federal government data as reported in IMPLAN (MIG, Inc. 2010) & Economic Impacts of Alabama's Agricultural, Forestry, and related Industries (http://www.aces.edu/pubs/docs/A/ANR-1456/ANR-1456.pdf)

Table 4 : Statewide Output Impact of forestry related industries[9]

Forest Products Manufacturing	Direct Output ($Mn)	Output Impact ($Mn)
Paper mills	3,848.7	7,526.4
Paperboard mills	2,534.6	5,322.1
Sawmills and wood preservation	1,108.0	2,177.1
Paperboard container manufacturing	719.2	1,167.3
Pulp mills	364.6	871.9
Wood windows and doors and millwork manufacturing	331.7	697.5
Veneer and plywood manufacturing	226.7	484.2
Coated and laminated paper, packaging paper and plastics film manufacturing	223.4	397.3
All other paper bag and coated and treated paper manufacturing	228.4	349.6
Reconstituted wood product manufacturing	151.4	275.2
All other converted paper product manufacturing	90.1	167.0
Wood container and pallet manufacturing	119.1	164.6
Engineered wood member and truss manufacturing	69.7	152.2
All other miscellaneous wood product manufacturing	85.1	151.4
Stationery product manufacturing	59.4	101.3
Total for Forest Products Manufacturing	**10,160.1**	**20,004.9**

Table 5 : Statewide employment impact of forestry related industries[10]

Forest Products Manufacturing	Direct Employment	Employment Impact
Paper mills	5,015	37,809
Paperboard mills	3,301	28,100
Sawmills and wood preservation	4,956	14,653
Paperboard container manufacturing	1,990	5,662
Wood windows and doors and millwork manufacturing	2,149	5,399
Pulp mills	472	4,991
Veneer and plywood manufacturing	1,371	3,766
Coated and laminated paper, packaging paper, and plastics film manufacturing	460	1,974
All other paper bag and coated and treated paper manufacturing	621	1,651
Reconstituted wood product manufacturing	454	1,619
Wood container and pallet manufacturing	1,035	1,447
Engineered wood member and truss manufacturing	498	1,223
All other miscellaneous wood product manufacturing	462	1,074
All other converted paper product manufacturing	296	969
Stationery product manufacturing	194	544
Total for Forest Products Manufacturing	**23,274**	**110,880**

[8] Federal government data as reported in IMPLAN (MIG, Inc. 2010) & Economic Impacts of Alabama's Agricultural, Forestry, and related Industries (http://www.aces.edu/pubs/docs/A/ANR-1456/ANR-1456.pdf)

[9] Same source as previous - Output Impact = Direct Output + Indirect Effects + Induced Effects

[10] Employment Impact = Direct Employment + Indirect Effects + Induced Effects (the direct employment and employment impacts are in number of full-time and part-time jobs).

According to the *U.S. Census Bureau and Auburn Forest Products Development Center* in the Forest Resource Report 2011 from Alabama Forestry Commission, Alabama's forest industry was the state's second largest manufacturing industry, producing an estimated $12.78 billion worth of products in 2010 (Table 6). Of this total, $8.00 billion was pulp and paper products, $3.22 billion was lumber and other wood products, and $1.6 billion was furniture and other secondary wood products. The value-added contribution of the forest industry in 2010 was estimated at $6.45 billion, or slightly over 50% of the total shipment value.

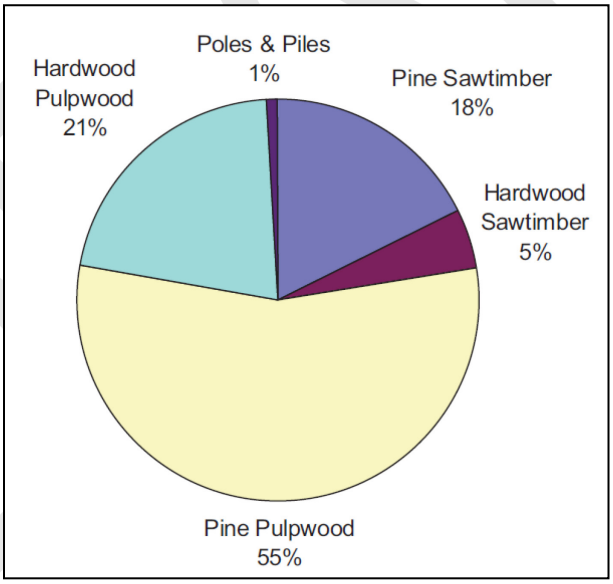
Table 6 : Alabama Forestry & Forest Industry Economic Impact - 2010

NAICS	Industry	Employees (number)	Payroll ($000)	Value-Added ($000)	Value of Shipments
113	Forestry & Logging	4,558	152,104	N/A	N/A
321	Lumber & Wood Products	21,155	481,509	1,339,901	3,220,020
322	Pulp & Paper Products	12,020	760,675	4,176,566	8,001,900
337	Furniture & Related Products	9,081	297,952	935,487	1,556,856
TOTAL		**46,814**	**1,692,240**	**6,451,954**	**12,778,776**

Source: Alabama Forestry Commission-Forest Resource Report 2011 (from U.S. Census Bureau and Auburn Forest Products Development Center)

The following figure shows the distribution of forest products by usage in 2011.

Figure 9 : Percentage of forest products harvested by product class - Alabama in 2011



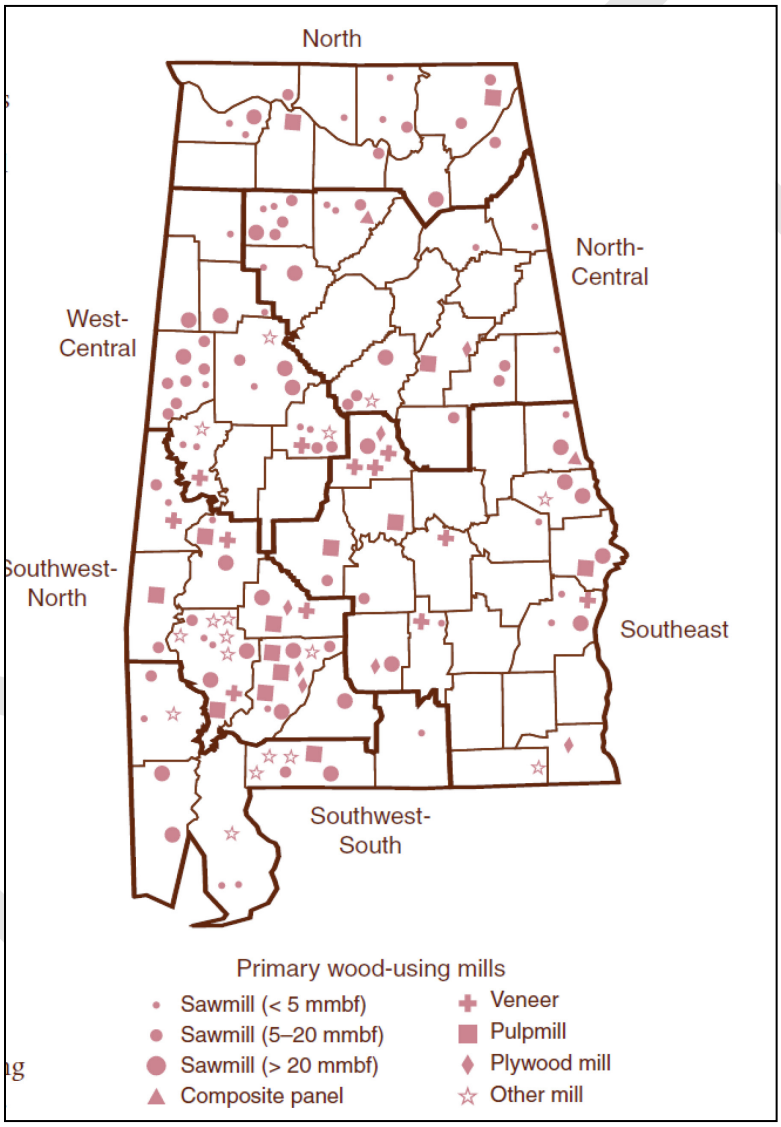
Source: Alabama Forestry Commission-Forest Resource Report 2011

We can see that the great majority of timber harvested is used to produce pulp for papermaking (76%), with most of the rest going to sawmills and plywood.

In the *Comprehensive Statewide Forest Inventory Analysis Study*[11], primary wood-using mills were identified, located, and their operational status confirmed. 65 wood-using mills in the state are made up mostly of sawmills, mulch, chip-and-saw and pulp mills

In 2005, about 145 sawmills, pulpwood mills, and other primary wood-processing plants distributed across the State were identified (Figure 10). They appear to be rather evenly distributed throughout the state.

