Forest sustainability in the state of Mississippi, 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 Mississippi, including general condition, management and sustainability assessment.

2. Mississippi forests overview

2.1. Location and distribution

Mississippi is located in the South East of the USA and covers a total surface area of 125 443 km². The State of Mississippi has 82 counties and is bordered by four other states: Louisiana and Arkansas to the west, Tennessee to the north, Alabama to the east and Gulf of Mexico to the south.

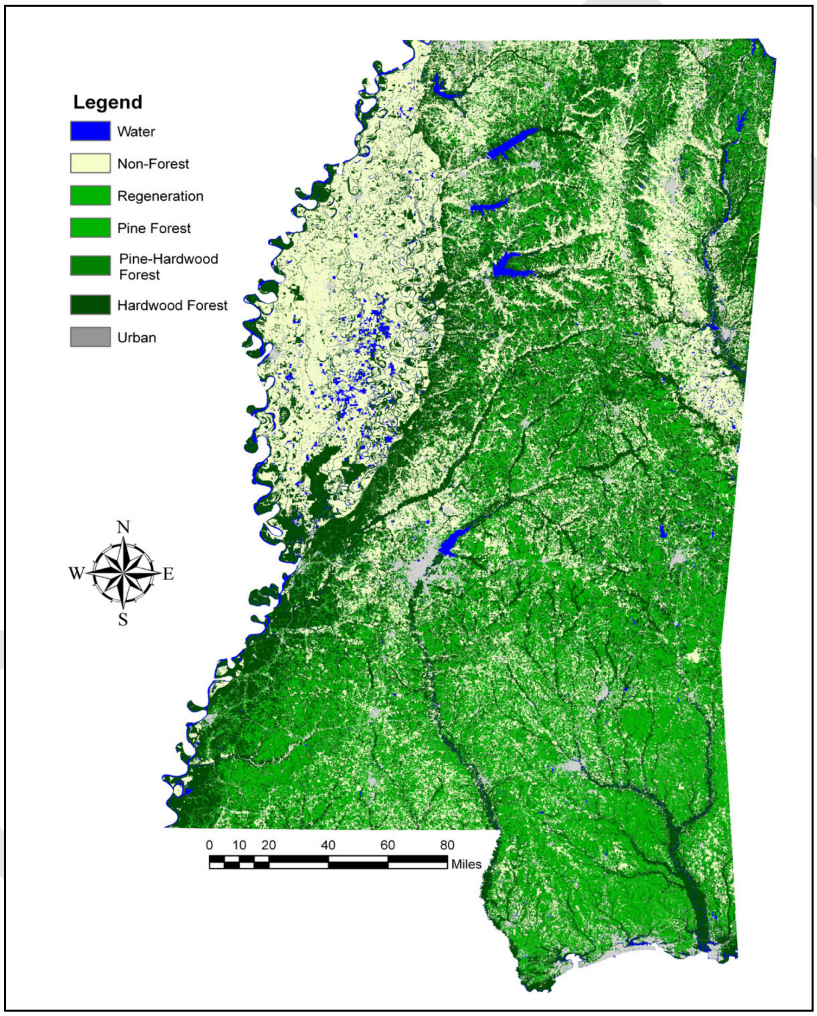
Figure 1: General maps of Mississippi

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

The forests of Mississippi are part of the large forest area of the East coast of the USA. Nowadays, forest covers about 65% of the State's land area with 7.88 million ha[1] (63% of the State's total area). Nearly all of the forest land (99.8%) is considered available for timber production (timberland), the rest being reserved or otherwise unavailable production.

As seen on the figures below, forests are more abundant in the southern half of the state, than in the northern half. In particular, forests are very scarce in the north-west part of the state(Mississippi alluvial plains), which is essentially devoted to agriculture.

Figure 2 : Forest land cover in Mississippi

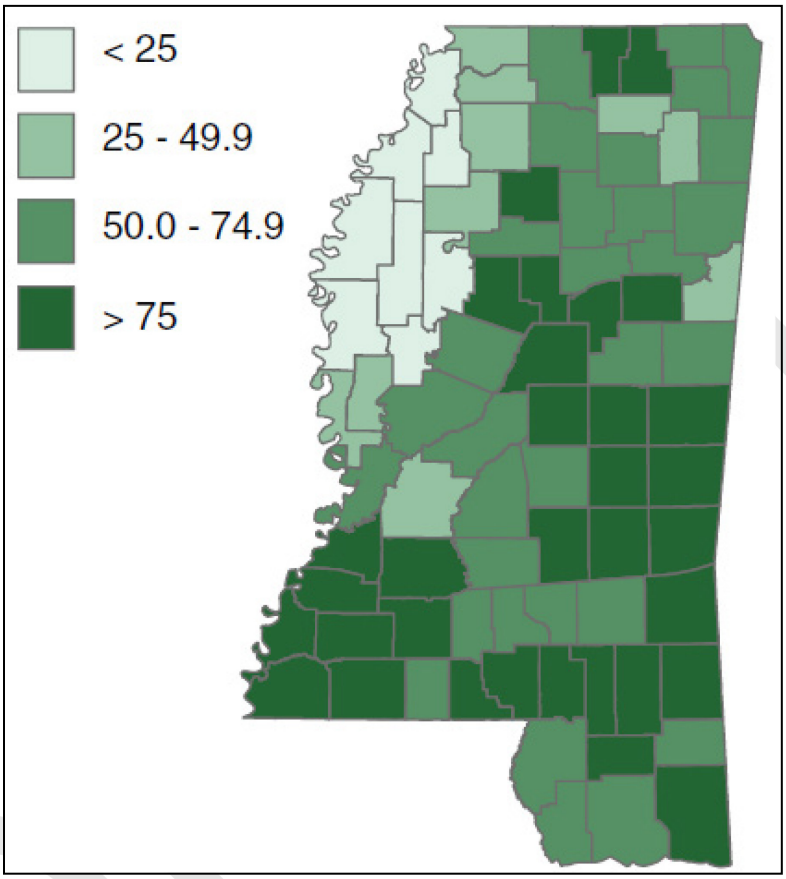


Source: 2012-2013 Forest Inventory, Southwest Region, Mississippi
(Mississippi Institute for Forest Inventory & Mississippi Forestry Commission)
(http://www.mifi.ms.gov/documents/2013_Forest_Inventory_Southwest_Region_MS.pdf)

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

In 2006 (Figure 3), out of 82 Mississippi counties, 31 are estimated to be 50–75% forested and 33 counties are ≥ 75% forested. Eight counties are estimated to be < 25% forested and are located in the north esat.

Figure 3 : Percentage of land in forest by county



Source: Forest Inventory & Analysis factsheet (2006)
(USDA – Forest Service & Mississippi Forestry Commission)
(http://www.mfc.ms.gov/pdf/Info/FF/Other/FINAL_MS2006.pdf)

2.1. Ecological zones

Mississippi is mainly made of lowlands with the low fertile delta between the Yazoo and Mississippi rivers. The delta is bordered by the loess deposits and further by a sandy Gulf coastal terraces, piney woods and prairie. In the north-eastern part of the State, some higher sandy hills can be found. Mississippi's low point is sea level at the Gulf of Mexico. Only 245m above sea level, Woodall Mountain, in Tishomingo County (northeast part of the state), is the highest point in Mississippi.

Mississippi has a humid subtropical climate, characterized by long summers and short, mild winters.

Depending on the place, the average daily high temperatures recorded in July and August is in the range 33°C to 34°C while the average daily low temperatures recorded in January is in the range -1°C[2]. The temperature varies little statewide in the summer; however, in winter, the region near Mississippi Sound is significantly warmer than the inland portion of the state.

Depending on the place, the average precipitations range generally from 1 275 to 1 750 mm per year[3].

Mississippi includes the 4 following ecoregions[4]:

A. South-eastern Plains (n°65 on Figure 4)

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.

B. Mississippi Alluvial Plain (n°73 on Figure 4)

This riverine ecoregion extends from southern Illinois, at the confluence of the Ohio River with the Mississippi River, south to the Gulf of Mexico. It is mostly a flat, broad floodplain with river terraces and levees providing the main elements of relief. Soils tend to be poorly drained, except for the areas of sandy soils. Winters are mild and summers are hot, with temperatures and precipitation increasing from north to south. Bottomland deciduous forest vegetation covered the region before much of it was cleared for cultivation. Presently, most of the northern and central parts of the region are in cropland and receive heavy treatments of insecticides and herbicides. Soybeans, cotton, and rice are the major crops.

C. Mississippi Valley Loes Plains (n°74 on Figure 4)

This ecoregion stretches from near the Ohio River in western Kentucky to Louisiana. It consists primarily of irregular plains, with oak-hickory and oak-hickory-pine natural vegetation. Thick loess tends to be the distinguishing characteristic. With flatter topography than the Southeastern Plains ecoregion to the east, streams tend to have less gradient and more silty substrates. Agriculture is the dominant land use in the Kentucky and Tennessee portion of the region, while in Mississippi there is a mosaic of forest and cropland.

