

## **CHAPTER 8: FORESTRY LANDS ASSESSMENT (DRAFT)**

*The following chapter and associated GIS data are drafts that are pending peer review.*

### **Introduction**

The North Carolina Division of Forest Resources (NC DFR) is mandated and directed by Chapters 77, 113 and 143 of the North Carolina General Statutes and by Title 15, Chapter 9 of the North Carolina Administrative Code to protect, manage and develop the forest resources of the state. NC DFR accomplishes this mission by providing forest management assistance and reforestation services to private landowners, forest fire prevention and suppression, and insect and disease control programs. The DFR Forestry Lands Assessment attempts to capture the scope of that mission across the state.

Forested landscapes provide many ecosystem services, from wildlife habitat to water quality protection. As a result, many of the assessments in the One NC Naturally Conservation Planning Tool (CPT) consider forests to some extent. Likewise, this assessment values these associated ecosystem services in addition to economic values of North Carolina's Forest Resources. It is also appropriate to consider other forest resource issues that are not included elsewhere in the plan, such as forest health and wildfire threat. The resulting Forestry lands assessment is represented by two map products: Important Forest Lands and Threatened Forest Resources.

This assessment is designed to be used as a multipurpose tool to:

1. Assist with prioritization of conservation projects;
2. Benefit local planning efforts by providing a regional perspective on forest resources; and
3. Educate residents about the importance of their forests as working lands.

### **Related Assessments and Tools**

There are two prior regional-scale assessments of forest resources which provide data and methodology to the Forestry Lands Assessment: the Southern Wildfire Risk Assessment (SWRA) and the Southern Forest Land Assessment (SFLA). Both assessments were cooperative projects by the Southern Group of State Foresters. The Southern Group of State Foresters is made up of Puerto Rico and thirteen southern states: Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas.

The SWRA project, begun in 2003, is a region-wide risk assessment that identifies areas at risk for wildland fire in the South. Among the outputs of the assessment are indices of wildland fire susceptibility, fire effects, and fire

response accessibility, provided as 30-meter GIS datasets. The SFLA was conducted to identify important rural lands across the southern landscape where future efforts in rural forestry assistance should be focused. The primary GIS datasets produced for the SFLA were Resource Richness, Resource Threat, and Resource Priority. The priority layer is a combination of the richness and threat layers.

It is important to note that a future assessment, termed the “Long-Term State-Wide Assessment and Strategy for Forest Resources” (LTSWA) is forthcoming at the State level. The LTSWA is mandated by the 2008 Farm Bill for any state wishing to continue to receive cooperative federal funding, and will cover conditions and trends of forest resources in the state, threats to forest lands and resources in the state, priority areas within the state, and multi-state areas with are regional priorities. Multiple spatially-explicit models highlighting priority forest resource areas will be developed during this process. The Division of Forest Resources will also develop a strategy to address the threats to forest resources identified by the assessment. The assessment guidance, provided by the USDA Forest Service, mandates that assessments will be conducted using 30-meter or finer GIS data. This assessment must be completed by April of 2010.

As the LTSWA project moves forward, it can be expected that LTSWA products will replace the data produced for this Forest Lands Assessment, thus this assessment should be considered an “interim” assessment.

## **Methodology**

This assessment is logically grouped into two sections:

- **Important Forest Lands**
- **Threatened Forest Resources (GIS data not complete)**

