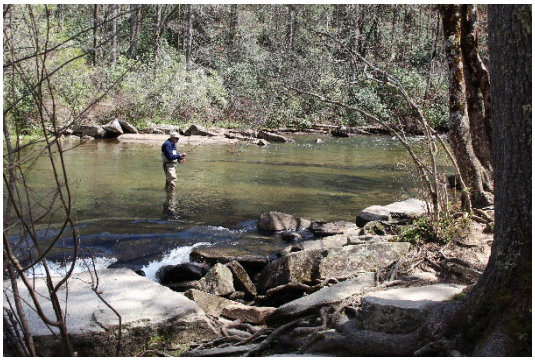

2020 **North Carolina Forest Action** Plan

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N.C. Department of Agriculture and Consumer Services.
Steve Troxler, Commissioner

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North Carolina Department of Agriculture and Consumer Services
N.C. Forest Service

Steven W. Troxler
Commissioner

Scott Bissette
Assistant Commissioner

December 18, 2020

Dear friends and colleagues,

For any ongoing effort, evaluation is instrumental in helping determine what works well and where improvements are needed. The management of our forest resources is no exception. It is necessary to periodically evaluate the condition of these resources and to analyze whether our programs and policies can help the people of North Carolina effectively conserve, develop and manage our woodlands. Recognizing this, we invited partners and forest stakeholders across the state to provide input and help make this plan a relevant and useful tool.

This 2020 North Carolina Forest Action Plan not only evaluates past and current forest conditions, but also considers future conditions that may impact conservation. The plan includes goals and objectives that offer actions for the next 10 years that are needed to address key findings of this assessment. Specific strategies, developed through a multi-stakeholder approach, are listed to help us achieve these goals and objectives.

From the mountains to the coast, we are fortunate to have rich and diverse forest resources in North Carolina. Our forests clean our air, filter our water and provide essential wildlife habitat and recreational opportunities. Forests are the dominant land use in North Carolina, and the forest industry in our state is a robust economic engine ensuring jobs for thousands of our citizens.

There are many challenges and stressors to the sustainability of our woodlands, such as climate variability, the spread of invasive species and increasing urbanization. There are also clear opportunities to conserve, restore and even expand our forests. Together, we can continue to enhance the quality of life for all North Carolinians through active forest management and responsible stewardship. We hope you find this 2020 North Carolina Forest Action Plan useful and look forward to continuing our strong forestry partnerships across all of North Carolina.

Scott Bissette
Assistant Commissioner of Agriculture

David Lane
North Carolina State Forester

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Executive Summary

Driven by the need to efficiently target our collective efforts and resources, the 2020 North Carolina Forest Action Plan represents a clear path for protecting, conserving and enhancing North Carolina's forest resources and the many benefits we enjoy from them. While the mandate for this critical assessment originated in the 2008 Farm Bill under the Cooperative Forestry Assistance Act, its origins are deeply-seated in a public that demands increased impact, accountability and innovation from its agencies. With that challenge as our goal, a committed group of staff, partners and sister agency personnel collaborated over the past year to make this Forest Action Plan a reality.

The format of this Plan reflects the connection between the three national forest priorities and the associated goals established by North Carolina. Each goal ties directly to one of the national priorities and provides a "forest roadmap" for the State. The five goals identified for North Carolina's forests are:

Goal 1. Increase the Sustainable Management and Conservation of Forests

Goal 2. Reduce Negative Impacts from Forest Threats

Goal 3. Increase the Beneficial Use of Prescribed Fire

Goal 4. Manage and Conserve Forests for Clean Water

Goal 5. Conserve and Enhance the Benefits and Sustainable Management of Urban Forests

As part of each goal, "five key points" are highlighted to help readers quickly identify notable themes and issues. Each goal section provides a comprehensive assessment of the current conditions, trends and the impending threats and opportunities for our forests. Objectives that provide specific pathways for achieving each goal are provided. All objectives include strategies that stakeholders should consider incorporating into their organizations' work plans and efforts. These strategies involve actions at various levels (ex. State, county, individual woodland owners) but all are aimed at making North Carolina's rural and urban forest resources healthier, more resilient and productive.

Maps can be found throughout the Plan to communicate forest conditions and highlight areas that will benefit by implementing recommended strategies. Many maps are issue-specific and were developed to inform stakeholders, focus implementation and ultimately improve the strategic utilization of resources. Priority maps are not intended to restrict overall program delivery nor interfere with equitable provision of assistance or services.

North Carolina is fortunate to have diverse and strong forest resources. It also has a Forest Community of stakeholders that have proven they are capable of effective collaboration. We hope this Forest Action Plan will be a relevant and useful tool as we all strive to conserve and sustain our woodlands that provide us with so many benefits.

Acknowledgements

Managing and protecting our forests are shared responsibilities that cross many jurisdictions, ownerships and disciplines. The 2020 North Carolina Forest Action Plan (NCFAP) was created with the input and assistance of a wide variety of forest stakeholders from across the state. Thank you to all who were involved in this effort.

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North Carolina's Forests and Forest Owners

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Goal 2: Forest Threats — Gail Bledsoe / Rob Trickel
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Goal 4: Manage and Conserve Forests for Clean Water —Tom Gerow
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Stakeholders/Contributors

Since the NCFAP addresses all forests in North Carolina, it was imperative that it be developed using a collaborative approach. In late 2019, 61 stakeholders/organizations provided survey feedback relating to the conditions, opportunities and needs of North Carolina's forests. This input, and the efforts of the multi-stakeholder working groups, were the basis for how the NCFAP was developed. 22 stakeholders/organizations provided review feedback on the draft NCFAP via a mid-2020 survey. The survey was shared with multi-stakeholder groups such as the Natural Resources Conservation Services (NRCS) State Technical Committee, the State Stewardship Coordinating Committee and the North Carolina Forest Advisory Council. To gain buy-in and support, the N.C. Forest Service presented to groups such as the State Stewardship Coordinating Committee and the U.S. Forest Service leadership team about the draft NCFAP and the process used to develop it.

Some of these referenced participants are listed below. Our apologies to any contributors we may have omitted.

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Shelby Nursery, Inc.	Trey Warrick
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The Conservation Fund	Justin Boner
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The Longleaf Alliance	Ryan Bollinger
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The Nature Conservancy	Jeff Marcus

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2020 N.C. Forest Action Plan (NCFAP) Overview

The 2008 Farm Bill amended the Cooperative Forestry Assistance Act of 1978 to include the requirement that each state develop a long-term, statewide assessment and strategies for managing its forest resources. North Carolina developed the initial 2010 NCFAP through a collaborative effort with a long list of forest stakeholders. Cross-boundary, landscape-scale strategies were identified to address issues of concern as well as opportunities. This 2010 effort was framed in the context of the following three national forest priorities:

- ***Conserve and Manage Working Forest Landscapes for Multiple Values and Uses***
- ***Protect Forests from Threats***
- ***Enhance Public Benefits from Trees and Forests***

This updated 2020 NCFAP is a thorough review of North Carolina's forests, with a focus on changes and trends that have occurred since the initial 2010 NCFAP. Five multi-stakeholder working groups were established to address the following NCFAP goals:

Goal 1. Increase the Sustainable Management and Conservation of Forests

Goal 2. Reduce Negative Impacts from Forest Threats

Goal 3. Increase the Beneficial Use of Prescribed Fire

Goal 4. Manage and Conserve Forests for Clean Water

Goal 5. Conserve and Enhance the Benefits and Sustainable Management of Urban Forests

In addition to highlighting strategies and key partnerships, each goal documented the following information as it related to its topic:

1. Current Condition and Trends
2. Notable Threats
3. Supporting Information
4. Priority Areas
5. Strategies
6. Notable Resources Needed
7. Example Metrics
8. Key Partnerships

Working groups utilized a combination of geospatial and programmatic data to communicate trends and needs relevant to each goal. Priority maps, along with issue and program-specific maps, have been utilized to focus the conversation. The intent is for all forest stakeholders in North Carolina to reference this ten-year plan and incorporate applicable strategies into their organization's efforts so we can collectively keep North Carolina's woodlands healthy, productive and resilient.

North Carolina's Forests and Forest Owners

In continuous operation since 1930, the USDA Forest Service Forest Inventory and Analysis (FIA) program published the first reports for North Carolina in 1938. The FIA program collects, analyzes, and reports information about the status and trends of America's forests. This information can be used in many ways, such as for evaluating wildlife habitat conditions, assessing the sustainability of ecosystem management practices and supporting the planning and decision-making activities undertaken by public and private enterprises. In North Carolina, the FIA program operates as a partnership between the USDA Forest Service, the Southern Research Station and the N.C. Forest Service (NCFS). North Carolina FIA summary data and reports are available at https://www.fs.usda.gov/srsfia/states/north_carolina.shtml. Readers interested in learning more about the FIA Program can visit https://www.fia.fs.fed.us/about/about_us/.

Forestland

Forestland Area, 2019[1,2]

- Forests are the dominant land use in North Carolina, covering 18,750,216 acres or 61% of the state's total land area.
- About 3% of forestland, or 630,629 acres, is in reserved status and removed from commercial timber production. Most of this occurs in the Great Smoky Mountains National Park, national wildlife refuges and national forest wilderness areas. Less than 1% of forestland, or 36,880 acres, is unproductive from a commercial timber standpoint due to conditions such as soil and site productivity, elevation, steepness, poor drainage, rockiness and others.
- Ninety-six percent of forestland, or 18,082,708 acres, is classified as timberland. This classification includes forestland capable of commercial timber production and not in reserved status or unproductive.

Additional highlights are available in the USDA Forest Service FIA program's publication "Forests of North Carolina, 2019" which can be found in this plan's Appendix section.

Timberland

Forest Types (area of timberland)

- Hardwood forest types dominate North Carolina's timberland area with 11.5 million acres or 64%. Softwood types comprise 6.4 million acres or 36%.
- The most prevalent forest type groups in terms of timberland area are oak-hickory at 6.8 million acres or 38%; loblolly-shortleaf pine at 5.9 million acres or 32%; oak-pine at 2.2 million acres or 12%; and, oak-gum-cypress at 1.7 million acres or 9%.

Species Groups (net volume of all live trees on timberland)

- Hardwood species comprise 63% or 27.2 billion cubic feet of the total live tree volume, with 37% or 16.0 billion cubic feet occurring in softwood species.
- Live tree volume is concentrated in loblolly & shortleaf pines at 27%; yellow poplar at 14%; soft maple at 7%, sweetgum at 6%; and, other red oaks at 6%.

Species Groups (net volume of growing stock trees on timberland)

- Sixty percent of the total net volume of growing stock trees occurs in hardwood species groups totaling 23.5 billion cubic feet, with 40% occurring in softwood species groups totaling 16.0 billion cubic feet.
- The net volume of growing stock trees is concentrated in loblolly-shortleaf pine at 30%; yellow poplar at 15%; sweetgum at 7%; and, other red oaks at 6%.

Species Groups (net volume of sawtimber trees on timberland)

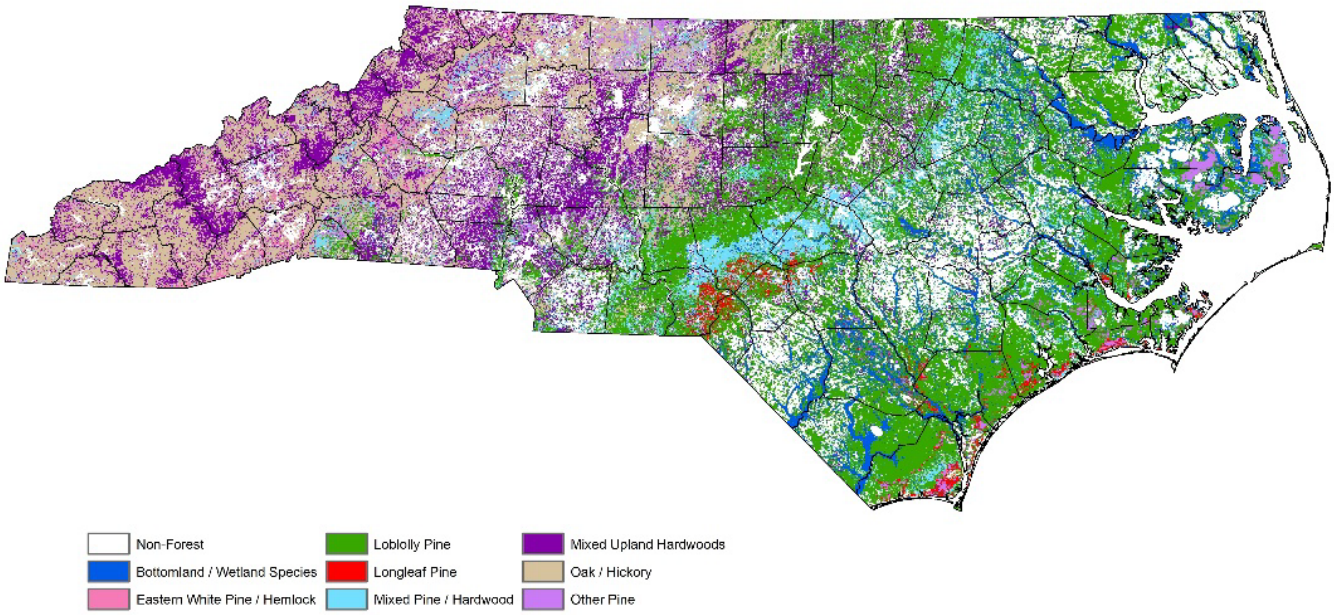
- Fifty-seven percent of the total net volume of sawtimber trees occur in hardwood species groups totaling 85.1 billion board feet, with 43% occurring in softwood species groups totaling 63.1 billion board feet.
- The net volume of sawtimber trees is concentrated in loblolly-shortleaf pine at 31%; yellow poplar at 17%; other red oaks at 6%; and, select white oaks at 6%.

North Carolina's Urban Forests[7]

Urban lands in North Carolina total 3.9 million acres or 11.5% of North Carolina's 34.4 million acres. Refer to Figure 5.3.1 in the Goal 5 section of this document.

- There are an estimated 319.8 million urban trees, storing 53 million tons of carbon.
- North Carolina's urban tree canopy cover is 54.2%.
- Each year, urban trees sequester 21 million tons of carbon and capture 50.3 million tons of pollutants.

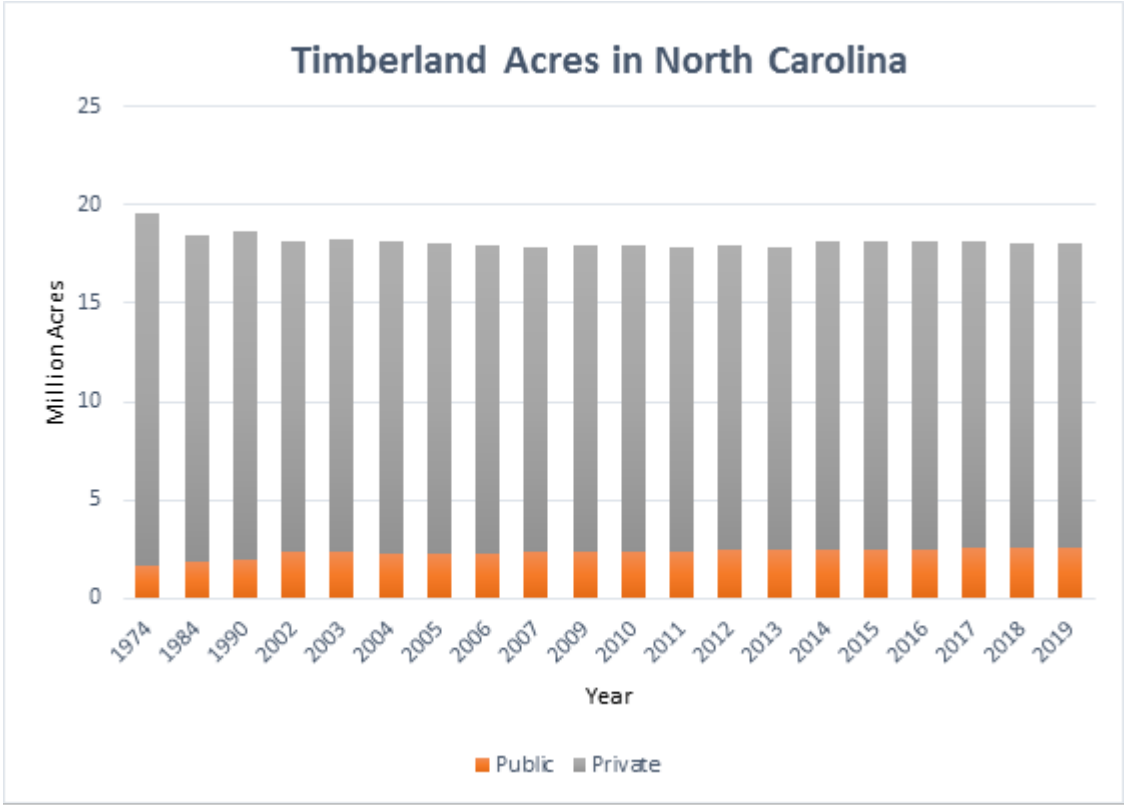
Figure A. Distribution of Major Forest Types in North Carolina



Status of North Carolina's Timberlands

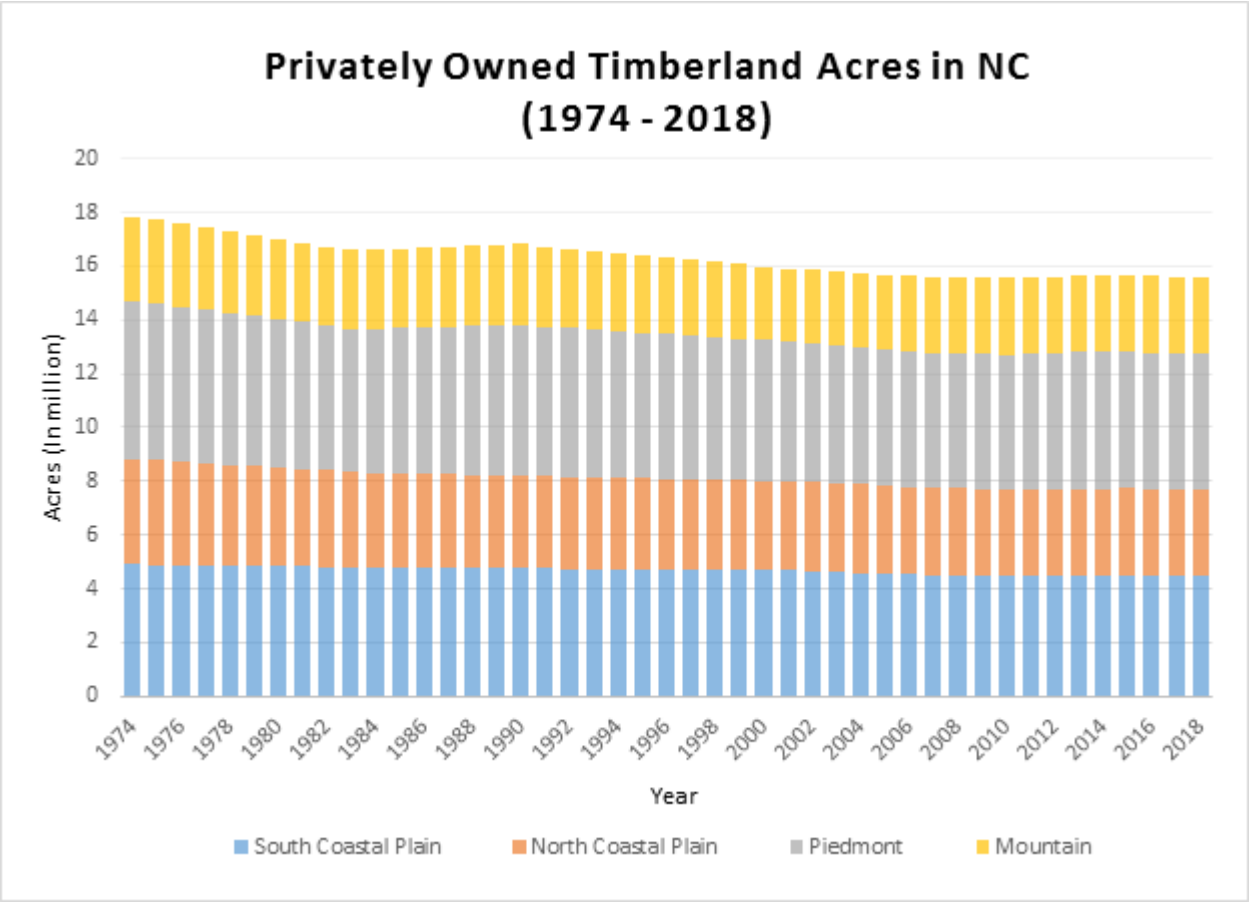
Readers interested in viewing detailed FIA-based growth and removal charts for North Carolina can refer to the "Growth and Removals on North Carolina Timberlands" report in this plan's Appendix section. These charts offer a variety of specific assessments, including those categorized by forest product class and even by region of the state.

Figure B. Total Publicly- and Privately-Owned Timberland Acres in North Carolina[6]



The total timberland acres in North Carolina declined from around 19.5 million acres in 1974 to about 17.8 million acres in 2011, and from 2012, it experienced a steady growth reaching 18.1 million acres in 2019. While total acres of privately-owned timberland decreased in North Carolina, acres of publicly owned timberland increased in recent years. In 2019, total acres of public and private timberland in North Carolina were 2.5 million acres and 15.5 million acres, respectively.

Figure C. Total Privately-Owned Timberland Acres in North Carolina by Survey Units[6]



The total privately-owned timberland in North Carolina has been slightly declining over the years. In 2018, total acres of private timberland sum about 15.5 million acres, down 3% since 2000. In terms of region, the Piedmont region has more than 5 million acres of timberland, followed by the Southern Coastal Plain with 4.4 million acres, the Northern Coastal Plain with 3.2 million acres, and the Mountains region with 2.8 million acres.

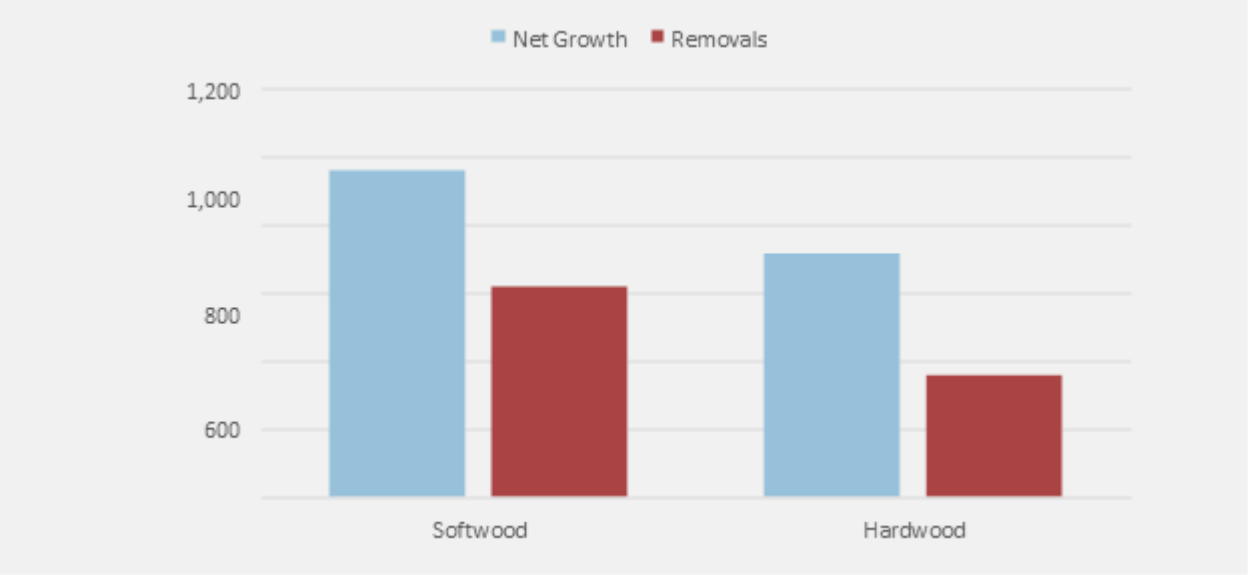
Figure D. Timber Growth and Removal Table and Chart[3]

All Live Trees

Growth and removals of all live trees on all timberland in North Carolina, 2019

	Softwood	Hardwood	All
Net Growth	956.6	713.0	1,669.6
Removals	620.8	360.6	981.4
Ratio (G:R)	1.54	1.98	1.70

Volume in million cubic feet per year.