[2]Source : http://www.weather.com/weather/wxclimatology/monthly/graph/39762

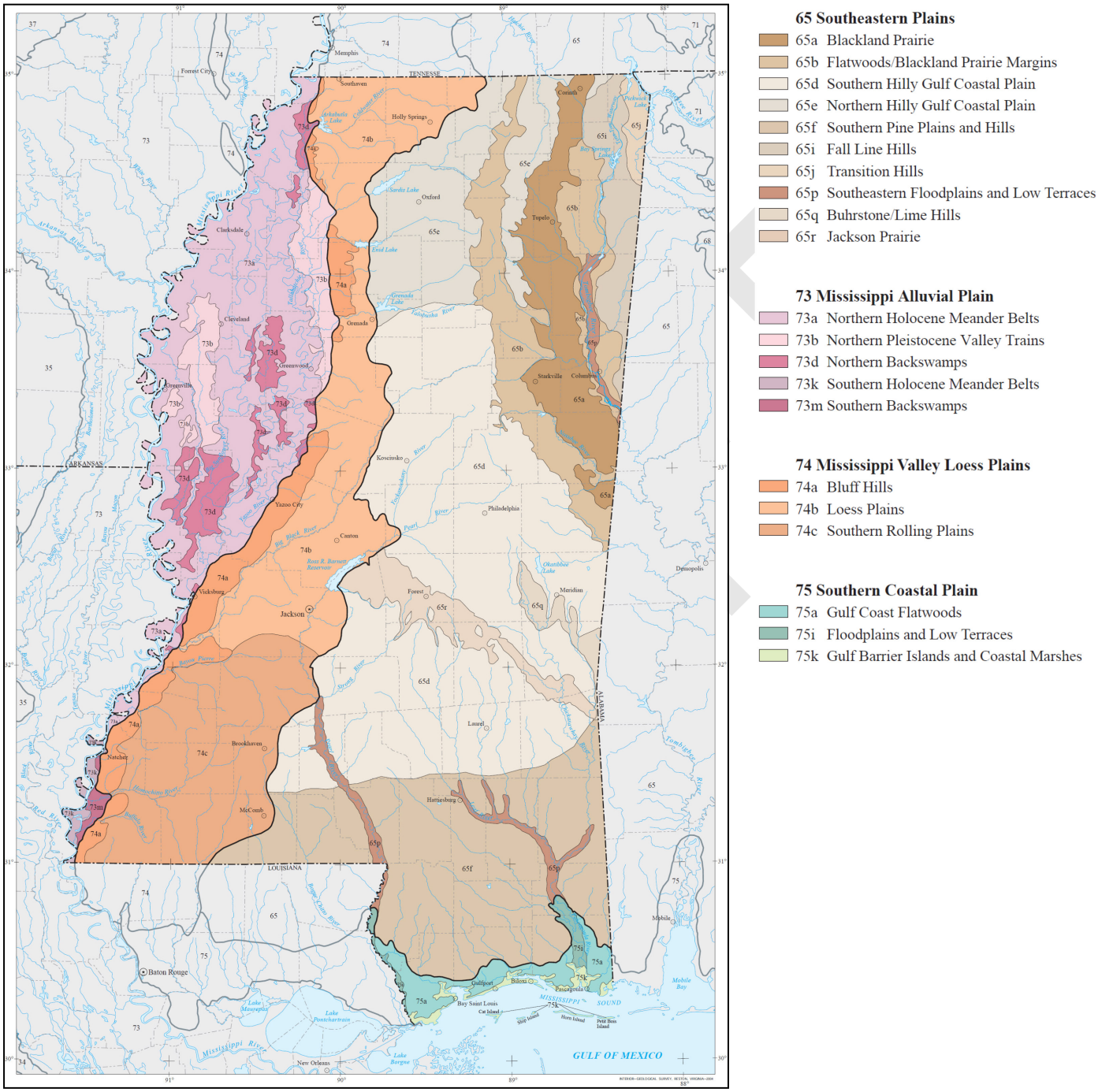
[3]Source : http://average-rainfall.weatherdb.com/

[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. Southern Coastal Plain (n° 75 on Figure 4)

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 4: Ecoregions of Mississippi (Levels III & IV)



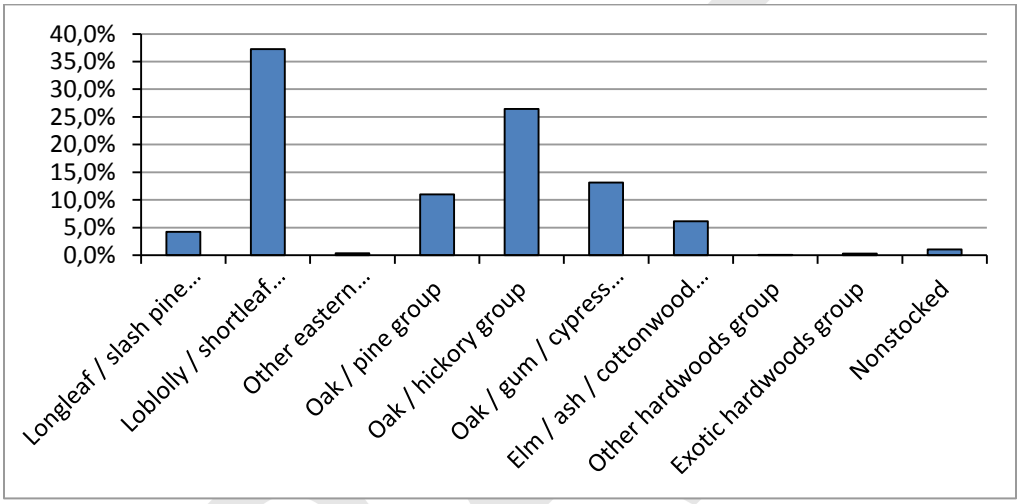
Source: Environmental Protection Agency – Western Ecology Division (http://www.epa.gov/wed/pages/ecoregions/ms_eco.htm)

2.2. Forest species

The loblolly-shortleaf pine forest-type group occupies the largest proportion of forest land in Mississippi (37.2%). The next most common forest-type groups are oakhickory (26.4%), oak-gum-cypress (13.1%), and oak-pine (11%).

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

Figure 5: 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

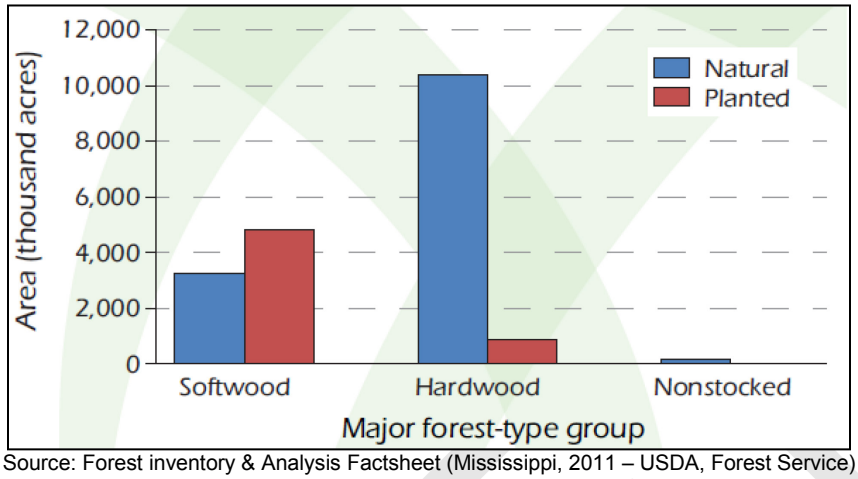
Forest type group	Area (ha)	% of total forestland area
Loblolly / shortleaf pine group	2937347	37.2%
Oak / hickory group	2083470	26.4%
Oak / gum / cypress group	1034230	13.1%
Oak / pine group	869755	11.0%
Elm / ash / cottonwood group	484485	6.1%
Longleaf / slash pine group	332742	4.2%
Nonstocked	83883	1.1%
Other eastern softwoods group	29051	0.4%
Exotic hardwoods group	25398	0.3%
Other hardwoods group	5557	0.1%
Total	**7885919**	**100.00%**

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

According to a 2011's inventory[5], naturally regenerated stands comprise more than two times as much forest area as artificially regenerated stands in Mississippi. Loblolly-shortleaf pine accounts for 80% of all planted area, and softwoods, in general, account for 84% of artificially regenerated forests (Figure 6). In all, about 30% of Mississippi's forest land shows evidence of artificial regeneration.

[5] Forest inventory & Analysis Factsheet 2011 – USDA, Forest Service-http://www.srs.fs.fed.us/pubs/su/su_srs063.pdf

Figure 6: Forest land area by major forest-type group and stand origin (Mississippi, 2011)



Source: Forest inventory & Analysis Factsheet (Mississippi, 2011 – USDA, Forest Service) (http://www.srs.fs.fed.us/pubs/su/su_srs063.pdf)

2.3. Forest ownership

Approximately 88% of Mississippi's forestland area is privately-owned and the 12% remaining is publicly-owned (federal, state and local public owners). Of the privately-owned land, about 90% is owned by non-industrial private sector and the remaining is owned by forest industries.

Mississippi's timberland and forestland ownership patterns are given in the following table.

Table 2 : Area of forest land and timberland by ownership groups

Forest land / Ownership groups		Area (ha)		% of total forestland area
Forest Service	National forest	542227	542227	6.9%
Other federal	National Park Service	4124	205784	2.6%
	Fish and Wildlife Service	70775		
	Department of Defense or Energy	85551		
	Other federal	45334		
State and local gov't	State	94430	194408	2.5%
	Local (county, municipal, etc.)	97430		
	Other non federal lands	2548		
Private	Undifferentiated private	6943500	6943500	88.0%
Total			7885919	100.0%
Timberland / Owner ship groups		**Area (ha)**		**% of total timberland area**
Forest Service	National forest	539835	539835	6.9%
Other federal	Fish and Wildlife Service	70775	201660	2.6%
	Department of Defense or Energy	85551		
	Other federal	45334		
State and local gov't	State	94430	192075	2.4%
	Local (county, municipal, etc.)	95097		
	Other non federal lands	2548		
Private	Undifferentiated private	6937534	6937534	88.1%
Total			7871104	100.0%

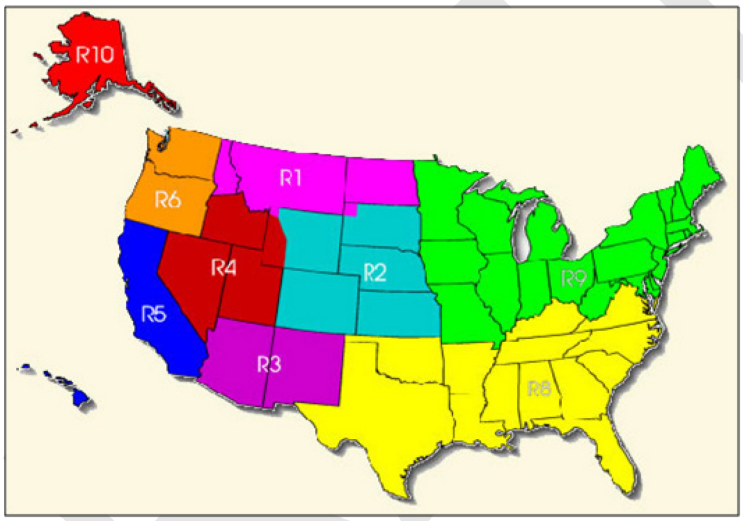
Source: adapted from US Forest service, FIA Program (http://apps.fs.fed.us/fido/standardrpt.html)

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"* [6]

Forest management of 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, Mississippi and other States like Alabama and Georgia belongs to the R8 region: Southern Region.

Figure 7 : Regional areas of the Forest Service



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

The authority responsible for forest management in Mississippi 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 Mississippi Forestry Commission (MFC) is in charge of forest management.

Established as a state agency in 1926, the mission of the Mississippi Forestry Commission is to provide active leadership in forest protection, forest management, forest inventory and forest information distribution, necessary for sustainable forest-based economy.