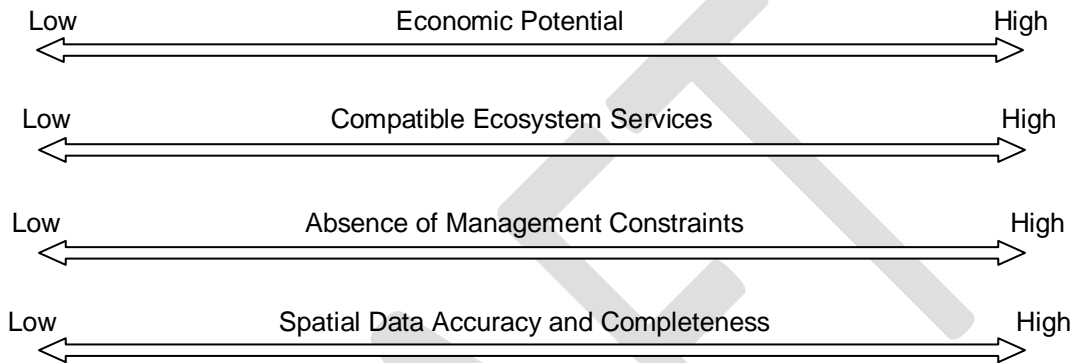
The ‘Important Forest Lands’ are those which are important for sustaining the forest products sector of our economy and providing ecosystem services that are compatible with forest management, such as protecting drinking water supplies. ‘Threatened Forest Resources’ are those resources that, if left unmanaged, are at risk of no longer providing their full benefit due to potential degradation from wildfire, pests, disease or forest fragmentation.

For each section, a set of principles were developed and agreed upon by NC DFR management to ensure that the assessment reflected the goals and values of the Division. These ‘guiding principles’ were used to select data layers that were included in the analysis. This ensures that the resulting map is as accurate and cohesive as possible.

## Important Forest Lands

In considering the factors that affect the value of a working forest, potential data layers were placed into one of three categories: economic potential, ecosystem services, and management constraints. These categories, plus an additional consideration for the accuracy and completeness of the data, were used as the guiding principles for this section:

### Guiding Principles for Important Forest Lands



### **Economic Potential**

North Carolina's forest land is one of the greatest influences on the state, providing great economic value and adding immeasurably to the quality of life for its citizens. In 2007, the forest products industry became the number one manufacturing industry in North Carolina, employing over 100,000 people and contributing \$3.6 billion in wages. Because forests are so important to the economy of North Carolina, measures that capture economic potential of the land were considered in the assessment. Data layers are detailed below:

#### **1. Soil Productivity Class - Goal: To place emphasis on areas that have the highest capacity for economic return.**

Physical and chemical properties of soil, such as percent organic matter, texture and pH, determine the productivity, and to some extent, the economic potential of a particular soil type for a given tree species.

Currently, the assessment uses a very basic process for assigning scores for soil productivity based on estimated Site Index. Site Index is a measure of forest soil productivity, expressed on a per-species basis as the height that dominant individuals of a species will reach at a specific "base age", typically 25 or 50 years old. The USDA Natural Resources Conservation Service has assigned Site Index values to soil polygons for a range of common species. The highest site index, regardless of species, is assigned and then reclassified based on the table below:

Site Index	Score
90+	10
80-89	8
70-79	6
60-69	4
40-59	2
Null	0

In the future, once soils data from across the state has been prepared, we will change to the following method for determining soil productivity: Each of the soil types in North Carolina have been classified by their ability to produce timber income and published in the *2006 Use Value Manual for Agricultural, Horticultural and Forest Land*. The manual gives five soil productivity classes based on site index, plus a sixth for soils of no value. This data will be combined with the existing STATSGO and SURGO spatial soils data to generate a new layer with the values listed below.

Soil Productivity Class	Score
I	10
II	8
III	6
IV	4
V	2
VI	0

**2. Haul Distance – (Currently Unavailable)** *Goal: To place emphasis on the areas closest to primary producers of forest products.*

Proximity to market, often referred to as ‘haul distance’, is a significant factor in the value of standing timber. Not only does haul distance affect the cost of delivery from a mill’s perspective, but having multiple markets available allows more options for management of a tract, such as ‘commercial thinning’. The values below represent an estimate of the average haul distances based on professional judgment of forest industry professionals in North Carolina. The values for the distances are based on the average haul for 75%, 95% and greater than 95% of the wood supply. Each area will be scored for its distance each of the following markets:

Mill Type	Score = 2	Score = 1	Score = 0
Chip / Saw	< 65 miles	65 – 110 miles	> 110 miles
Pulp	< 65 miles	65 – 110 miles	> 110 miles
Plywood Veneer	< 80 miles	80 – 120 miles	> 120 miles
Composite	< 80 miles	80 – 120 miles	> 120 miles
Pole	< 80 miles	80 – 120 miles	> 120 miles

**3. Forest Patch Size - Goal:** *To place emphasis on areas that will allow more management options and economic potential.*

Large forest areas allow more economic return and greater flexibility for forest management. In addition, wildlife species that prefer interior forest or that require large areas of forest as their home range also benefit from contiguous forest patches. Scores are assigned based on the total area of contiguous forest land in any patch:

Acres	# Pixels	Score
10,000+	44,965+	10
2,000-9,999	8993-44964	8
500-1,999	2248-8992	6
200-499	899-2247	4
50-199	225-898	2
0-49	0-224	0

**Ecosystem Services**

In addition to the economic return, a working forest also provides many other benefits as it grows from an early successional habitat to a closed canopy forest. Among these ecosystem services are: protection of water quality, improvement of air quality, provision of wildlife habitat and corridors, and carbon sequestration. This assessment takes these needed services into account by including layers that reflect their value.

**4. Water Supply Watersheds - Goal:** *To place emphasis on areas where working forests can protect water quality and provide real benefit to municipalities.*

The North Carolina Division of Water Quality Water Supply Watershed Protection Program has identified all watersheds that contain municipal water supply surface water intakes as 'Water Supply Watersheds'. These watersheds are subject to municipal ordinances which guide land use and development in order to protect the source of their drinking water. Conservation of these areas, which comprise approximately 20% of the total land area of North Carolina, is vitally important. All other things being equal, a working forest in these areas has a greater benefit to society than elsewhere. Water Supply Watersheds will be scored as 10 and other areas as 0 for this layer.

**5. Areas Adjacent to Conservation Lands – Goal:** *To place emphasis on areas where a working forest can add to existing open space.*

North Carolina is blessed with many holdings that are managed for open space, both private and public. Although many of these holdings, such as parks and Significant Natural Heritage Areas, may not be working lands, they can benefit from having adjacent lands conserved as a working forest to increase the overall size of the open space. Likewise, a working forest will benefit from adjacent lands or 'neighbors' that support the forest management activities. This layer will

be created from buffers placed on the 'Managed Areas' and 'Significant Natural Heritage Areas' data sets available from NC Natural Heritage. Areas within a ½ mile buffer will be scored as 10, areas within 1 mile will be scored as 5, and areas outside the buffer will be valued as 0.

**Management Constraints**

Some areas of the landscape are less accessible for forest management or carry extra restrictions. Other areas may be preserved for uses that are not compatible with the operational practices of a working forest. Areas that contain fewer of these management constraints are subsequently valued higher in the assessment.

**6. Riparian Buffers - Goal: To reduce emphasis on areas immediately adjacent to streams.**

While responsible forest management is one of the best land uses for protecting water quality, there are sensitive areas where management options require special care, such as riparian buffers. The stream distance used here was not chosen based on regulatory or recommended forest practices; rather, it was chosen as it is the minimum buffer size that could be maintained at a 30-meter pixel size. This layer will come from a buffer of the digital hydrography data set based on the NC DENR DWQ 24k Classified Streams. Values are listed below:

Distance from Stream	Score
0 – 50 meters	-10
> 50 meters	0

**7. Significant Natural Heritage Areas - Goal: To reduce emphasis on lands that contain Significant Natural Heritage Areas, which may not be compatible with the full suite of practices associated with forest management.**

The North Carolina Department of Environment and Natural Resources, Division of Parks and Recreation, and Natural Heritage Program, in cooperation with the NC Center for Geographic Information & Analysis, developed the Significant Natural Heritage Areas digital data to determine the areas containing ecologically significant natural communities or rare species. These areas should be managed to support those communities and therefore may not be compatible with traditional forest management. These areas will be scored according to their rank with the following premise: The rarer a particular community is, the less management tools will be available, and therefore it would be better conserved under a different management scheme.