Figure 10 : Primary wood-using mills by region in 2005 in Alabama



Source: Alabama's forest (2005) – A.J. Hartsell & T.G. Johnson

[11] CSFIAS – Bulleted Summary (Aug-2013) – Florida Department of Agriculture and Consumer Services – Florida Forest Service (http://freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Forest-Inventory)

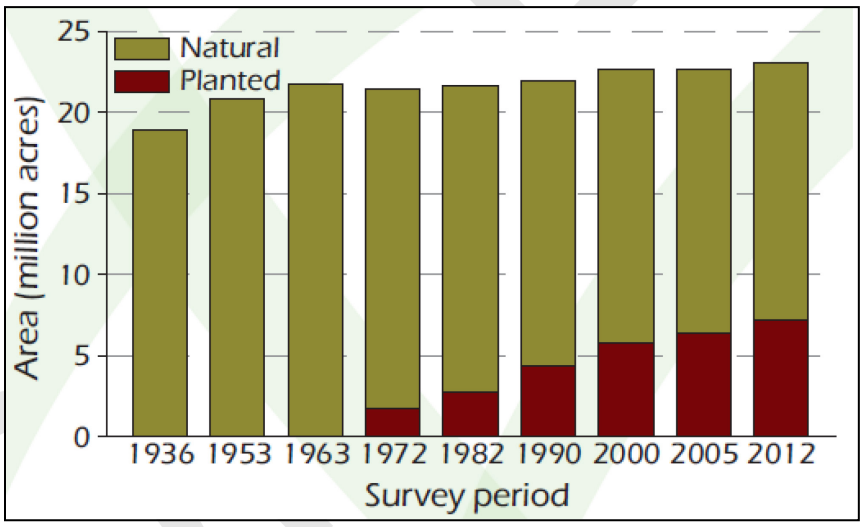
3. Sustainability of Alabama forest

3.1. Evolution of forest area and risk of conversion

As mentioned in the 2nd section, timberlands accounted for about 9.24 million ha (or 22.8 million acres) in 2012.

While this was an all-time high for Alabama, total timberland area has remained fairly constant since 2000, and has not changed by >6% since 1963. Although total timberland area has not changed substantially, the area of planted stands within the State has. Planted stands were first recorded during a 1972 survey. Since then they have increased by over 300%, and account in 2012 for over 2.8 million ha statewide (or 7 million acres).

Figure 11 : Area (acres) of timberland by survey period and stand origin (1936-2012)



Source: Forest Inventory & Analysis Factsheet – Alabama 2012[12]

Table 7[13] hereafter considers the detailed information available (2012) in the US Forest service database. As we can see, the forest area and timberland in Alabama has been rather stable with however a slight increase of about 0.7% between 2000 and 2012 (i.e. about 0.06% increase yearly on average).

[12] http://www.srs.fs.fed.us/pubs/su/su_srs067.pdf?bcsi_scan_0271f170321d1d0a=0&bcsi_scan_filename=su_srs067.pdf
[13] http://apps.fs.fed.us/fido/standardrpt.html

Table 7: Evolution from forested area (2000-2012) and timberland (1972-2012) in Alabama

Year	Forestland (ha)	Change (ha)	Change %	Timberland (ha)	Change (ha)	Change %
1972	-	-	-	8 643 128	-	-
1982	-	-	-	8 764 987	121 859	1.41%
1990	-	-	-	8 875 571	110 584	1.26%
2000	9 200 300	-	-	9 176 673	301 102	3.39%
2001	9 180 608	-19 692	-0.21%	9 156 815	-19 858	-0.22%
2002	9 168 697	-11 911	-0.13%	9 144 748	-12 067	-0.13%
2003	9 174 777	6 080	0.07%	9 145 275	527	0.01%
2004	9 174 572	-205	0.00%	9 142 538	-2 737	-0.03%
2005	9 200 472	25 900	0.28%	9 165 997	23 459	0.26%
2006	9 215 956	15 484	0.17%	9 181 493	15 496	0.17%
2007	9 215 235	-721	-0.01%	9 180 900	-593	-0.01%
2008	9 222 500	7 265	0.08%	9 188 164	7 264	0.08%
2009	9 230 985	8 485	0.09%	9 199 806	11 642	0.13%
2010	9 237 798	6 813	0.07%	9 206 775	6 969	0.08%
2011	9 257 917	20 119	0.22%	9 226 997	20 222	0.22%
2012	9 268 360	10 443	0.11%	9 242 349	15 352	0.17%

Source: adapted from US Forest service, FIA Program (http://apps.fs.fed.us/fido/standardrpt.html)

The yearly data of the Forestry Inventory and Analysis (FIA) makes possible to further investigate the recent trend of the forest areas in Alabama, through the evolution of forest area by county (see annex 1)[14].

About 99% percent of the total forested land is used for commercial timber production (timberland). The remaining forested area is reserved forest land or other type of forested land out of production (this is the difference between forest land and timberland as in Table 7).
The FSC risk assessment platform www.globalforestregistry.org considers the USA are at unspecified risk in terms of conversion of forest to other land uses, because the following criterion is not verified in the country:

- There is no net loss AND no significant rate of loss (> 0.5% per year) of natural forests and other naturally wooded ecosystems such as savannahs taking place in the eco-region in question

Indeed, even though at the national level, forested area in the USA increase by 0.1% yearly on average, there are important regional variations and forest extent is known to be decreasing in different parts of the country. Hence the Global Forest Registry recommends performing an analysis at the state level.

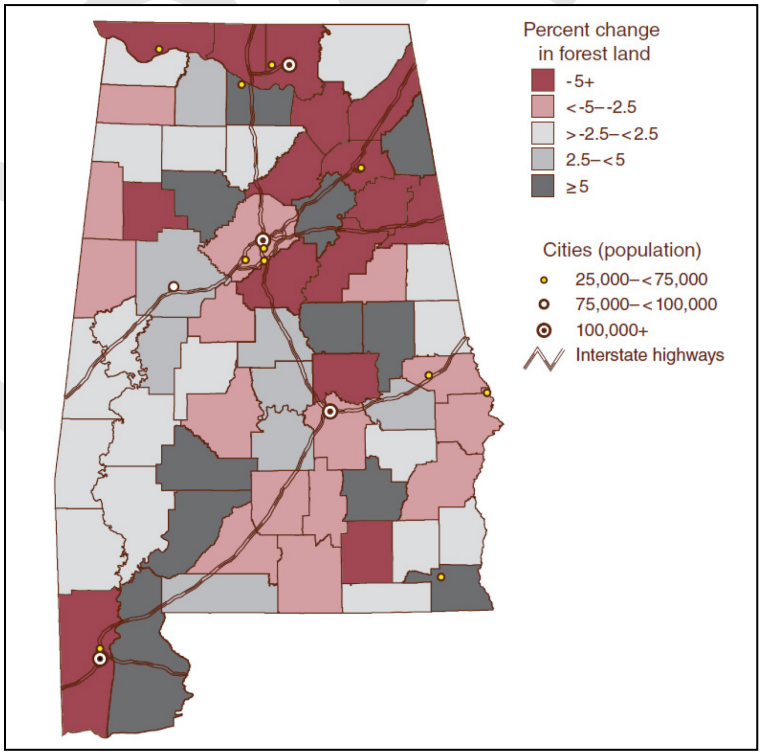
[14] http://apps.fs.fed.us/fido/standardrpt.html

As we have seen above that the most recent trend in Florida was the increase of 0.7% of the forested area between 2000 and 2012, we can't exclude a risk of conversion and recommend an analysis at a finer level.

As can be seen in annex 2, most of the counties feature a fairly stable forested area or a slight increase between 2000 and 2012. Annex 2 makes it possible to identify counties where the average annual losses of forest were in excess of 0.5% (which is the threshold the Global Forest Registry refers to in its risk assessment). Actually, there are only 4 counties (Calhoun, De Kalb, Mobile and Randolph) where the 0.5% threshold was exceeded as yearly average in the period 2000-2012 (out of the 67 counties in Alabama).

According to the assessment 2000-2005 of the Forest Service (Alabama's forests, 2005 - Hartsell and Johnson) most of Alabama's forest land loss occurred in the northern and northeastern portions of the State (Figure 12). There appears to be a correlation between the presence of large cities and interstate highways and loss of forest land. One area with significant deforestation is bracketed by I–65 to the west and I–20 to the east. Interstate 59 runs between the two. Two of the State's largest cities, Birmingham and Huntsville, are located there. The counties containing and surrounding the State's other two large cities, Montgomery and Mobile, also lost forest land. Both of these urban areas contain interstate highways as well. The proximity of large cities and easy road access are key elements for urbanization residential developments and, hence, appears to be correlated with the loss of forest land.