The Commission contains several services in relation with her core missions:

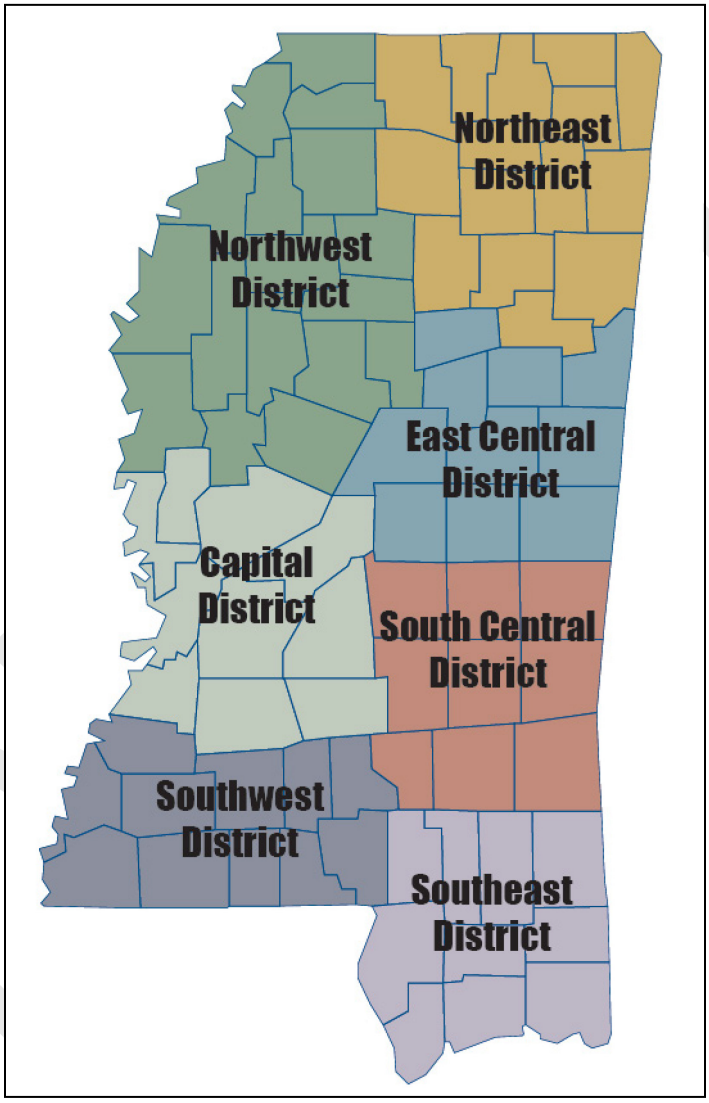
- Forest Protection and information (Fire Services, Information and Outrach)
- Institute for Forest Inventory,

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

- Geographic Information System,
- Forest Management
- Business Support

The Mississippi Forestry Commission is divided in seven administrative districts, as shown on the figure below:

Figure 8 : Mississippi Forestry Commission Administrative Districts



Source: Mississippi forestry commission – 2012 annual report (http://www.mfc.ms.gov/pdf/AboutUs/MFC_2012_Ann_Report_V1.pdf)

2.5. Overview of wood-related industry

Mississippi's forest industry consists of four major sectors[7]:

- Solid Wood Products which includes pine and hardwood lumber, plywood, poles, oriented strand board, and other "composite" forest products.
- Pulp and Paper which includes fine writing papers, "liner-board" used for cardboard boxes, tissue and absorbent papers, and market pulp.
- Wood furniture and related products which consists mostly of upholstered wood furniture such as couches, love seats, and recliners.
- Timber harvesting which includes the harvesting and transportation sector.

According to a 2008 study by the Mississippi State University[8]:

- The total industry output of Mississippi's forest products industry generates an economic impact of nearly $17.4 billion annually.
- The forest products industry accounts for $7.1 billion annually in value added economic impact for the state.
- The Mississippi forest industry contributes to 8.3% of all jobs in Mississippi. An estimated 123,659 full or part-time jobs have their "roots" in Mississippi's forest products industry. (This total includes direct, indirect, and induced employment).
- In terms of wages and salaries paid annually, Mississippi's forest products industry generates a statewide economic impact of $4.4 billion.
- In 2007, Mississippi's forest landowners, mostly private, non-industry owners, collected $630.8 million for their standing timber sold that year.

According to a most recent (2010) study by the Mississippi State University[9], the forest industry accounts for 4.32% of Mississippi's total economy and generated about 2.4% of the state's total employment.

According to the Mississippi Forestry Commission[10], forestry, logging, primary wood products, and furniture manufacturing contribute between $11 billion and $14 billion annually to the state's economy. Approximately 54000 individuals are directly employed in logging, forestry and other wood-processing industries, with a combined income of $ 1.1 billion.

[7] http://msucares.com/forestry/economics/important.html - Mississippi State University

[8] J. Henderson and I. Munn

[9] Economic Contribution of Mississippi's Forest Products Industry over Time (R. Dahal, I. Munn, J. Henderson) http://sofew.cfr.msstate.edu/papers/dahal12.pdf

[10] 2012 annual report - http://www.mfc.ms.gov/pdf/AboutUs/MFC_2012_Ann_Report_V1.pdf

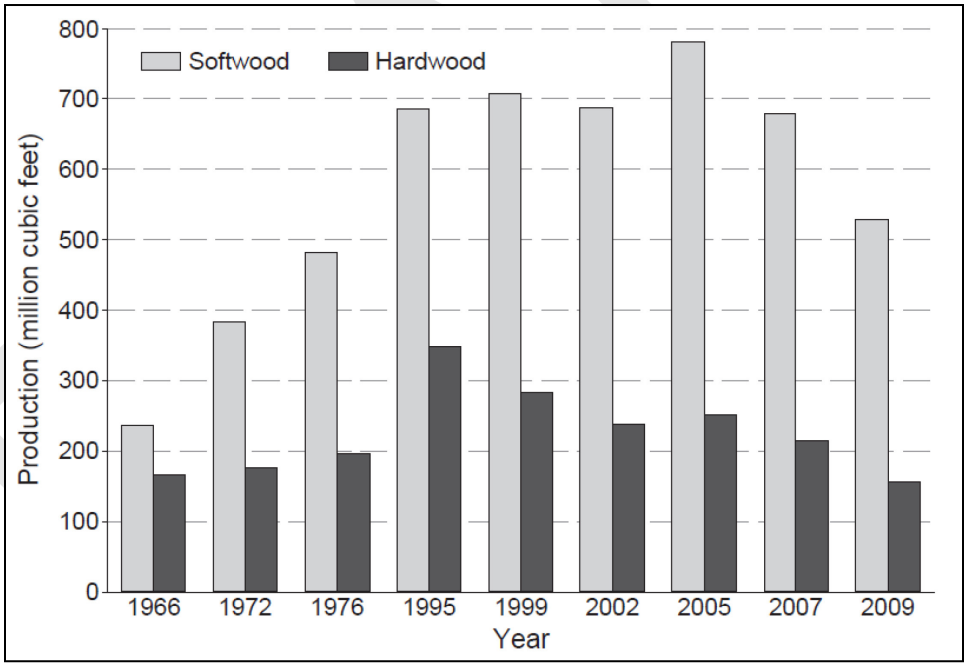
The information below presents a few highlights about Mississippi's timber product output (TPO)[11] and the main available figures related to the period 2007-2009. Between 2007 and 2009, TPO from roundwood was down 5.92 million m³, or 23%, to 19.4 million m³. Output of softwood roundwood products decreased 22%, and output of hardwood roundwood products was down 27% to 4.41 million m³ (Figure 9).

Pulpwood and saw logs were the principal roundwood products in 2009. Combined output of these products accounted for 90% (17.4 million m³) of Mississippi's total industrial roundwood output (Figure 10).

The number of primary roundwood-using plants in 2009 for Mississippi was 73, a loss of 11 mills from 2007 (Figure 11).

Across all products, 69% of roundwood harvested was retained for processing at Mississippi mills. Exports of roundwood to other States amounted to 6.1 million m³, while imports of roundwood amounted to 1.4 million m³, making the State a net exporter of roundwood.

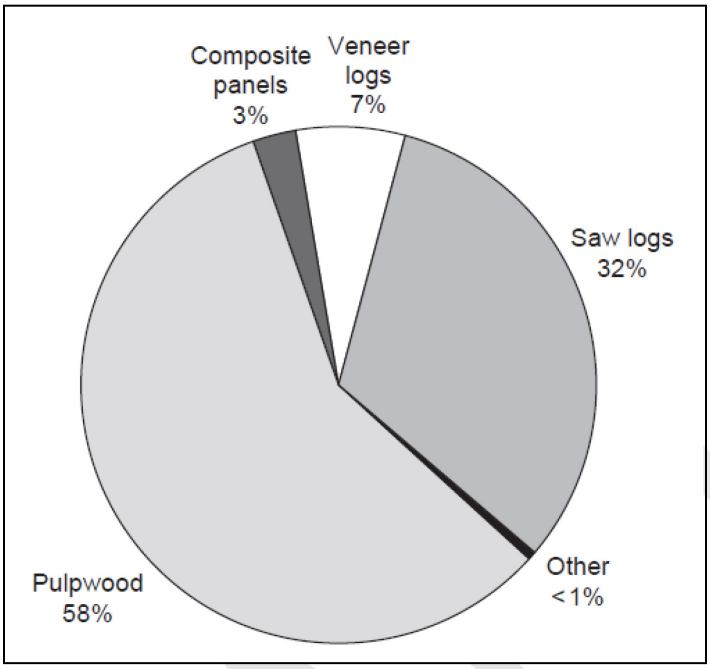
Figure 9 : Roundwood production for all products by species group and year (Mississippi – 1966-2009)



Source: USDA – Forest Service (Assessment of TPO and Use, 2009)

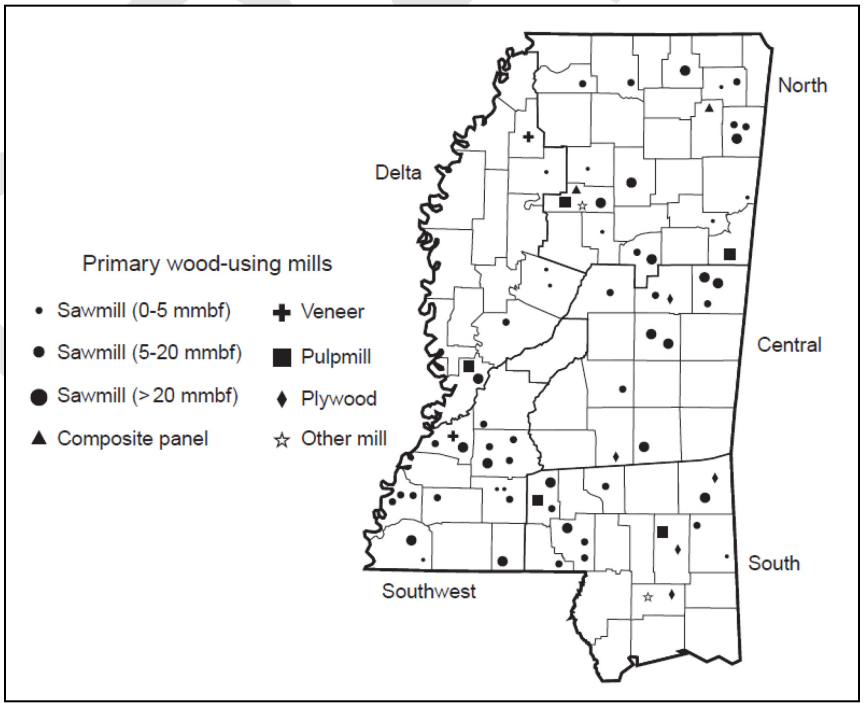
[11] Mississippi's Timber Industry - An Assessment of Timber Product Output and Use, 2009 http://www.srs.fs.usda.gov/pubs/38650