SNHA Rank	Score
A	-10
B	-8
C	-5
D	-2

**8. Slope – Goal:** *To place emphasis on areas that are easier to manage and maintain high water quality.*

Extreme slope can present a challenge to forest management in nearly all phases of management, from road construction to tree planting. While the steepest areas have and continue to provide all of the benefits of a working forest, they also require more diligence on the part the operator. More measures are necessary to ensure a successful job and this not only increases cost, but there is more is at stake when problems do occur. Slope will be based on the NC DOT DEM Lidar-derived dataset and scored as follows:

Slope	Score
1% - 10%	10
11% - 20%	8
21% - 30%	6
31% - 40%	3
> 40%	0

**9. Wetlands – Goal:** *To place emphasis on areas that are more suitable and accessible for forest management.*

Advances in low ground pressure equipment and ‘mat logging techniques’ have made it possible to access timber in wet areas with minimal disturbance. However, even with those tools available, some areas are still only accessible a few months of the year or even only during certain years. The score of -10 for wetlands and 0 for other areas reflects the preference for areas that are more suitable for forest management. In the future this layer will be replaced with a merged layer including data describing wetland quality from the NC Division of Coastal Management. This will be used to discriminate low-quality wetlands which can be very compatible with forest management.

**Masks**

A mask serves the purpose of identifying areas that should or should not be considered in the final area. For instance, if you chose to ‘mask out’ open water, then your final map would not contain any data for those areas, which would make sense here because there are no forests to be managed in the middle of a lake. Two masks will be used for the ‘Important Forest Lands’ layer:

**10. Forest Lands Mask – Goal:** *To ensure that only areas of forest lands are considered on this map.*

This mask will remove from consideration all areas that are not or could not be forested. These areas include agricultural lands, open water, bare rock, unconsolidated sediment and high density urban areas. This source for this information is the 2001 MRLC Landcover dataset, which broadly classifies land cover type. In the future, agriculture may be removed from the mask to show areas where afforestation would be an appropriate forestry activity.

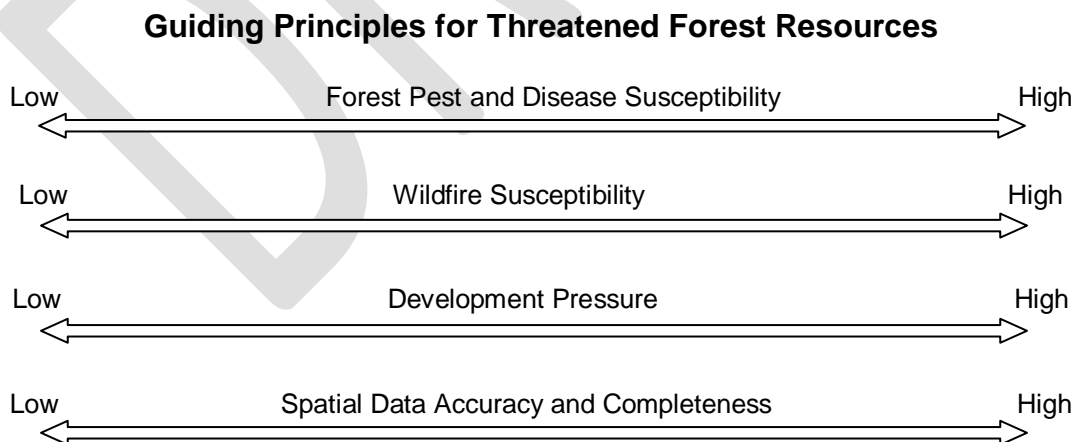
**11. Preserved Land Mask** - Goal: To remove lands that are preserved and have no potential to be managed as a working forest from consideration for this map. This is land that is already set aside as open space but has restrictions that do not allow traditional forest management. This data comes from the 'Lands Managed for Conservation and Open Space' dataset from NC One Map. Lands in this data set, such as National or State Parks, will be identified and assigned a null value in the final map.