Figure 12 : Percent change in forest land area by county – 2000 to 2005



Source: Alabama's forest (2005) – A.J. Hartsell & T.G. Johnson

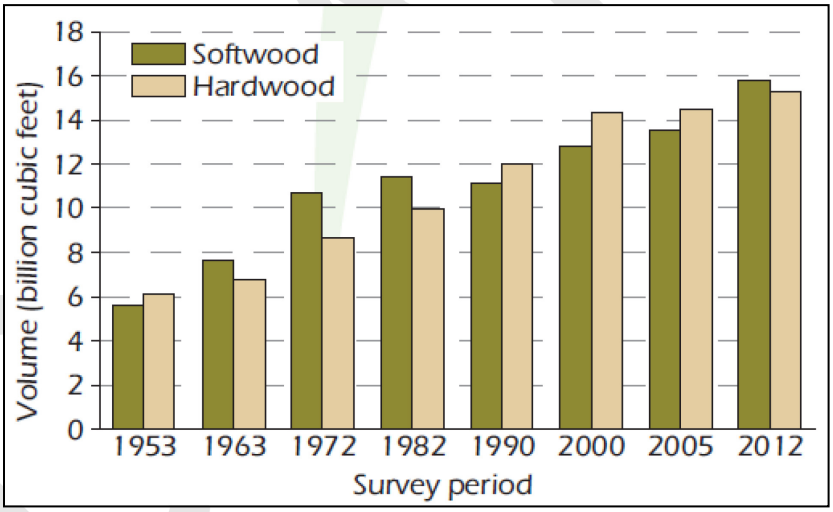
3.2. *Living wood volumes and removals*

The information contained in this section comes from the *USDA-Forest Service* report: "Forest inventory & analysis factsheet - Alabama 2012[15]".

As shown in the Figure 13, volume of both hardwood and softwood species has consistently increased in each survey. Softwood volume has increased by 180% since 1953, while hardwood volume gained 151% percent over the same period. The total volume of all growing-stock trees rose by 165% between 1953 and 2012. Softwood and hardwood growing-stock volumes have increased over 16 and 6 %, respectively, since the 2005 survey.

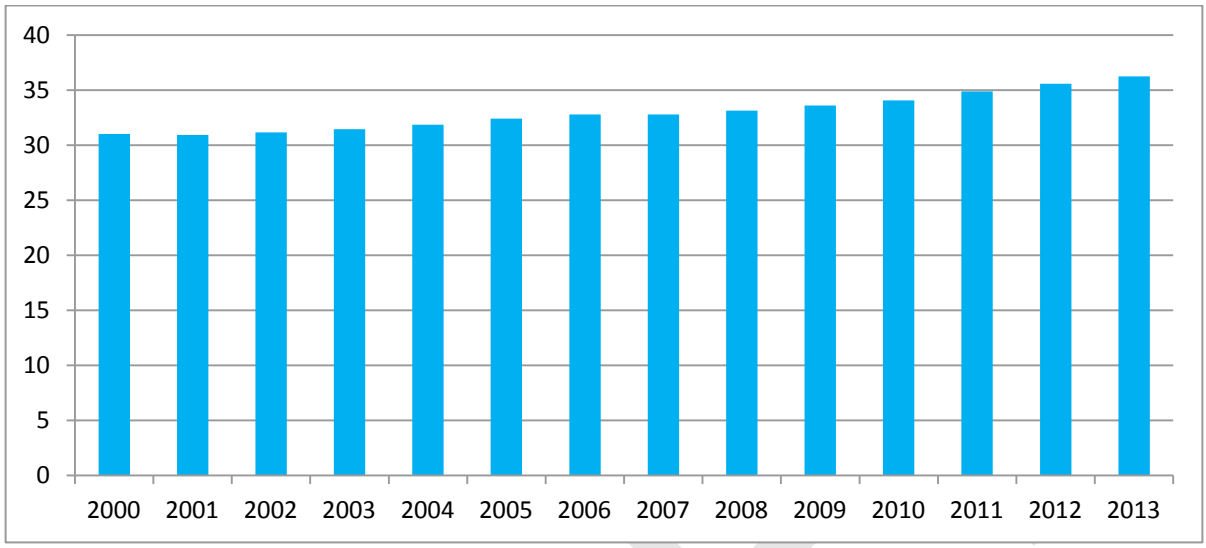
The recent trend, during the period 2000 to 2012 shows an obvious increase of volumes of living trees for softwood, why the volumes of round wood have remained fairly stable, with only a very slight increase recorded. In total, the volumes of living trees (hardwood and softwood put together) has been increasing by about 15% between 2000 and 2012 (an average increase of 1.2% annually), as can be seen on Figure 14.

Figure 13 : Volume of growing stock on timberland by species group and survey period (Alabama)



[15] http://www.srs.fs.fed.us/pubs/su/su_srs067.pdf?bcsi_scan_0271f170321d1d0a=0&bcsi_scan_filename=su_srs067.pdf

Figure 14 : Recent evolution of net volume of live trees in Alabama (at least 5 inches d.b.h./d.r.c.), in cubic feet, during the period 2000-2012.



Source: data retrieved from Forest Inventory and Analysis National Program (USDA www.fia.fs.fed.us)

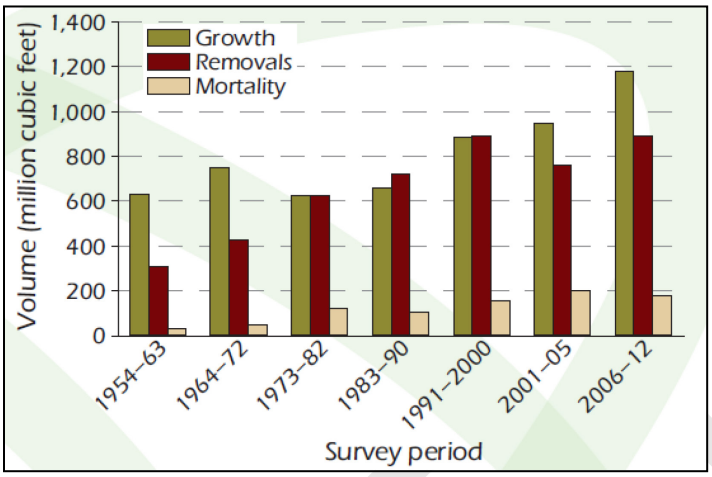
The reason why the stocks of living hardwood and softwood have evolved differently are analysed hereunder.

The average annual softwood growth has steadily increased since the 1954–63 survey, while the average annual removals were stagnating since the beginning of the subprime crisis (Figure 16). As a result, after year 2000, the average annual softwood growth exceeded average annual removals for softwood species.

This evolution can be explained by the following factors:

- One contribution to the increase in area of planted pine stands (Figure 11 - previous section), very often at the expense of hardwood stands. These artificially regenerated softwood forests receive more intensive management than natural hardwood stands, and are therefore apt to produce more wood volume per acre.
- Another explanation is an increase in forests maturity (larger proportion of older stands with a larger volume of living biomass). The current growth to removals ratio of softwoods in Alabama is 1.3, meaning that for every 1m³ of tree volume harvested, 1.3 m³ grew.
- Another contribution to the positive balance in the stock of living trees after 2005, is that softwood mortality experienced a slight decline for the first time since the 1983–90 inventory (storm related damages, diseases, fires). Mortality by insects is lower than the previous survey period, indicating in particular that Southern Pine Beetle infestations were in decline between 2005 and 2012

Figure 15 : Average annual estimates of growth, removals and mortality of softwood growing stock by survey period (Alabama 2012)



Current average annual growth and removals of hardwood species in Alabama peaked during the 1991–2000 inventory years (Figure 17), but started decreasing after 2000. Current hardwood mortality, on the increase since the 1964–72 inventory, is at its highest recorded level. Weather was the primary agent of tree mortality accounting for 55% of the mortality in hardwood (Table 8).. Much of this mortality can be attributed to hurricanes and other storm-related damage, including hurricanes Katrina in 2005, and Isaac in 2012.