Figure 10 : Roundwood production by type of product (Mississippi, 2009)



Source: USDA – Forest Service (Assessment of TPO and Use, 2009)

Figure 11 : Primary wood-using mills by region (Mississippi 2009)



mmbf = million board feet

Source: USDA – Forest Service (Assessment of TPO and Use, 2009)

3. Sustainability of Mississippi forest

3.1. Evolution of forest area an risk of conversion

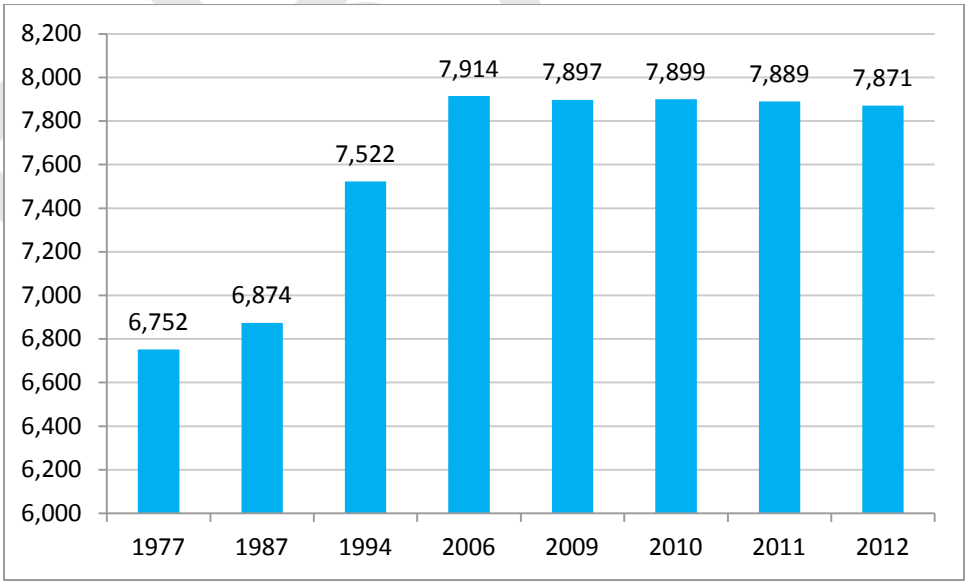
According to the USDA's FIA data (Figure 12 and Table 3). ission), timberland area increased since the 1970ies to reach 7.5 millions ha in the mid-1990 and 7.9 million ha in 2006. Timberland area has remained rather stable afterwards, despite a recent trend to a slight decrease, with a loss of about 0.7% of the forest area between 2006 and 2012 (i.e. 0.1% decrease yearly on average).

Table 3 : Evolution from forested area (2006-2012) and timberland (1977-2012) in Mississippi

Year	Forestland (ha)	Change (ha)	Change %	Timberland (ha)	Change (ha)	Change %
1977	-	-	-	6 752 059	-	-
1987	-	-	-	6 874 240	122 181	1.81%
1994	-	-	-	7 522 034	647 794	9.42%
2006	7 940 868	-	-	7 914 377	392 343	5.22%
2009	7 919 210	-21658	-0.27%	7 897 194	-17 183	-0.22%
2010	7 920 761	1551	0.02%	7 899 352	2 158	0.03%
2011	7 908 176	-12585	-0.16%	7 889 172	-10 180	-0.13%
2012	7 885 919	-22257	-0.28%	7 871 105	-18 067	-0.23%

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

Figure 12 : evolution timberland surfaces in Mississippi between 1977 and 20012



Source: adapted from Forest Inventory & Analysis Factsheet - Mississippi, 2011 – USDA, Forest Service

Mississippi is divided into five survey units (Figure 13). As can be seen on Figure 14, the evolution of the extent of timberland since the 1930ies has been different in the different regions, with consistent growth in the North and the Southwest and a decrease in the Delta region in the early 20th century, which is related to agriculture.

Figure 13 : Mississippi counties and Forest Inventory and analysis units

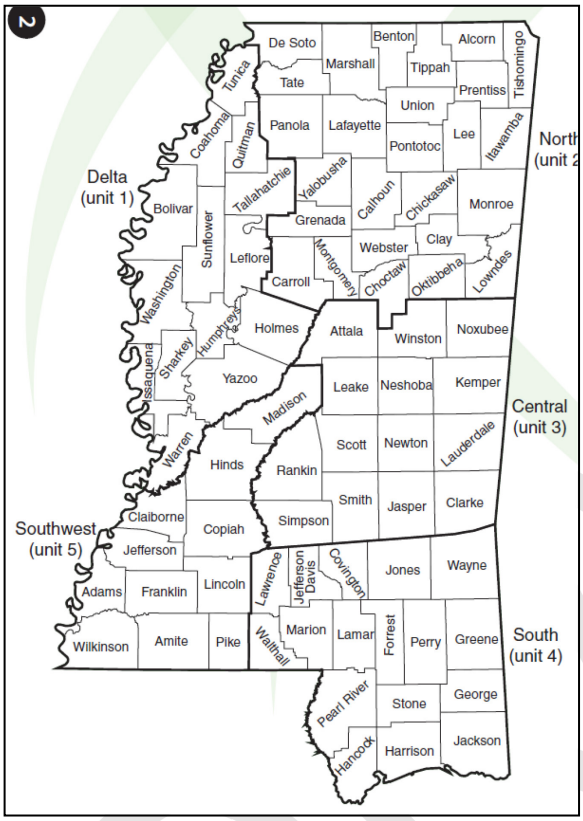
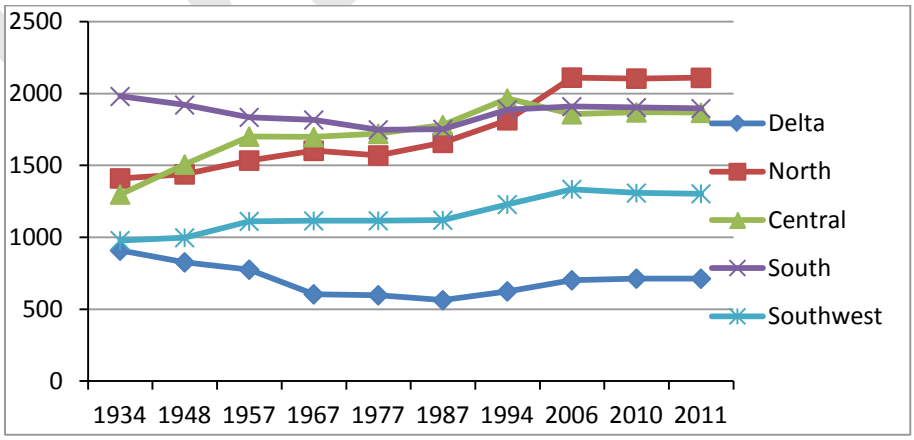


Figure 14 : Timberland area (in thousand ha) change by year and Forest Inventory and Analysis survey units



Source: adapted from Forest inventory & Analysis Factsheet - Mississippi, 2011 – USDA, Forest Service

The yearly data of the Forestry Inventory and Analysis (FIA) makes possible to further investigate the recent decrease of the forest areas in Mississippi, through the evolution of forest area by county (see annex 1)[12].

About 99.8% percent of the total forested land is used for commercial timber production. 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 3).

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 are known to be decreasing in different parts of the country. Hence the Global Forest Registry recommends performing an analysis at the state level.

As we have seen above that the most recent trend in Mississippi was the loss of 0.7% of the forested area between 2006 and 2012, we can't exclude a risk of conversion and recommend an analysis at a finer level. The risk can be seen as unspecified at the state level.

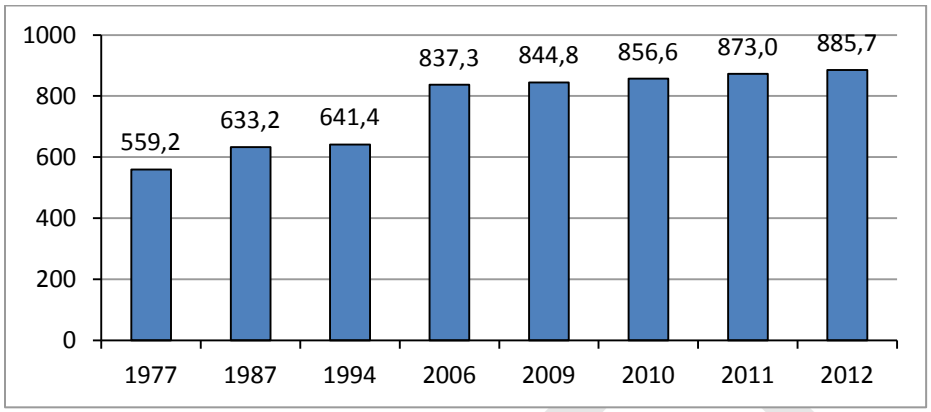
At the county level annex 2 makes possible to identify counties where the average annual losses of forest were in excess of 0.5% (which is the threshold the Global Forest Registry refers to in its risk assessment). There are 13 counties where the 0.5% threshold was exceeded as yearly average in the period 2006-2012 (out of the 82 counties in Mississippi).

3.2. Living wood volumes and removals

The FIA data on the figure below show the evolution of net volume of live trees since 1977. A significant increase is observed between 1977 and 2006 (increase of about 49%). Despite the slight reduction of timberland areas between 2006 and 2011 (as mentioned above), the volume of standing trees does show an increase (by about 5.7%) during this period. It reflect higher wood volumes per unit of surface, and an increased maturity of the forests.