Forestland Ownership

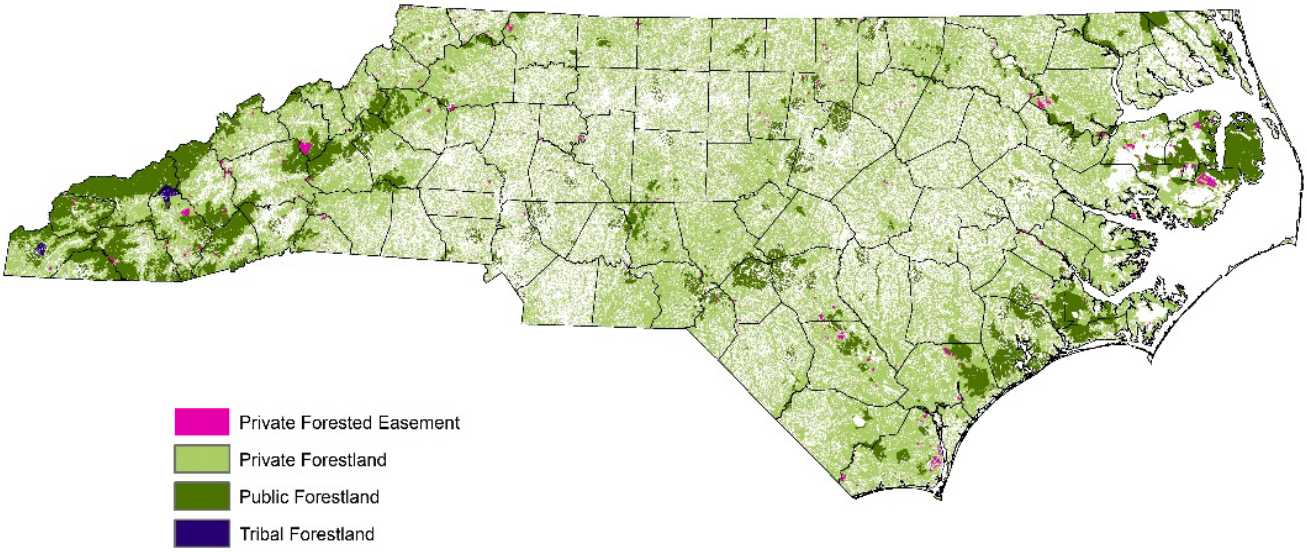
Forestland Ownership, 2019[4]

North Carolina is fortunate to have such diverse forest types. The many different categories of forest owners and the critical role that private landowners play in overall forest sustainability in North Carolina is significant. This section breaks down and describes the different ownership categories that own forestland across North Carolina.

Figure E. Estimated Area of Forestland by Ownership Category, North Carolina, 2017-2018

Ownership Category	Acres (thousands)	Percentage
Private		
Family	10,548	56%
Corporate	4,686	25%
Other private	306	2%
Total private	**15,540**	**83%**
Total Tribal	**25**	**<1**
Public		
Federal	2,082	11%
State	842	5%
Local	269	1%
Total public	**3,193**	**17%**
Total	**18,758**	**100%**
Note: Data may not add to totals due to rounding		
Source: Butler et. al. 2020		

Figure F. Forest Ownership in North Carolina



Private Forestland Owners

- About 83% of forestland, or 15.6 million acres, is privately owned.
- Ninety-five percent of private forestland is categorized as nonindustrial ownership, with 5% in forest industry ownership.
- Within the nonindustrial category, individual landowners hold 70% of private forestland, or 10.5 million acres, and comprise the largest forest ownership category at 56%.
- The remaining 30% of nonindustrial private forestland is held by nonforest industry corporations, conservation and natural resource organizations, unincorporated local partnerships, associations and clubs, and Native American entities.

North Carolina's Family Forest Owners, 2018

- Family ownership is a subset of the nonindustrial private category discussed in the previous section and is synonymous with individual private ownership.

Family forest ownership of 10+ acres:

- The USFS estimates that approximately 179,000 individuals and families own about 9.5 million acres of North Carolina forestland in parcels of at least 10 acres.
- About 49% is categorized as joint spousal ownership. About 28% is owned by individuals while 15% is other joint ownership. Ten percent is controlled by a family LLP or LLP while 4% is controlled by a trust or estate.
- About 18% of owners in this group indicated that they have a written management plan, corresponding to about 4.4 million acres collectively. Sixteen percent of all owners indicated that they have implemented practices from their management plan.
- Sixty-one percent indicated that they have cut or harvested trees, with 42% harvesting logs, 22% cutting firewood and 17% harvesting pulpwood or wood chips. Twenty-seven percent used or consulted a forester for the harvest.
- Nineteen percent indicated that they have participated in property tax programs.
- The greatest concerns of landowners in this group were property taxes, trespassing/poaching, dumping/vandalism, wildfire, keeping the land intact and government regulation.

Family forest ownership of 10-99 acres:

- Approximately 119,000 individuals and families own about 2.3 million acres of forestland in parcels of 10-50 acres.
- Approximately 141,000 individuals and families own about 3.2 million acres of forestland in parcels of 10-99 acres.

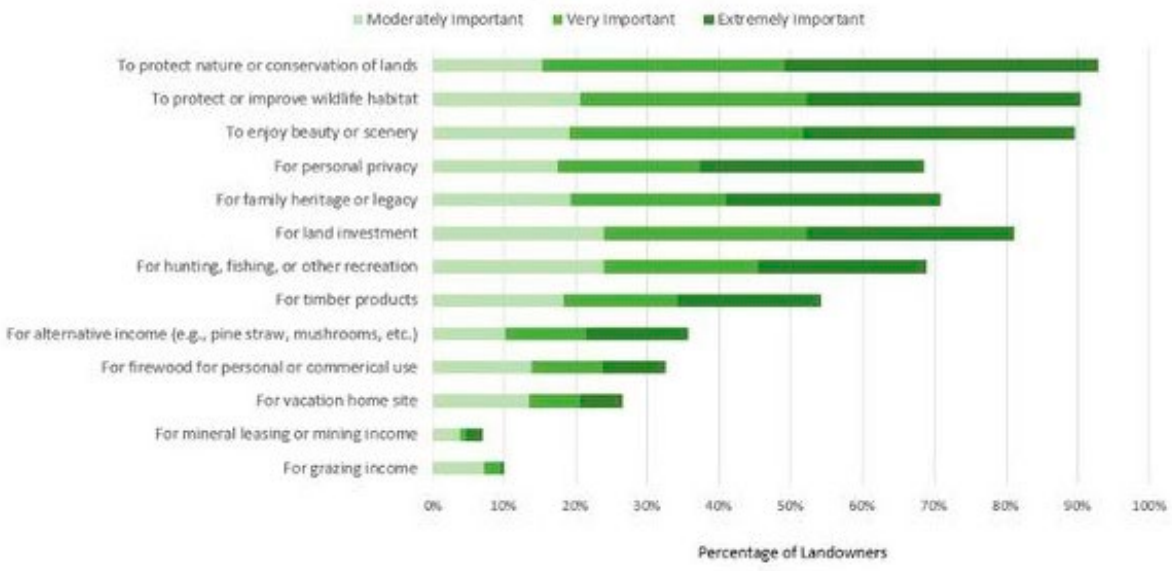
Family forest ownership of 100+ acres:

- Approximately 21,000 individuals and families own about 5.3 million acres of forestland in parcels of 100 acres of more.
- About 5,000 individuals and families own more than 500 acres of forestland.
- Fifty-five percent of owners in this category indicated that they have a written management plan. Twenty-nine percent of these plans were written by a private consulting forester. Fifty percent of owners indicated that they have implemented management practices from their plan.
- Eighty-eight percent of these owners indicated that they have harvested or cut trees, with 74% harvesting timber for sale and 24% for personal use. Fifty-seven percent indicated that a forester was used or consulted for the harvest.
- Forty-nine percent indicated that they plan to harvest timber for sale in the next five years.
- Forty-nine percent indicated that they are currently enrolled in a property tax program.
- Eleven percent indicated that they have participated in cost share programs.
- The greatest concerns of landowners in this group were property taxes, trespassing/poaching, dumping/vandalism, government regulation, keeping the land intact and wildfire.

2020 North Carolina State University Extension Forestry Woodland Owner Survey Highlights[5]

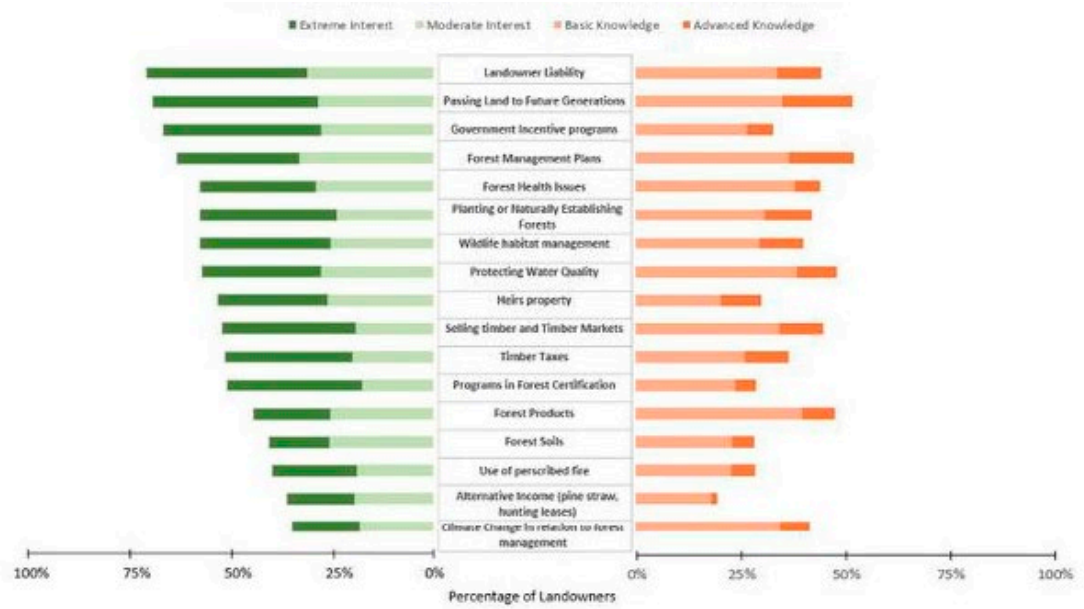
Nonindustrial private forestland (NIPF) owners in North Carolina were asked to rank 13 potential reasons for owning forestland, using a scale of "Not important" to "Extremely important." Most landowners indicated that noneconomic reasons were more important in owning their land than economic reasons, with an average ranking of "Moderate" to "Extremely important." The top 3 reasons NIPF landowners own their land focus on conservation, wildlife and aesthetics.

Figure G. Nonindustrial Private Forestland Landowner's Reason for Owning Land — Ranked by Level of Importance



Landowners expressed their current level of interest and knowledge in 17 forestry topics. The top five topics of interest relate to owning and managing land with less focus on economic-based topics such as selling timber and timber markets which ranked 10th, and timber taxes which ranked 11th. Of the top five topics of interest, most landowners expressed having the most knowledge about passing their land to future generations and forest management plans. For the remaining topics, most landowners had minimal knowledge of the subject area, indicating the need for more educational programs and materials.

Figure H. Forestry Topics Ranked by Highest Level of Interest Compared to Current Level of Knowledge



Public ownership of forests in North Carolina, 2019

- Of the 17% of forestland in public ownership, 3.2 million acres or 65% is in federal ownership. Approximately 1.2 million acres of this forestland are national forests, controlled by the U.S. Forest Service (USFS). Other federal ownership includes the National Park Service (NPS), U.S. Fish and Wildlife Service (USFWS), Department of Defense (DoD), Department of Energy (DOE), and other federal agencies.
- State and local governments control 1.1 million acres or 35% of all public ownership.

USFS National Forests in North Carolina

- The USFS is the largest owner of public forestland in North Carolina, controlling approximately 1.25 million acres of forestland across four national forests: Nantahala and Pisgah (Mountains), Uwharrie (Piedmont) and Croatan (Coastal Plain).

Figure I: Area of National Forests and Associated Ranger Districts, North Carolina

Area of North Carolina's National Forests and Ranger Districts		
National Forest	**Ranger District**	**Acres**
Croatan	Croatan	161,291
Nantahala		**527,253**
	Cheoah	122,032
	Nantahala	245,266
	Tusquittee	159,955
Pisgah		**516,137**
	Appalachian	160,849
	Grandfather	192,473
	Pisgah	162,815
Uwharrie	Uwharrie	51,406
Total	all	1,256,087

Source: USFS National Forests in North Carolina Staff,
Forest Supervisor's Office, Asheville, NC 2020

Consistent with the USFS motto, "Caring for the Land and Serving the People," the following four overarching themes guide management and operational priorities on the four diverse national forests units, comprising the National Forests in North Carolina (NFsNC):

- **Connecting People to the Land**

  From the very beginning, the NFsNC have been recognized for their importance to people. The rich cultural mosaic of people who have called this region their home depends on the forest for scenic beauty, year-round outdoor play and exercise, spiritual renewal, traditional uses like hunting and gathering, and economic opportunity. With this theme, the forest recognizes the contribution of the NFsNC to communities and quality of life in the broader region and the cultural traditions and economies that depend on the forest. Management focuses on sustainable recreation, volunteerism, nature-based education, forest products, protection of cultural resources and historic sites, and relationships with federally recognized tribes.

- **Sustaining Healthy Ecosystems**

  The NFsNC support a diversity of forest communities that range from longleaf pine to northern hardwood forests. With this theme, the forest focuses on improving the ability of forests to remain healthy and resilient despite stresses and disturbances. Objectives under this theme address maintaining and improving the diversity of forest structure (age classes or seral stages), composition (species), and function; managing the use of silvicultural and fire tools; managing for wildlife habitat and rare species and communities; and, controlling noxious weed and invasive plants.

- **Providing Clean and Abundant Water**

  Water is a life-sustaining resource for the NFsNC and the natural and social communities that depend on them. Beyond the ecological communities, forest waters also support municipal water supplies, tribal lands, agriculture and industry. With this theme, management focuses on sustaining surface water and groundwater flow, maintaining natural hydrology and fish and wildlife habitat, controlling erosion, and stabilizing streambanks and applying best management practices (BMPS) for water quality. Activities under this theme include watershed improvement projects, road maintenance, stream restoration and habitat management.

- **Partnering with Others**

  The USFS collaborates with partners to enhance its mission to sustain the NFsNC. Forest managers work with other federal, state and local governments, tribes, and partners across boundaries to achieve shared objectives. Working collaboratively allows us to accomplish more work on the ground than any one agency could do alone. The forest strives to be a model for partnerships where citizens and groups can engage in project development early in the process, and the forest works to identify opportunities to accomplish cross-boundary needs that serve the American public.

Economic Contributions

North Carolina's national forests support local economies through recreation, timber, energy, minerals and livestock grazing. Additionally, counties with national forests or grasslands receive funds to support schools, road maintenance and stewardship projects. The USFS also invests in such things as the construction and maintenance of infrastructure, environmental restoration and forest health. In 2016, the sum of these activities on the NFsNC supported approximately 6,330 local jobs and $225,176,000 in local labor income.

North Carolina's national forests provide immense public recreation opportunities, supporting 6.2 million visitors in 2016. Recreation and wildlife activities on USFS lands in North Carolina in 2016 provided 5,680 jobs, approximately $416 million in economic activity and $186 million in wages.

Figure J: Acres and Volume of Timber Harvests on National Forests in North Carolina, 2012-2020

Year	Acres	Volume (MBF)
2012	1,875	29,104
2013	1,214	16,262
2014	1,419	10,885
2015	1,498	21,352
2016	1,444	14,241
2017	1,467	13,243
2018	1,198	17,651
2019	533	8,735
2020	1,088	11,930

Source: USFS National Forests in North Carolina staff, Forest Supervisor's Office, Asheville, NC 2020

Figure K. Economic Contributions of USFS Recreation to North Carolina, 2016

Activity	Units of Measure	Output in 2016
Wildlife and Fish Locals	Visits	503,703
	Expenditures	$15,533,000
Wildlife and Fish Non-residents	Visits	103,168
	Expenditures	$18,336,000
All Other Rec Activities Locals	Visits	3,998,253
	Expenditures	$52,789,000
All Other Rec Activities Non-Residents	Visits	1,554,876
	Expenditures	$329,266,000

Source: Forest Service National Visitor Use Monitoring Program and Ecosystem Management Coordination
https://www.fs.fed.us/emc/economics/contributions/at-a-glance.shtml

The Shared Stewardship Initiative (https://www.fs.usda.gov/managing-land/shared-stewardship) is a USDA Forest Service initiative aimed at working with a variety of partners to do the right work, in the right place, and at the right scale. By coordinating at the state level to prioritize needs, the goal is to be able to increase the scope and scale of critical forest treatments that support communities and improve forest conditions.

Federal, state and private land managers in North Carolina face a range of challenges. Among these challenges are population increase resulting in more development; catastrophic storms; droughts; flooding, insect and disease outbreaks; invasive species; and, a lack of adequate markets to help drive investments in sustainable forest management.

The USFS, National Forests in North Carolina, N.C. Department of Agriculture and Consumer Services (NCDA&CS) / N.C. Forest Service (NCFS), N.C. Wildlife Resources Commission (NCWRC), and the USDA Natural Resources Conservation Service (NRCS) entered into a shared stewardship agreement Sept. 25, 2019.

This agreement establishes a framework for these parties to work collaboratively on accomplishing mutual goals, to further common interests and effectively respond to the increasing ecological challenges and natural resource concerns, whether aquatic or terrestrial, in North Carolina.

This agreement outlines strategies for cooperation and coordination as well as confirms a commitment on behalf of the partners to proactively work across all lands, addressing challenges in three key areas:

- Restoring fire adapted communities and reducing the risk of wildfire;
- Identifying, managing, and reducing threats to forest and ecosystem health; and,
- Conserving working forestland.

In addition to the Shared Stewardship Initiative, the Good Neighbor Authority (https://www.fs.usda.gov/managing-land/farm-bill/gna) "allows the USDA Forest Service to enter into agreements with state forestry agencies to do the critical management work to keep our forests healthy and productive." The USFS and the NCFS have already utilized the Good Neighbor Authority agreement model successfully (ex. inventorying sections of National Forests in North Carolina), and it holds promise for future collaborations.

U.S. Department of Defense

- The DoD controls about 304,200 acres of forestland in North Carolina. Prominent forested installations include Fort Bragg and Camp Mackall (U.S. Army) and Camp Lejeune (U.S. Marine Corps).

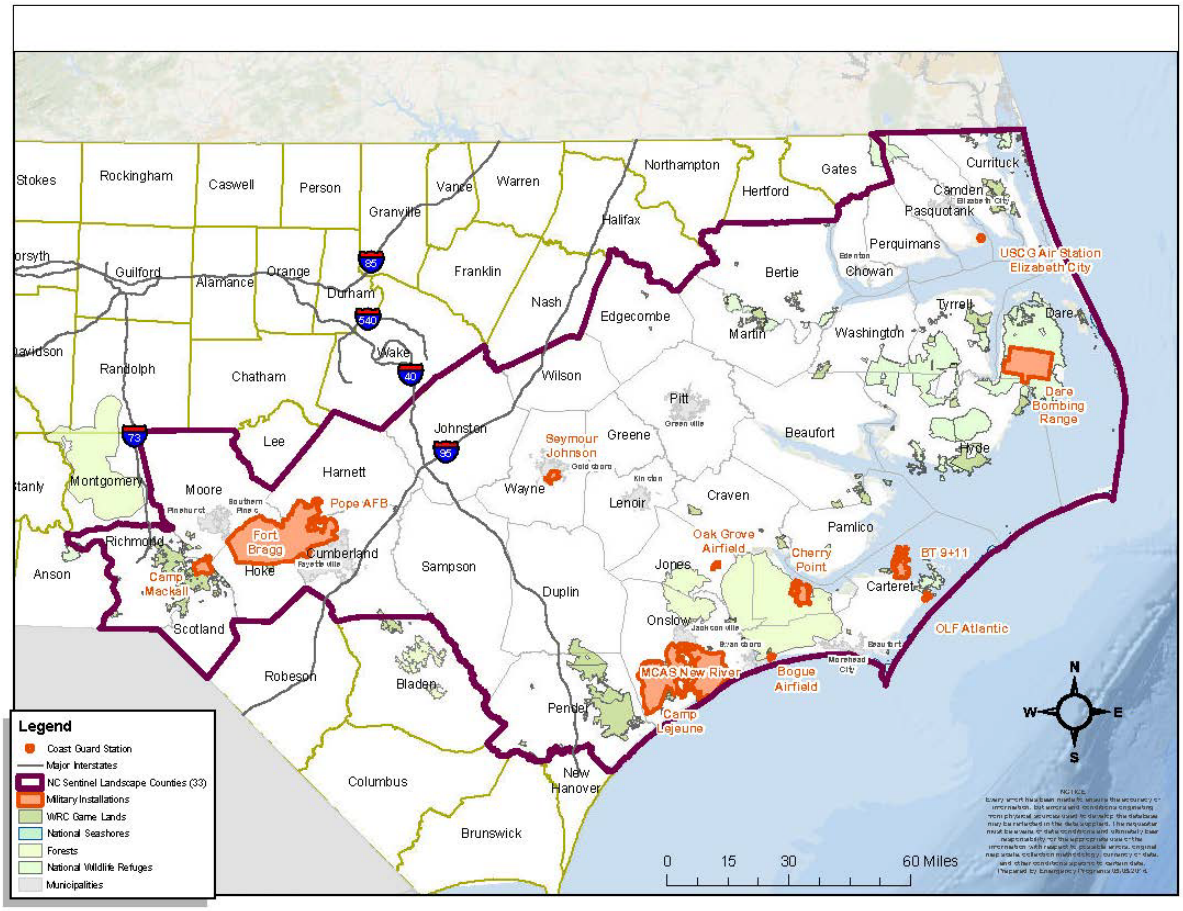
The **Eastern North Carolina Sentinel Landscape** (https://sentinellandscapes.org/landscapes/eastern-north-carolina/) spans nearly 11 million acres across a 33-county region in North Carolina's Coastal Plain and Sandhills. The sentinel landscape is home to five key military installations and ranges: Fort Bragg, Dare County Bombing Range, Marine Corps Base Camp Lejeune, Marine Corps Air Stations Cherry Point and New River, and Seymour Johnson Air Force Base. Behind agriculture, military-related activity is the second largest economic driver in the state. For years, Eastern North Carolina Sentinel Landscape partners have worked together to support endangered species recovery while simultaneously strengthening the military mission and energizing local agricultural economies.

An expansive network of farms, ranches and working forests is embedded in the Eastern North Carolina Sentinel Landscape. In total, cropland and forestland make up 72% of land cover across the landscape. This composition is indicative of the industry's wider impact on the state. Agriculture and agribusiness contribute $92 billion annually to North Carolina's gross domestic product (GDP) and employ 17% of the state's workforce. Farms, ranches, and working forests also support the state's national defense mission by reducing the risk of incompatible development around military installations and ranges. As a result, promoting sustainable management practices on North Carolina's working lands is a top priority for Eastern North Carolina Sentinel Landscape partners.

The N.C. Sentinel Landscape Partnership, working together since 2009 and nationally recognized in 2016, has synergized four main areas:

- Working lands conservation by preserving working forests and farms with easements, outreach and support;
- Landscape scale conservation by coordinating state and local programs that preserve agribusiness through limited assurances for production;
- Building local purchasing capacity through programs like Food and Fuels for the Forces that make it easier for the military to buy from local farmers and foresters; and,
- Innovative conservation strategies that protect the military training mission through testing of market-based conservation and other innovative programs.

Figure L. Eastern North Carolina Sentinel Landscapes Area



Additional Federal Agencies Owning Forestland in North Carolina

- The NPS owns approximately 289,300 acres of forestland in North Carolina. North Carolina's portion of the Great Smoky Mountains National Park contains about 261,000 total acres and comprises the majority of NPS forestland in the state.
- The USFWS manages 13 national wildlife refuges in North Carolina. These refuges contain about 257,500 acres of forestland.
- Other federal agencies control about 6,100 acres of forestland in North Carolina.

North Carolina State Government

- Approximately 852,700 acres of North Carolina forestland is managed by various state government agencies. The NC Wildlife Resources Commission, NC State Parks and the NC Forest Service, among others, are State agencies with significant forest holdings.

North Carolina Forest Service (NCFS)

- The NCFS manages nearly 60,000 acres of state forests and educational state forests (ESFs).
- These properties are managed to achieve multiple use objectives, including but not limited to outreach and education; forest management demonstration and training; recreation; water quality improvement; research; forest health and species restoration; and, forest products income generation.
- Details about the seven NCFS ESFs (Jordan Lake, Holmes, Tuttle, Clemmons, Turnbull Creek, Rendezvous Mountain and Mountain Island) can be found at https://www.ncesf.org/.
- Details about the NCFS state forests (Bladen Lakes, DuPont, Headwaters and Gill) can be found by visiting https://www.ncforestservice.gov/ and reviewing the "State Forests" section.