Figure 16 : Average annual estimates of growth, removals and mortality of hardwood growing stock by survey period (Alabama 2012)

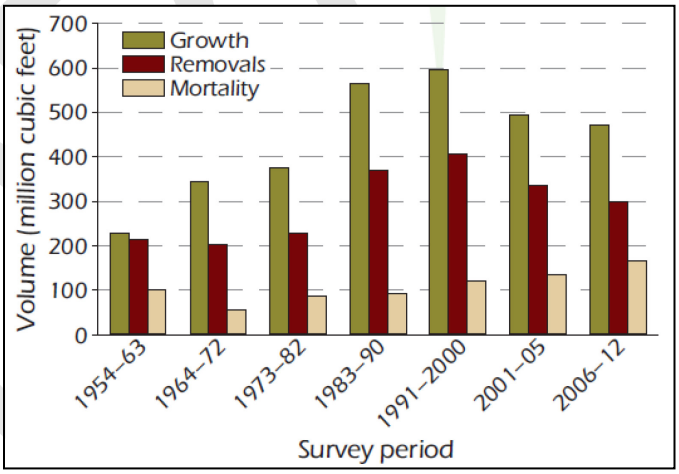


Table 8: Average annual mortality of growing stock on timberland by cause and species group (Alabama 2012)

Cause	All species	Soft-woods	Hard-woods
	- - - million cubic feet - - -		
Insect	62.0	61.5	0.5
Disease	43.0	14.8	28.2
Fire	4.4	3.4	1.1
Animal	7.8	0.2	7.6
Weather	161.7	69.1	92.5
Vegetation	30.0	16.2	13.8
Unknown	39.9	16.7	23.2
Total	348.8	181.8	167.0

Despite increased mortality and lower annual growth, the volumes of living trees for roundwood has remained fairly stable (with just a slight increase) in the period 2000 to 2012, as has been shown on Figure 13. This is because the harvested volumes of hardwood have dramatically fallen during the same period.

3.3. Protection of ecosystems and biodiversity

As shown on Table 9, the conservation land in Alabama covers 484 068 ha, which is about 3.6% of the state area. This figure include both public and private land, under various conservation status. Figure 18 shows an overview of all protected areas in Alabama. Those protected areas are either public (federal, state, county or local) or private lands.

Table 9: Land under protection status in Alabama (as of 2011)

	Status 1	Status 2	Status 3	Total
Acres	88635	306650	800873	1196158
Ha	35869	124097	324102	484068
Percentage of state area	0.26%	0.91%	2.39%	3.57%

Source : USGS Gap analysis http://gapanalysis.usgs.gov/

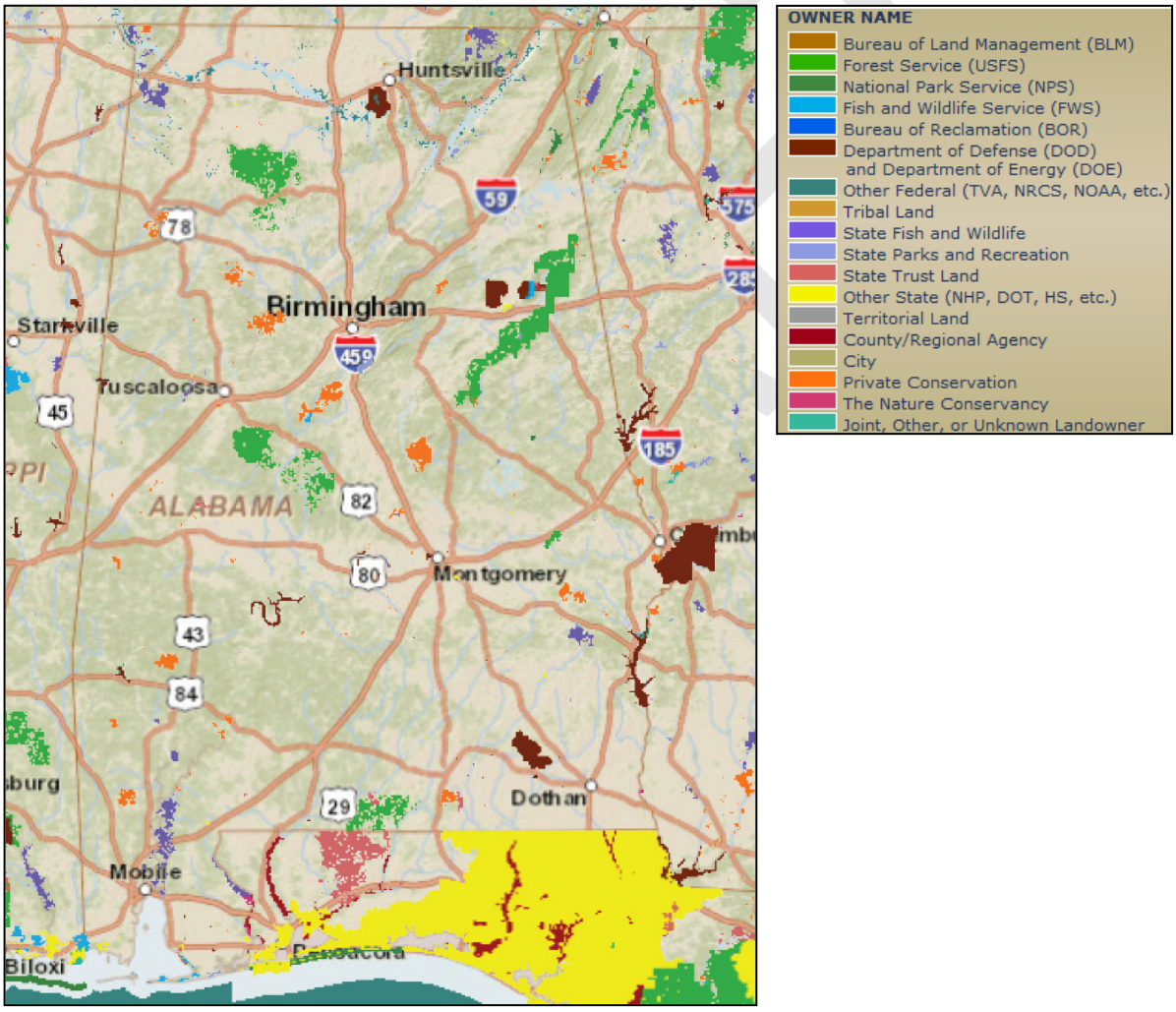
Status 1: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management.

Status 2: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.

Status 3: Area having permanent protection from conversion of natural land cover for the majority of area. Subject to extractive uses of either broad, low-intensity type (eg. Logging) or localized intense type (eg. Mining). Confers protection to federally listed endangered and threatened species throughout the area.

Note that different figures exist in terms of total conservation area in the State, depending on the categories of protection that are taken into account (particularly in the status 3 as defined above). For example, Figure 17 includes military zones, which are not designated for the purpose of biodiversity and ecosystems protection, even though they might be of considerable interest because the areas are very large and continuous, with most of the time very little human disturbance.