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

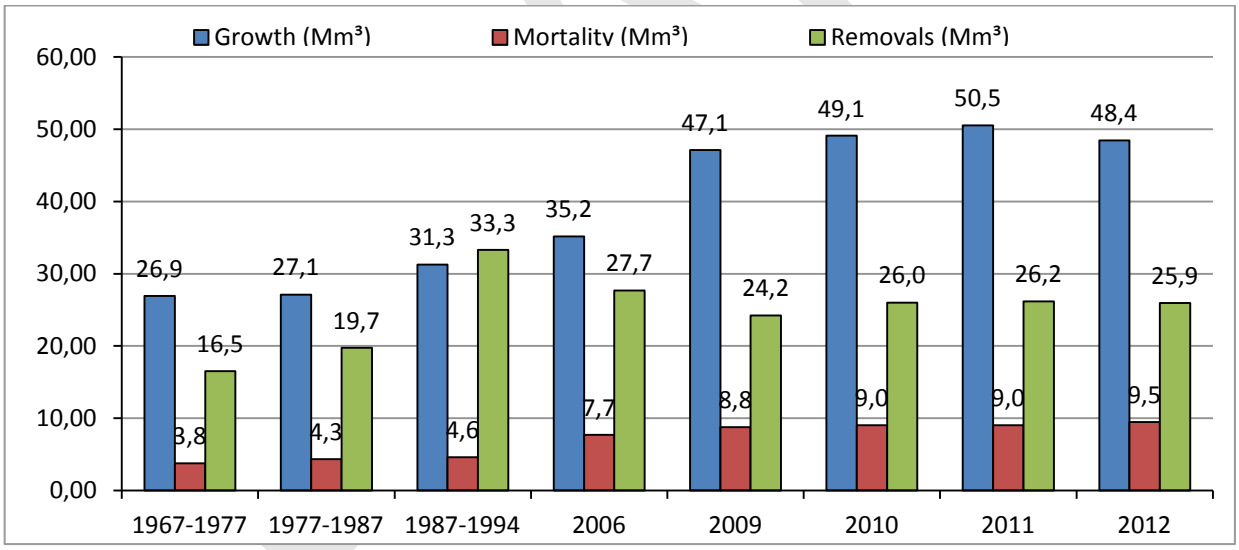
Figure 15 : Net volume of live trees in timberland (at least 5 inch d.b.h./d.r.c.), in million m³ since 1977



Source: adapted from USDA – Forest Service (http://apps.fs.fed.us/fido/standardrpt.html)

According to the USDA – Forest Service, in 2012, the net annual growth of growing-stock volume averaged 48.4 million m³, annual mortality 9.5 million m³ and annual removals 25.9 million m³. The data covering the period between 1967 and 2012 is presented on the following figure.

Figure 16 : Average net annual growth, removals and mortality of growing stock on timberland (at least 5 inch d.b.h.), in million m³



Source: adapted from USDA – Forest Service (http://apps.fs.fed.us/fido/standardrpt.html)

As we can see, the growing rate is constantly increasing between 1967 and 2011 (even though a slight decrease is observed between 2011 and 2012). On the other hand the levels of removals are have stagnating since 2006, after the start of the subprime crisis. Since the removals have stabilized at a level lower than in the 90ies and the annual growth has been increasing, there is each year an annual increase in standing timber volumes, as already presented on Figure 15.

Table 4 and Figure 17 show the evolution of net volume, by species group, of live trees in forest land for the survey years available (2006-2012) in the Forestry Inventory and Analysis (FIA) of the USDA – Forest Service[13].

We can see that the loblolly-shortleaf pine forest-type group is responsible for much of the increase in the annual growth, reflecting not only a reduction of the harvesting, but also conversions of different kind of forests into more intensive artificial loblolly pine plantations.

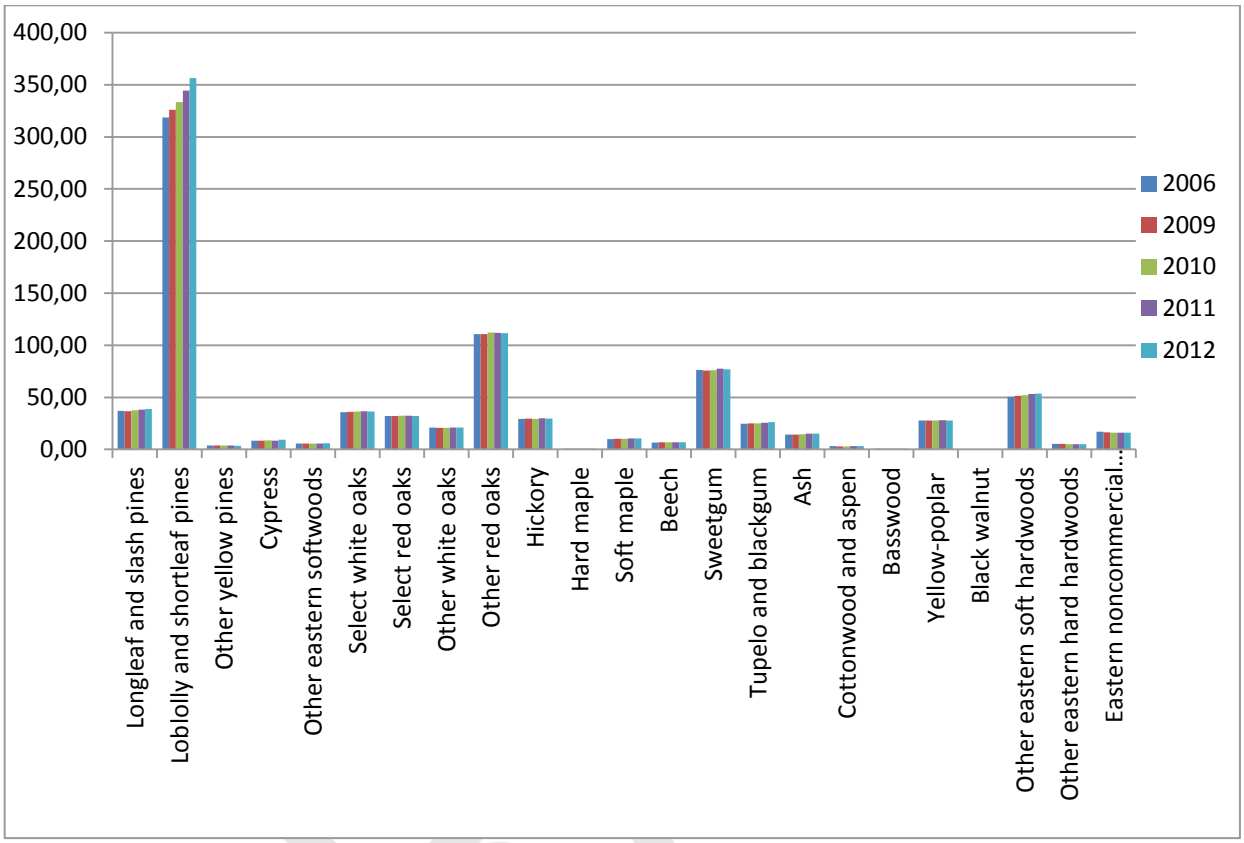
Table 4 : Net volume of live trees in forest land (at least 5 inch d.b.h./d.r.c.), in million m³, by species group and survey years

	2006	2009	2010	2011	2012	Change 2006-2012	
Trees species groups	**Mm³**	**Mm³**	**Mm³**	**Mm³**	**Mm³**	**Mm³**	**%**
Longleaf and slash pines	36.88	36.7	37.56	38.33	38.98	2.1	5.70%
Loblolly and shortleaf pines	318.5	325.83	333.34	344.3	356.45	37.95	11.90%
Other yellow pines	3.8	3.71	3.71	3.73	3.61	-0.19	-5.00%
Cypress	8.47	8.3	8.63	8.55	9.23	0.76	9.00%
Other eastern softwoods	5.58	5.61	5.82	5.8	5.91	0.33	5.90%
Select white oaks	35.73	36.08	36.47	36.69	36.51	0.78	2.20%
Select red oaks	32.1	32.17	32.32	32.43	32.06	-0.04	-0.10%
Other white oaks	21.16	20.82	20.73	20.92	20.99	-0.16	-0.80%
Other red oaks	110.63	110.84	112.18	111.8	111.61	0.98	0.90%
Hickory	29.45	29.56	29.4	29.83	29.63	0.18	0.60%
Hard maple	0.68	0.7	0.68	0.62	0.63	-0.05	-7.30%
Soft maple	10.06	10.31	10.34	10.53	10.53	0.46	4.60%
Beech	6.72	6.8	6.98	6.79	6.78	0.06	0.80%
Sweetgum	76.45	75.73	76.06	77.56	76.92	0.47	0.60%
Tupelo and blackgum	24.72	25	25.15	25.52	26.34	1.62	6.60%
Ash	14.19	14.42	14.59	15.08	15.06	0.87	6.10%
Cottonwood and aspen	3.22	2.98	2.92	3.19	3.22	-0.01	-0.20%
Basswood	0.78	0.79	0.84	0.87	0.79	0.01	1.30%
Yellow-poplar	27.69	27.73	27.8	28.13	27.77	0.09	0.30%
Black walnut	0.36	0.39	0.39	0.41	0.38	0.02	6.70%
Other eastern soft hardwoods	50.54	51.29	51.9	53.19	53.67	3.13	6.20%
Other eastern hard hardwoods	5.37	5.32	5.16	5.18	5.02	-0.35	-6.50%
Eastern noncommercial hardwoods	16.93	16.46	16.25	16.15	16.15	-0.77	-4.60%
Total	**840**	**847.5**	**859.21**	**875.59**	**888.23**	**48.23**	**5.70%**

Source: adapted from USDA – Forest Service (http://apps.fs.fed.us/fido/standardrpt.html)

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

Figure 17 : Evolution (2006-2012) in million m³ of live trees on forest land (at least 5 inch d.b.h./d.r.c.) by forest-type group



Source: adapted from USDA – Forest Service (http://apps.fs.fed.us/fido/standardrpt.html)

3.3. *Protection of ecosystems and biodiversity*

As shown on Table 5, the conservation land in Mississippi covers 671834 ha, which is about 5.4% of the state area. This includes both public and private land, under various conservation status. Figure 18 shows an overview of all protected areas in Mississippi. Those protected areas are either public (federal, state, county or local) and private lands.