Local Government

- Approximately 270,400 acres of forestland are managed by local government entities.

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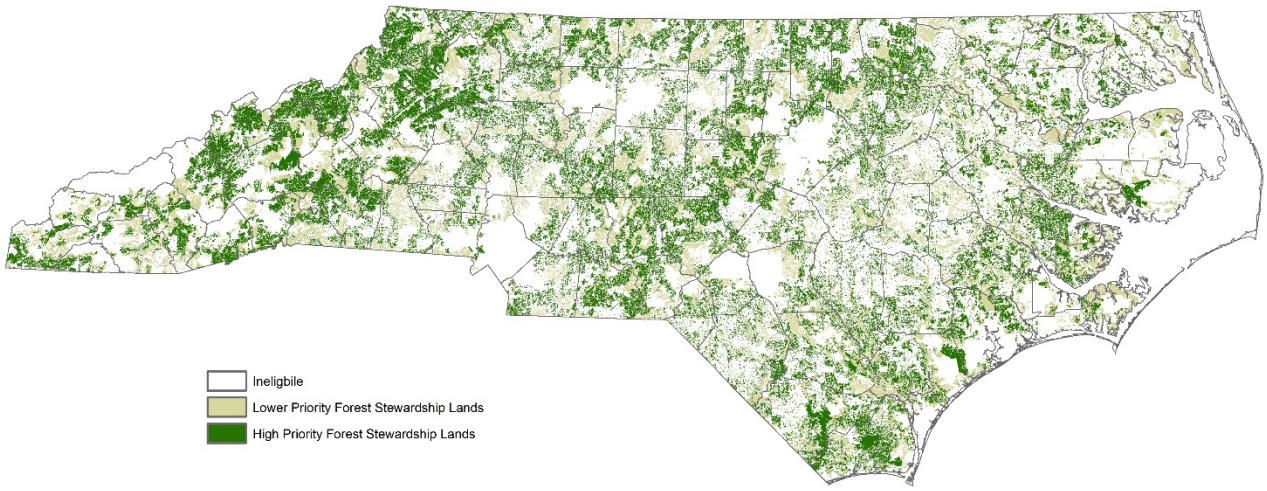
Use of Priority, Issue and Program-specific Maps

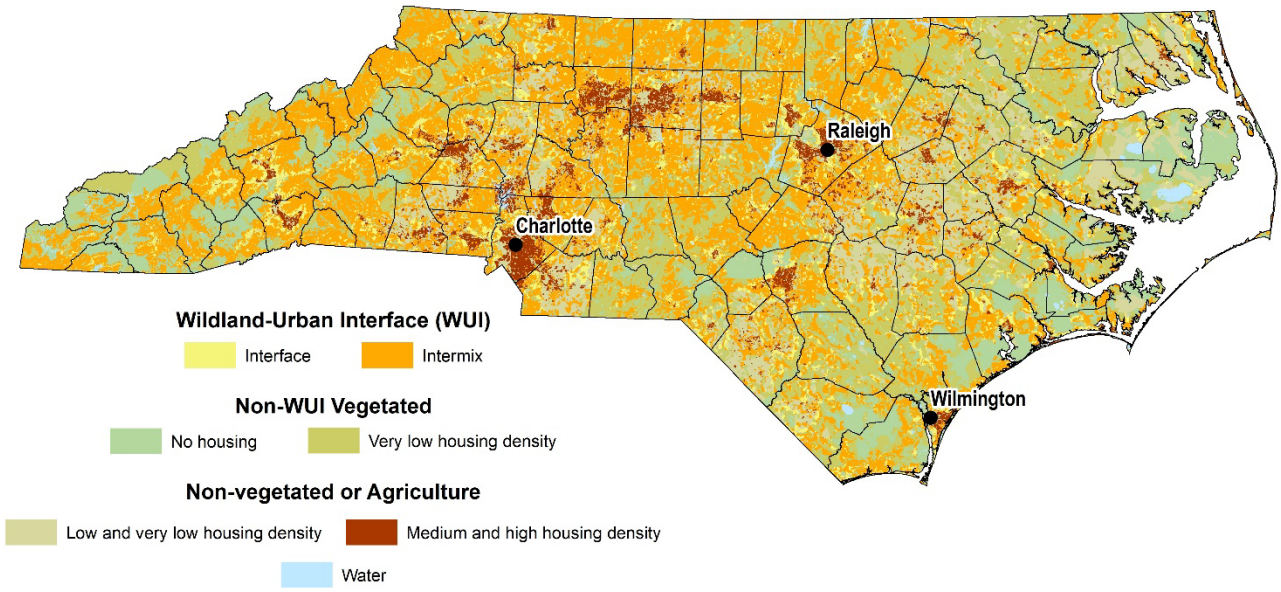
Maps are an integral part of the forest action plan and help tell a story about North Carolina's forests and forest resources. Maps can also help stakeholders visualize where actions and resources may be needed most. The Forest Stewardship priority map shown below is one of the "higher-level" maps that utilizes many GIS layers from the Southern Forest Land Assessment. It is an example of a landscape-level map that the NCFS takes into consideration when delivering its Forest Stewardship program and other priority stewardship activities.

EXAMPLE: Figure 1.2.1 Forest Stewardship Program Priority



Issue and program-specific maps can be found in each goal section and are likely to be the most helpful. Typically, these maps use fewer GIS layers to be even more focused for a specific purpose. One example in Goal 2 Objective 2.1 is the “Wildland Urban Interface for North Carolina” map.

EXAMPLE: Figure 2.1.4. Total Wildland Urban Interface in North Carolina



An issue-specific map like this can help when determining where to prioritize efforts related to delivering FireWise USA® program outreach to mitigate potential wildfire impacts.

There is a tremendous amount of North Carolina geospatial data that can help stakeholders assess our forest resources and prioritize future actions. Sources such as NC OneMap, the North Carolina Natural Heritage Program, the Southern Forest Land Assessment, and GIS layers from the North Carolina Forest Action Plan and the North Carolina Wildlife Action Plan can help in making informed decisions. Readers are encouraged to reach out to other stakeholders in North Carolina and discuss how such resources can be obtained and utilized to help increase the sustainability and resiliency of North Carolina’s forests.

Collaboration on Regional and Multistate Priorities

This plan addresses many forestry issues that overlap landowner and county boundaries. Some of these same forestry issues also extend beyond regional areas and even state boundaries. Prime examples include the restoration of forest and wildlife species of concern; protection of large and/or critical watersheds; and mitigating the spread of invasive species across border areas. Such management issues come with significant challenges, often stemming from the numerous entities involved and their varied awareness levels and priorities.

There are numerous examples of ongoing regional and multistate collaborations that prioritize the conservation of North Carolina's forests. **Ongoing examples include but are certainly not limited to**:

- **North Carolina Sandhills Conservation Partnership (NCSCP)**—https://ncscp.org/
    - The mission of the NCSCP is to coordinate the development and implementation of conservation strategies for the red-cockaded woodpecker (Picoides borealis), other native biota, longleaf pine and other ecosystems throughout the Sandhills of North Carolina.

- **North Carolina Onslow Bight Conservation Forum**—https://longleafalliance.org/ncobcf
    - The North Carolina Onslow Bight Conservation Forum provides for open discussion among participants concerning the long-term conservation and enhancement of biological diversity and ecosystem sustainability throughout the Onslow Bight landscape compatible with land use, conservation and management objectives of the participating organizations and agencies.

- **Cape Fear Arch Conservation Collaboration**—https://www.capefeararch.org/
    - The Cape Fear Arch is a special geologic feature stretching from Cape Lookout, North Carolina to Cape Romain, South Carolina. It contains nationally significant animal and plant communities, many of which are found nowhere else on earth. The Collaboration's mission is to develop and implement a community conservation vision that builds awareness, protection, and stewardship of the region's important natural resources.

- **Eastern North Carolina Sentinel Landscape**—https://sentinellandscapes.org/landscapes/eastern-north-carolina/ and https://sentinellandscapes.wordpress.ncsu.edu/
    - The Eastern North Carolina Sentinel Landscape spans nearly 11 million acres across a 33-county region in North Carolina's Coastal Plain and Sandhills. The sentinel landscape is home to five key military installations and ranges: Fort Bragg, Dare County Bombing Range, Marine Corps Base Camp Lejeune, Marine Corps Air Stations Cherry Point and New River, and Seymour Johnson Air Force Base. Behind agriculture, military-related activity is the second largest economic driver in the state. For years, Eastern North Carolina Sentinel Landscape partners have worked together to support endangered species recovery while simultaneously strengthening the military mission and energizing local agricultural economies.
    - North Carolina Sentinel Landscapes is an innovative partnership focused on collaboration and coordination between farmers, foresters, conservationists and military installations in order to provide mutual benefits to protect the state's two largest economic sectors – agriculture and defense.

- **The Longleaf Alliance**—https://longleafalliance.org/
    - The mission of The Longleaf Alliance is to ensure a sustainable future for the longleaf pine ecosystem through partnerships, landowner assistance and science-based education and outreach.

- **Appalachian RC&D Fire Adapted Communities Coalition**—http://www.blueridgercd.com/appalachian-rcd-fire
    - The intent of the Southern Appalachian RC&D Coalition is to expand the success of the fire adapted communities concept along the Appalachian Mountain chain from Georgia to Virginia to help reduce the risk of wildfire for communities in the wildland urban interface, most of which borders national forests.

- **Hemlock Restoration Initiative (HRI)**—https://savehemlocksnc.org/
    - The objective of the Hemlock Restoration Initiative (HRI) is to restore eastern and Carolina hemlocks to their native habitats throughout North Carolina and to mitigate damage to hemlocks caused by infestation of the hemlock woolly adelgid (HWA).

There are also numerous groups that bring cross-border stakeholders together to achieve forest conservation priorities. All southern state forestry agencies are members of the Southern Group of State Foresters (https://www.southernforests.org/), which has numerous subcommittees devoted to accomplishing priorities in a number of focus areas. Other collaborative entities, such as the Southern Fire Exchange (https://southernfireexchange.org/), strive to increase Southern prescribed burners' capabilities in an effort to increase the amount of beneficial prescribed burning.

Since the 2010 NCFAP, there have been numerous examples of North Carolina stakeholders effectively achieving previously identified priorities related to forest conservation. Some of these were highlighted in the "North Carolina Forest Action Plan 5-Year Review," which was updated Nov. 20, 2015, and readily available on the North Carolina Forest Action Plan website. It can also be obtained by contacting the N.C. Forest Service state headquarters.

Some of these achievements were made possible through the strategic use of grant funding. **Examples include but are certainly not limited to:**

- **USFS Landscape-Scale Restoration (LSR)** (https://www.fs.usda.gov/managing-land/private-land/landscape-scale-restoration) grants, critical to longleaf management training for natural resource professionals and landowners, which is one of the fundamental reasons the species is beginning to be restored to its natural range.

- **National Fish and Wildlife Foundation (NFWF)** (https://www.nfwf.org/) grants, including the funding for trainings, dedicated to the effective management of forest habitats critical to threatened and endangered species as well as species of concern.

- **Arbor Day Foundation** (https://www.arborday.org/) funds, which have been used to replant trees in North Carolina State Forests.

- **USFS Forest Legacy** (https://www.fs.usda.gov/managing-land/private-land/forest-legacy) funds, which have funded conservation easements on strategically important "working forests" across North Carolina.

Among the many benefits and uses of our forests, their ability to provide clean water supplies, critical wildlife habitat and carbon sequestration appears to gain increasing attention and interest. Simultaneously, the more traditional priorities such as a strong timber economy and forest recreation remain highly desired. The following five goal sections will discuss in more detail what North Carolinians need to do to ensure that our woodlands can deliver the greatest good to all citizens.

Are North Carolina's Forests Sustainable and Resilient?

There is great interest in determining if the forests of North Carolina are sustainable and resilient. These are complex issues involving numerous facets of how our forests are managed, conserved and protected. To answer the question adequately, it helps to understand the context in which it is being asked and to support that answer with relevant, scientifically-based information. We believe that a simple "yes" or "no" answer, without addressing specific aspects of the question, is an oversimplification.

The various sections of this plan provide a current overview of relevant aspects of that question. The previous "North Carolina's Forests and Forest Owners" section and its associated Appendix items utilize USFS Forest Inventory and Analysis (FIA) data to show statewide forestland acreage as well as growth and removal trends. It is positive to see that North Carolina's forestland continues to remain relatively stable, particularly when the state's increasing population and urbanization are considered. The growth-to-removal ratios are also positive indicators that point toward sustainability.

This plan's five goal sections provide in-depth details that directly relate to the issues of sustainability and resiliency. **Examples include but are not limited to:**

- **Goal 1, "Increase the Sustainable Management and Conservation of Forests,"** which addresses forest markets, reforestation rates and forestry cost share, private landowners with forest management plans, and critical forest habitat needed for species of concern;

- **Goal 2, "Reduce Negative Impacts from Forest Threats,"** which addresses resiliency-related issues associated with threats from wildfires, invasive species and insect/disease stressors;

- **Goal 3, "Increase the Beneficial Use of Prescribed Fire,"** which addresses the role prescribed fire plays in increasing forest resiliency from wildfire. Prescribed fire is also needed to meet the goal of sustaining certain tree and wildlife species;

- **Goal 4, "Manage and Conserve Forests for Clean Water,"** which addresses compliance with forestry-specific water quality protection regulations, implementation of Best Management Practices that help protect water resources, and identification of priority watersheds where concentrated conservation and/or restoration efforts may be warranted; and,

- **Goal 5, "Enhance the Ecosystem Services, Benefits and Sustainable Management of Urban Forests,"** which addresses the status of North Carolina's urban tree canopies as well as strategies to increase the retention and resiliency of urban and community tree inventories.

As with the use of issue-specific geospatial data and maps, we believe these more detailed discussions can provide meaningful information to consider as we ask ourselves how we can strengthen the sustainability and resiliency of North Carolina's forests. North Carolina has a strong forestry community, and its forests are sustainable and resilient in many ways. This Plan identifies the threats, concerns and opportunities that stakeholders need to consider as we plan our forest conservation and sustainability for the next 10 years.

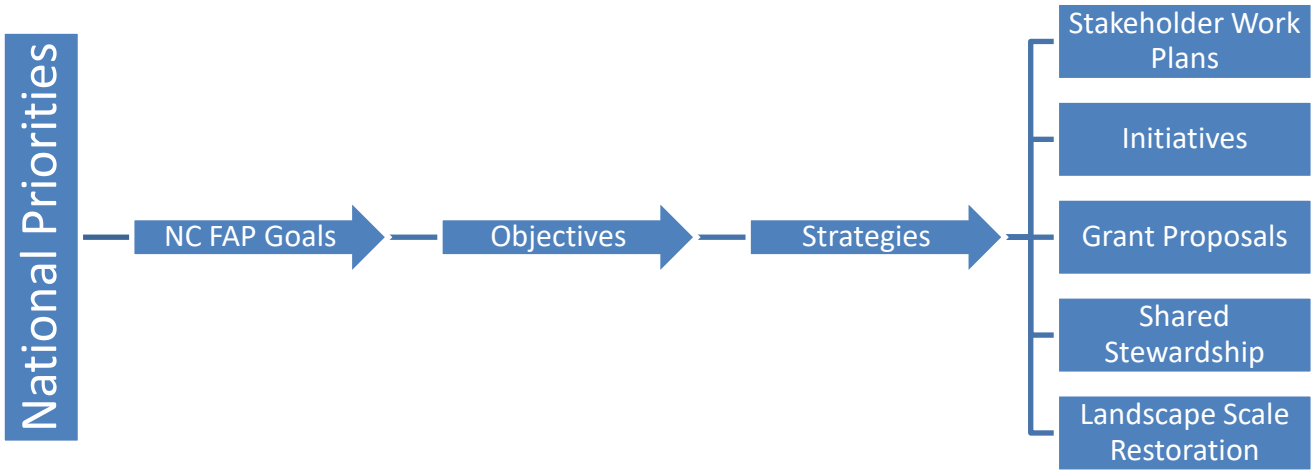
Connection Between National Priorities and N.C. Forest Action Plan (NCFAP) Goals

The 2008 Farm Bill tasked all states and territories with the development of Forest Action Plans, and it provided three overarching national priorities that each plan should address. To address these priorities in North Carolina, we formed five working groups to develop goals. These groups are listed below.

Forest Management & Conservation	***Forest Threats***
Prescribed Fire	***Water Resources***
Urban and Community Forestry	

Working groups were comprised of stakeholders with key knowledge, local expertise and interest in these subject areas, and together, they developed five goals that connect directly to the three national forest priorities. Each goal assesses North Carolina's forest resources and identifies objectives and strategies to improve the health, resiliency and productivity of these forest resources as they relate to each working group.

The strategies identified in this plan are intended to have applicability for all forest stakeholders in North Carolina and should be used as a roadmap in their decision-making processes. With finite resources to invest in the forests of North Carolina, this approach will help these groups target funding, time and resources more efficiently. This is more important than ever as the challenges to our forests continue to increase.



The flow chart above represents the connection between the national priorities and North Carolina's goals. The end results of the strategies show a sample list of the intended impact this Plan will have on our collective actions and ultimately the state of our forests.

N.C. FOREST ACTION PLAN GOALS

A. National Priority: Conserve and Manage Working Forests for Multiple Values and Uses

Goal 1. Increase the Sustainable Management and Conservation of Forests

Five key points:

- North Carolina's forests are currently being managed sustainably with growth significantly exceeding harvest across many geographical regions of the state.
- The forestry sector was the top employer among manufacturing sectors in the state, directly generating approximately $274.2 million in state and local taxes and $850.4 million in federal taxes.
- Invasive species, diseases, insects, and climate change present an ongoing and unpredictable threat to future forest productivity and habitats.
- Conservation, restoration and appropriate management of North Carolina's forest resources are important to ensure the long-term sustainability and value of terrestrial and aquatic species populations and habitats.
- Additional outreach and education are needed to increase public awareness and involvement in conservation programs aimed at sustaining priority forest, aquatic and wildlife habitat.

Objectives:

1.1—Promote forest sustainability and forest market viability, current and future, for consumers and producers.

1.2—Conserve high-priority forest ecosystems and landscapes.

1.3—Assist landowners with actively and sustainably managing forests for economic and social benefits.

1.4—Strengthen and develop outside partnerships with public and private entities at federal, state, and local levels to improve and coordinate services and service delivery.

1.5—Restore and conserve priority forest, aquatic and wildlife habitat.

Strategies:

1.1.1—Promote forest sustainability and support favorable business environments for forest-based industries.

1.1.2—Promote favorable tax structures and financial incentives that support the retention of working forests.

- Advocate for the reinstatement of the North Carolina Conservation Tax Credit Program and continued support for the Present Use Valuation Program.

1.1.3—Provide technical assistance, information and outreach to forestland owners, partnering agencies and forest-based industries regarding forest sustainability and forest-market opportunities.

1.1.4—Identify and promote the retention and recruitment of domestic and export markets for biomass, underutilized species and low-grade materials, and traditional forest products.

1.2.1—Collaborate with other natural resource organizations to identify high-priority forest ecosystems and landscapes.

1.2.2—Assist land management professionals with the delivery of programs and services that conserve high-priority forest ecosystems and landscapes.

1.2.3—Promote restoration and conservation strategies that address declining tree species and forest ecosystems.

- Educate the public on the benefits, ecological importance, and value of restoring and conserving declining tree species and forest ecosystems.

1.3.1—Educate natural resource professionals, policymakers, the general public, landowners and schoolchildren about forests, markets, wildlife and the social, ecological and economic benefits they provide.

1.3.2—Provide increased technical and professional assistance to forest landowners that results in more active and sustainable management of their forestland.

- Promote awareness of conservation programs, such as stewardship, tree farm, etc., and priority focus areas.

1.3.3—Seek increased funding for forestry cost share programs as well as forest nursery and tree improvement programs.

1.4.1—Assess, evaluate, and develop new technical services and programs to effectively reach nontraditional, underserved and traditional forest landowners.

1.5.1—Support the goals and strategies outlined in the 2016 North Carolina Wildlife Action Plan (NCWAP), and coordinate with agencies regarding aquatic conservation priorities.

1.5.2—Restore and conserve forestland with priority terrestrial and aquatic habitat by promoting conservation initiatives, partnerships and shared goals.

1.5.3—Increase and expand wildlife habitat conservation and restoration training for natural resource professionals, agency personnel and consultants that work with private landowners.

1.5.4—Increase local government and public participation in programs intended to restore critical terrestrial and aquatic habitats at risk.

Forest Markets

Objective 1.1—Promote forest sustainability and forest market viability, current and future, for consumers and producers.

CURRENT CONDITIONS AND TRENDS

Forests in North Carolina

- Industrial forestland has been moving into other ownership categories over the past 40 years, but the transition accelerated after 2000.[8]
    - Across the south, the largest private owners of forestland in the 1970s were integrated forest product companies.
    - Today, the largest private landowners are timber investment management organizations and public real estate investment trusts.
    - A significant amount of former forest industry land was purchased for conservation purposes.
- Pine plantations make up only 17% of North Carolina's forestland, but they produce almost 50% of all wood products.[1] Total industrial output for the state is roughly 75% pine and 25% hardwood. Pine plantations support timber markets and stumpage prices that benefit all forest landowners.
- North Carolina's timber inventory has increased by 45% since 1974.[12]

Economic Contribution of North Carolina's Forests[4]

- In 2018, the forest sector in North Carolina— including forestry and logging operations, sawmills, furniture mills, and pulp and paper industries—directly contributed $20.8 billion in industry output, which was just about 2% of the statewide economic output.
- The forest sector employed about 75,000 people with a payroll of $4.2 billion and a value-added gross state product of $6.3 billion.
- Including direct, indirect and induced effects, the forest sector in North Carolina had a total contribution of $33.6 billion in industry output to the North Carolina economy, supporting more than 150,400 full-time and part-time jobs with a payroll of about $8.3 billion.
- The forest sector was the top employer among manufacturing sectors in the state.
- Every job created in the forest sector resulted in another 1.01 jobs in North Carolina.
- The forest sector in North Carolina directly generated about $274.2 million in state and local taxes and $850.4 million in federal taxes.
- Primary solid wood mills directly generated about $35.7 million in state and local taxes and more than $100 million in federal taxes.
- International exports from the North Carolina forest sector totaled about $1.44 billion.

Additional details related to the economic contributions of North Carolina's forestlands can be found in Appendix Item V: "Economic Contribution of the Forest Sector in North Carolina, 2018."

Forest Products Exports

- There are two North Carolina seaports.
    - Wilmington (bulk, break bulk and container)
    - Morehead City (bulk and break bulk; no container)

    - North Carolina ports are much smaller than ports in Norfolk and Charleston. As a result, several countries bypass North Carolina ports in favor of the larger, more diversified ports to the north and south.
    - Some forest products from North Carolina cross state lines to be shipped from ports in neighboring states.
- Fuel pellet exports
    - South-wide fuel pellet exports are worth $1 billion.[1]
    - More than 80% of fuel pellets go to western Europe, where the United Kingdom is the largest single market.
    - Export is expanding to South Korea and Japan.
- Most log exports go to China.
    - More than 90% of pine logs and more than 50% of oak lumber[1]
    - Containerized logs go to China in shipping containers that would otherwise be returned empty.
    - China, currently, will not accept pine logs from ports in Virginia or South Carolina due to pinewood nematode concerns.
- Phytosanitary requirements
    - Each country has its own import standard.
    - Most logs are treated by debarking and sampling for pinewood nematode.
    - This method is acceptable to China but is not accepted by other countries.
    - Need consistent phytosanitary agreements, fumigant agreements
    - Methyl bromide is the only fumigant allowed for exporting logs to several countries. Log exports to these countries will depend on being able to meet their phytosanitary requirements.
- "Trade War" with China[1]
    - Annual increase of 17-18% in pine log exports before tariff
    - Since 2018, tariffs on goods shipped to China have greatly reduced exports of pine logs and all hardwood products.
        - Between 2018 and 2019, 50% drop in pine log exports
        - Between 2018 and 2019, 30% drop in oak lumber exports
        - Between 2018 and 2019, 75% drop in other hardwood lumber exports
    - Phase 1 trade agreement includes a Chinese commitment to purchase more U.S. products but does little to directly address tariffs.

Technology is lowering the cost of production.