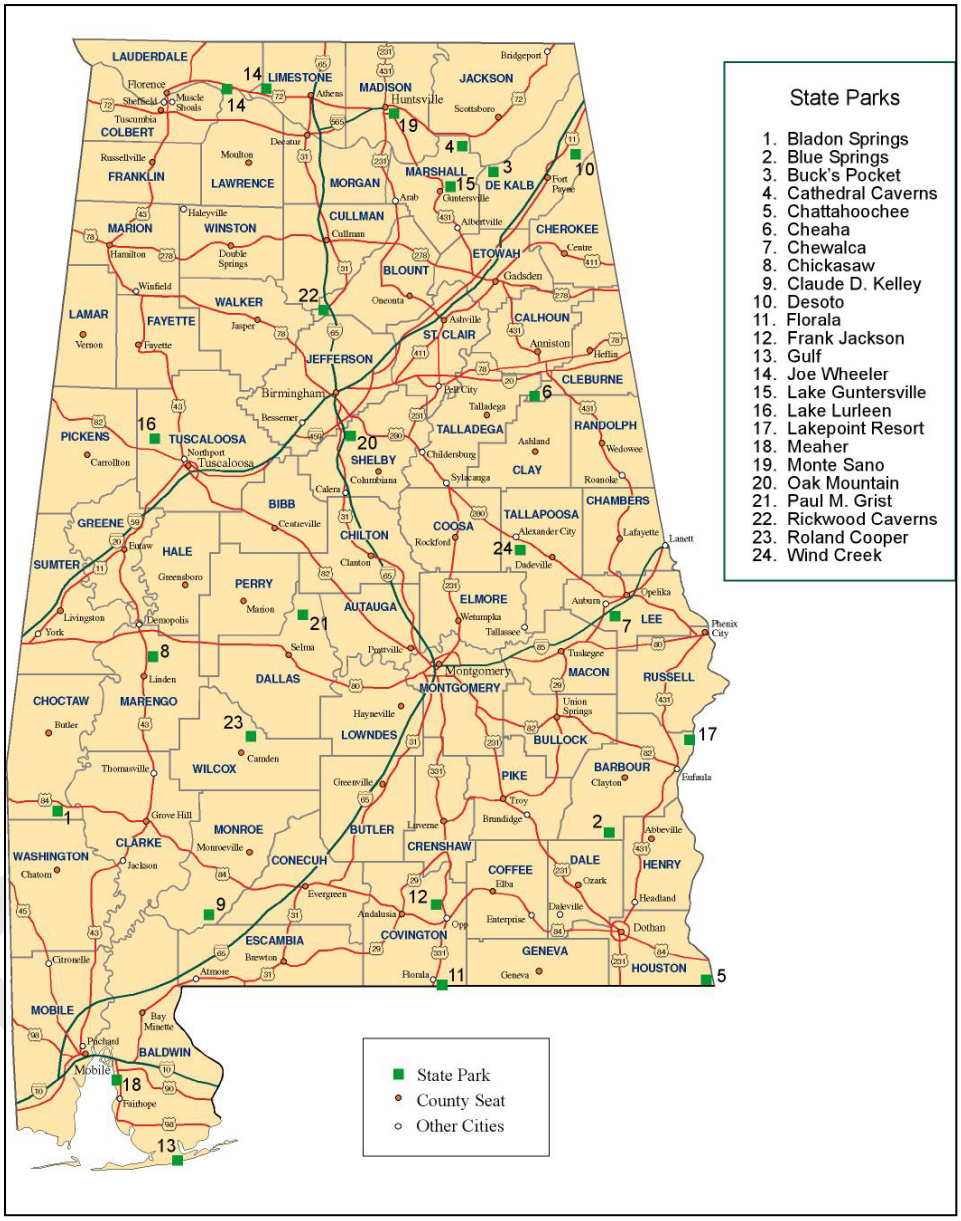
Figure 17 : Protected areas in Alabama



Source: National Gap Analysis Program (GAP) – Protected areas data viewer (http://gis1.usgs.gov/csas/gap/viewer/padus/Map.aspx)

Alabama includes 24 state parks and a few national parks. Figure 19 shows the state parks in Alabama. Figure 20 shows the national parks in Alabama.

Figure 18 : State Parks in Alabama



Source: http://alabamamaps.ua.edu/contemporarymaps/alabama/recreation/stateparks.jpg (http://www.netstate.com/states/maps/al_maps.htm)

Figure 19 : National parks in Alabama

Source: http://usparks.about.com/cs/usparklocator/l/blpkal.htm

Table 10 shows the new surfaces put into conservation between 1998 and 2005. More recent data are unfortunately not available at the moment.

Table 10: New land under conservation status per year in Alabama (1998-2005)

Year	1998	1999	2000	2001	2002	2003	2004	2005	Total
Acres	4601.0	39000.0	2160.0	33258.0	2526.5	2765.0	17133.5	3915.5	105359.5
ha	1862.0	15782.7	874.1	13459.0	1022.4	1119.0	6933.7	1584.5	42637.5

http://www.conservationalmanac.org

The increase of conserved lands shows a very irregular pattern. The total newly conserved land recorded between 1998 and 2005 accounts for about an increase by 9% of the conserved land in the state.

Even though the protected areas in Alabama are rather modest (compared to other US states), there have been recent efforts to improve the situation. A number of conservation schemes have been introduced to increase the conservation land in Alabama, including initiatives to encourage conservation on private land (which is particularly important given the proportion of private forests in Alabama).

The most important programs are described hereunder[16]:

- **The Forever Wild Program[17]:** this program was established in 1992 and has purchase lands for general recreation, nature preserve, additions to wildlife management areas and states parks. The program receives 10 percent of the interest income from "The Alabama Trust Fund" which is comprised of payments from the sale or lease of rights to explore and drill for oil and gas in offshore areas off the coast of Alabama. The Trust income paid cannot exceed $15 million in any one fiscal year. On November 2, 2012 voters opted to extend the constitutional amendment to fund the Forever Wild program for another 20 years.

- **Enable local financing[18]:** While the Alabama Constitution imposes limitations on local taxes, creating a dedicated funding source through sales taxes, property taxes, and/or general obligation bonds is possible. Municipalities and counties have the authority to issue bonds for land acquisition including land for parks. Though no specific instances of bonds for land acquisition could be found, more and more cities have been creating parks for open space and recreation, likely through capital improvement budgets.

- **The Forest Legacy Program[19]:** The purpose of the Forest Legacy Program (FLP) is to identify and purchase environmentally important forestland through the use of conservation easements and fee purchases. Landowner participation is entirely voluntary. As these resources are managed, many traditional values and uses of the forests will continue to be available. In that framework, the following program objectives were established to achieve the overall goal of protecting environmentally important private forestlands in Alabama threatened by conversion to non-forest uses :

    - Prevent conversions of forestlands to other uses.
    - Preserve and protect fish and wildlife habitats, significant natural communities, and biological diversity.
    - Preserve and protect riparian habitats.
    - Preserve and protect water quality, fisheries, and water supplies.
    - Preserve and protect natural beauty.
    - Preserve and protect forest-based recreation opportunities.
    - Preserve forestlands for current and future timber production.

[16] http://www.srs.fs.usda.gov/econ/data/forestincentives/al.htm
[17] http://www.conservationalmanac.org/
[18] http://www.conservationalmanac.org/
[19] Source : Alabama Forestry Commission - hhttp://www.forestry.state.al.us/forest_legecy_program

- **Alabama Agricultural and Conservation Development Commission Program[20]:** The purpose of the AACDCP is to provide financial assistance through cost-share grants to owners of land used for agricultural or timber production for applying soil conservation, water quality improvement, or reforestation and forest improvement practices in the State. Sign-up for the cost-share program occurs annually and applications are available in local Soil and Water Conservation District offices in each of the 67 counties of Alabama.

- **The Conservation Reserve Program (CRP)[21]** is a land conservation program administered by the Farm Service Agency (FSA). In exchange for a yearly rental payment, farmers enrolled in the program agree to remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality. The long-term goal of the program is to re-establish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat.

- **Healthy Forests Reserve Program[22]:** The purpose of the Healthy Forests Reserve Program (HFRP) is to assist landowners, on a voluntary basis, in restoring, enhancing and protecting forestland resources on private lands through easements, 30-year contracts and 10-year cost-share agreements. The objectives of HRFP are to :

    - Promote the recovery of endangered and threatened species under the Endangered Species Act (ESA);
    - Improve plant and animal biodiversity;
    - Enhance carbon sequestration.

- **Treasure Forest Program[23]**: The Treasure Forest program is a voluntary program sponsored by the Alabama Natural Resources Council that seeks to promote sound and sustainable, multiple-use forest management. This type of management encourages landowners to use their forests wisely to meet their own needs while at the same time protecting and enhancing the environment.

- **Alabama Stewardship Program[24]:** The Forest Stewardship Program (FSP) provides technical assistance, to nonindustrial private forest owners to encourage and enable active long-term forest management. A primary focus of the Program is the development of comprehensive, multi-resource management plans that provide landowners with the information they need to manage their forests for a variety of products and services. Since its establishment in 1991 through 2006, the Program has produced more than 270,000 multi-resource management plans encompassing more than 12.5 million ha of nonindustrial private forest (NIPF) land. Forest Stewardship plans lay out strategies for achieving unique

[20] http://swcc.alabama.gov/pages/aacdc.aspx?sm=b_i

[21] http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp

[22] http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/forests/

[23] http://www.forestry.state.al.us/treasure_forest.aspx

[24] http://www.forestry.state.al.us/stewardship.aspx

landowner objectives and sustaining forest health and vigor. Actively managed forests provide timber, wildlife habitat, watershed protection, recreational opportunities and many other benefits for landowners and society.

- **The Tree Farm System mission[25]:** is to promote the growing of renewable forest resources on private lands while protecting environmental benefits and increasing public understanding of all benefits of productive forestry. This program provides landowners with the opportunity to become SFI certified. The Sustainable Forestry Initiative (SFI) requires landowners to manage their forests to meet the needs of the present without compromising the forests of the future. Tree Farm landowners have timber management as one of their management objectives. Even so, Tree Farms are more than pine plantations or Christmas tree farms. Tree Farms are varied in nature and contain many different habitats and stages of forest regeneration, from seedlings to mature timber. Biodiversity is a critical component of a certified Tree Farm. Tree Farmers must maintain natural forest buffers, follow approved conservation principles, and use best management practices.

[25] Alabama Forestry Commission

3.4. Protection of water

In the US, the Clean Water Act (CWA) was introduced in 1972 to regulate the discharge of pollutants in water. In this framework, forestry operations are considered as nonpoint sources and, hence, are generally exempted for permit under CWA as long as Best Management Practices (BMP) are developed and implemented. It is the responsibility of states to develop, implement and assess the Best Management Practices, under the control and funding of the federal Environmental Protection Agency (EPA). Even though the impact on water is the core of the BMP, many states have gone further and used the BMP as a tool for other management purpose (soil, landscape, wildlife etc...).