Table 5 : Land under protection status in Mississippi (as of 2011)

	Status 1	Status 2	Status 3	Total
Acres	37189	442584	1180364	1660137
Ha	15050	179107	477676	671834
Percentage of state area	0.1%	1.4%	3.8%	5.4%

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

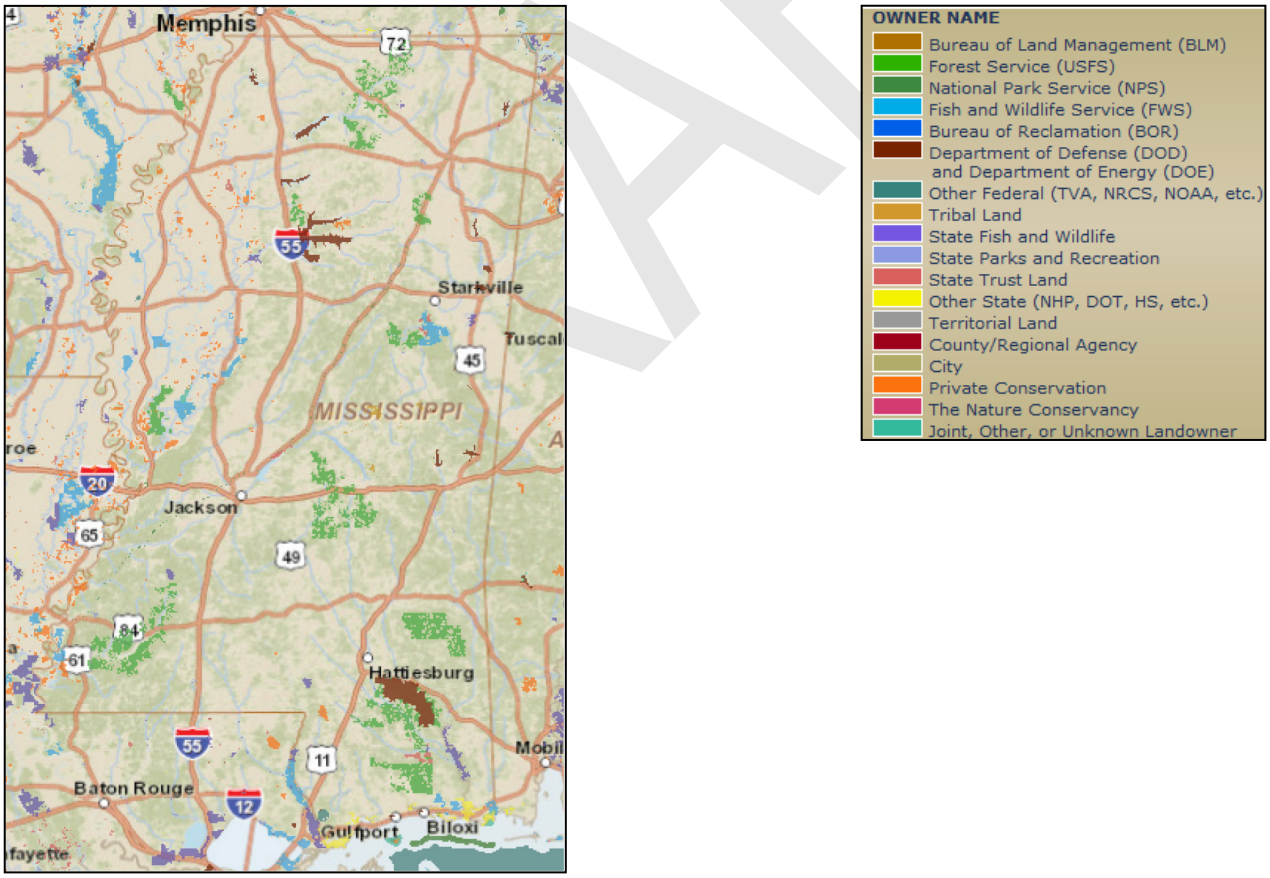
Status 1: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through 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 18 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.

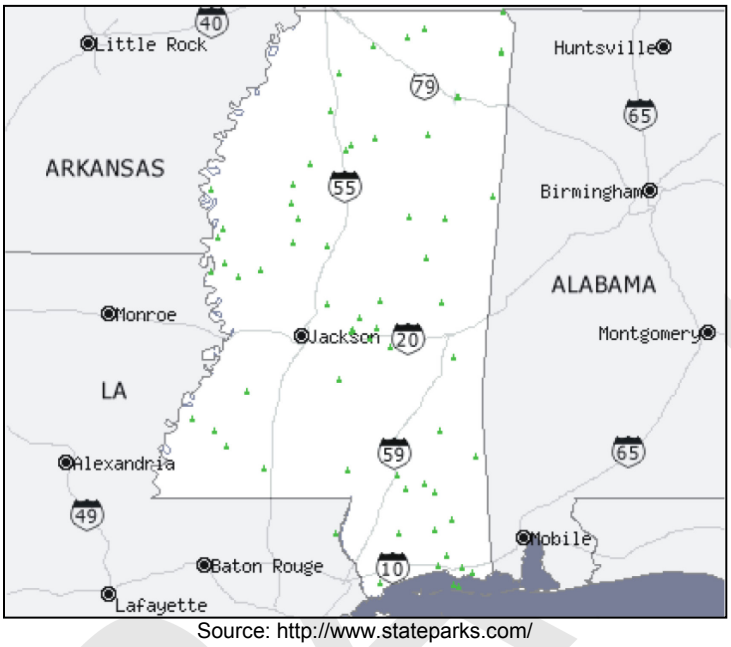
Figure 18 : Protected areas in Mississippi



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

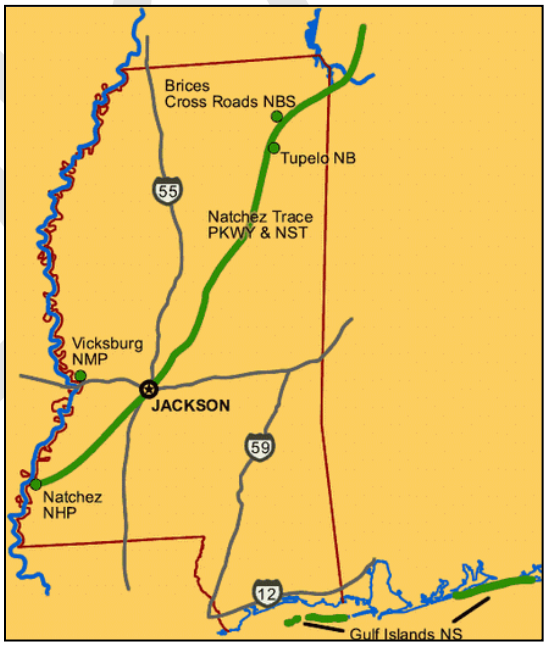
Figure 19 shows the location of State parks in Mississippi. Figure 20 shows the location of national parks in Mississippi.

Figure 19 : State Parks in Mississippi



Source: http://www.stateparks.com/

Figure 20 : National parks in Mississippi



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

Table 6 shows the new surfaces put into conservation between 1998 and 2005. Unfortunately, more recent statistics are not yet available regarding the new land turned to conservation.

Table 6 : New land under conservation status per year in Mississippi (1998-2005)

Year	1998	2001	2002	2003	2005	Total
Acres	1899.0	6239.0	1006.2	3236.6	293.3	12674
ha	768.5	2524.8	407.2	1309.8	118.7	5129

http://www.conservationalmanac.org

We can observe that the yearly average of new areas put into conservation and the total of new land between 1998 and 2005 are low in Mississippi compared to other nearby states (for the same period, the area of new land put under conservation is 2 times higher in Louisiana and Arkansas and 8 times higher in Alabama). It represents an increase by only 0.7 % in 7 years (0.1% per year).

A number of conservation schemes have been introduced recently to increase the conservation land in Mississippi, including initiatives to encourage conservation on private land (which is particularly important given the proportion of private forests in Mississippi).

The most important programs are described hereunder:

- **Wildlife Heritage Fund**[14]: The Department of Fish, Wildlife and Parks administers the Wildlife Heritage Fund, which is comprised of funds generated through both legislative appropriations and the sale of hunting and fishing licenses. Funds are used to acquire important habitat for Wildlife Management Areas.

- **Tidelands Trust Fund**[15] **:** The Department of Marine Resources administers The Tidelands Trust Fund, which contains funds derived from the lease of tidelands and submerged lands. Funds may be used to cover administrative cost, lost property taxes, and also includes the acquisition or enhancement of public access areas to the public trust tidelands or public improvement projects.

- **Conservation Tax Credits**[16] (Tax Credit for Natural Heritage Priority Conservation or Scenic Streams Land Donations): This tax credit program was passed in 2003, and applies to fee and easement properties, lands adjacent to streams that are fully nominated by the Mississippi Scenic Streams Stewardship Program, or priority sites of the Mississippi Natural Heritage Program. The landowners will receive 50% of his or her transactions costs (up to a $10000 maximum credit.

[14] http://www.conservationalmanac.org/secure/almanac/southeast/ms/programs.html
[15] http://www.conservationalmanac.org/secure/almanac/southeast/ms/programs.html
[16] http://www.conservationalmanac.org/secure/almanac/southeast/ms/programs.html

- **The Conservation Reserve Program (CRP)**[17]: The Conservation Reserve Program is a land conservation program administered by the Farm Service Agency. 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.

- **The Forest Legacy Program**[18] (FLP) is a USDA Forest Service program in partnership with Mississippi that will help support local efforts to protect environmentally sensitive, privately owned forestlands threatened by conversion to nonforest use through land acquisition and conservation easements. A statewide Assessment of Need (AON) was completed in 2007 as a first step to identifying the three Forest Legacy areas (North, Central and Southeast Mississippi) where important natural forest communities exist on private lands that are potentially threatened by conversion from urban and suburban growth or other threats.

- **The Forest Resource Development Program**[19] (FRDP) was established for developing the state's forest economy. This program provides cost-share funding for tree planting and forest improvement practices for the purpose of long-term timber production. This program helps offset a landowner's expense by sharing the cost of implementing specific forestry practices designed to produce timber and enhance wildlife development. Cost-share payments cover 50 to 75% (depending on the practice) of the total cost of implementing one or more forestry practices, with a maximum limit set for each individual practice.

- **The Forest Stewardship Program**[20] promotes natural resource planning on private, nonindustrial forestlands. Landowners not currently under forest management are encouraged to utilize stewardship management through the development and implementation of a Forest Stewardship Management Plan. These plans are based on sound management principles designed to restore and protect forest resources and water quality and to improve fish and wildlife habitats. The Forest Stewardship Program is funded by the USDA Forest Service. The program is carried out by MFC through its Forest Stewardship Committee. Technical assistance is provided by local, federal, state and private natural resource agencies and organizations. The State Plan for the Mississippi Forest Stewardship Program provides the framework for conducting the program. The plan also contains stewardship background, guidelines and forms for landowners and resource professionals.

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

[17] http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp
[18] Mississippi forestry commission – 2012 annual report - http://www.mfc.ms.gov/pdf/AboutUs/MFC_2012_Ann_Report_V1.pdf
[19] Mississippi forestry commission – 2012 annual report - http://www.mfc.ms.gov/pdf/AboutUs/MFC_2012_Ann_Report_V1.pdf
[20] Mississippi forestry commission – 2012 annual report - http://www.mfc.ms.gov/pdf/AboutUs/MFC_2012_Ann_Report_V1.pdf

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 Mississippi, the latest version of BMP was released in 2008[21]. Mississippi's BMP are non-regulatory guidelines for silvicultural practices designed to protect water quality. By monitoring silvicultural activities, the overall integrity of water quality improves as well as the restoration and protection of all watersheds.