- "Lumber producers across the South have invested in new equipment…to increase capacity and efficiency. … An increase in efficiency, or an increase in the amount of lumber produced from the same volume of wood, implies lower levels of wood demand. … South-wide average yields of one thousand board feet (MBF) per 4.6 tons or less are the norm on a volume/weight basis."[9]
- Very little waste is produced by most sawmills. Markets have been found for nearly anything formally discarded as waste.
- Pine sawtimber stumpage prices are highest in the central Piedmont.
    - Heavy competition from several local mills
    - These mills have invested heavily in mill technology to offset stumpage prices.
- Increased technology has allowed more efficient production of sawtimber.
    - Gains in loblolly pine genetics have produced more volume of straighter trees on shorter rotations.
    - GIS has allowed remote sensing to replace expensive on-the-ground inventories.

- Herbicide competition control is cheaper and more effective than at any time in the past.

Recent Trends

- South-wide, pine sawtimber prices have dropped nearly 40% since 2005.[1]
  - Much of this is due to an oversupply of pine in the larger diameter classes.
  - Average softwood diameters have increased over the past 20 years due to low sawtimber prices and landowners deferring timber sales, hoping for market improvements. This has created an overabundance of softwood sawtimber.
    - Growth of 345 million cu. ft/year for large diameter pine[2]
    - Growth of 130 million cu. ft/year for small diameter pine[2]
    - Extensive CRP pine plantations established during the mid-80s are now 35 years old and are contributing to the pine sawtimber oversupply.
  - Increasing pulpwood prices compared to sawtimber prices
    - In the year 2000, average sawtimber stumpage prices in North Carolina were 5.7 times higher than pulpwood stumpage prices ($37.63/ton ST versus $6.53/ton PW)[6]
    - In the year 2018, average sawtimber stumpage prices in North Carolina were 2.3 times higher than pulpwood stumpage prices ($25.11/ton ST versus $10.86/ton PW)[6]
    - A 2.3x differential is economically unsustainable in the long run and could result in a shift to more pulpwood rotations.
- Very recent increase in timber prices
  - Housing starts have more than doubled since 2008. The market continues to slowly improve, increasing the demand for sawtimber.[1]
    - 75% of structural wood products go into housing.[1]
    - However, before 2006 more than 80% were single family structures. Multifamily units are increasing as millennials purchase fewer houses than previous generations at the same age.[1]
- Pine sawmills are doing well with low sawtimber stumpage prices, high milling efficiency and high lumber prices.
- Wood pellet manufacturing has expanded since 2010.
  - Two wood pellet manufacturing facilities have opened in the Northern Coastal Plain and the Southern Coastal Plain regions.
  - Forest landowners have benefited from the subsequent strengthening of forest markets and increases in pulpwood stumpage prices.
  - Two wood pellet storage facilities are strategically located at ports in Wilmington, NC and Chesapeake, VA.
  - In North Carolina, 10-12% of all pulpwood now goes to pellet fuel.
- North Carolina has developed a diversified market for pulpwood.
  - Paper/packaging
  - Fluff
  - OSB
  - Energy
  - Pellets
  - Chip mills
- Since 2010, roundwood consumption in North Carolina has increased.

- Increased housing starts have resulted in an upturn in sawtimber consumption, 19.5 million tons in 2018.[5]
- Increased export of fluff has resulted in an upturn in pulpwood consumption, 7.7 million tons in 2018.[5]
  - About 10-12% of the world's fluff comes from North Carolina pulp mills.

Foreign Factors

- Mountain pine beetle outbreaks in western Canada have led to extensive Canadian investment in southern sawmills over the past 10+ years.
- There is a 20% tariff on Canadian softwood lumber coming to the U.S.
  - Canadian construction lumber remains a major force in housing.

Possible Emerging Markets

- Mass timber is an important future market opportunity as architects specify these products and as building codes change to allow more construction with these materials.
- Biofuel is a possible future market.
- Thermally modified wood is on the horizon.
- Renewable, forest-based nanomaterials is emerging as a future market.

NOTABLE THREATS

Labor Issues

- Trucking
  - Aging truck driver workforce
  - Increased short-haul trucking routes have increased competition for truck drivers who prefer not to be on the road for days at a time.
  - Increased trucking costs
- Aging logging workforce[10]
  - The average logger has been in the business for 36 years, with a minimum of 10 years and a maximum of 60 years.
  - The average logging company owner has owned their business for 33 years, with a minimum of 10 years and maximum of 60 years.
- Stricter immigration rules or revised guidelines can impact seasonal worker availability for tree planting, timber stand improvement (TSI) site prep, etc.

Environmental Threats

- Extreme weather events such as hurricanes, global warming, floods, drought, fire, etc.
- Emerald ash borer (EAB) is negatively impacting the ash market.
- Mountain pine beetle in Canada is impacting southern forestry markets.
- Spotted lanternfly has the potential to disrupt wood markets.

Business Threats

- Cost of insurance
- Only 2-3 insurance carriers available for logging companies

- Cost of logging and trucking equipment
- Liability
    - Workers' comp costs
    - Tort environment makes insurance expensive.

Supply Threats

- There is an oversupply of sawtimber in North Carolina, leading to lower sawtimber prices
    - Low sawtimber prices for pine sawtimber could lead to private landowners switching to pulpwood rotations.
        - More stand entries
        - More herbicide applied
        - More site preparation
        - Reduced prescribed burning
        - Reduced variety of wildlife habitat

Political Threats

- Increasing pressure from environmentally centered nongovernment organizations (NGOs), both domestic and European Union-based, has been a challenge for the utility-scale wood pellet industry.
- Shovel logging and other bottomland hardwood timber harvesting systems will be scrutinized for the foreseeable future.
    - However, all mill permits have been approved.
    - Environmental groups have been unsuccessful at stopping fuel wood harvest, but they have made it more complicated and expensive.
- Methyl bromide opposition limits export to some countries.

SUPPORTING INFORMATION

- N.C. Cooperative Extension
    - https://content.ces.ncsu.edu/economic-contribution-of-the-forest-sector-in-north-carolina
    - https://forestry.ces.ncsu.edu/economic-impact-data/
    - https://content.ces.ncsu.edu/north-carolinas-forest-and-forest-products-industry-by-the-numbers
- National Association of State Foresters (NASF) & Southern Group of State Foresters (SGSF)
    - https://texasforestinfo.tamu.edu/tsa/
    - https://southernforests.org/services
    - https://www.southernforests.org/services/forest-products-network
    - https://texasforestinfo.tamu.edu/tsa/StandardReports/TimberSupply_NorthCarolina_all_wt.pdf
    - https://primary.forestproductslocator.org/
- U.S. Forest Service (USFS)
    - https://www.fs.usda.gov/srsfia/states/north_carolina.shtml
- Mass timber
    - https://forestproud.org
    - https://www.woodworks.org

- Workforce development
    - https://www.beprobeproud.org/
    - https://www.forestryworks.com/

PRIORITY AREAS

- USFS land
    - Volume growth is far greater than volume removal on federally owned land.
        - Growth of pine is 2.51x harvest.
        - Growth of hardwood is 8.32x harvest.
    - Southern pine beetle
        - "Further, outbreaks on several National Forests in the South over the last couple of decades reveal that overstocked, undermanaged pine stands remain a significant problem on some federal lands."[11]

NOTABLE RESOURCES NEEDED

- Continued strengthening and diversification of NC's forest products markets (ex. traditional, mass timber, biofuels manufacturers, wood pellets, etc.)
- Additional sawtimber markets for underutilized species and lower grades, especially for hardwood species
- Renewable, forest-based nanomaterials
    - Need continued research and additional manufacturer
- Stronger workforce development
    - Labor is the #1 issue.
    - Sawmills cannot find qualified workers.
    - Need new programs to recruit younger people into the logging and trucking fields
        - Apprentice training programs
        - Community college training
        - Increased high-school level guidance toward skilled-labor careers
        - Examples: "Be Pro Be Proud," in Arkansas or "Forest Works," in Alabama
- Need an increase of weight limits (90,000lbs) on interstates
- Increased state investment in Inland ports and rail lines
- Increased public outreach to educate the general public on forest sustainability trends such as growth versus drain ratios to promote environmental successes

EXAMPLE METRICS

- Dollar value of the North Carolina forest products industry
- North Carolina jobs in forestry-related industries
- Forest-based industries created
- Tax revenues from forestry-related industries
- Products manufactured by primary and secondary processors

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Forest Management

Objective 1.2—Conserve high-priority forest ecosystems and landscapes.

Objective 1.3—Assist landowners with actively and sustainably managing forests for economic and social benefits.

Objective 1.4—Strengthen and develop outside partnerships with public and private entities at federal, state, and local levels to improve and coordinate services and service delivery.

CURRENT CONDITIONS AND TRENDS

- See the "Forests in North Carolina" section of the Markets goal above for information about the extent and makeup of North Carolina's forests.
- North Carolina loses 67,857 ac/year of forestland to non-forest uses such as crops and development. At the same time, North Carolina gains 0.322 ac/year of forestland as non-forest land reverts to forest. This indicates a net loss of 7,535 ac/year of forest which is a loss of 0.04% per year-f
- In North Carolina, 400,587 ac/year of forestland is harvested or thinned. Most landowners report that timber is not their primary reason for owning their forestland, however most report having harvested timber or planning to harvest timber.[1,3]
- Most forest landowners in North Carolina want to learn more about timber management (39%), insects and disease (35%), and wildlife management (32%).[4]
- Most forest landowners would like more information about favorable tax policies (48%), timber markets (22%), and cost share (21%).[4]
- About 16% of forest landowners in North Carolina have leased their forestland for hunting, grazing or recreation.[4]
- Less than 1% of forest landowners have taken advantage of any carbon sequestration program.[4]
- Only about 3% of forest landowners in North Carolina have any portion of their land in a conservation easement, and less than 1% are participating in any kind of green certification program.[4]
- About 19% of forest landowners are participating in a present use property tax program.[4]

- **Management Plans**
    - About 18% of all forest landowners in North Carolina have a management plan, however, these 18% own nearly ½ of all the nonindustrial private forestland in the state. Approximately 89% of these landowners have implemented at least some of the recommendations in their management plan.[4]
    - Most active management plans were written by either private consulting foresters (42%) or state foresters (37%).[4]
    - A 2014 North Carolina Legislative mandate required the NCFS to begin charging woodland owners for certain types of forestry management plans.
        - This change reduced the number of woodland owners requesting management plans and the number of forestry management plans written by the NCFS for private landowners by nearly 40%.[2] Refer to Figure 1.2.1

- **Forest treatments**
  - About 209,000 ac/year of forestland are harvested.[5]
  - About 139,700 ac/year are commercially thinned with an additional 32,100 ac/year of partial harvest and about 10,400ac/year or seed-tree or shelterwood harvest.[5]
  - About 111,600 ac/year of forestland in North Carolina are artificially regenerated. Of this, 82,400 ac/year are site prepared.[5]
  - About 130,600 ac/year regenerate naturally.[5]
  - NCFS reforestation (Refer to Figures 1.2.2 and 1.2.2.)
    - The NCFS has recorded nearly a 50% drop in forest establishment over the past 20 years. See table below.[2]
    - Over the past 10 years, the NCFS has recorded about 70% of the site preparation ac/year compared to previous years. Much of this drop can be attributed to a lack of available cost share funding. See the table below.[2]
    - Over the past 10 years, the NCFS has recorded about the same number of release ac/year compared to previous years. See the table below.[2]

- **Forest nurseries[12]**
  - The past 10 years have seen vast improvement in the productivity of pine seedling genetic material quality available to landowners on the open market.
  - Several southern state agencies have closed their nursery operations, and some integrated forest product companies (ex. Weyerhaeuser, Federal Paper Board) have also sold their nurseries to seedling manufacturers (ex. IFCO, Arborgen).
  - Increasingly, production is moving from open pollinated (half-sibling) seedlings toward controlled pollination (full sibling) seedlings.
  - While still a small part of the seedling market, there has been an increase in availability of clonal seedlings.
  - More containerized seedlings are being produced each year.
    - Has become the default standard for longleaf pine and shortleaf pine
    - More and more common for loblolly pine
  - A broad selection of hardwood and wetland species are available for purchase each planting season.

- **Cost share funding**
  - State administered funding
    - The N.C. Forest Development Program (FDP)
      - About $2.1 million is allocated to forestry projects each year.
      - Provides cost share for site preparation, tree planting and timber stand improvement (TSI)
    - The Agricultural Cost Share Program
      - Administered by the various county soil and water districts
      - Provides cost share money for planting open fields to trees
    - Southern Pine Beetle Prevention Program (SPBPP)
      - Federal grant money administered by the NCFS
      - About $160,000/year is granted to the NCFS. Most of this goes directly to cost share projects.
      - Provides cost share for:
        - Precommercial thinning
        - Understory prescribed burning

- Herbicide understory hardwood control
- Federally administered funding
  - Environmental Quality Incentives Program (EQIP)
    - Administered by the Natural Resources Conservation Service (NRCS)
    - About $2 million/year for longleaf pine and general forestry
  - Conservation Reserve Program (CRP)
    - Administered by the Farm Services Agency (FSA)
    - Establishing conservation practices on retired agricultural land and establishing 10-15-year rental contracts
    - Open and general periodic signups for different practices
    - Combined with state money to form the Conservation Reserve Enhancement Program (CREP) for purchasing longer government control of private lands (ex. 30-year or permanent easements)

- **Citizen education about forest and natural resource management**
  - North Carolina is experiencing a population shift from rural areas to urban centers.
    - "While 15 of North Carolina's 100 counties grew 10% or more in population between 2010 and 2018, 43 counties saw a net loss of people."[6]
    - "Private employment grew 30% in large, urban counties between 2000 and 2018 but fell about 6% in rural counties."[6]
    - "Median household income in the state was $50,000 in 2013-17, but $39,000 in completely rural counties."[6]
    - "Agricultural communities in particular have suffered the effects of mechanization and government policies that encourage it, he said. Farms need fewer hands to work them. Absentee land ownership has grown as small farms struggle. Global competition has shuttered factories that had been keystone employers for decades."[6]
    - "As county tax bases decline, less money is spent on education. Health systems have centralized, shutting down rural hospitals. Young people leave for more promising places."[6]
    - This population shift will result in an increase in the number of voters with little understanding of active forest management activities or who see such activities in a negative light.
  - NCFS Educational State Forests (ESFs) educate thousands of school children each year about active forest and natural resource management.
  - The NCFS, N.C. Cooperative Extension, American Tree Farm, many county forestry committees/clubs, the Black Family Land Trust, the Sustainable Forestry and African American Land Retention Project, and many others work to educate landowners and the public about responsible forest management.
  - Forestry education must reach deeper into the urban environment in order to secure a future legal environment that will allow active forest management.

NOTABLE THREATS

- Hemlock wooly adelgid
- Emerald ash borer
- Gypsy moth
- Laurel wilt
- Spotted lanternfly
- Cogongrass
- Urbanization
- Increasing smoke-sensitive areas may limit prescribed burning.
- Growing urbanizing population with little understanding, or favorable toleration, of active forest management activities (clearcutting, herbicide)
- Climate change

SUPPORTING INFORMATION

- www.ncforestservice.gov
- http://www.ncagr.gov/
- www.ces.ncsu.edu/forestry
- www.ncwildlife.org
- http://portal.ncdenr.org/web/wq/
- www.acf-foresters.com
- https://www.nrcs.usda.gov/wps/portal/nrcs/site/nc/home/
- https://www.fsa.usda.gov/state-offices/North-Carolina/index
- https://www.treefarmsystem.org/
- https://foreststewardsguild.org/
- https://www.keepingforests.org/resources
- http://www.bflt.org/
- https://www.recforestry.org/
- https://www.longleafalliance.org/
- https://www.capefeararch.org/
- http://www.ncscp.org/
- https://www.nature.org/en-us/
- https://www.srs.fs.fed.us/pubs/gtr/gtr_srs178.pdf

PRIORITY AREAS

- America's Longleaf Restoration Initiative (ALRI)
    - http://www.americaslongleaf.org/
    - Longleaf pine in its native range in North Carolina
- Shortleaf Pine Initiative
    - http://shortleafpine.net/shortleaf-pine-initiative
    - Shortleaf pine in its native range in North Carolina
- Bottomland Hardwoods and Swamp/Wetland Forest Types[11]
    - Bald cypress in its native range
    - Hemlock in its native range

- White Oak Initiative SGSF Landscape Scale Restoration Grant
    - Cooperative project between state forestry agencies and USFS R8 and R9
- Sustainable Forestry and African American Land Retention Project
    - Underserved landowners in the Northeast Coastal Plain region
    - NRCS funding for historically underserved, socially disadvantaged, beginning, limited resource and veteran farmers, ranchers and landowners
- N.C. Sentinel Landscape Partnership
    - https://sentinellandscapes.wordpress.ncsu.edu/
- Cooperative Initiatives with USFS North Carolina National Forests
    - Stevens Act Burning
    - Shared Stewardship
    - Good Neighbor Authority (GNA) projects
- American Forest Foundation (AFF) Southern Wildlife at Risk Initiative
    - AFF opportunity areas identified in report
    - Forest family owners delivering wildlife habitat and sustainable wood supply
- The Nature Conservancy (TNC) priority landscapes
    - Southern Blue Ridge
    - Longleaf Pine
    - Albemarle – Pamlico Sound Region
- NCFS Forest Stewardship Priority Map
    - Refer to Figure 1.2.4.
- NCFS Forest Legacy Priority Map
    - See Appendix item "Forest Legacy Assessment of Need" for full discussion of program, including the priority / eligibility map.

NOTABLE RESOURCES NEEDED

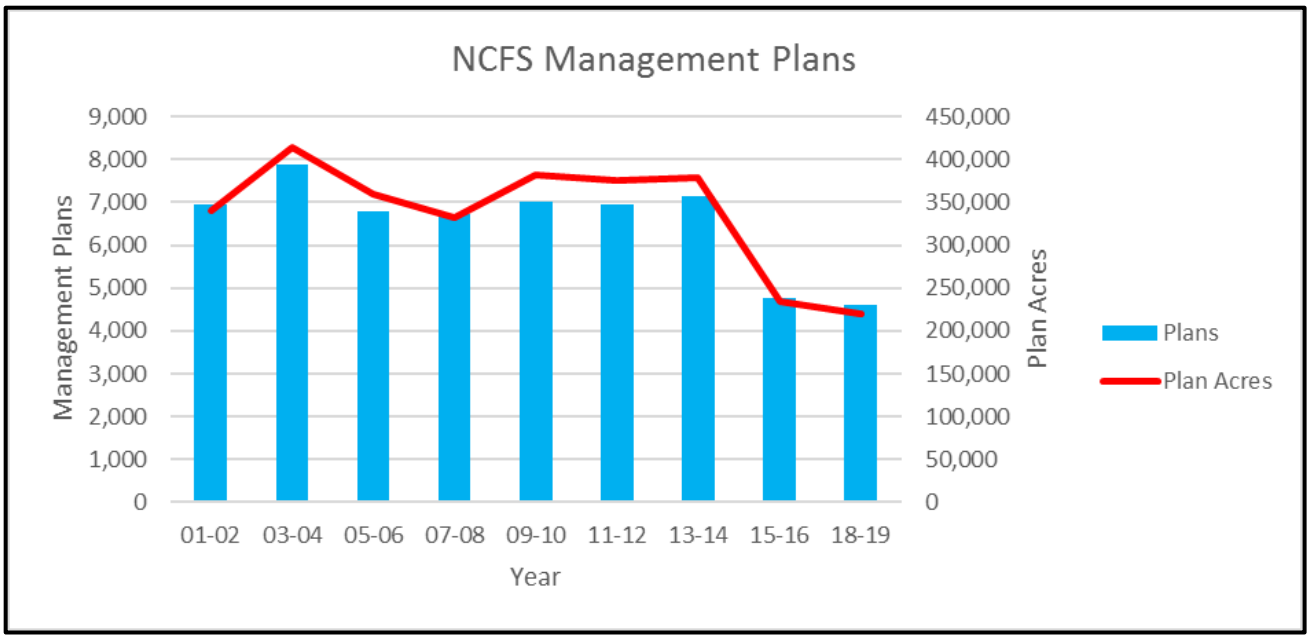
- State and federal cost share funding for reforestation and forest stand improvement (FSI)
- Block granting of federal forestry program funding to the state level
- State and federal funding for conservation initiatives
- Cross-training between conservation agencies on shared program policies and procedures
- Contribution agreement between the NCFS and USDA NRCS & FSA for shared positions and funding to support technical assistance to help deliver USDA programs
- Contribution agreement between the NCFS and N.C. Cooperative Extension to support education and technical assistance
- Funding for forestry research, forest nursery and tree improvement programs
- Increased forestland protection through easements, programs and land acquisitions
- Favorable tax incentives for retaining, conserving and managing forestland such as the N.C. Conservation Tax Credit Program
- Extend Present Use Value (PUV) to all forest landowners, not just private landowners, who are actively managing their land in order to keep productive woodland as woodland
- Favorable regulatory policies that encourage active and sustainable forest and habitat management
- Increased positions for agency mapping and computer application development
- Additional natural resource positions for technical assistance in priority areas
- Increased marketing of conservation programs and services to the general public

- Advertising campaign to highlight past forestry successes, present needs and future opportunities (ex. Smokey Bear or Woodsy Owl but with a forest management focus)
- Conservation agency salary plans to address employee retention, to incentivize performance and encourage career advancement
    - Progressive salary increases
    - Outcome-based incentives
    - Adequate salary increases to secure the best promotional candidates

EXAMPLE METRICS

- Acres of reforestation
- Acres of site preparation or herbicide release
- Acres of precommercial thinning
- Acres of prescribed burning
- Acres of commercial thinning
- Acres enrolled in conservation/cost share programs
- Acres of improved or conserved habitat
- Landowners assisted
- Landowner/group outreach events/workshops
- State or regional partnership projects or conservation initiatives

Figure 1.2.1. NCFS Management Plans Provided (2001-02 to 2018-19)



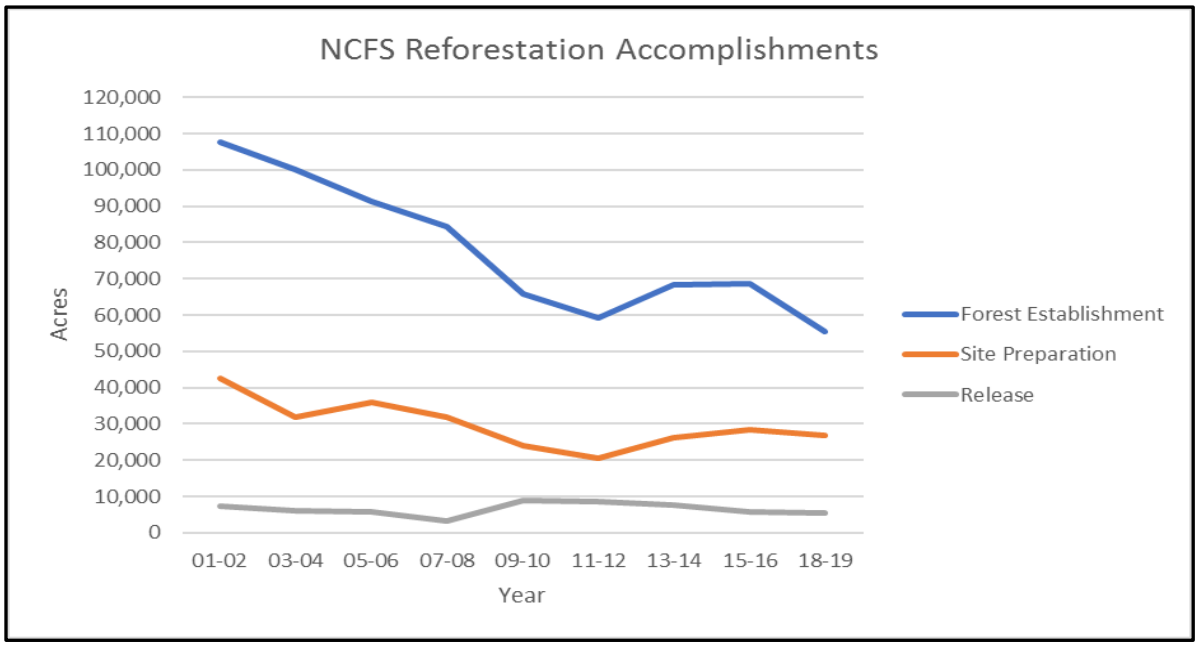
Source: NCFS Forest Management Accomplishment Database

Figure 1.2.2. NCFS Reforestation Acres (2001-02 to 2018-19)

NCFS Reforestation Acres									
	Year								
Practice	01-02	03-04	05-06	07-08	09-10	11-12	13-14	15-16	18-19
Forest Establishment	107,597	100,110	91,346	84,450	65,798	59,239	68,383	68,799	55,304
Site Preparation	42,614	31,771	36,005	31,985	24,072	20,483	26,075	28,361	26,945
Release	7,256	5,958	5,813	3,183	9,084	8,681	7,666	5,886	5,581

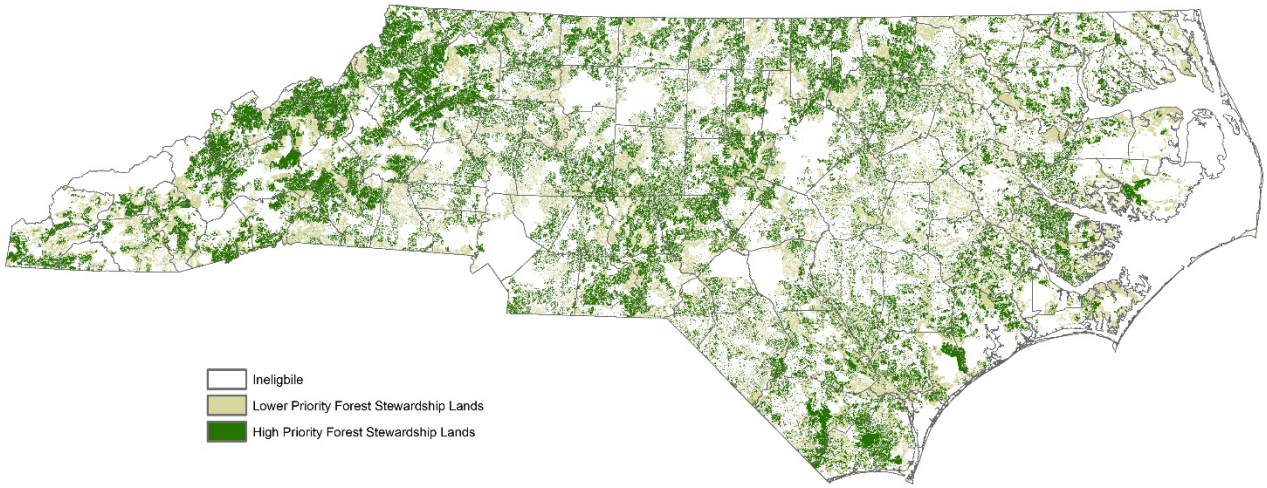
Source: NCFS Forest Management Accomplishment Database

Figure 1.2.3. NCFS Reforestation Accomplishments (2001-02 to 2018-19)



Source: NCFS Forest Management Accomplishment Database

Figure 1.2.4. Forest Stewardship Priority



Note: The "ineligible" areas shown in Figure 1.2.1 are associated with public lands, urban areas, etc. that do not qualify to participate in the NCFS Forest Stewardship program.