In the state of Alabama, the latest version of Best Management Practices was released in 2007[26]. Alabama's Best Management Practices are non-regulatory guidelines (except for the U.S. Army Corps of Engineer's baseline BMP) suggested to help Alabama's forestry community maintain and protect the physical, chemical and biological integrity of waters of the state as required by the Federal Water Pollution Control Act, the Alabama Water Pollution Control Act, the Clean Water Act, the Water Quality Act and the Coastal Zone Management Act.

The Alabama Forestry Commission is not an environmental regulatory or enforcement agency, but it does have the responsibility to maintain and update Alabama's Best Management Practices for Forestry whenever necessary to help Alabama's forestry community meet state water quality needs.

The topics covered by the BMP:

- Preharvest planning
- Streamside Management areas
- Road construction/reconstruction
- Road management
- Timber harvesting
- Site preparation and forest regeneration
- Fire management
- Revegetation of disturbed areas
- Forest chemical management
- Wetland forest management

In Southeast USA, there are specific arrangements for the site preparation before establishing pine plantations on wetlands[27]. Such operations are no exempt of permitting on wetlands and a specific permit under CWA section 404 has to be obtained. This makes possible for the administration to better control the mechanical works in sensitive environment.

[26] http://www.forestry.alabama.gov/Publications/BMPs/2007_BMP_Manual.pdf
[27] http://water.epa.gov/lawsregs/guidance/wetlands/silv2.cfm

Under the CWA, it is required to regularly evaluate to what extent the BMP are actually implemented in the practice. The last assessments in the state of Alabama were performed 2010 that included 245 closed out tracts.

Percent of implementation of BMP for forestry was evaluated for the following categories listed in the table below[28 & 29] (year 2010's numbers included):

Table 11: BMP implementation in Alabama (2009-2010) by regional category

Category	Year	Implementation	# of Sites
Harvesting	2009	96%	246
	2010	98%	245
Mechanical Site Prep	2009	98%	70
	2010	98%	50
Forest Roads	2009	93%	243
	2010	93%	243
Stream Crossing	2009	96%	125
	2010	96%	94
Streamside Management Zones	2009	92%	202
	2010	97%	207
Firebreaks	2009	90%	84
	2010	97%	70
Chemical Application	2009	100%	120
	2010	98%	108
Overall Implementation	2009	97%	246
	2010	**97%**	**245**

It shows very good results. It was estimated that 97% of the relevant BMP were implemented in 2010. However, these inspections showed in 2010 five tracts to have a significant risk to water quality as compared to only two tracts in 2009. These inspections covered 187 different landowners representing about 9900 ha of timberland.

3.5. Protection of soils

The protection of soil, including soil erosion, soil compaction and soil fertility, is addressed in the Best Management Practice applicable to forestry in Alabama. It includes considerations of soil in the following topics:

- Streamside management zones
- Forest roads management (drainage, steepness, outfall protection)

[28] http://www.forestry.state.al.us/bmpmon.aspx?bv=2&s=1
[29] http://www.forestry.alabama.gov/PDFs/SGSF_BMP_Report_2012.pdf

- Timber harvesting (skidding, trash disposal,...)
- Reforestation & stand management (mechanical site preparation, firebreaks management, prescribed burning, chemical site preparation (EPA guidelines compliance),...)
- Forested wetland management (road and stream crossing, reforestation in wetlands)
- Revegetation & stabilization (vegetative establishment, gully stabilization,...)

As described under section 3.4, it appears from the BMP Implementation and Compliance Survey (latest report dated 2010) that the BMP are generally well implemented in the State of Alabama.
Despite some search about this topic, we are not aware of any monitoring programme at the State level exists in order to assess the soils condition (erosion, compaction, fertility) as well as their evolution over time.

3.6. Protection of carbon stocks

In forest land the carbon stocks mainly includes:

- living above ground and below ground woody biomass,
- soil organic carbon,
- carbon in litter.

Between 2000 and 2012, we have seen in the section 3.1 an increase of about 0.7% of the forest area. We have seen in section 3.2 that the volume of standing trees has been increasing as well for the same period. In this context, the sequestrated carbon stock in living biomass has increased.

As shown in the Table 11 and related Figure 22 (data from the US Forest service (FIA Program)), we can see a relatively consistent overall increase of carbon stocks regarding the living above/below ground woody biomass and the litter since 2000.

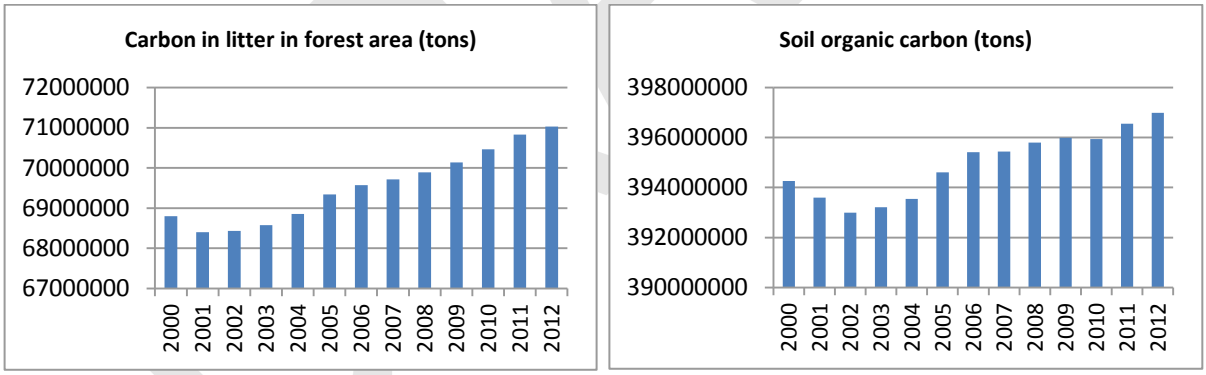
The soil organic carbon has increased as well since 2003 after a decrease over the previous three years.

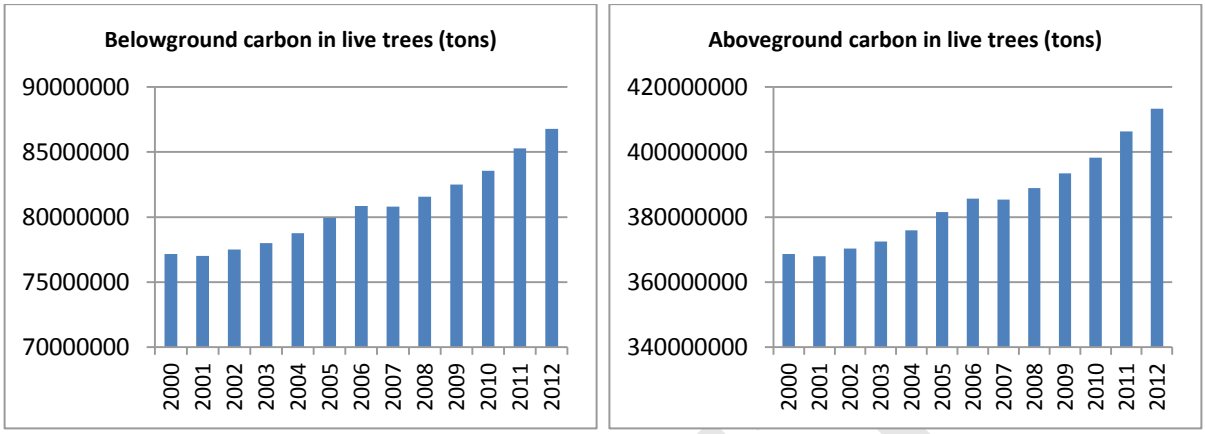
Table 12: Carbon stocks evolution in forestland – (Alabama 2000-2012)

Year	Carbon in litter in forest area (short tons)	Soil organic carbon (short tons)	Belowground carbon in live trees (at least 1 inch d.b.h./d.r.c.) (short tons)	Aboveground carbon in live trees (at least 1 inch d.b.h./d.r.c.) (short tons)
2000	68 800 210	394 267 340	77 149 720	368 595 136
2001	68 405 419	393 591 163	77 017 130	367 978 233
2002	68 432 998	392 997 412	77 512 812	370 288 953
2003	68 573 724	393 211 159	78 000 379	372 510 500
2004	68 854 345	393 542 841	78 766 305	375 953 311
2005	69 338 525	394 609 356	79 940 455	381 547 261
2006	69 572 685	395 409 551	80 843 101	385 635 559
2007	69 715 850	395 435 779	80 805 719	385 377 700
2008	69 889 441	395 802 929	81 560 045	388 901 448
2009	70 133 987	395 987 963	82 496 226	393 453 054
2010	70 462 713	395 937 433	83 546 911	398 265 794
2011	70 831 167	396 555 717	85 270 349	406 344 647
2012	71 027 946	396 985 796	86 784 799	413 354 149

Source: adapted from US Forest service, FIA Program (http://apps.fs.fed.us/fido/standardrpt.html

Figure 20 : Carbon stocks evolution in forestland (accessible forests) – (Alabama 2000-2012)





Source: adapted from US Forest service, FIA Program (http://apps.fs.fed.us/fido/standardrpt.html

3.7. Protection of air quality

The main impact of forestry on air quality relates to the use of fire. Using fire under controlled conditions is a common practice in Alabama forestry ("prescribed fire"), and can have different objectives:

- Reduce hazardous fuels under tree stands to prevent wildfires
- Prepare sites before seeding and planting
- Improve wildlife habitat
- Improve forage for grazing
- Manage competing vegetation
- Control insects and disease
- Enhance appearance
- Improve access

The use of fire is subject to permit issued by the Alabama Forestry Commission. When weather conditions are such that there are an abnormal number of wildfires, or several unusually large wildfires in an area, or when there is an issue with severe smoke causing air quality degradation, the State Forester may issue a Fire Alert for specified counties. This allows the Alabama Forestry Commission to restrict the issuing of Burning permits.