## Threatened Forest Resources

The Southern Group of State Foresters funded a GIS-based assessment of the forest resources in the Southern United States; a project known as the 'Southern Forest Lands Assessment'. The SFLA is a southern region assessment designed to determine forest land importance values that will guide expenditures of federal Forest Service funds in the Region.

This assessment contains a 'Forest Resource Threat' layer which is comprised of three relevant datasets. This layer reflects the concerns of the Division and is suitable for inclusion into the North Carolina Strategic Conservation Plan as our 'Threatened Forest Resource' layer. A description of that data set is below.

In considering the factors that affect the health and condition of a forest, three types of data were considered: Forest Pest and Disease Susceptibility, Wildfire Risk, and Development Pressure. These categories, plus an additional consideration for the accuracy and completeness of the data, are the guiding principles for this section.



**1. Forest Pest and Disease Susceptibility – Goal: To place emphasis on forest resources that are at risk of mortality due to forest pest or disease and where planning and management can reduce this risk.**

A National Insect and Disease Risk Map (NIDRM) was completed in 2006 as a strategic assessment of the risk of tree mortality due to major insects and diseases. The NIDRM is compiled from nearly 190 separate models in a GIS-based framework that assigns risk to individual 1 kilometer pixels based on forest type, host species basal area, and numerous other factors associated with different host species and damage agents. The risk assigned is a projection of expected volume lost in trees 1" and larger in diameter over the next 15 years. This data will be scored as follows:

Percent mortality expected over 15 years	Score
0% - 5%	0
6% - 15%	33
16% - 25%	66
26% - 100%	100

**2. Wildfire Susceptibility – Goal: To place emphasis on areas with high risk of wildfire where planning and management can reduce this risk.**

The Southern Group of State Foresters funded the Southern Wildfire Risk Assessment, a region-wide risk assessment to identify areas at risk for wildland fire within each State. This product considers terrain, surface fuels and canopy fuels, historical weather, historical fire occurrence and fire behavior metrics to calculate probabilities of any unit of land burning. The output from this model, the 'Wildfire Level of Concern' will be used to score this layer as follows:

Level of Concern	Score
0	0
10 - 400	11
401 – 2,400	22
2,401 – 45,800	33
45,801 - 642,900	44
642,901 – 1,359,300	55
1,359,301 – 3,426,800	67
3,426,801 – 4,999,900	78
4,999,901 – 14,999,000	89
> 14,999,000	100

**3. Development Pressure – Goal:** *To place emphasis on rural areas that are expected to increase significantly in housing density in the next 25 years.* As populations expand into rural areas, the ability of these areas to be managed and function as an intact resource diminishes. This layer is based on an analysis of expected housing density increase between the years 2000 and 2030, conducted by David Theobald, Colorado State University.

The layer is based on the following premises:

1. There is resource threat from increases in density (subtle or extreme) occurring in rural areas.
2. There is more threat to the resource when increases are larger in magnitude.
3. Once housing density reaches a certain threshold, there is little chance we can affect change; therefore, increases in density in developed areas has no more threat.