Forest Stewardship Program		
Priority Level	**Acres**	**% of SLFA Priority**
Lower Program Priority	13,026,387	**53%**
Higher Program Priority	11,707,173	**47%**
Sum:	**19,902,278**	**100%**

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Wildlife

Objective 1.5—Restore, and conserve priority forest, aquatic and wildlife habitat.

CURRENT CONDITIONS AND TRENDS

- North Carolina supports a high degree of diverse terrestrial and aquatic species as well as many unique habitats from the mountains to the coast. Many of these species and habitats are nationally significant resources with a high level of conservation priority.
- Many Species of Greatest Conservation Need (SGCN) have declining populations with at least some influence from forest management practices. Forest management by public and private land managers has a significant influence on habitat quality for many species.
- Several organizations and agencies have focused their efforts on forest habitat protection and restoration, prioritizing forest connectivity, rare and sensitive ecosystems, working forests, and promoting adaptive or resilient landscapes.[8]
- Throughout North Carolina, these organizations and agencies participate in conservation partnerships with diverse members, including forest industry and local governments. These partnerships focus on state and regional conservation species and habitat priorities.
- These partnerships also bring together key partners in forestland conservation and are well positioned to accomplish shared objectives by combining and leveraging resources and funding.
- State forestry, wildlife agencies and organizations have developed a series of strategic plans and programs to prioritize proactive, nonregulatory, and incentives-based conservation actions and to identify areas of greatest conservation opportunity to focus strategic conservation efforts.
- The 2015 N.C. Wildlife Action Plan (NCWAP) identifies fish and wildlife SGCN and other species for which there are research or management priorities. The plan describes 40 types of aquatic, wetland, and terrestrial natural communities that provide important habitat for SGCN and other priority species.
- In North Carolina, there are 41 federally endangered and threatened animal species protected by the U.S. Fish and Wildlife Service (USFWS) under the Federal Endangered Species Act. Twenty-nine of those species have recovery plans. In addition, there are 67 state endangered and threatened species and 115 state species of Special Concern protected by the N.C. Wildlife Resources Commission (NCWRC) under the State Endangered Species Act.
- There are 27 federally endangered and threatened plant species in North Carolina, protected under general statute by the USFWS. The N.C. Plant Conservation Program, a unit of the Department of Agriculture and Consumer Services, is responsible for the protection of 134 state endangered and threatened plant species and 19 plant species of Special Concern in the state.
- Audubon North Carolina has identified 96 Important Bird Areas (IBAs) in North Carolina, comprising 4.9 million acres. These IBAs provide essential habitat for one or more species of birds at some time during their annual cycle of breeding, migrating or wintering. Nearly all of North Carolina's IBAs include public lands, land trust conservation lands, and land owned or managed by private citizens. In addition, 30 of North Carolina’s IBAs have been approved by BirdLife International as globally significant. This means that the site is important to the protection of the species on a worldwide scale.
- Partners in Amphibian and Reptile Conservation has identified Priority Amphibian and Reptile Conservation Areas (PARCAs). These areas provide essential habitat for North Carolina’s high diversity of reptiles and amphibians.

- North Carolina contains the largest estuarine system of any single Atlantic coast state, with numerous estuarine rivers, creeks, sounds, inlets, and ocean bays that create a diverse system over 2.3 million acres in size. Located at the convergence of the mid-Atlantic and south Atlantic biogeographical provinces, North Carolina supports a mix of northern and southern fish species. This combination of species richness, extensive estuarine and marine waters, and the diversity and abundance of habitats makes North Carolina's coastal fisheries among the most productive in the United States.[3]
- North Carolina is one of the nation's leading coastal fishing states, with landings by commercial and recreational fishermen ranking among the top Atlantic coast states every year. More than 90% of North Carolina's commercial fisheries landings and more than 60% of the recreational harvest (by weight) are comprised of estuarine-dependent species that depend on coastal sounds and rivers to complete their life cycles. The state's history of productive fisheries is due not only to its large and diverse ecosystem, but also to flexible and responsive management of coastal fisheries with extensive data collection and public participation, as well as a strong heritage of commercial and sport fishing throughout eastern North Carolina.[3]
- More than 340 natural community types, ranging from the grassy balds in the mountains to the maritime forests of the beaches and barrier islands, have been described in North Carolina. The Natural Heritage Program documents the best examples of these natural communities throughout the state with site reports, element occurrence records and GIS-based maps. These natural communities are described in the "Guide to the Classification of the Natural Communities of North Carolina (Fourth Approximation)."[7]
- A 2017 NCWRC report contains a summary of protected wildlife species of North Carolina. The species listed in this document have been recognized as needing additional conservation by the NCWRC under the State Endangered Species Act (G.S. 113-331 to 113-337) and by the USFWS under the Federal Endangered Species Act (16 U.S.C. 1531 to 1543).[2]
- Environmental advocacy groups continue to file lawsuits or petition the USFWS to propose listing numerous candidate species for protection under the Endangered Species Act. Increased federal or state regulation can have a beneficial impact on species conservation but can also have a negative impact on private or federal forest management options. A balanced conservation approach is needed to promote voluntary cooperation that protects and conserves priority species and habitats.

NOTABLE THREATS

- Critical habitat loss, fragmentation, and degradation from anthropogenic land use alteration including development, transportation and service corridors, and conversion of forests to non-forest land uses
- Wildlife disease and pathogens associated with habitat impacts
- Decline or loss of native wildlife as well as protected, threatened or endangered species
- Invasive species
- Forest management practices that negatively impact water quality, water quantity, habitat diversity and at-risk species habitat
- Climate change resulting in increased frequency and severity of weather events such as storms and droughts

SUPPORTING INFORMATION

- N.C. Wildlife Resources Commission Wildlife Action Plan
  - https://www.ncwildlife.org/plan
- The Southeast Aquatic Habitat Plan (SAHP)
  - https://southeastaquatics.net
- National Fish and Wildlife Foundation
  - https://www.nfwf.org/
- National Fish and Wildlife Foundation Business Plan: Longleaf Forests and Rivers
  - https://www.nfwf.org/sites/default/files/2019-12/longleaf-forests-rivers-business-plan.pdf
  - http://southeastfreshwater.org/2016/12/05/final-report-pdfs/
- Audubon North Carolina Important Bird Areas of North Carolina
  - https://nc.audubon.org/saving-important-bird-areas-3
- The Nature Conservancy North Carolina Strategic Plan 2018-2025
- N.C. Department of Environmental Quality (DEQ) 2016 Coastal Habitat Plan
  - http://portal.ncdenr.org/web/mf/habitat/chpp/downloads
- Coastal Habitat Protection Plan
  - http://portal.ncdenr.org/web/mf/Habitat/CHPP
- Two key resources from the N.C. Wildlife Resources Commission:
  - https://www.ncwildlife.org/Portals/0/Conserving/documents/2002_GuidanceMemorandumforSecondaryandCumulativeImpacts.pdf; and,
  - https://www.ncwildlife.org/Portals/0/Conserving/documents/ConservingTerrestrialHabitatsandSpecies.pdf
- Southeast (SE) Conservation Adaptation Strategy
  - http://secassoutheast.org/
- The Southeastern Conservation Blueprint
- U.S. Fish & Wildlife Service
  - https://www.fws.gov/southeast/north-carolina/

PRIORITY AREAS

- 2015 Wildlife Action Plan Conservation Opportunity Areas (COA) and Habitat Threat Risk Assessment (TRA)
- Natural Heritage Areas identified by the N.C. Natural Heritage Program, which are also incorporated as a component of the Biodiversity and Wildlife Assessment. Both are available at the Natural Heritage Data Explorer.
  - https://ncnhde.natureserve.org/
- South Atlantic Landscape Conservation Cooperative Conservation Blueprint and Planning Atlas
  - https://salcc.databasin.org/
- SARP-USFWS-NFHP Aquatic Habitat Restoration Program Conservation Opportunity Areas (See SAHP above.)
- NCPARC Priority Amphibian and Reptile Conservation Areas (PARCA's)
  - https://parcplace.org/wp-content/uploads/2017/08/PARCA_System_Criteria_and_Implementation_Guidance_FINAL.pdf

- Audubon North Carolina – Important Bird Areas (IBA) of North Carolina
    - http://nc.audubon.org/sites/default/files/static_pages/attachments/important_bird_areas_2011.pdf
- Audubon North Carolina Forest Landbird Legacy Program and Priority River Basins
    - https://nc.audubon.org/landing/forest-legacy-landbird-project-0
- The Nature Conservancy (TNC) priority landscapes
    - Southern Blue Ridge
    - Longleaf Pine
    - Albemarle – Pamlico Sound Region
- The Nature Conservancy (TNC) Tools & Data
    - www.conservationgateway.org/ConservationPlanning/ToolsData/Pages/tools-and-data.aspx
- Strategic Habitat Areas of the Coastal Habitat Protection Plan
    - http://portal.ncdenr.org/web/mf/Habitat/CHPP
- National Wild Turkey Federation Focal Landscapes
    - Eastern Flatwoods
    - Western Carolinas
    - Southern Appalachians
- NCFS Forest Stewardship Priority Map
- NCFS Forest Legacy Priority Map
    - See Appendix IX – Forest Legacy Program Assessment of Need.

NOTABLE RESOURCES NEEDED

- Identification of lead individuals, key partners and organizations for improved cooperation and collaboration between state agencies, key stakeholders and cooperative partners
- Development and implementation of interorganizational MOUs and cooperative agreements
- Increased state and federal funding for conservation initiatives, grants, and programs to engage consulting foresters, private landowners and local governments in wildlife habitat conservation and restoration
- Forestry, wildlife and conservation programs for financial and tax benefits (ex. N.C. Conservation Tax Credit)
- Increased personnel capacity of foresters and wildlife technical guidance biologists to implement funding for wildlife conservation land programs
- Increased forestland protection using conservation programs to secure easements and land acquisitions, particularly in high priority landscapes
- Favorable tax incentives for protecting, conserving and managing forestland and critical habitat for at risk-species
- Favorable regulatory policies that encourage active and sustainable forest and habitat management
- Favorable regulatory and incentive programs to encourage retention of small parcels for ecosystem services rather than forest products (ex. flood control, air quality, carbon storage, etc.)
- Funding for training and dedicated personnel to provide direct technical services related to conserving, restoring and connecting ecologically functioning forests
- Funding to support tree nurseries in the production of native forest ground cover and riparian plant or tree species

- Funding for training and dedicated personnel to provide technical services related to identifying and restoring critical terrestrial and aquatic habitat at risk
- Information for foresters and land managers on how to balance revenue generation and habitat management for bottomland hardwood, longleaf pine, shortleaf pine, northern hardwoods and other priority forest types
- Funding for public education and outreach (ex. websites, newsletter articles, emails, billboards and radio/television PSAs)
- Additional resource managers to assist landowners with developing and implementing comprehensive forest-management plans that incorporate landowner wildlife management objectives as well as focus on utilizing silviculture and stewardship practices that mimic natural ecosystem conditions beneficial to native wildlife species
- Increased marketing of conservation programs and services to the general public
- Increased investment partnerships by water utilities in forest conservation and source water protection

EXAMPLE METRICS

- Landowners assisted with management plans and management actions for priority species or habitat
- Landowners implementing management practices to restore priority habitat
- State or regional partnership projects or conservation initiatives
- Acres of priority habitat and/or landscapes conserved through land protection (ex. fee simple acquisition; conservation easements; long-term management agreements)
- Stream miles and floodplain acres improved or conserved in priority sub-watersheds
- Properties and/or acres enrolled in Safe Harbor; NC Forest Legacy Program; NC Registry of Natural Heritage Areas; or similar conservation agreements
- Landowner/group outreach events
- Consulting foresters and other natural resource professionals trained
- Landowners participating in wildlife management educational events
- Population trends of priority species

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2. *Protected Wildlife Species of North Carolina.* N.C. Wildlife Resources Commission. October 2017.
3. NCDEQ (North Carolina Department of Environmental Quality). *North Carolina Coastal Habitat Protection Plan Source Document.* Morehead City, NC. Division of Marine Fisheries. 2016.
4. Bailey, M.A., J.N. Holmes, K.A. Buhlmann, and J.C. Mitchell. *Habitat Management Guidelines for Amphibians and Reptiles of the Southeastern United States.* Partners in Amphibian and Reptile Conservation Technical Publication HMG-2, Montgomery, Alabama. 2006.
5. Elkins, D.C., et al. *The Southeastern Aquatic Biodiversity Conservation Strategy. Final Report.* Athens, GA. University of Georgia River Basin Center. 2016.
6. "Southeast Conservation Adaptation Strategy." *Recent Trends in Southeastern Ecosystems: Measuring Progress toward the SECAS Goal.* 2019.
7. Schafale, M. *Guide to the Classification of the Natural Communities of North Carolina*. Fourth Approximation. North Carolina Heritage Program, Department of Environment and Natural Resources. 2012.
8. "Keeping Forests as Forests." *Mapping the South's Forests of the Future*. May 2018.

KEY PARTNERSHIPS

American Forest and Paper Association	American Forest Foundation
American Hardwood Export Council	Appalachian Hardwood Manufacturers Inc.
Association of Consulting Foresters	Audubon North Carolina
Black Family Land Trust	Cape Fear Arch Conservation Collaborative
Carolina Loggers Association	Conservation Trust for NC
County forestry committees/clubs	Economic Development Partnership of North Carolina
Forest Landowners Association	Forest Proud
Forest Stewards Guild	Forest Resources Association
Greater Uwharrie Conservation Partnership	Keeping Forests as Forests
Land Conservation Assistance Network	Land for Tomorrow Coalition
Landowner associations	Longleaf Alliance
N.C. Coastal Land Trust	N.C. Cooperative Extension
N.C. Department of Agriculture & Consumer Services, Pesticide Division	N.C. Forest products companies
N.C. Forest Service Forest Stewardship Program	N.C. Forestry Association
N.C. Natural Heritage Program	N.C. Partners in Amphibian and Reptile Conservation
N.C. Partners in Flight	N.C. Soil & Water Conservation Districts
N.C. State Ports Authority	N.C. State University College of Natural Resources
N.C. Tree Farm	N.C. Wildlife Resources Commission
National Alliance of Forest Landowners	National Hardwood Lumber Association
National Wild Turkey Federation	North Carolina Sandhills Conservation Partnership
Onslow Bight Conservation Forum	Society of American Foresters
South Atlantic Landscape Conservation Cooperative	Southern Forest Products Association
Southern Group of State Foresters	Sustainable Forestry and African American Land Retention Project
The Forest Productivity Cooperative	The Nature Conservancy
The Sustainable Forestry Initiative	U.S. Fish and Wildlife Service
U.S. Forest Service	U.S. Industrial Pellet Association
USDA Farm Services Agency	USDA Natural Resources Conservations Service
Wood Utilization and Design Institute	Woodworks

B. National Priority: Protect Forests from Threats

Goal 2. Reduce Negative Impacts from Forest Threats

Five key points:

- Fire exclusion contributes to the decline or loss of fire-dependent ecosystems and species and creates fuel conditions that produce destructive wildfires.
- Population increases in North Carolina's wildland urban interface (WUI) areas create significant challenges for firefighters and residents.
- Firefighting capacity to rapidly and effectively control wildfires has decreased over the past decade across North Carolina.
- Major forest pests and nonnative invasive (NNI) plants significantly damage the ecological and economic vitality of North Carolina's forests. Risks to the ecological and economic vitality of North Carolina's forests will intensify as new forest pests and NNI plants are introduced and complex challenges to protecting forests from threats increase.
- Climate change and major weather events will directly impact forest resources, creating challenges to traditional forest management strategies and potentially compounding other forest threats.

Objectives:

- 2.1—Minimize the impacts of wildfire on forests, citizens and communities.
- 2.2—Minimize negative impacts to forest health caused by major, locally significant or imminent insects, diseases and nonnative invasive plants.
- 2.3—Identify impacts and develop long-term approaches that minimize negative influences on forests caused by climate change, air quality and weather events.

Strategies:

- 2.1.1—Increase resources and capacity to respond to and manage wildland fires.
- 2.1.2—Educate the public, land management professionals and government officials on WUI fire risks, issues and mitigation techniques.
- 2.1.3—Encourage interorganizational planning, policymaking and collaboration that lead to the use of wildfire mitigation principles in construction and community planning.
- 2.1.4—Increase decision support tools regarding fire danger, weather products and fire response planning.

- 2.1.5—Encourage preparation and implementation of Community Wildfire Protection Plans (CWPPs).
- 2.1.6—Develop fire prevention and response plans, as well as training, for areas with increased fuel loading.
- 2.2.1—Train natural resource professionals to better identify, understand, report and respond to forest health threats.
- 2.2.2—Develop diverse information and education materials for the public to address identification and management of forest insect, disease and nonnative invasive threats.
- 2.2.3—Promote the use of local or treated firewood to prevent the spread of invasive pests.
- 2.2.4—Survey and monitor outbreaks and spread of major and locally significant forest insect and disease threats.
- 2.2.5—Monitor the spread and movement (early detection) of imminent and future introduced nonnative invasive species.
- 2.2.6—Promote interorganizational policymaking, collaboration, and rapid response planning and implementation to address introduction and containment of forest health threats.
- 2.2.7—Use integrated pest management practices including sound silviculture and urban forest/arboriculture practices to mitigate forest health risks and minimize damage from threats.
- 2.3.1—Promote research and knowledge sharing targeted toward better understanding of potential direct impacts to trees and forests from climate change and air quality.
- 2.3.2—Develop and promote forest management practices specifically for areas most likely to be affected by sea-level change and saltwater intrusion.
- 2.3.3—Increase tree planting and use of silviculture practices to expand carbon storage capacities.
- 2.3.4—Promote interorganizational preplanning to include response planning, policymaking and collaboration that leads to coordinated responses for managing forest resources affected by damaging weather events.

Image of the Party Rock Wildfire near Lake Lure, NC. Photo credit: John Cayton, 2016.

Wildland Fire

Objective: 2.1.—Minimize the impacts of wildfire on forests, citizens and communities.

CURRENT CONDITIONS AND TRENDS

- Since 2010, there have been 41,551 wildfires in North Carolina, burning 399,125 acres. Human activity is still the leading cause of wildfires.[1] Fire report data going back to 1970 has "debris burning" identified as the leading cause at 38%.[2]
- The cost of wildfire response is increasing, with the 2016 wildfires costing an estimated $55 million.
- North Carolina leads the nation with 13.5 million acres[3] in WUI. WUI acreage is growing as more people move to the state and into once rural areas. Today, there are 2.25 million homes and 4.8 million people living in the state.
- The projected 11.5% increase in North Carolina's population from 2010-2020[4] is a trend that will lead to an increase in WUI problems for the state.
- Since the initiation of this project, 899 CWPPs have been completed, and 94 are in various stages of development. These CWPP's are being completed at the local fire district level and bring together all wildland fire partners for the district. This collaborative approach is used to identify Areas of Concern and Communities at Risk. Mitigation practices are then identified to address threats from wildland fire. An approach N.C, has taken is to utilize the State Fire Assistance—Mitigation grant funds to complete fuel reduction activities identified in the CWPP's. In many cases these fuel reduction projects would not have been without this program. Completed CWPP's are available at each NCFS county office and you can find those contacts by visiting the NCFS website.
- There are 37 active Firewise USA® sites.[5]
- North Carolina's WUI Risk Index estimates 2.3 million acres are at risk for moderate to major impacts from wildfires to people and their homes.[6]

NOTABLE THREATS

- Increase in WUI
  - Data from 1990-2010 showed an increase of 3,005,048 acres in total WUI during that period for North Carolina.
- Climate change
  - See objective 2.3.
- Qualified wildland firefighters
  - There are fewer trained personnel in higher level incident command positions than ever before. Retention, attrition and speed to competency have all played a part. Currently, 49% of the N.C. Forest Service (NCFS) workforce has service that amounts to 10 years or less.
- Increased fuel loading related to fire exclusion and plant mortality from nonnative diseases and pests
- Increased population leading to more human activity in or near woodlands

SUPPORTING INFORMATION

- N.C. Forest Service "Fire Control and Prevention"
  - https://ncforestservice.gov/fire_control/fire_control.htm
- Southern Wildfire Risk Assessment Portal (SWRAP)

- https://southernwildfirerisk.com/
- National Interagency Fire Center (NIFC)
  - https://www.nifc.gov/index.html
- National Cohesive Wildland Fire Management Strategy
  - http://www.southernwildfire.net/
- Resist Wildfire N.C.
  - http://www.resistwildfirenc.org/

PRIORITY AREAS

- Areas that are identified as moderate to extreme risk in the SWRAP and/or identified as areas of concern in CWPPs
- Fuel reduction treatments in and around large landholdings such as national forests, military installations, game lands, wildlife refuges, state parks, etc.
- Maintaining areas where fuel reduction treatments have been accomplished

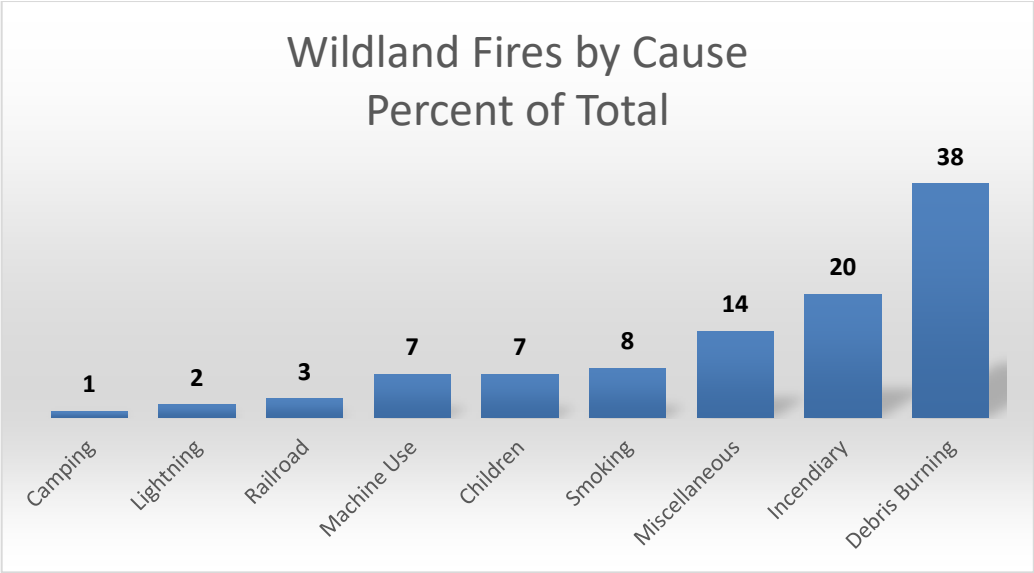
NOTABLE RESOURCES NEEDED

- Funding for wildland fire agencies' equipment such as PPEs, radios, engines, tractor-plow units, transports, aircraft, weather stations, smoke monitors, etc.
- Funding for fire department wildland fire equipment such as PPEs, brush trucks, engines, Class A foam equipment, etc.
- Funding for training
- Funding to conduct public outreach including materials such as billboards, television PSAs, workshops and newspaper print ads
- Funding for education and outreach
- Funding for situational awareness equipment and software

EXAMPLE METRICS

- Trained wildland firefighters and incident management teams
- FEPP/FFP equipment screened and distributed
- Volume of wildland firefighting PPE, equipment and foam purchased by fire departments
- Firewise USA® sites
- CWPPs completed and/or updated
- Outreach efforts targeting WUI landowners and communities (ex. number of attendees)
- Acres treated to reduce hazardous fuel loads
- Homes lost to wildfire

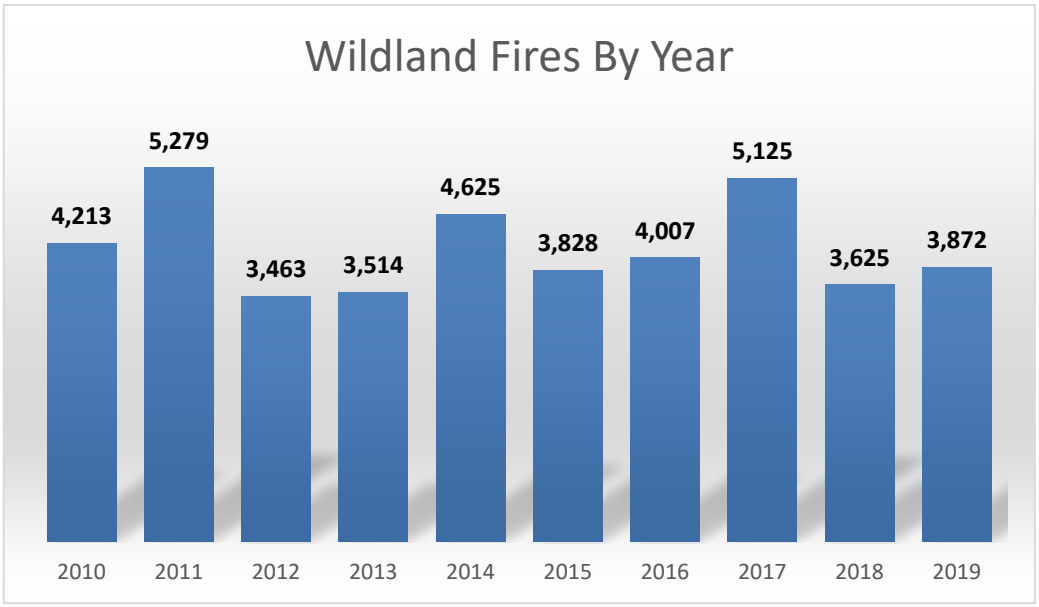
Figure 2.1.1. Wildland Fires by Cause Since 1970



In North Carolina, debris burning continues to be the leading cause of wildland fire in the state. It is important to note that only 2% of wildfires are caused by lightning.