The Mississippi Forestry Commission's role in water quality is to monitor the use of best management practices. Findings are report to the Mississippi Department of Environmental Quality (MDEQ). The Mississippi Forestry Commission works with landowners, forest industry, loggers and others to help ensure that forestry practices do not cause pollution under the Clean Water Act and state laws. Properly installed and maintained, BMP are practical and inexpensive ways to prevent erosion and resulting pollution from forestry activities.

The topics covered by the BMP:

- Streamside management zones
- Wetland regulatory requirements
- Skid trails and haul roads
- Erosion control methods
- Forest harvesting
- Site preparation
- Tree planting
- Artificial revegetation of disturbed forest site

In Southeast USA, there are specific arrangements for the site preparation before establishing pine plantations on wetlands[22]. Such operations are not 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.

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 Mississippi were performed in 2010. A total of 237 sites in 80 counties located in 10 watersheds in Mississippi with recent silvicultural activity were randomly selected to evaluate the voluntary implementation of best management practices.

[21] http://www.mfc.ms.gov/pdf/Mgt/WQ/Entire_bmp_2008-7-24.pdf
[22] http://water.epa.gov/lawsregs/guidance/wetlands/silv2.cfm

Percent of implementation of BMP for forestry was evaluated for the following categories listed in the table below[23 & 24] (2003 and 2007 numbers included for information):

Table 7 : BMP implementation in Mississippi (2003-2010) by regional category

Category	Year	Implementation
Harvesting	2003	93%
	2007	95%
	2010	95%
Site Preparation	2003	90%
	2007	91%
	2010	96%
Forest Roads	2003	95%
	2007	96%
	2010	91%
Stream Crossing	2003	89%
	2007	91%
	2010	92%
Streamside Management Zones	2003	89%
	2007	93%
	2010	94%
Firebreaks	2003	81%
	2007	92%
	2010	92%
Chemical Application	2003	95%
	2007	96%
	2010	98%
Overall Implementation	2003	89%
	2007	93%
	2010	**93%**

It shows good results: it was estimated that 93% of the relevant BMP were implemented in 2010. The 2010 survey results matched the 2007 results and exceed the 2003 survey results in all categories.

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 Mississippi. It includes considerations of soil in the following topics:

- Forestry operations in wetlands
- Planning of road locations
- Logging and harvesting practices
- Regeneration operations

[23] http://www.mfc.ms.gov/pdf/Mgt/WQ/2010_BMP_%20Implementation_Survey.pdf
[24] http://www.southernforests.org/resources/publications/SGSF%20BMP%20Report%202012.pdf/view

- Timber stand activities
- Skid trails and haul roads management
- Stream crossing, streamside management zones
- Mechanical site preparation
- Fire-lines realization
- Chemicals use

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 Mississippi.
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.

We have seen in section 3.2 that the volume of standing trees has been consistently increasing in Mississippi over the last three decades, together with the extent of forested area (and even in a larger extent than the increase of forest areas). In this context, the sequestrated carbon stock in living biomass has increased.

As shown in the Table 8 and related Figure 21 (data from the US Forest service (FIA Program)), we can see a constant increase of carbon stocks regarding the living above/below ground woody biomass and the litter since 2006.

However, the estimation of the organic carbon in soils leads to the conclusion that there has been a slight decrease (presumably because of the evolution of management practices and cover type). This decrease between 2006 and 2011 is about 0.5%.

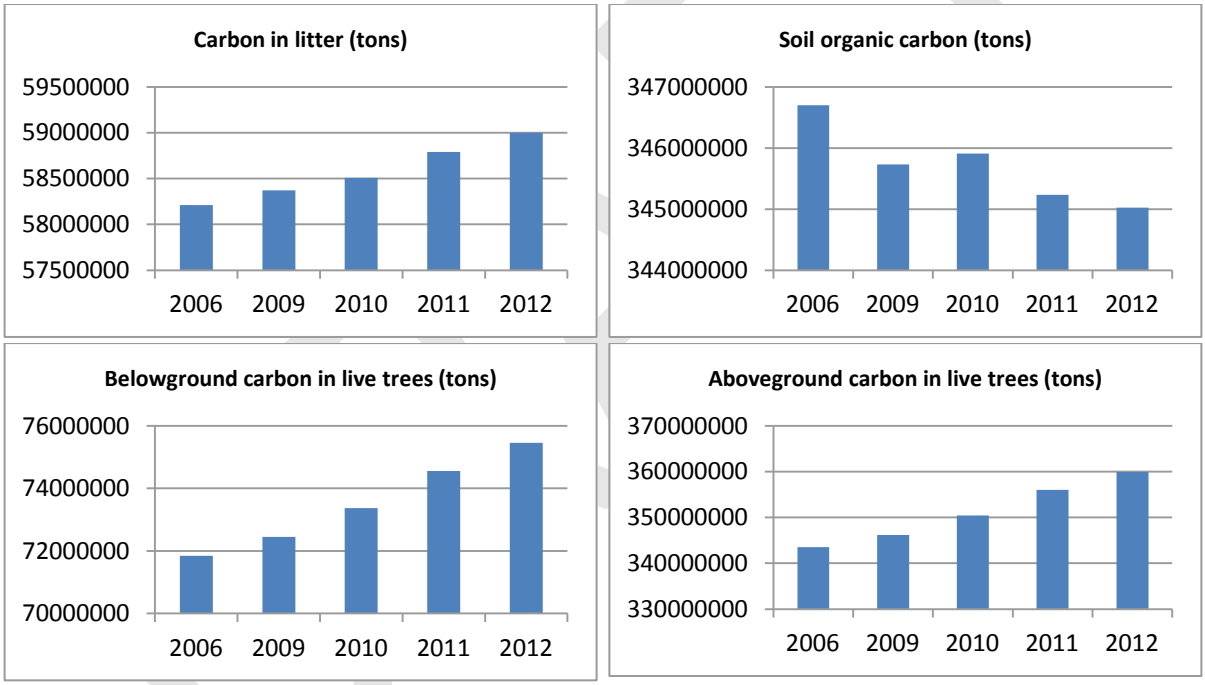
Despite this decrease in soil organic carbon, we can see on Table 8 that the total of the main carbon stocks in forest land in Mississippi is estimated to have increased by more than 2% between 2006 and 2011.

Table 8 : Carbon stocks evolution in forestland – (Mississippi 2006-2012)

Year	Carbon in litter (tons)	Soil organic carbon (tons)	Belowground carbon in live trees (at least 1 inch d.b.h./d.r.c.) (tons)	Aboveground carbon in live trees (at least 1 inch d.b.h./d.r.c.) (tons)
2006	58 211 330	346 703 101	71 842 873	343 495 702
2009	58 373 041	345 730 325	72 448 464	346 199 759
2010	58 507 211	345 912 211	73 369 833	350 466 904
2011	58 790 108	345 232 828	74 561 392	356 029 517
2012	58 999 429	345 027 431	75 460 976	359 948 081

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

Figure 21 : Carbon stocks evolution in forestland (accessible forests) – Mississippi, 2006-2012



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 Mississippi forestry ("prescribed fire"), and can have different objectives[25]:

[25] http://www.mfc.ms.gov/wildfirecontrol.php#v

- Understory management
- Reduce hazardous fuels under tree stands to prevent wildfires
- Prepare sites before seeding and planting
- Wildlife habitat improvement

Prescribed burning is relied upon and utilized heavily in particular in the management of pine stands.

In conjunction with the Mississippi Department of Environmental Quality (DEQ), the Mississippi Forestry Commission issues burning permits based on the daily fire weather forecast. Permits are required for any fire set for a recognized agricultural and/or forestry purpose.

In Mississippi, tens of thousands of acres are planted in pine each year. This acreage, along with the acres previously planted and natural stands, adds up to an enormous amount of acreage that could be burned each year. In meeting this need, burners must consider the impact of smoke and take steps to manage its impact as much as possible. In that framework, the Mississippi Forestry Commission created the "Voluntary smoke management guidelines[26]". This document is intended to provide guidelines forest resource managers which can reduce the risk of adverse impacts of smoke from forestry or agricultural-related burns on smoke-sensitive areas.

Another factor that has become a matter of concern to DEQ is ozone. Ozone is a criteria pollutant or one that can affect human health. If an "Ozone Action Day" is declared by DEQ's Executive Director for DeSoto, Hancock, Harrison or Jackson counties, burning is prohibited.

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 [27]
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 [28]
1.3 There is little or no evidence or reporting of illegal harvesting in the district of origin[29]
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[30]

[26] http://www.mfc.ms.gov/pdf/Protection/Voluntary_Smoke_Management_Guidelines_2012.pdf
[27] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[28] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[29] www.illegal-logging.info ; www.eia-international.org ; http://www.ahec-europe.org/
[30] http://www.transparency.org/cpi2012/results

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 Mississippi are:

- SFI (Sustainable Forestry Initiative[31]), which is endorsed by PEFC (Programme for the Endorsement of Forest Certification)
- ATFS (American Tree Farm System[32]), which is specifically suitable for small private owners
- FSC (Forest Stewardship Council[33]), which is represented in more than 50 countries.

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

Table 9 : Certified forest land in Mississippi (2011)

	SFI	FSC	ATFS	Total certified
Acres certified	1 946 526	634 064	2 039 987	4 620 577
Ha certified	787 731	256 597	825 553	1 869 881
Percentage forests	9.92 %	3.23 %	10.40%	23.55%

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

[31] http://www.sfiprogram.org
[32] https://www.treefarmsystem.org
[33] https://us.fsc.org

4. Conclusions

Mississippi has an important forest that covers about 65% of the State's land area. Most of this forest is privately owned (88%).

The loblolly-shortleaf pine forest-type group occupies the largest proportion of forest land in Mississippi (37.2%). The next most common forest-type groups are oakhickory (26.4%), oak-gum-cypress (13.1%), and oak-pine (11%).

The forest area has increased dramatically in the second half of the 20th century than has been rather stable, even though we do observe that the latest trend is slow but consistent decrease, with a loss of about 0.7% of the forest area between 2006 and 2012 (i.e. 0.1% decrease yearly on average).

A significant increase in the volume of standing trees in timberland has been recorded between 1977 and 2006 (increase by about 49%), while the forest surface where rapidly expanding.
Between 2006 and 2011, the annual tree growth has been consistently increasing in Mississippi, despite a slight reduction of forest land extent. The annual harvested volume has been stagnating since 2006. As a result, between 2006 and 2012, the net volume of standing trees in forestland and timberland has increased by 5.7%. The largest part of the increase in volumes of standing trees is related to loblolly pines, which tend to be managed more intensively.

Because of the increase of the volume of standing trees, the carbon stock associated to living woody biomass is growing. The increases of carbon stock on Mississippi's forest is estimated to be in excess of 2% between 2006 and 2011, even though the component of the carbon stock within soil organic matter is estimated to has decreased by 0.5% during the same period.