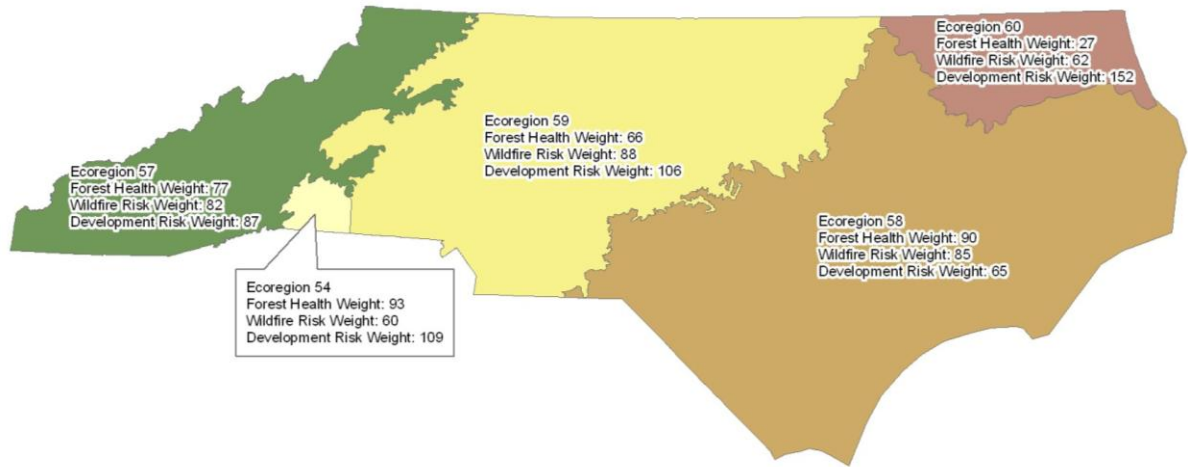
Pixel values are based on changes expected between 2000 and 2003. The scores range 0 to 100 based on the magnitude of expected increase in housing density, where 0 represents no threat and 100 represents high threat:

2000	2030														
	UP	Rural					Exurban					SubU	Urban		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	50	70	90	100	100	100	100	100	100	100	100	100	100	100
2		0	60	80	90	100	100	100	100	100	100	100	100	100	100
3			0	70	90	100	100	100	100	100	100	100	100	100	100
4				0	80	90	100	100	100	100	100	100	100	100	100
5					0	90	100	100	100	100	100	100	100	100	100
6						0	100	100	100	100	100	100	100	100	100
7							0	70	70	70	70	70	70	70	70
8								0	30	30	30	30	30	30	30
9									0	10	10	10	10	10	10
10										0	0	0	0	0	0
11											0	0	0	0	0
12												0	0	0	0
13													0	0	0
14														0	0
15															0

UP = Undeveloped Private  
 SubU = Suburban

**3. Weighting – Goal:** *To vary the importance of each layer depending on how important that factor is within a specific ecoregion.*

The importance of development pressure, forest health, and wildfire risk as contributing factors to overall forest threat varies between ecoregions. Forestry experts from North Carolina and neighboring states collaborated to assign weights for each layer within each ecoregion that occurs in the state. To calculate the final score for a given pixel, each layer's score is multiplied by its corresponding weight, and the multiplied scores are added. Weights for each layer can be viewed in the figure below, by ecoregion



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## Data Layer Summary

The 'Important Forest Lands' layer is a composite of the following data layers:

### *Economic Potential*

- 1. Soil Productivity Class**
- 2. Haul Distance**
- 3. Forest Patch Size**

### *Ecosystem Services*

- 4. Water Supply Watersheds**
- 5. Areas Adjacent to Conservation Lands**

### *Management Constraints*

- 6. Riparian Buffers**
- 7. Significant Natural Heritage Areas**
- 8. Slope**
- 9. Wetlands**

### *Mask Layers*

- 10. Forest Lands Mask**
- 11. Preserved Land Mask**

The 'Threatened Forest Resources' layer is a composite of the following data layers from the Southern Forest Lands Assessment:

- 1. Forest Pest and Disease Susceptibility**
- 2. Wildfire Susceptibility**
- 3. Development Pressure**