Under ADEM (Alabama Department of Environmental Management) regulations, non-agricultural burns are not allowed during the months of May, June, July, August, September and October in several counties. In an effort to uphold these restrictions, the Alabama Forestry Commission does not issue burn permits for miscellaneous burns or for land clearing in these counties in these months.

3.8. Illegal logging

The FSC risk assessment platform www.globalforestregistry.org considers the USA are at low risk in terms of illegal logging, because the following criteria are all verified:

1.1 Evidence of enforcement of logging related laws in the district [30]
1.2 There is evidence in the district demonstrating the legality of harvests and wood purchases that includes robust and effective system for granting licenses and harvest permits [31]
1.3 There is little or no evidence or reporting of illegal harvesting in the district of origin[32]
1.4 There is a low perception of corruption related to the granting or issuing of harvesting permits and other areas of law enforcement related to harvesting and wood trade[33]

3.9. Civil rights and traditional rights

The FSC risk assessment platform www.globalforestregistry.org considers the USA are at low risk in terms of violation of civil and traditional rights, because the following criteria are all verified:

- There is no UN Security Council ban on timber exports from the country concerned
- The country or district is not designated a source of conflict timber (e.g. USAID Type 1 conflict)
- There is no evidence of child labor or violation of ILO Fundamental Principles and Rights at work taking place in forest areas in the district concerned
- There are recognized and equitable processes in place to resolve conflicts of substantial magnitude pertaining to traditional rights including use rights, cultural interests or traditional cultural identity in the district concerned
- There is no evidence of violation of the ILO Convention 169 on Indigenous and Tribal Peoples taking place in the forest areas in the district concerned

3.10. Forest certification

The main forest certification schemes used in Alabama are:

- SFI (Sustainable Forestry Initiative[34]), which is endorsed by PEFC (Programme for the Endorsement of Forest Certification)
- ATFS (American Tree Farm System[35]), which is specifically suitable for small private owners.

[30] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[31] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[32] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[33] http://www.transparency.org/cpi2012/results
[34] http://www.sfiprogram.org
[35] https://www.treefarmsystem.org

Although much less used than the two systems mentioned above, the FSC (Forest Stewardship Council[36]) certification scheme is also used in Alabama.

The certified forest area under each of those schemes as for 2011 is presented in the table hereunder:

Table 13: Certified forest land in Alabama (2011)

	SFI	FSC	ATFS	Total certified
Acres certified	3 255 868	6 074	3 231 821	6 493 763
Ha certified	1 317 603	2 458	1 307 872	2 627 933
Percentage forests	14.35 %	0.03 %	14.24%	28.62%

Source: http://www.southernforests.org/resources/publications/SGSF%20Forest%20Certification%20Report%20r1.pdf

4. Conclusions

Alabama has an important forest that covers about 68% of the state. Most of this forest is privately owned (94%).

The "Loblolly Pine/Shortleaf Pine" forest type group is the predominant forest type, with approximately 37% of the total forestland area. The "Oak/Hickory" forest type group ranks second in Alabama accounting for approximately 31%.

The forest area and timberland in Alabama has been rather stable with however a slight increase of about 0.7% between 2000 and 2012 (i.e. about 0.06% increase yearly on average). Some counties do show a diminution of forest land, mostly associated with urbanisation, but only 4 counties did show during the period 2000-2012 an average loss of forest lands in excess of 0.5% annually.

Over the most recent annual inventory period (2006-2012), the stocks of living hardwood have remained rather stable because the increased mortality and increased conversion of hardwood stands to softwood plantations was compensated by a sharp decrease in the harvested volumes. During the same period, the softwood annual growth have been increasing sharply, while the harvested volumes and losses by mortality were stable or slightly decreasing, resulting in a general increase of volumes of living softwood. When statistics for softwood and hardwood are aggregated, we can see that the total volumes of living wood increased by about 15% in the period 200 to 2012 (i.e. an average 1.2% increase yearly).

Because of the increase of the volume of standing trees, the carbon stocks associated to living above ground and below ground woody biomass also shows an increase over the last decade. The litter and the soil organic matter also show the same trend.

[36] https://us.fsc.org

Alabama has various types of conservation lands dedicated to the protection of biodiversity and ecosystems, including State parks, National parks, private reserves... The extent of the protected areas is rather limited (3.6%). Even though the protected areas in Alabama are rather limited, there have been recent efforts to improve the situation and various schemes have been introduced to promote conservation land.

Alabama has developed Best Management Practices (BMP) for forestry to comply with the Clean Water Act. Those BMP address both water and soil conservation. The most recent survey shows a good level of compliance and implementation of the BMP in the actual forestry operations (97% compliance according to the most recent survey).

Even though controlled fires are very often used in forest management practices in Alabama, the use of fire is strongly regulated and fire is banned from specific places during summer months to protect the most populated areas from air pollution.

The FSC risk assessment platform www.globalforestregistry.org considers the USA are at low risk in terms of violation of illegal logging and in terms of violation of traditional and civil rights.

The forest certification systems are little developed in Alabama, with about 28% of forest certified under 3 systems SFI, ATFS and FSC.

ANNEX 1:

Forest area in Alabama by county (forest area in ha) from 2000 to 2012

County	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Autauga (1)	114255	116347	116182	116615	117666	118528	119704	119655	122009	124189	123498	122646	121722
Baldwin (3)	304777	310110	309359	304287	300744	303294	302128	300929	300584	299706	297942	296367	299372
Barbour (5)	168412	167249	167220	168387	169622	173811	176234	176120	177462	177744	176109	174470	169530
Bibb (7)	135055	133572	134111	134671	134706	136660	138159	136982	134748	136920	136589	135124	133209
Blount (9)	90763	86871	89557	90000	88276	87286	85498	84576	84514	85732	89197	90896	90284
Bullock (11)	127777	123044	121123	121978	122841	125139	127511	129945	129455	130001	129525	128092	127145
Butler (13)	156908	156297	154289	155233	154114	157167	157818	157861	159240	160470	162057	160959	164857
Calhoun (15)	95160	91522	83822	84156	79509	77764	78080	78225	80574	80522	79885	79451	79570
Chambers (17)	125189	125243	125541	126081	124381	128195	127122	127163	129223	129228	126380	126268	125610
Cherokee (19)	95371	89585	88863	94591	98708	106703	106385	105553	102872	106836	104436	99913	102128
Chilton (21)	129145	129667	130334	129373	133396	134353	134146	131638	132776	130405	126970	126372	126645
Choctaw (23)	213489	215300	214980	213386	212881	211677	210952	212518	213506	211521	211617	211526	211992
Clarke (25)	309767	304238	300470	301349	300955	301264	304688	303840	304766	303334	303413	303845	301502
Clay (27)	126241	125355	126207	129655	129573	129096	128572	127626	129904	126687	123457	124373	126022
Cleburne (29)	111529	111148	113563	111196	108070	110001	112487	111645	111936	109136	110770	112079	110208
Coffee (31)	96212	97924	93553	92840	94750	95958	95997	96309	95880	94488	93208	90234	93748
Colbert (33)	83717	85146	88158	89041	88879	91291	91746	91613	91449	92004	89820	89662	89004
Conecuh (35)	190709	189838	187602	187863	185448	185425	185154	185837	182263	177650	179400	180667	181886
Coosa (37)	150595	154787	155469	154725	155507	156827	156435	155396	155224	155951	155158	156382	156443
Covington (39)	196684	202547	199689	198709	193308	193315	191194	191487	189465	189295	192861	198434	202414
Crenshaw (41)	126298	127885	126266	128260	123926	124228	124233	125899	125378	122787	122725	128011	125833
Cullman (43)	90676	89463	94222	93257	93473	92835	91553	92060	91770	91805	94005	93034	92306
Dale (45)	96302	95628	98287	96505	95338	95128	94738	95636	97771	97533	101579	103765	103380
Dallas (47)	156632	157034	151224	151978	154639	163173	164893	169018	168414	167623	167842	169253	171517
De Kalb (49)	87200	86598	84409	76631	77215	79245	77743	78308	75446	73446	74191	74204	75605
Elmore (51)	101904	97839	97617	98137	97463	98051	98248	97520	97567	97166	97246	100687	99071
Escambia (53)	197784	191562	192577	193583	195519	194386	194377	192203	191400	191464	190762	191928	188691
Etowah (55)	79593	80021	74190	74607	75146	76980	77381	76776	79125	83361	82442	79444	75758
Fayette (57)	128918	129782	129656	127943	127398	126323	128208	128888	132745	132726	132264	132792	136729
Franklin (59)	115408	114921	115362	117107	113922	114356	116270	116028	117373	116035	113859	113844	116169
Geneva (61)	77675	77455	82765	82053	80918	83863	84044	81494	80720	78379	85061	89155	86442
Greene (63)	122625	117868	120102	120319	122285	118819	115433	120717	122738	125107	124909	125504	130960
Hale (65)	98452	99826	101023	101539	110190	111045	111398	110547	112885	112723	112381	113271	115268
Henry (67)	101399	99030	94533	92777	89515	87929	92528	92560	91870	93609	99446	101754	104003
Houston (69)	65895	66885	70622	68468	67499	67984	64641	66012	61597	65413	67465	71880	73711
Jackson (71)	167301	166040	171585	172713	177636	176464	177177	175623	174266	173774	173704	173844	169309
Jefferson (73)	174040	169825	170464	170879	174061	177531	174465	170851	170008	170622	168684	163155	164521
Lamar (75)	127265	126412	127104	127508	122992	124192	126932	129047	129224	129162	128717	129030	129154