Mississippi 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 (5.4%). According to available statistics for the period 1998 to 2005, the yearly average of new areas put into conservation and the total of new land under conservation during this period is rather low compared to other nearby states and compared to the extent of the existing land in conservation (increase by only 0.1% yearly). Even though the protected areas in Mississippi are rather limited, there have been recent efforts to improve the situation and various schemes have been introduced to promote conservation land.

Mississippi 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 (2010) shows a good level (93%) of compliance and implementation of the BMP in the actual forestry operations.

Even though controlled fires are regularly used in forest management practices in Mississippi (mainly in the southeast), the use of fire is strongly regulated and fire is banned from specific places during some periods of the years to avoid disturbance related to 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 Mississippi, with about 23% of forest certified under 3 systems SFI, ATFS and FSC.

ANNEX 1:

Forest area in Mississippi by county (forest area in ha) from 2006 to 2012

County	2006	2009	2010	2011	2012
Adams (1)	96912	92022	92992	92980	91871
Alcorn (3)	64642	64283	64193	66446	66650
Amite (5)	155609	152281	152976	152210	155213
Attala (7)	156944	156869	159228	159088	159170
Benton (9)	80377	80785	82406	82522	81578
Bolivar (11)	51758	52123	54389	54566	54304
Calhoun (13)	97488	95190	95086	100142	101231
Carroll (15)	125625	123812	124191	123448	122036
Chickasaw (17)	65469	65889	65810	65512	64837
Choctaw (19)	93820	93793	94206	94101	93776
Claiborne (21)	99967	99876	100569	100629	98650
Clarke (23)	155854	157922	157336	156795	155391
Clay (25)	57594	58815	58763	60867	61023
Coahoma (27)	28398	28573	28505	28625	27998
Copiah (29)	173474	170407	169263	167988	168163
Covington (31)	56993	56540	56854	56786	56840
De Soto (33)	45125	42334	44634	44725	44997
Forrest (35)	93078	91033	90735	89589	89507
Franklin (37)	132566	129395	129078	129078	130751
George (39)	89397	90285	90236	88190	86989
Greene (41)	174951	175481	175122	174817	172764
Grenada (43)	65851	65731	64481	61562	61138
Hancock (45)	86499	86294	86266	84523	82457
Harrison (47)	110744	109421	108788	110712	110398
Hinds (49)	98655	97905	98923	98366	99445
Holmes (51)	136799	138992	138471	138696	139908
Humphreys (53)	22859	23194	23410	23436	25921
Issaquena (55)	48899	48451	47429	47619	49881
Itawamba (57)	116974	117192	117009	116828	116711
Jackson (59)	143189	143469	143238	142335	139985
Jasper (61)	137260	138717	138784	138825	137928
Jefferson (63)	115354	113750	113562	111917	112961
Jefferson Davi (65)	73345	72219	72187	72941	72049
Jones (67)	128891	129013	129214	128838	131248
Kemper (69)	170609	171472	170904	171646	172004
Lafayette (71)	118014	117024	118296	118091	118040
Lamar (73)	102483	100050	99729	99347	95827
Lauderdale (75)	141065	142596	138386	138669	138708
Lawrence (77)	79986	80786	80570	79799	79258
Leake (79)	119961	120534	120558	119203	118296
Lee (81)	38681	37849	37821	37312	35559
Leflore (83)	28044	29150	30640	30657	30572
Lincoln (85)	125810	124181	123858	123858	124709
Lowndes (87)	56692	55464	57985	55591	55776
Madison (89)	118195	112414	109521	109498	108523
Marion (91)	105495	107391	107863	107710	107424
Marshall (93)	116111	115821	115127	114990	113125
Monroe (95)	117285	119889	119737	119628	115638
Montgomery (97)	91052	90049	89462	89341	89562

County	2006	2009	2010	2011	2012
Neshoba (99)	120831	122333	122355	123376	122598
Newton (101)	126199	126700	125563	125911	124377
Noxubee (103)	130411	132048	132071	132029	126466
Oktibbeha (105)	102927	102100	102008	101924	102196
Panola (107)	85051	84064	86339	88562	88856
Pearl River (109)	154658	151102	150696	150371	149873
Perry (111)	136372	137150	136883	137532	136382
Pike (113)	67734	68365	68333	67724	65763
Pontotoc (115)	72481	71263	70759	70602	72054
Prentiss (117)	68782	67621	67544	67467	67405
Quitman (119)	15784	15935	15359	15345	15333
Rankin (121)	131481	135780	135786	134918	134396
Scott (123)	115163	115935	117650	117769	119522
Sharkey (125)	47127	46954	46890	47000	47306
Simpson (127)	107789	106700	106914	107255	106576
Smith (129)	131425	132166	132226	129522	130964
Stone (131)	116364	116556	116308	113655	113519
Sunflower (133)	5443	5660	5624	5617	8016
Tallahatchie (135)	51553	55285	55235	55454	57241
Tate (137)	44207	43492	44541	45099	45195
Tippah (139)	91647	91516	91386	91912	91492
Tishomingo (141)	79294	78911	76483	76397	76617
Tunica (143)	25399	27928	27861	27978	27774
Union (145)	52381	51518	51461	51405	50337
Walthall (147)	83579	83687	83492	83530	82385
Warren (149)	102972	102909	102657	103108	100586
Washington (151)	22054	21877	21856	19603	19458
Wayne (153)	177991	177645	179297	177779	178189
Webster (155)	71180	69677	69694	69621	69962
Wilkinson (157)	154513	154102	153655	153663	151532
Winston (159)	114294	114308	114319	114385	114173
Yalobusha (161)	103762	101321	101258	101107	101133
Yazoo (163)	119177	119874	119470	119515	121457
Totals:	**7940868**	**7919210**	**7920761**	**7908176**	**7885919**

ANNEX 2:

Loss and gain of forestland (in %) by county between 2006 and 2012

County	Total change (ha) 2006-2012	Total change (%) 2006-2012	Yearly average (%) 2006-2012
Washington (151)	-2596	-11.77%	-1.96%
Madison (89)	-9672	-8.18%	-1.36%
Lee (81)	-3122	-8.07%	-1.35%
Grenada (43)	-4713	-7.16%	-1.19%
Lamar (73)	-6656	-6.49%	-1.08%
Adams (1)	-5041	-5.20%	-0.87%
Hancock (45)	-4042	-4.67%	-0.78%
Union (145)	-2044	-3.90%	-0.65%
Forrest (35)	-3571	-3.84%	-0.64%
Tishomingo (141)	-2677	-3.38%	-0.56%
Pearl River (109)	-4785	-3.09%	-0.52%
Copiah (29)	-5311	-3.06%	-0.51%
Noxubee (103)	-3945	-3.03%	-0.50%
Pike (113)	-1971	-2.91%	-0.48%
Quitman (119)	-451	-2.86%	-0.48%
Carroll (15)	-3589	-2.86%	-0.48%
George (39)	-2408	-2.69%	-0.45%
Marshall (93)	-2986	-2.57%	-0.43%
Yalobusha (161)	-2629	-2.53%	-0.42%
Stone (131)	-2845	-2.44%	-0.41%
Warren (149)	-2386	-2.32%	-0.39%
Jackson (59)	-3204	-2.24%	-0.37%
Jefferson (63)	-2393	-2.07%	-0.35%
Prentiss (117)	-1377	-2.00%	-0.33%
Wilkinson (157)	-2981	-1.93%	-0.32%
Jefferson Davi (65)	-1296	-1.77%	-0.29%
Webster (155)	-1218	-1.71%	-0.29%
Lauderdale (75)	-2357	-1.67%	-0.28%
Montgomery (97)	-1490	-1.64%	-0.27%
Lowndes (87)	-916	-1.62%	-0.27%
Newton (101)	-1822	-1.44%	-0.24%
Walthall (147)	-1194	-1.43%	-0.24%
Coahoma (27)	-400	-1.41%	-0.23%
Monroe (95)	-1647	-1.40%	-0.23%
Leake (79)	-1665	-1.39%	-0.23%
Franklin (37)	-1815	-1.37%	-0.23%
Claiborne (21)	-1317	-1.32%	-0.22%

County	Total change (ha) 2006-2012	Total change (%) 2006-2012	Yearly average (%) 2006-2012
Greene (41)	-2187	-1.25%	-0.21%
Simpson (127)	-1213	-1.13%	-0.19%
Chickasaw (17)	-632	-0.97%	-0.16%
Lawrence (77)	-728	-0.91%	-0.15%
Lincoln (85)	-1101	-0.88%	-0.15%
Oktibbeha (105)	-731	-0.71%	-0.12%
Pontotoc (115)	-427	-0.59%	-0.10%
Smith (129)	-461	-0.35%	-0.06%
Harrison (47)	-346	-0.31%	-0.05%
Clarke (23)	-463	-0.30%	-0.05%
De Soto (33)	-128	-0.28%	-0.05%
Covington (31)	-153	-0.27%	-0.04%
Amite (5)	-396	-0.25%	-0.04%
Itawamba (57)	-263	-0.22%	-0.04%
Tippah (139)	-155	-0.17%	-0.03%
Winston (159)	-121	-0.11%	-0.02%
Choctaw (19)	-44	-0.05%	-0.01%
Perry (111)	10	0.01%	0.00%
Lafayette (71)	26	0.02%	0.00%
Wayne (153)	198	0.11%	0.02%
Sharkey (125)	179	0.38%	0.06%
Jasper (61)	668	0.49%	0.08%
Hinds (49)	790	0.80%	0.13%
Kemper (69)	1395	0.82%	0.14%
Attala (7)	2226	1.42%	0.24%
Neshoba (99)	1767	1.46%	0.24%
Benton (9)	1201	1.49%	0.25%
Marion (91)	1929	1.83%	0.30%
Jones (67)	2357	1.83%	0.30%
Yazoo (163)	2280	1.91%	0.32%
Issaquena (55)	982	2.01%	0.33%
Rankin (121)	2915	2.22%	0.37%
Tate (137)	988	2.23%	0.37%
Holmes (51)	3109	2.27%	0.38%
Alcorn (3)	2008	3.11%	0.52%
Scott (123)	4359	3.79%	0.63%
Calhoun (13)	3743	3.84%	0.64%
Panola (107)	3805	4.47%	0.75%
Bolivar (11)	2546	4.92%	0.82%
Clay (25)	3429	5.95%	0.99%

County	Total change (ha) 2006-2012	Total change (%) 2006-2012	Yearly average (%) 2006-2012
Leflore (83)	2528	9.01%	1.50%
Tunica (143)	2375	9.35%	1.56%
Tallahatchie (135)	5688	11.03%	1.84%
Humphreys (53)	3062	13.40%	2.23%
Sunflower (133)	2573	47.27%	7.88%
Totals:	**-54949**	**-0.69%**	**-0.12%**

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