Source: NCFS Fire Report Database

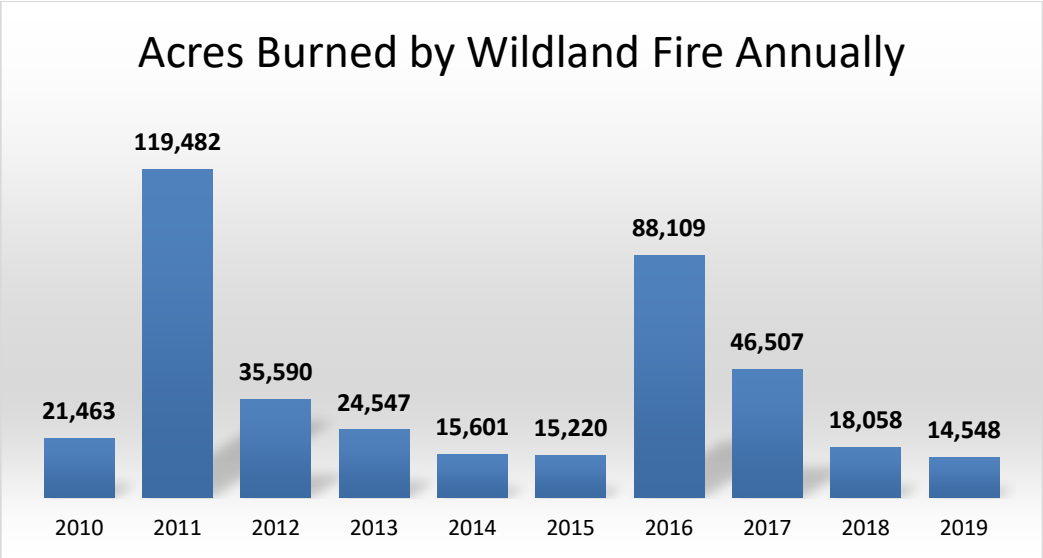
Figure 2.1.2. Wildland Fires by Year



The number of wildland fires does fluctuate from year to year, but over the last 10 years, North Carolina has had an average of 4,155 wildland fires annually. Climate conditions plays an important part in the number of wildland fires that occur in North Carolina each year.

Source: National Interagency Fire Center (NIFC)

Figure 2.1.3. Acres Burned by Wildland Fire Annually



The number of acres consumed by wildland fire can change drastically. While most wildland fires are kept small at 2 acres or less, weather events that produce low relative humidity combined with strong winds can cause fires to grow quickly. During years with persistent drought conditions, the acres burned can increase exponentially. Years 2011 and 2016 are examples of this effect.

Source: National Interagency Fire Center (NIFC)

Figure 2.1.4. Total Wildland Urban Interface in North Carolina

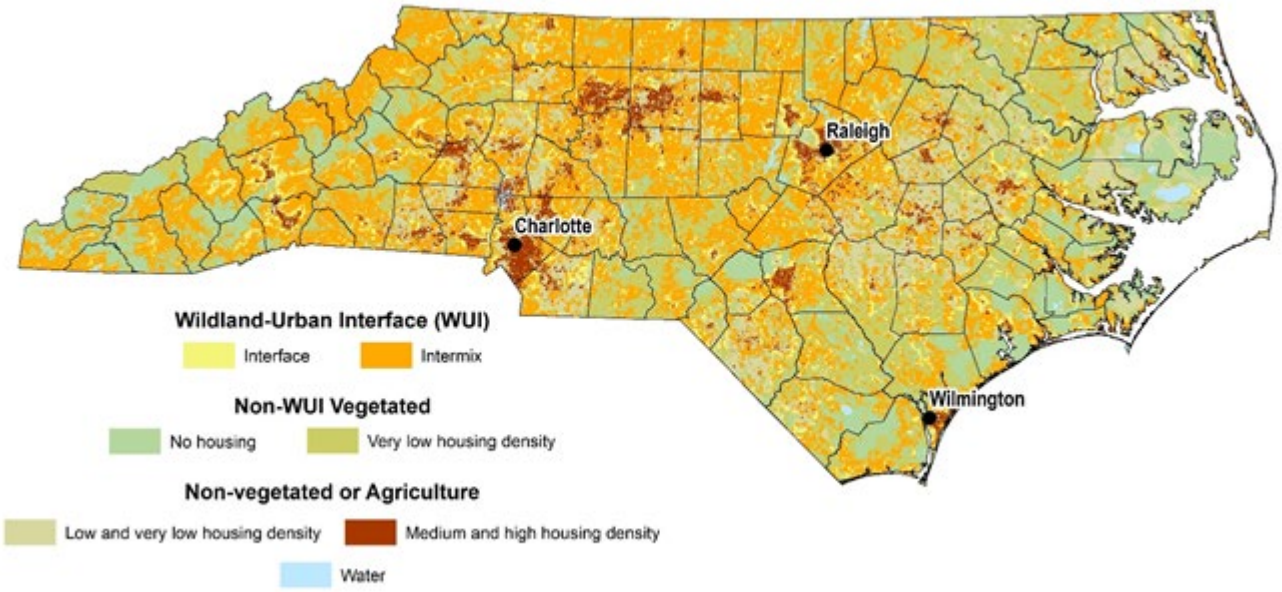


Figure 2.1.5. Annual Wildfire Occurrence in North Carolina (10-Year Average)

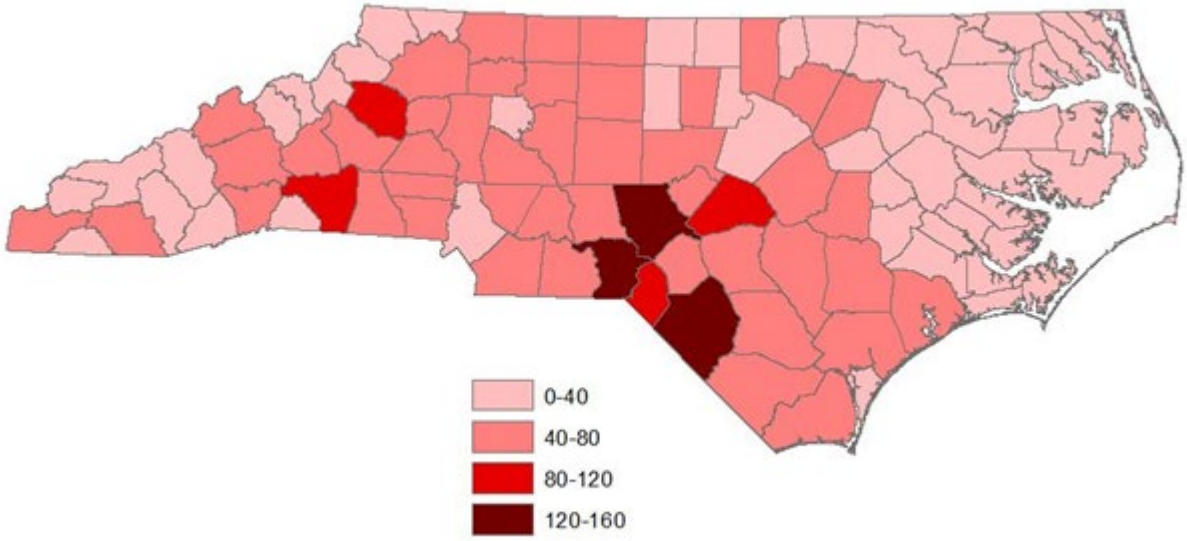
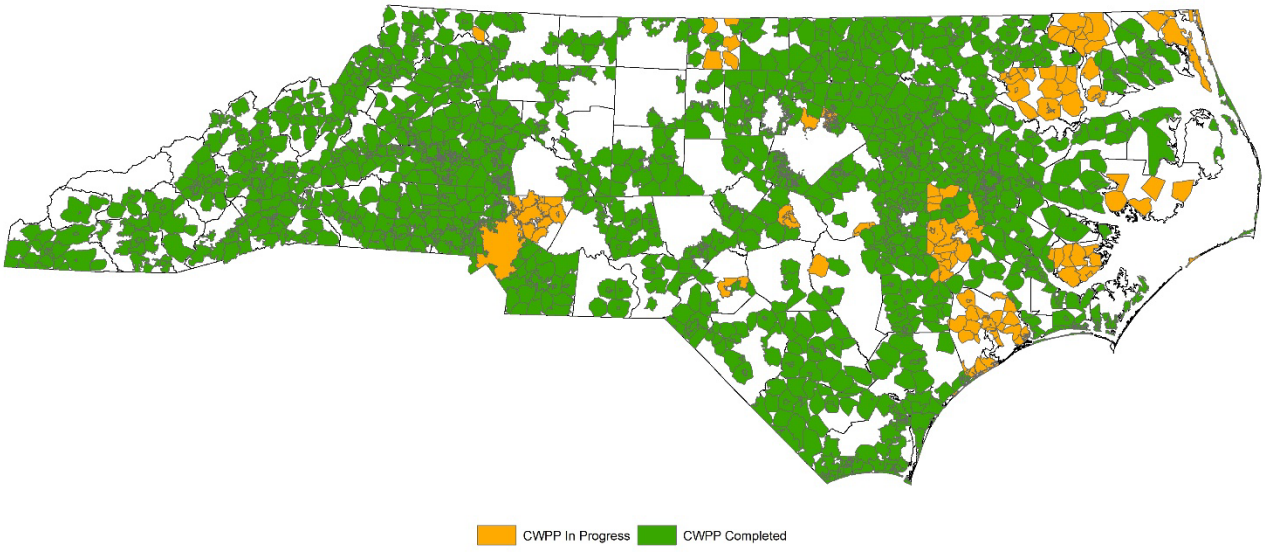


Figure 2.1.6. CWPPs in North Carolina



REFERENCES

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2. N.C. Forest Service Wildfire Statistics page. https://www.ncforestservice.gov/fire_control/fc_statisticsCause.htm
3. Wildland-Urban Interface Change 1990-2010. http://silvis.forest.wisc.edu/data/wui-change/
4. N.C. Office of State Budget Management / Projected Population Change 2010-2020 https://files.nc.gov/ncosbm/demog/countygrowth_2020.html
5. Firewise USA® sites. https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA/Firewise-USA-Resources/Firewise-USA-sites
6. Southern Wildfire Risk Assessment Summary Report. https://southernwildfirerisk.com/

Forest Health

Objective: 2.2.—Minimize negative impacts to forest health caused by major, locally significant or imminent insects, diseases and nonnative invasive (NNI) plants.

CURRENT CONDITIONS AND TRENDS

- Recently introduced NNI insects, disease pathogens and plants continue to threaten tree species and forests in the state. Following are harmful NNI invasive forest pests introduced into North Carolina since the 2010 N.C. Forest Action Plan (NCFAP).
    - **Major threats**:
        - Insect—Emerald ash borer (first North Carolina positive in 2013), now infesting ash trees in 55 North Carolina counties
        - Disease/Insect—Laurel wilt (first North Carolina positive in 2011), vectored by redbay ambrosia beetles and now infecting bays and sassafras in 11 North Carolina counties
        - Plant—Cogongrass (first North Carolina positive in 2012), now infesting six North Carolina counties
    - **Potential Threat**:
        - Disease/Insect—Thousand cankers disease of walnut (first North Carolina positive in 2010), vectored by walnut twig beetle and found only in Haywood County
- In addition to the recent introductions listed above, 19 native and established exotic insects, diseases and invasive plants are considered major threats that continue to impact North Carolina trees and forests.

Insects

European gypsy moth
Hemlock woolly adelgid
Ips engraver beetle
Southern pine beetle

Diseases/Declines
Beech bark disease
Fusiform rust
Heterobasidion root disease
Oak decline (disease decline)

Invasive Plants

Autumn olive
Callery pear
Chinese privet
Garlic mustard
Japanese knotweed
Japanese privet
Japanese stiltgrass
Miscanthus/Chinese silvergrass
Oriental bittersweet
Paulownia/princess tree
Tallowtree/popcorntree
Tree-of-heaven

- Other native and exotic insects, diseases and plants are considered locally significant threats and continue causing damage in small geographic areas, threatening trees during periodic cycles, or impacting only stressed or damaged trees. These include but are not limited to:

Insects	Diseases/Declines	Invasive Plants
Balsam woolly adelgid	Brown spot needle blight	Chinaberry
Black turpentine beetle	Butternut canker	Chinese and Korean *Lespedeza*
Black twig borer	*Caliciopsis* canker	Chinese and Japanese *Wisteria*
Black spotted brown moth	Dogwood anthracnose	Common reed
Fall and spring cankerworms	Littleleaf disease	English ivy
Fall webworm	Oak wilt	Japanese honeysuckle
Forest tent caterpillar	Pitch canker	Japanese meadowsweet
Pales weevil	*Phytophthora* root rot	Kudzu
Pine *Colaspis* beetle	Procerum pine root decline	Mimosa
Matsucoccus macrocicatrices (scale)		Multiflora rose
Pine sawflies		Periwinkle
Variable oak leaf caterpillar		
Yellow poplar weevil		

NOTABLE THREATS

- The following insects, diseases and plants have been detected in the U.S. but are not currently found in North Carolina. At this time, they are considered imminent threats to North Carolina forests and can potentially be major threats to our trees and forests if they become established in the state.
    - Insects:
        - Asian gypsy moth, previously detected in North Carolina and other states but not currently established in the U.S.
        - Asian longhorned beetle, detected in South Carolina, summer 2020).
        - *Sirex* woodwasp, currently found in Northeast U.S.
        - Spotted lanternfly, currently found as far south as Northern Virginia
            - NOTE: Spotted lanternfly will mainly affect agricultural crops and will likely affect urban forest trees.
    - Disease:
        - Sudden oak death—the pathogen that causes this disease has been detected in North Carolina, but to date, the disease has not manifested in the environment.
    - Plant:
        - Wavy leaf basket grass, currently found in Virginia
- Additional harmful nonnative insects, diseases and invasive plants may be brought into the U.S. from abroad through global trade and commodity movement, emphasizing the need for coordinated monitoring to ensure early detection and rapid response to new threats.
- Domestically, movement of untreated firewood from areas where major forest insect and disease threats are present is a main cause for spread of these threats to new areas.

SUPPORTING INFORMATION

- General pest threats
  - www.ncforestservice.gov/forest_health/forest_health.htm
  - www.ncforestservice.gov/forest_health/forest_health_handbook.htm
  - http://southernforesthealth.net/, www.eddmaps.org/species/
  - www.ncforestservice.gov/forest_health/fh_maps.htm
- https://savehemlocksnc.org/
- Regulatory information
  - www.ncagr.gov/plantindustry/plant/disease/disease.htm
  - www.ncagr.gov/plantindustry/plant/entomology/index.htm
  - www.ncagr.gov/plantindustry/plant/weed/weedprog.htm
  - www.aphis.usda.gov/aphis/resources/pests-diseases/hungry-pests/pest-tracker/states/north+carolina
- Pests spread through firewood movement
  - www.Dontmovefirewood.org
  - www.ncforestservice.gov/forest_health/fh_firewood.htm
  - www.ncforestservice.gov/forest_health/pdf/Map_Invasives_NCTracking.pdf

PRIORITY AREAS

- Areas of high risk for southern pine beetle infestation
- Areas of high risk for current major and potential insect and disease pest threats
- Areas of high risk for imminent introduced insect and disease pest threats
- Areas within the range of hemlock in the state, specifically Hemlock Conservation Areas on public and private lands that are established and maintained through the North Carolina Hemlock Restoration Initiative (HRI) along with numerous partners
- Designated insect and disease treatment/restoration areas on U.S. Forest Service (USFS) lands in North Carolina determined through coordinated efforts of National Forests in North Carolina (NFNC) and the N.C. Forest Service (NCFS).

NOTABLE RESOURCES NEEDED

- Funding for training programs and materials for professionals
- Funding for information and education materials
- Funding for monitoring and trapping supplies/equipment
- Funding for increased GIS, database and server capability
- Development and implementation of interorganizational MOUs
- Natural resource professionals to provide technical services
- Increased availability of silvicultural equipment and operators

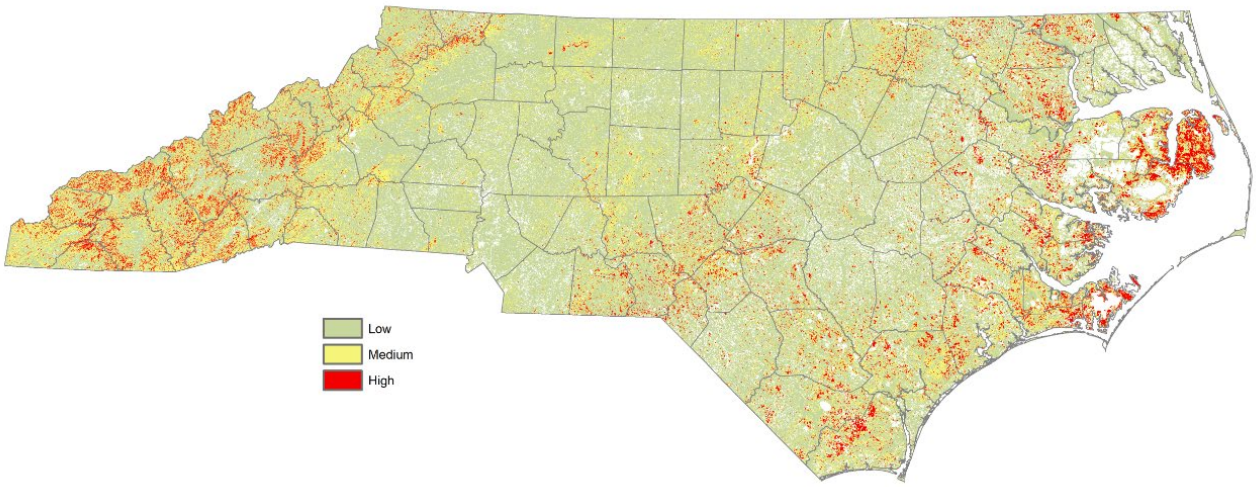
EXAMPLE METRICS

- Professionals trainings offered
- Training aids developed (ex. podcasts, webpages, news articles, posters, brochures)
- Internet users of applicable websites
- Insect and disease surveys completed

- Monitoring surveys completed
- Partnerships developed to assist with monitoring
- Strategic plans developed and implemented
- Collaborative projects completed
- Regulation and/or policy improvements mitigating forest threats
- Forest management plans addressing forest health risks
- Innovative approaches developed to minimize forest health risks
- Silviculture practices implemented to minimize forest health risks
- Acres thinned or managed (prescribe burn or understory control) utilizing Southern Pine Beetle Prevention Program Cost-share Program

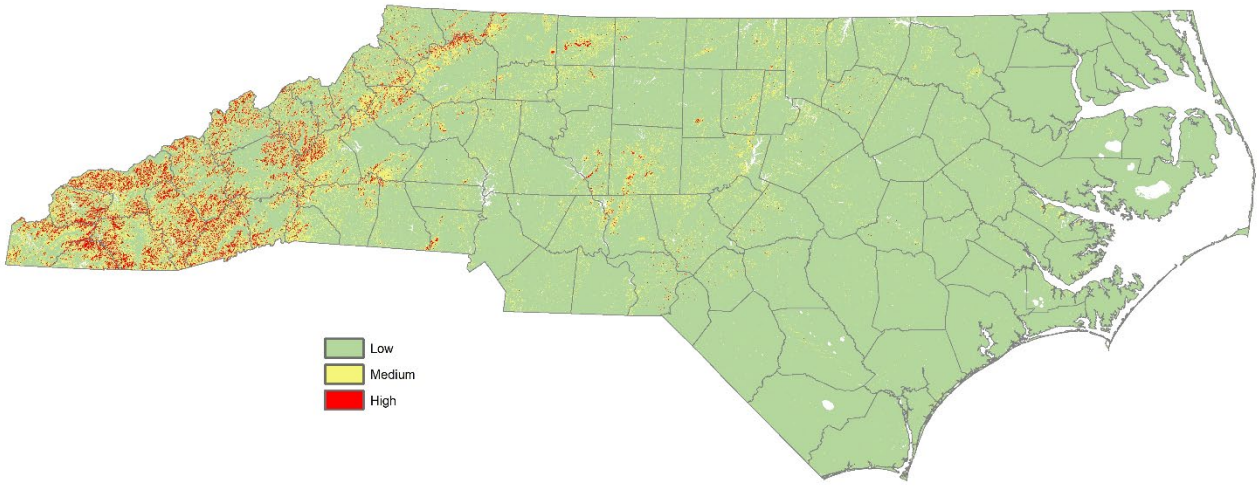
Emerald ash borer. Photo credit: Dr. James E. Zablotny, USDA.