Lauderdale (77)	68640	69059	70400	71101	71977	70627	70874	69574	69636	69758	67817	66599	66685
Lawrence (79)	88973	88962	87849	84874	87898	89117	86359	86092	88229	88201	86689	91605	91025
Lee (81)	103079	101598	104465	104943	108298	106815	108337	106501	106300	106200	105570	103102	102695
Limestone (83)	47049	47087	44464	45003	42674	40284	40502	40604	40402	43130	43260	43202	44628
Lowndes (85)	120440	122107	125205	126305	127183	125965	125990	128492	126978	126678	124278	122890	121751
Macon (87)	125225	125848	124378	125027	128109	124337	123901	123737	127872	130471	129505	128844	130831
Madison (89)	71294	72305	73819	73260	71258	67727	68123	67878	69299	69390	71660	72268	76726
Marengo (91)	171453	173886	173436	175812	179635	181863	184289	184680	187819	190153	190835	193299	189784
Marion (93)	145353	144356	144284	144469	144658	145647	146990	145732	143397	144533	143768	142549	143312
Marshall (95)	64510	60351	59843	57877	55839	56153	57128	57572	57493	57473	57504	60883	60695
Mobile (97)	218183	216667	207881	204415	202902	205218	205016	205258	204349	203991	202279	202910	201073
Monroe (99)	231644	232681	228631	229551	231259	234843	235170	232926	233254	232704	230963	230904	233141
Montgomery (101)	93189	94417	91067	89260	95885	96339	96250	95901	92454	94981	100575	102127	100423
Morgan (103)	83778	80290	78594	79759	76703	77252	81079	83036	82637	81298	79125	80271	81343
Perry (105)	142151	143342	141731	146247	147046	146774	145285	146384	147026	143978	145424	143630	144104
Pickens (107)	195396	196180	191816	192158	191323	187545	188179	186685	186071	185971	189019	188695	188895
Pike (109)	117716	118434	119644	123848	124700	123252	123241	122766	122707	122291	123630	125111	122719
Randolph (111)	123459	122496	121339	120022	116685	117189	116792	112866	112753	112747	111178	111612	114061
Russell (113)	114820	117440	117866	122380	123505	121424	118889	118908	118712	122654	124047	123819	122857
St. Clair (115)	133647	132713	131449	127145	130619	130272	129364	130660	129532	127228	129266	129274	125913
Shelby (117)	130106	132734	135423	135383	138325	122748	127337	130899	133543	138802	139176	143337	139785
Sumter (119)	170073	172141	175693	176986	172567	173278	175454	176334	178277	178491	177731	180318	179596
Talladega (121)	123645	120821	120031	118143	116735	116914	117291	121959	121600	124486	125634	123960	125441
Tallapoosa (123)	161417	161769	162016	162761	163832	163344	163041	162957	162431	160035	158916	157518	155668
Tuscaloosa (125)	272549	270223	273806	278026	279321	281730	280064	281239	279203	277007	276357	274950	276532
Walker (127)	164023	166350	169246	168202	161428	165130	163787	158157	154762	153384	156352	157393	158362
Washington (129)	250178	249644	251939	252907	252929	251492	253697	254589	257777	258428	257064	257037	260592
Wilcox (131)	204569	207247	210148	210793	206236	206901	206150	206629	207083	209193	207769	205874	207372
Winston (133)	126615	129596	130136	129720	132578	134006	133103	132112	132759	132778	132834	131623	130631
Totals:	9200300	9180608	9168697	9174777	9174572	9200472	9215956	9215235	9222500	9230985	9237798	9257917	9268360

ANNEX 2 :

Loss and gain of forestland (in %) by county between 2000 and 2012

County	Total change (%) 2000-2012	Yearly average (%) 2000-2012
Calhoun (15)	-16.38%	-1.37%
De Kalb (49)	-13.30%	-1.11%
Mobile (97)	-7.84%	-0.65%
Randolph (111)	-7.61%	-0.63%
Marshall (95)	-5.91%	-0.49%
St. Clair (115)	-5.79%	-0.48%
Jefferson (73)	-5.47%	-0.46%
Limestone (83)	-5.15%	-0.43%
Etowah (55)	-4.82%	-0.40%
Conecuh (35)	-4.63%	-0.39%
Escambia (53)	-4.60%	-0.38%
Tallapoosa (123)	-3.56%	-0.30%
Walker (127)	-3.45%	-0.29%
Pickens (107)	-3.33%	-0.28%
Morgan (103)	-2.91%	-0.24%
Lauderdale (77)	-2.85%	-0.24%
Elmore (51)	-2.78%	-0.23%
Clarke (25)	-2.67%	-0.22%
Coffee (31)	-2.56%	-0.21%
Chilton (21)	-1.94%	-0.16%
Baldwin (3)	-1.77%	-0.15%
Marion (93)	-1.40%	-0.12%
Bibb (7)	-1.37%	-0.11%
Cleburne (29)	-1.18%	-0.10%
Choctaw (23)	-0.70%	-0.06%
Blount (9)	-0.53%	-0.04%
Bullock (11)	-0.49%	-0.04%
Lee (81)	-0.37%	-0.03%
Crenshaw (41)	-0.37%	-0.03%
Clay (27)	-0.17%	-0.01%
Chambers (17)	0.34%	0.03%
Monroe (99)	0.65%	0.05%
Franklin (59)	0.66%	0.05%
Barbour (5)	0.66%	0.06%
Lowndes (85)	1.09%	0.09%
Jackson (71)	1.20%	0.10%
Wilcox (131)	1.37%	0.11%
Perry (105)	1.37%	0.11%

Talladega (121)	1.45%	0.12%
Tuscaloosa (125)	1.46%	0.12%
Lamar (75)	1.48%	0.12%
Cullman (43)	1.80%	0.15%
Lawrence (79)	2.31%	0.19%
Henry (67)	2.57%	0.21%
Covington (39)	2.91%	0.24%
Winston (133)	3.17%	0.26%
Coosa (37)	3.88%	0.32%
Washington (129)	4.16%	0.35%
Pike (109)	4.25%	0.35%
Macon (87)	4.48%	0.37%
Butler (13)	5.07%	0.42%
Sumter (119)	5.60%	0.47%
Fayette (57)	6.06%	0.50%
Colbert (33)	6.32%	0.53%
Autauga (1)	6.54%	0.54%
Greene (63)	6.80%	0.57%
Russell (113)	7.00%	0.58%
Cherokee (19)	7.08%	0.59%
Dale (45)	7.35%	0.61%
Shelby (117)	7.44%	0.62%
Madison (89)	7.62%	0.63%
Montgomery (101)	7.76%	0.65%
Dallas (47)	9.50%	0.79%
Marengo (91)	10.69%	0.89%
Geneva (61)	11.29%	0.94%
Houston (69)	11.86%	0.99%
Hale (65)	17.08%	1.42%
Totals:	0.74%	+ 0.06%

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