Figure 2.2.1. Major Forest Health Risk Map



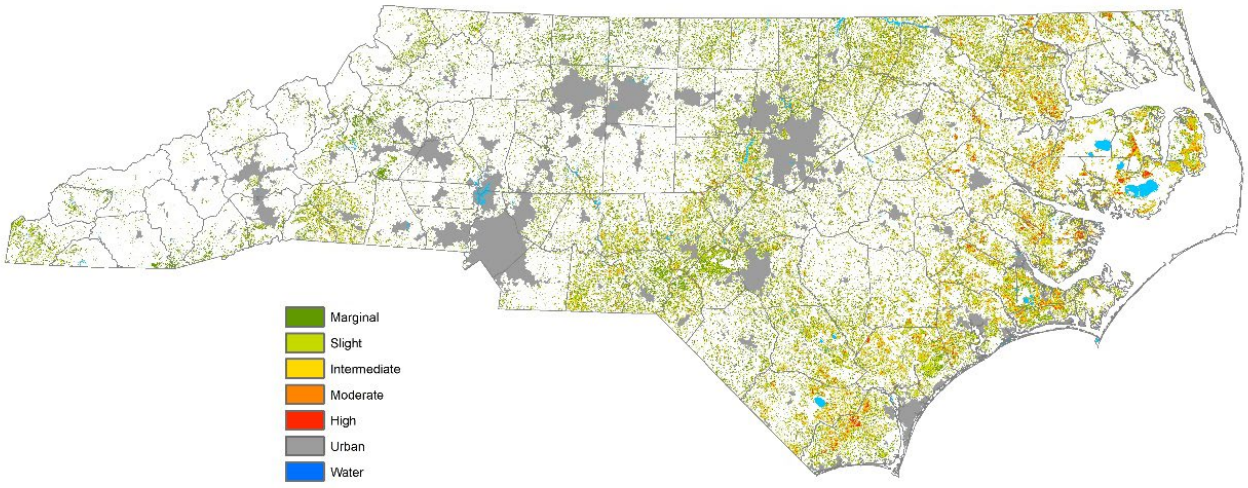
This map includes forests at risk of threats by one or more major forest pests. These major threats are listed in the Current Conditions and Trends section.

Figure 2.2.2. Imminent Forest Health Risk Map



This map includes areas at risk of threats from Asian gypsy moth, Asian longhorned beetle, spotted lanternfly and sudden oak death.

Figure 2.2.3. Southern Pine Beetle Hazard Map



This map displays areas with potential for experiencing southern pine beetle (SPB) activity. North Carolina has not had a major outbreak since 2002. The most susceptible stands are usually unmanaged and stressed from the environment, competition, age or a combination of factors. Cost share assistance programs like the Southern Pine Beetle Prevention Program, along with sound forest management practices, minimize future SPB outbreaks and restore productive stands with healthy, managed forests.

NCFS personnel treating hemlocks. Photo credit: Dr. Kelly Oten, NCFS.

Climate and Weather

Objective: 2.3.—Identify impacts and develop long-term approaches that minimize negative influences on forests caused by climate change, air quality and weather events.

CURRENT CONDITIONS AND TRENDS

Climate and Weather

Following are current climate and weather trends as reported by the North Carolina Climate Science Report, 2020[1]:

- "The 10 most recent years (2009-2018) represent the warmest 10-year period on record in North Carolina, averaging about 0.6°F warmer than the warmest decade in the 20th century (1930-1939). Recently released data indicates that 2019 was the warmest year on record in North Carolina."
- "There is no long-term trend in annual total precipitation averaged across the state. However, there is an upward trend in the number of heavy rainfall events (3 inches or more in a day), with the last four years (2015–2018) having seen the greatest number of events since 1900."
- Sea level has risen an average of "1.8 inches per decade since 1978 at Duck, NC and 0.9 inches per decade since 1935 at Wilmington, NC."

Major weather events observed since 2010 include:

- Since 2010, 17 hurricanes and tropical cyclones affected North Carolina, causing wind damage (breakage/uprooting) to trees, storm surge, salt deposition, and/or heavy rainfall and flooding.
- Recent Hurricanes Matthew (2016), Florence (2018), and Dorian (2019) produced prolonged torrential rains, saturated soils and extraordinary inland flooding.
- Salt deposits from storm surge, storm tides and evaporated sea spray impacts salt intolerant vegetation near the coast and along tidally influenced rivers.
- Droughts were observed in 2011, 2016 and 2019, in different locations of North Carolina. In each of those years, there were large-scale, long-duration wildfires that required substantial resources and contributed to poor air quality due to prolonged periods of smoke.

Forest Impacts

- Dramatic swings in wet and dry weather patterns are resulting in more intense fires, thus resulting in more acres burned and more resources needed to contain the fires.
- Declines of mature oaks and other species have been prevalent over the past few years. Usually, older trees weakened by prolonged drought, or conversely soil saturation, soil compaction, root damage or mechanical injury have experienced weakened natural defense responses, making them susceptible to attack by secondary insects and pathogens. Eventually, they succumb to this cycle of accumulating stress.
- *Ips* engraver beetles have been very active in recent years, attacking pines stressed by overstocking, periodic drought, unseasonably excessive soil wetness and other abiotic stressors.
- Salt intolerant trees in coastal areas and along tidally influenced rivers have been impacted by salt deposition from storm surge, storm tides and evaporated sea spray, likely causing loss of growth, stress and some scattered mortality.

- Recent windstorms have reinvigorated the concern about windthrow of residual trees along waterways, potentially contributing to blockages of flow. More intense and frequent rainstorms, particularly 'out of season' rainstorms, have resulted in observations from some operators noting that their 'normal' Best Management Practices (BMPs) they usually install do not seem to be functioning as well as in the past.
- There has been a resurgence of algal blooms in coastal waters and inland freshwaters. Forestry has been challenged, in some cases, regarding its contributions to causing these blooms, with increased scrutiny of harvesting and management practices from stakeholders.
- Urban tree canopy and carbon sequestration, and impervious surface conditions and trends are highlighted under Objective 5.4.

Economic and Financial Impacts to Forestry

- Weather-related impacts appear to be more intertwined with the inconsistency of timber markets. Examples include rapid onset of market allotment limits, or quotas, during dry periods; lack of timber supply during prolonged or repeated wet/flooded periods; and, disruption caused by the need to quickly salvage storm-damaged timber.
- Increased levels of disturbance risk, resulting from climate change, worsen the profitability of forestry regardless of the forest productivity scenario. Particularly in the case of decreased forest productivity scenarios, continuing to invest in forestry may result in economic losses for landowners; and, changes in disturbance risk and productivity are the most critical determinants for economic returns.

NOTABLE THREATS

Climate and Weather

The following climate and weather threat projections are from the North Carolina Climate Science Report, 2020[1]:

- "By the end of this century, annual average temperature increases relative to the recent climate (1996–2015) for North Carolina are projected to be on the order of 6°–10°F under a higher scenario … and 2°–6°F under a lower scenario …"
- There is low confidence concerning future changes in the number of winter coastal storms and future changes in the number of ice storms in North Carolina.
- It is likely (66-100% probability) that:
    - the number of hot and very hot days will increase;
    - the number of cold days (daytime maximum temperatures below 32°F) will decrease;
    - annual total precipitation for North Carolina will increase;
    - the frequency of severe thunderstorms in North Carolina will increase;
    - total snowfall and the number of heavy snowstorms in North Carolina will decrease due to increasing winter temperatures;
    - the intensity of the strongest hurricanes will increase with warming, and this could result in stronger hurricanes impacting North Carolina;
    - increases in extreme precipitation will lead to increases in inland flooding in North Carolina;
    - the frequency and severity of inland flooding will increase because of increases in the frequency and intensity of extreme precipitation;

    - future severe droughts in North Carolina will be more intense due to higher temperatures leading to increased evaporation, resulting in an increase in the frequency of climate conditions conducive to wildfires in North Carolina; and,
    - future urban growth will increase the magnitude of the urban heat island effect, resulting in stronger warming in North Carolina urban centers.
- It is very likely (90-100% probability) that:
    - the number of warm and very warm nights will increase;
    - summer heat index values will increase because of increases in absolute humidity;
    - extreme precipitation frequency and intensity in North Carolina will increase due to increases in atmospheric water vapor content; and,
    - heavy precipitation accompanying hurricanes that pass near or over North Carolina will increase, which would in turn increase the potential for freshwater flooding in the state.
- It is virtually certain that:
    - sea level along the North Carolina coast will continue to rise due to expansion of ocean water from warming and melting of ice on land, such as the Greenland and Antarctic ice sheets. High tide flooding, defined as water levels of 1.6-2.1 feet (0.5-0.65 meters) above Mean Higher High Water, is projected to become a nearly daily occurrence by 2100; and,
    - rising sea level and increasing intensity of coastal storms, especially hurricanes, will lead to an increase in storm surge flooding in coastal North Carolina.

Projections above generally cover the long-term view through 2100. The projected threats and issues affecting trees, forests and forestry programs listed below are primarily limited to the 10-year period from 2020-2029.

Forest Impacts

- The number of fires and the intensity of fires, as well as the number of acres burned, are expected to continue to increase due to the projected elevated intensity of droughts and dramatic swings in wet and dry weather patterns.
- Decline of mature oaks and other hardwoods is expected to continue and possibly increase as aging trees are exposed to swings in temperature and precipitation patterns as well as other abiotic threats.
- Changing weather patterns and overstocking will likely contribute to continued *Ips* engraver beetle and other bark beetle mortality.
- Repeated salt deposition will continue to impact coastal and tidally influenced riverine forests, causing eventual mortality to salt intolerant species and shifts in species composition to more tolerant species.
- We will see a continued loss of forests along the coastal fringe as saltwater intrusion expands its reach inland. New management options will be needed for landowners in these areas. A renewed emphasis may be needed to preserve, restore or reimagine the function/makeup of a maritime forest.
- As precipitation and temperature patterns fluctuate, and with an expected continued influx of population into North Carolina, there will be increasing demands and potential conflicts over availability of potable water sources. Forests may play a positive role in sustaining both water quality and supply; and, conversely may be viewed as a negative impact during droughts, especially regarding the influences of pine plantations on the availability of near-surface groundwater in localized watersheds.

- Likely increase in temperatures, periods of drought, and number of rainy days will affect prescribed burn opportunities by decreasing the number of burn days, altering available fuel and increasing fire intensity.
- A decrease in prescribed burning may lead to a decrease in biological diversity especially for species that are dependent on frequent burn return intervals.
- Longleaf pine and its associated plant community's tolerance to fire, ability to grow in wet and dry weather condition, ability to withstand strong winds, and resistance to beetle infestation make it well suited to thrive under predicted climate changes.
- Rising CO2 levels stimulate tree growth causing site indexes to increase over time (CO2 "fertilization"). This will lead to increased forest productivity.[2]
- Rising temperatures will allow top-performing southern-origin loblolly pine families to be moved further north, thereby increasing pine plantation productivity.
- Northward and westward migration of other tree and plant species, as well as insects and pathogens due to rising temperatures, will have varying effects on forest productivity and health.
- Climate, weather, and other abiotic threats to urban trees and forests are highlighted under Objective 5.4.

Economic and Financial Impacts to Forestry

- There will likely be a need for more robust and intensive deployment of BMPs to protect water quality from stressor impacts that result from a more widely variable weather pattern. Changes in operating practices may alter the financial aspects of a timber harvest, either positively or negatively, depending on each stakeholder's perspective.
- Agreements to limit CO2 emissions in Europe have led to a wood fuel pellet market in North Carolina. This additional market has been a financial boon for North Carolina forestland owners.

SUPPORTING INFORMATION

- North Carolina State University climate statistics
  - www.climate.ncsu.edu/climate/hurricanes/statistics
- U.S. Forest Service Southern Forest Futures, Sub-Regional Reports (2014):
  - https://www.srs.fs.usda.gov/futures/subregional-reports/
- U.S. Army Corps of Engineers, South Atlantic Coastal Study (ongoing):
  - https://www.sad.usace.army.mil/SACS/
- USDA Southeast Climate Hub:
  - https://www.climatehubs.usda.gov/hubs/southeast
- Natural and Working Land in North Carolina StoryMap, Coastal Habitats. Nicholas Institute for Environmental Policy Solutions:
  - https://storymaps.arcgis.com/collections/2154ab2816674f7d8c7429fe87f48830?item=4

PRIORITY AREAS

- Coastal areas subject to sea-level rise, storm surge and salt-spray
- Areas where host species are at the southern end of their natural range
- Urban forests

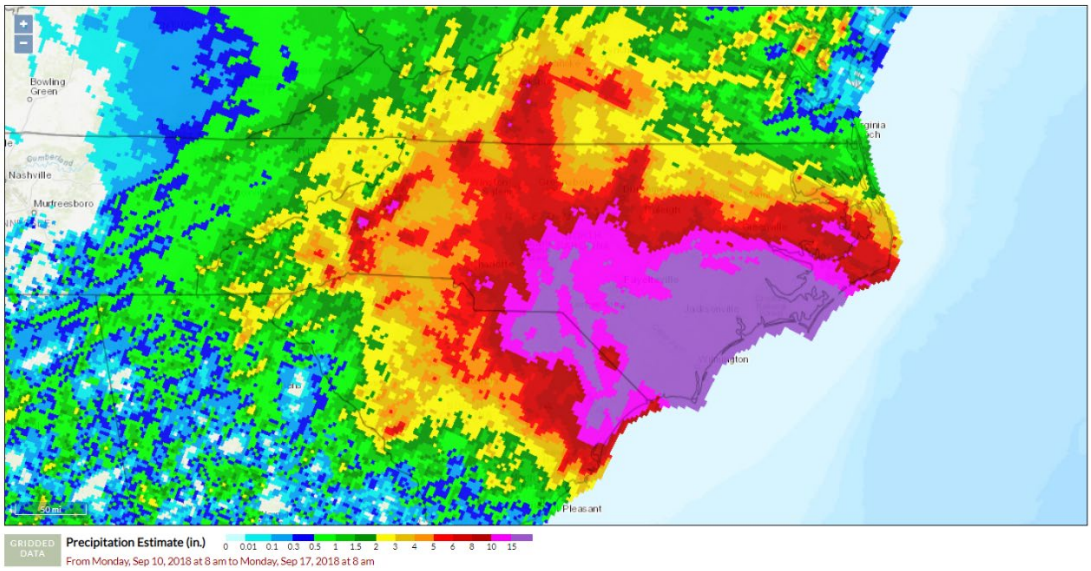
NOTABLE RESOURCES NEEDED

- Climatology research on impacts of climate change on North Carolina forests, trees and ecosystems
- Research and modeling related to saltwater intrusion
- Funding for natural resource professional training
- Funding for state and federal forest conservation cost share programs (ex. Forest Development Program)
- Funding for state and federal initiatives and conservation programs
- Forestry, wildlife and conservation programs for financial and tax benefits
- Natural resource professionals to provide technical guidance, assistance and implementation
- Funding to conduct research and outreach regarding carbon storage
- Funding to conduct social marketing and landowner outreach
- U.S. Forest Service funding (ex. redesign grants, urban and community forestry grants)
- Identification of lead individuals and/or organization and formation of teams focusing on policy-making, collaboration and planning (ex. Storm Working Group)
- Development and implementation of interorganizational MOUs
- Funding for personnel and equipment to develop forest health strike teams
- Funding to conduct ground monitoring and aerial surveys
- Funding for storm-related information and education materials

EXAMPLE METRICS

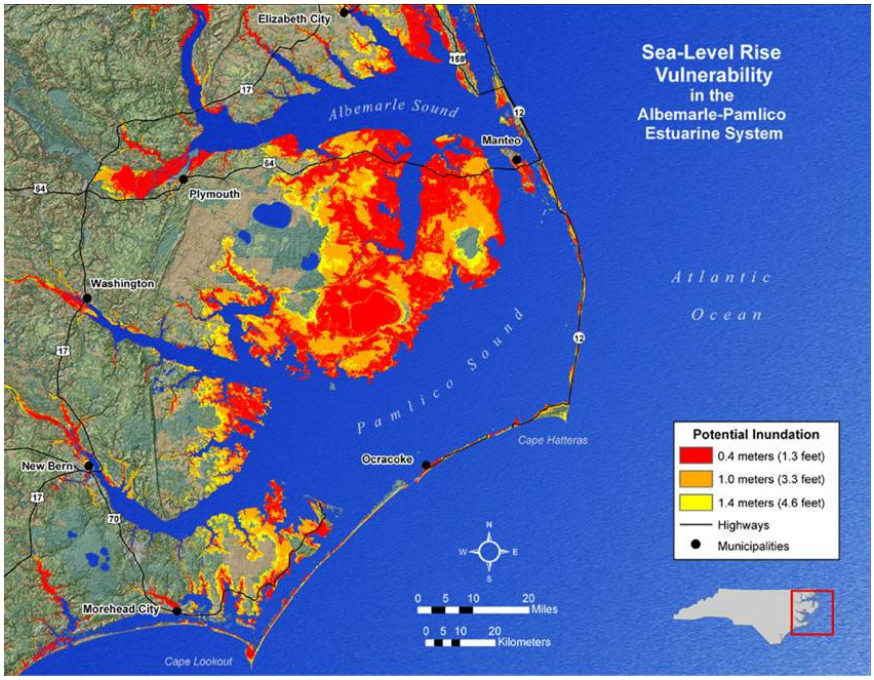
- Research projects that focus on identifying species'/ecosystems' tolerance and risk levels to climate conditions
- Collaborative projects implemented that mitigate or minimize impacts of climate change
- Forest management practices implemented in response to or in anticipation of climate change
- Forested acres identified and managed for transition to future conditions
- Landowner participation in carbon sequestration programs
- Identification of primary contacts for various coordinated responses
- Changes to state and local government regulations or policies to deal with response to weather events and forest damage
- Deployment of urban storm preparedness kits
- Utilization and training of Urban Forest Strike Teams (UFSTs)
- Completion of storm damage assessments

Figure 2.3.1. Total Precipitation Map from Hurricane Florence



North Carolina is no stranger to hurricanes and their impacts. The map above depicts the precipitation totals from Hurricane Florence. Elizabethtown recorded the highest total with 35.93 inches of precipitation from the storm.

Figure 2.3.2. North Carolina Sea-Level Rise Vulnerability Map



It is estimated that by the year 2100 global average sea level will increase anywhere from 1.3 to 2.4 feet depending on greenhouse gas emissions. Under this scenario, many areas of coastal North Carolina will be impacted daily by high tide flooding.

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2. Norbya, Richard J., DeLuciac, Evan H., Gielend, Birgit, Calfapietrae, Carlo, Giardinaf, Christian P., Kingg, John S., Ledforda, Joanne, McCarthyh, Heather R., Moorei, David J. P., Ceulemansd, Reinhart, Angelise, Paolo De, Finzij, Adrien C., Karnoskyk, David F., Kubiskel, Mark E., Lukacm, Martin, Pregitzerk, Kurt S., Scarascia-Mugnozzan, Giuseppe E., Schlesingerb, William H., and Orenh, Ram. *Forest response to elevated CO2 is conserved across a broad range of productivity.* 2005.
3. Sea-level rise vulnerability Map, North Carolina King Tides Project http://nckingtides.web.unc.edu/files/2015/09/APES_SLR-map.jpg

KEY PARTNERSHIPS

Bureau of Indian Affairs	N.C. Wildlife Resources Commission
Forest Restoration Alliance	National Weather Service
Georgia Forestry Commission	NSCU-Climate Hub
International Society of Arboriculture	NCSU—College of Agriculture and Life Sciences
Local government	NCSU—College of Natural Resources
N.C. Association of Consulting Foresters	South Carolina Forestry Commission
N.C. Department of Agriculture and Consumer Services—Plant Industry Division	Southern Group of State Foresters
N.C. Emergency Management	Tennessee Division of Forestry
N.C. Forestry Association	The Nature Conservancy
N.C. Invasive Plant Council	U.S. Animal and Plant Health Inspection Service
N.C. Native Plant Society	U.S. Department of Defense
N.C. Nursery and Landscape Association	U.S. Customs and Border Patrol
N.C. Office of Recovery and Resiliency	U.S. Fish and Wildlife Service
N.C. Office of State Fire Marshal	U.S. Forest Service
N.C. State Climate Office	USDA Southeast Climate Hub
N.C. State Extension	U.S. National Park Service
N.C. State Parks	Virginia Department of Forestry
N.C. Tree Farm System	WNC Communities—Hemlock Restoration Initiative
N.C. Urban Forest Council	

Goal 3. Increase the Beneficial Use of Prescribed Fire

Five key points:

- Prescribed burn interest and application is strong in North Carolina, resulting in an increased need for training, resource capacity and mentoring programs to address the high demand for prescribed burn services.
- While there are several impediments to prescribed burning, capacity to implement is the most limiting factor. Strategies that either increase the number of people burning or increase opportunities to burn must be prioritized.
- Restoration of fire adapted species and ecosystems, such as longleaf pine, shortleaf pine, Table Mountain/pitch pine, oak-pine woodlands and upland oak, is a major reason prescribed burning is applied across North Carolina by many conservation partnerships.
- Number of acres of longleaf pine forest and associated plant communities in North Carolina continue to increase. However, the number of acres of longleaf established annually have slightly declined. The number of acres of longleaf burned annually has varied greatly year-to-year, but on average, has remained flat.
- The N.C. Forest Service (NCFS) has a key role to play in promoting prescribed fire training; providing fuel condition and fire danger assessments; managing regulations related to prescribed fire; and, implementing prescribed fire on private and public lands.

Objectives:

3.1—Increase the number of acres burned and promote greater acceptance of prescribed fire to benefit forest health, wildlife habitat, fuel reduction and fire adapted ecosystems.

3.2—Restore and conserve fire adapted species, habitats and forest ecosystems with a continued emphasis on longleaf pine, shortleaf pine, Table Mountain/pitch pine, pine-oak heath and oak forests (dry, dry mesic and montane) and their associated plant communities.

Strategies:

3.1.1—Conduct applied fire and ecological research to better understand and manage the fire environment.

3.1.2—Increase the resource capacity of trained and qualified personnel to conduct prescribed burning on private land.

3.1.3—Educate the public on the importance, value and benefits of prescribed fire.

3.1.4—Support the efforts of prescribed burners to acquire adequate and affordable liability insurance.

3.1.5—Provide training on advanced topics for experienced burners, such as atmospheric dispersion modeling (ADM), growing season burning, reintroduction of fire into unburned stands and smoke management.

3.2.1—Identify, evaluate and support management and conservation opportunities or initiatives for fire adapted species, habitats and forest ecosystems.

3.2.2—Promote and publicize restoration efforts and the ecological importance of restoring fire to fire-dependent ecosystems.

3.2.3—Promote ecological research and techniques to restore and manage fire adapted species, habitats and ecosystems.

3.2.4—Support organizations and partners with programs and efforts to restore longleaf pine, shortleaf pine, Table Mountain/pitch pine and fire adapted oak ecosystems through continued participation and funding.

Lighting the baseline for a prescribed burn. Photo credit: NCFS.

Promoting Prescribed Fire

Objective 3.1.—Promote the greater acceptance and application of prescribed fire to benefit forest health, wildlife habitat, fuel reduction and fire adapted ecosystems.

CURRENT CONDITIONS AND TRENDS

- With few exceptions, prescribed fire is recognized and accepted by the public as an important forest management tool that improves wildlife habitat and reduces wildfire risk in many forest ecosystems.[3]
- Approximately 523,730 acres of prescribed burning were reported to the N.C. Forest Service (NCFS) from 2015-2019. Most of the acres burned were in the southeastern Coastal Plain and the Sandhills region. However, these figures rely on a voluntary reporting system. It is likely they are underreported.[6] See Figure 3.1.1.
- Since 2015, most acres of prescribed fire (66%) in North Carolina were burned by the NCWRC (29%), the NCFS (18%), and the USFS (19%).[6] See Figure 3.1.2.
- According to reported data, the acres burned during the growing season have remained unchanged since 2015 while there has been an increase in the number of acres burned during the dormant season.[6] See Figure 3.1.3.
- Many partners are placing emphasis on growing season burning to improve wildlife habitat and increase burning opportunities.[8] Experience, expertise and trained resources to safely apply growing season burns, however, are limited among prescribed burners.
- Conducting growing season burns is often constrained for fire control agencies, like the NCFS, when focus shifts from prescribed burning to wildfire readiness during the spring of the year.
- Prescribed burning under the Community Protection Plan program (CPP, Stevens Amendment) has remained constant since 2017, averaging 4,698 acres burned per year.[7] See Figure 3.1.4.
- From 2014 to 2019, approximately 263,597 acres were burned in the Southern Appalachia ecozones identified by the Southern Blue Ridge Fire Learning Network (SBRFLN).[8,9] See Figure 3.1.5.
- Demand for prescribed fire training and services continues to exceed capacity. Annual acres burned have remained relatively steady, and agencies are operating at capacity.
- Much focus has been placed on supporting and developing prescribed burn associations (PBAs) and providing one-on-one mentoring services for individual landowners to become certified burners.
- Three PBAs are active in Eastern North Carolina – Sandhills PBA, Bladen Lakes Area PBA and the Eastern N.C. PBA. There is interest in creating a PBA in Western North Carolina.
- Both the Sandhills PBA (SPBA) and the Bladen Lakes Area PBA have been successful in training new burners. Currently, 398 private landowners receive “updates and happenings” emails from the SPBA.[10] The Eastern N.C. PBA lacks a dedicated leadership position.
- Recent surveys have indicated and participation within the SPBA and the Bladen Lakes Area PBA mentoring programs confirm that there is strong demand from private landowners for one-on-one prescribed fire training services.
- The NCFS has increased offerings of the certified burner course, but demand is still not being met. Few graduates of the certified burner course complete certification due to an inability to access further training, such as conducting a burn, to become certified.
- Employee turnover, especially at the county level, and in-depth training requirements have resulted in fewer qualified burn bosses within the NCFS.
- The NCFS is currently reviewing its prescribed burn training requirements and is revising the burn boss course to address a decline in the number of qualified burn bosses.

- Acceptance and use of atmospheric dispersion modeling (ADM) have increased as more burners are beginning to understand the benefits of predictive modeling. Still, only a small percentage of burners are requesting models, which is likely due to an insufficient understanding of when and how a smoke model will allow for a burn when it would otherwise not be allowed by the ventilation index system.
- In North Carolina, there is no centralized reporting system to capture prescribed burn accomplishments, resulting in inaccurate and unreported prescribed burn data. The NCFS collects prescribed burn data for smoke management and maintains a forest management accomplishment database that includes prescribed burning. Neither reporting system is mandatory.[5,6]

NOTABLE THREATS

- Capacity
    - Lack of trained forest managers, private contractors and equipment to support burning
    - Lack of training to certify more burn bosses and to increase the number of burners qualified to use fire behavior and smoke modeling programs
- Population growth/wildland urban interface
    - Increasing population growth and the resulting urbanization of the landscape will increase development and fragmentation of forestland.
    - An influx of new residents may alter public perceptions and attitudes about smoke in the air and the use of fire.
- Smoke management
    - Air quality concerns impact the number of burning days.
    - Public safety and health within smoke sensitive areas
    - There are also liability concerns with reduced visibility on highways.
- Weather
    - Few burn days to burn safely and effectively while minimizing smoke impacts in a state with a rapidly growing population
- Climate change
    - Likely to result in increased temperatures, increased frequency and intensity of drought, and uneven and less predictable rainfall patterns, which is likely to decrease the number of burn days, alter available fuel and increase fire intensity.
- Resource
    - Limited funding to support prescribed burning by partners, limited cost share funds to support private landowners and high cost of implementation
- Low priority
    - Landowners are reluctant to implement prescribed burn programs due to the cost and difficulty.
- Liability
    - Private landowners and insurance companies have a limited understanding of prescribed fire and who bears the risk for property damage. Private contractors have few options to acquire coverage
- Agency culture and priorities
    - Within the NCFS, the amount of burning that takes place in different counties varies across the state, in part due to the vegetation, local weather patterns, terrain, experience, comfort level, priority and degree of support. The NCFS also limits prescribed burning by staff during “fire season” in the spring, even on suitable burn days.

SUPPORTING INFORMATION

- N.C. Wildlife Action Plan
  - https://www.ncwildlife.org/plan
- N.C. Prescribed Fire Council Strategic Plan
  - http://www.ncprescribedfirecouncil.org
- Cohesive Wildland Fire Strategy
  - https://www.fs.usda.gov/treesearch/pubs/38646
- Southern Fire Exchange
  - https://southernfireexchange.org/
- U.S. Forest Service Fire Research
  - https://www.srs.fs.usda.gov/pubs/
- Fire Weather Portal
  - https://climate.ncsu.edu/fwip/
- N.C. Forest Service Smoke Management database
- 2018 National Prescribed Fire Use Survey Report
  - https://www.stateforesters.org/wp-content/uploads/2018/12/2018-Prescribed-Fire-Use-Survey-Report-1.pdf
- Southern Blue Ridge Fire Learning Network
  - http://www.sbrfln.com/

PRIORITY AREAS

- Cape Fear Arch
- Sandhills Conservation Priority Area
- Greater Uwharrie
- Onslow Bight
- N.C. Sentinel Landscape
- Uwharrie-Sandhills Corridor
- National Forests of North Carolina
- NCWRC Game Lands
- N.C. State Parks
- N.C. State Forests
- Grandfather Restoration Project Area
- Southern Blue Ridge Escarpment
- Unaka-Great Smokies Conservation Area
- Central Escarpment
- South Mountains
- Northern Escarpment
- New River Headwaters
- Nantahala/Balsam Mountains Conservation Area

NOTABLE RESOURCES NEEDED

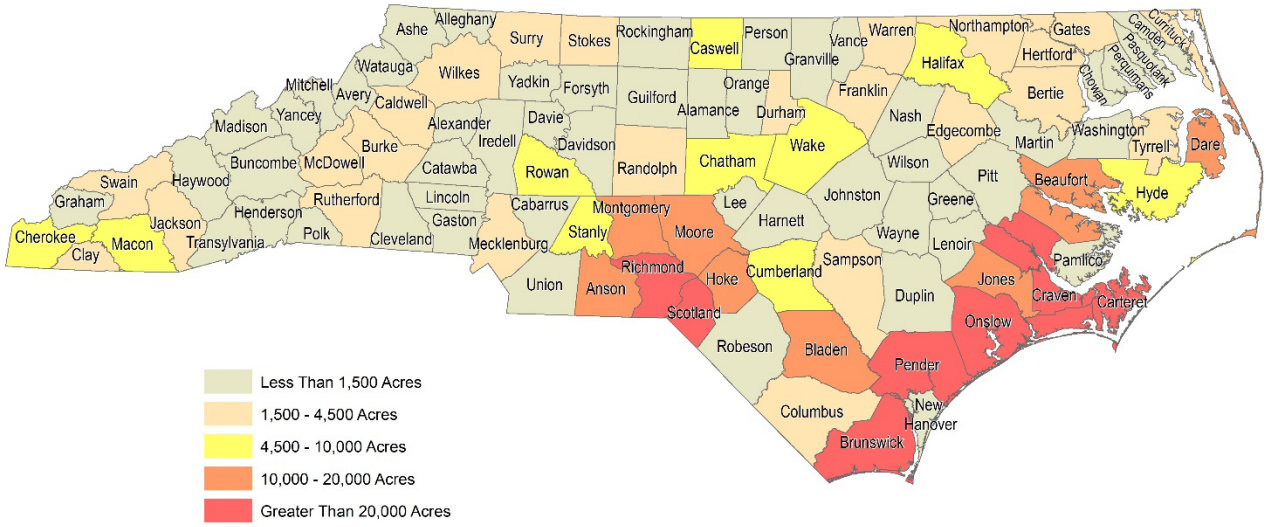
- Funding to support active learning programs, such as PBAs, to mentor new and beginning burners
- Increase offerings and capacity to host the N.C. Certified Burner course.

- Increase offerings of advanced fire training.
- Increase awareness and training opportunities for ADM.
- Provide additional equipment and personal protective equipment (PPE) for use by private burners or PBAs
- Funding and creation of a prescribed burn coordinator position within the NCFS to promote prescribed burning and help coordinate training, application, and mentoring programs among NCFS field units, state forests and our partners
- Explore the feasibility to fund and create dedicated prescribed burn crews within the NCFS to increase capacity for applying prescribed fire on state-owned forests.
- Explore the feasibility of amending the N.C. Prescribed Burning Act to reduce liability standard to gross negligence.
- Improved coordination and communication between natural resource agencies, nongovernment organizations (NGOs) and other partners
- Improved and centralized prescribed burn reporting system

EXAMPLE METRICS

- Acres burned by prescribed fire in North Carolina
- Prescribed burns conducted by private landowners
- Training workshops conducted and number of individuals trained
- Outreach and educational programs implemented, and materials developed
- Certified burn bosses, both public and private
- Prescribed burn crews
- PBAs and membership within them
- Utilization of smoke management modeling like ADM
- Prescribed burn coordinator positions

Figure 3.1.1. Total Reported Acres*Burned from 2014-2019, by County

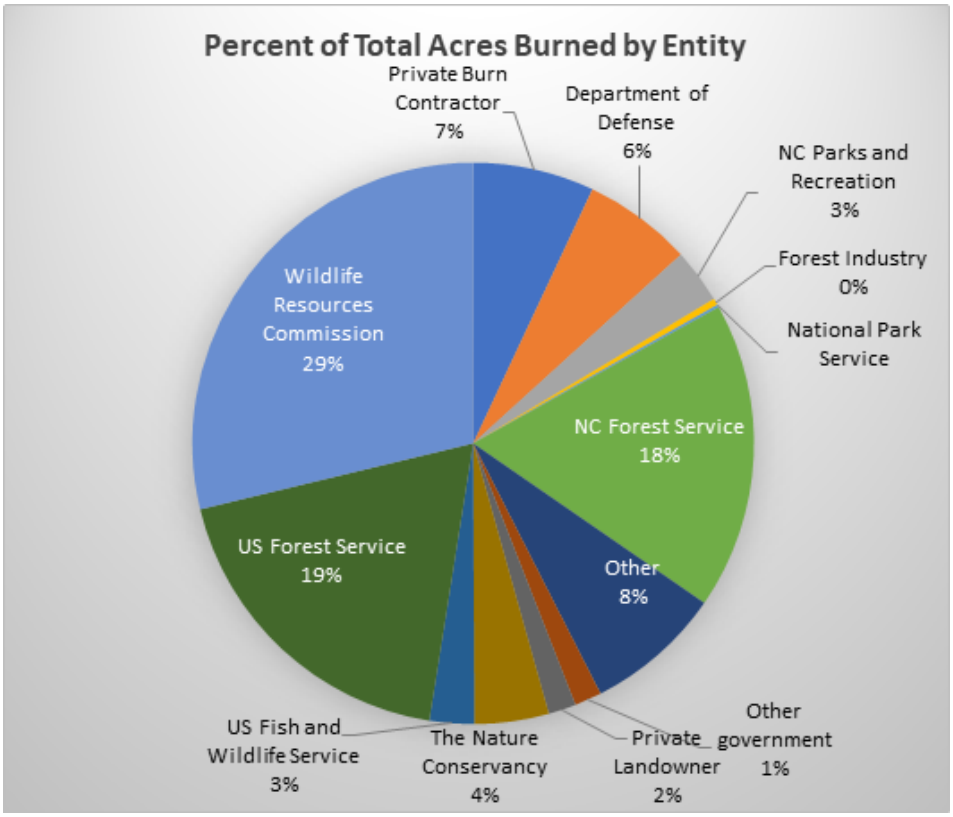


Most of the acres of prescribed fire have occurred in the Southeastern Coastal Plain and Sandhills regions of North Carolina.

*Source: NCFS Smoke Management Database; note this does not capture all acreage burned statewide.

Prescribed burn at Camp Butner in North Carolina. Photo credit: NCFS.

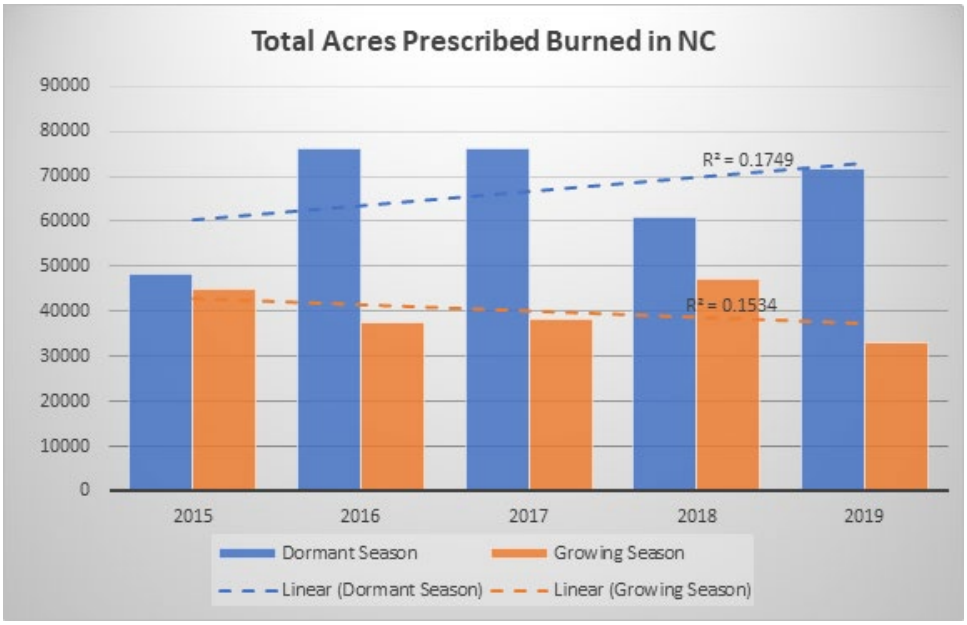
Figure 3.1.2. Prescribed Burns by Entity



Prescribed burns conducted by the NCWRC, NCFS and USFS account for two-thirds of the total acres burned in North Carolina. Private landowners and consulting foresters are responsible for only 9% of the total acres burned.

Source: NCFS Smoke Management Database

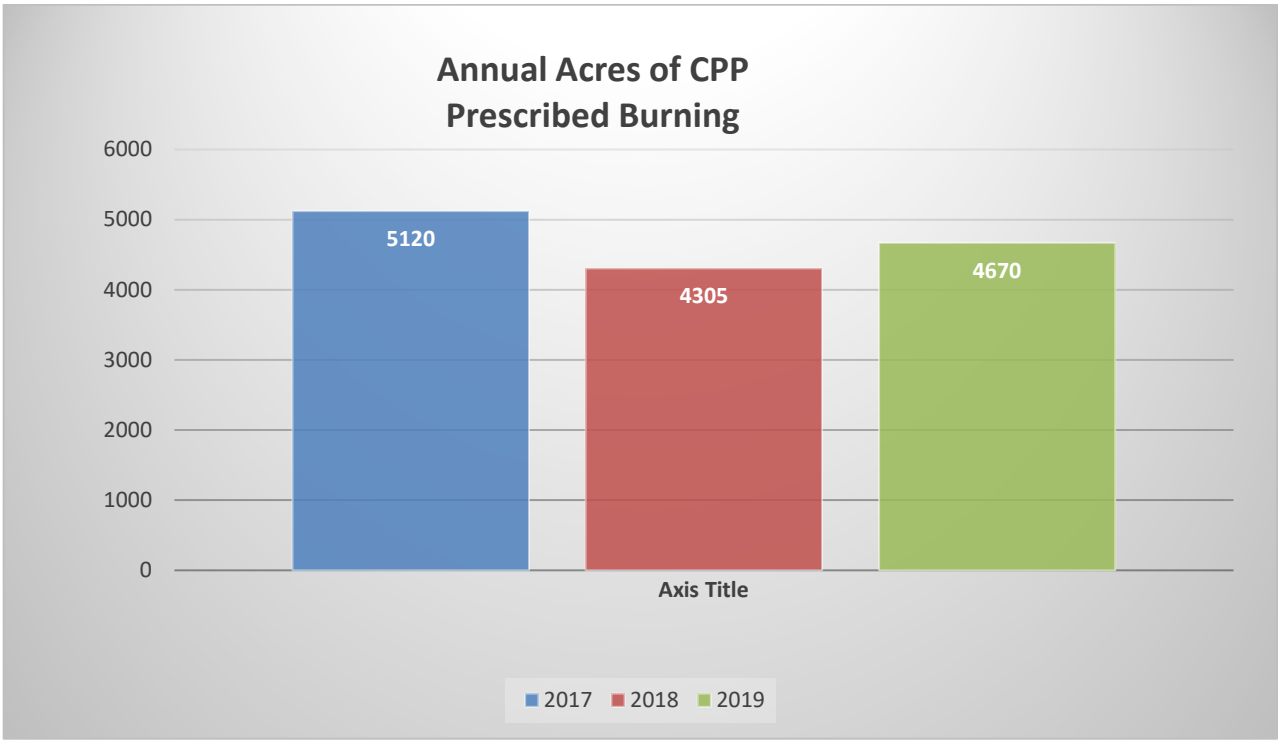
Figure 3.1.3. Total Acres of Prescribed Burning in North Carolina



Based on smoke management data reported to the NCFS, almost twice as many acres have been burned during the dormant season than during the growing season since 2015. From 2015-2019, there was no significant trend in number of acres burned during either season. Variation in total acres burned during both the dormant and growing seasons is due to several factors including weather, resource availability, and reporting accuracy.

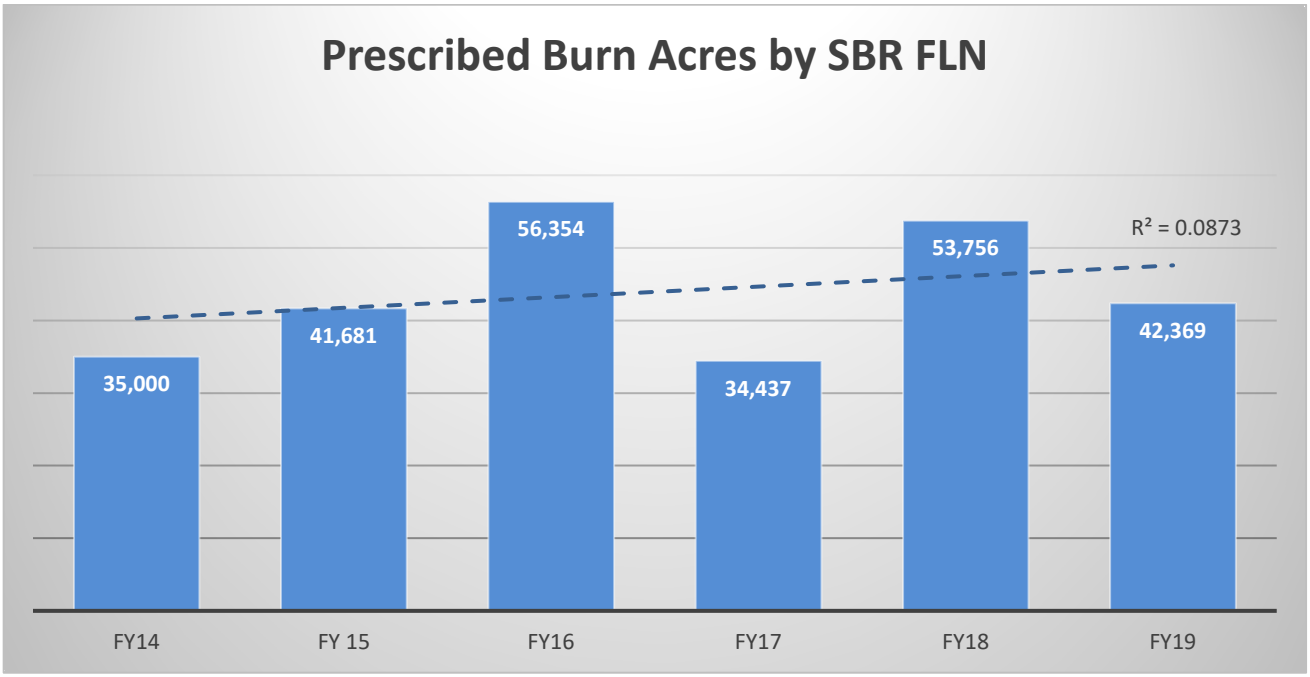
Source: NCFS Smoke Management Database

Figure 3.1.4. Annual Acres of CPP Prescribed Burning



The number of acres burned in North Carolina under the Community Protection Plan (CPP) program has remained constant over the last three years, averaging 4,698 acres per year. The CPP program offers hazard reduction burning on private property within 10 miles of national forest boundaries at no cost to the landowner.

Figure 3.1.5. Prescribed Burn Acres in SBRFLN Landscape (FY14-FY19)



Since FY2014, a total of 263,597 acres were burned in the SBRFLN landscape. The total number of acres burned per year has remained constant with a slightly increasing trendline over that time.

Source: Southern Blue Ridge Fire Learning Network Database

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Fire Adapted Communities

Objective 3.2.—Restore and conserve fire adapted species, habitats and forest ecosystems with a continued emphasis on longleaf pine, shortleaf pine and oak woodlands.

CURRENT CONDITIONS AND TRENDS:

Longleaf

- According to 2018 Forest Inventory and Analysis (FIA) data, North Carolina has 379,773 acres in longleaf pine and longleaf pine-oak forest types. This is likely an underestimate of the total acres of longleaf pine forests in the state. The total acres of longleaf pine and longleaf pine-oak forests documented through FIA plots has increased by 115,452 acres since its low point in 2002.[1] See Figure 3.2.1.
- The Longleaf Ecosystem Occurrences database project, coordinated by the Longleaf Alliance, is intended to provide a comprehensive assessment of the number of acres and the condition of longleaf in North Carolina. The project's expected completion date is 2021.[2] See Figure 3.2.1.
- North Carolina establishes an average of 7,789 acres of longleaf per year on public and private lands.[3]
- Since 2013, annual longleaf establishment in North Carolina has trended slightly downward.[3]
- Based on data reported to Americas Longleaf Accomplishment Report for North Carolina, an average of 106,851 acres of longleaf forest are burned on public and private lands in North Carolina. In general, public lands and land trust properties receive a much greater degree of fire management in longleaf forests than most private lands.[3] See Figure 3.2.2.
- Since 1996, the N.C. Forest Development program (FDP) has funded the planting of approximately 55,612 acres of longleaf pine.[4]
- The FDP has cost shared an average of 2,418 acres of longleaf establishment annually.[4]
- Since 1996, longleaf acres planted using FDP funds have declined.[4]
- Longleaf pine forests support many at-risk species that depend on fire to maintain suitable habitat conditions. See the N.C. Wildlife Action Plan (NCWAP) for a more extensive discussion of wildlife, associated with longleaf forests, and their management needs.[5]

Shortleaf

- According to the 2018 Forest Inventory and Analysis (FIA) database, North Carolina has 262,324 acres of shortleaf pine and shortleaf pine-oak forest types. Since 2002, total shortleaf pine and shortleaf pine-oak acreage declined 14%.[1] See Figure 3.2.3.
- Since 2002, shortleaf pine forests have declined 33% while shortleaf-oak forests have increased 6%.[1]
- From FY2009 to FY2019, the N.C. Forest Service (NCFS) reported an annual average of 290 acres of shortleaf pine artificial regeneration.[6]
- The NCFS Nursery program grows 500,000 shortleaf pine seedlings annually, which can equate to more than 1,000 acres of planted shortleaf pine across all ownership categories each year.
- FIA data suggests a lack of shortleaf regeneration and a shift in forest composition toward oak dominance. This trend is likely due to land use conversion, preference to loblolly pine, and a lack of appropriate forest management that includes disturbance.[1]

Oak Woodlands

- Through ecozone mapping, the Southern Blue Ridge Fire Learning Network (SBRFLN) has identified oak-pine, shortleaf-oak, dry-mesic oak, dry oak, high elevation red oak, and mesic oak forests as ecosystems that are fire mediated.[7]
- Approximately 58% of the 2.4 million acres mapped is identified as fire adapted. Fire mediated landscapes vary from 80% in the Southern Blue Ridge Escarpment to 41% in the New River Headwaters. See Figure 3.2.4.[8,9]
- From 2014 through 2019, approximately 263,597 acres were burned by prescribed fire in the Southern Appalachia ecozones identified by the SBRFLN.[7]

Conservation Partnerships

- There are significant and increasing efforts to promote prescribed burning that restores and maintains shortleaf, Table Mountain/pitch pine, oak-pine, and fire adapted oak woodlands in the North Carolina Mountains and Piedmont. The SBRFLN formed eight landscape restoration teams to focus on the use of prescribed fire in the Southern Appalachians.
- Interest in ecosystem restoration is strong and is supported by several conservation partnerships including the North Carolina Longleaf Coalition, Onslow Bight Conservation Forum, Cape Fear Arch Conservation Collaborative, Greater Uwharrie Conservation Partnership, N.C. Prescribed Fire Council, Sandhills Conservation Partnership, Sandhill Prescribed Burn Association, and the Sandhill–Uwharrie Corridor Working Group, SBRFLN and N.C. All Lands Strategy Partnership. These partnerships provide information sharing forums, resource sharing, leveraging of grants, advocacy, and other efforts to support ecosystem management.
- Three prescribed burn associations (PBAs) have been formed in North Carolina to encourage, support, and mentor private landowners in becoming certified burners and developing their own burn programs. These partnerships are in the Sandhills region, Bladen Lakes/Cape Fear Arch, and Northeastern North Carolina.

NOTABLE THREATS

- Land-use change
- Increasing urbanization
- Conversion to non-fire adapted ecosystems
- Wildland urban interface
- Funding decreases
- Grants
- Cost share assistance
- Lack of prescribed fire and appropriate frequency, intensity and seasonality
- Succession to other non-fire adapted pines or hardwood
- Degradation of understory herbaceous and grassy layer
- Limited capacity to apply fire
- Knowledge gaps on how to manage specific fire adapted ecosystems
- Some species are more difficult to manage.
- Not a large part of university curriculum
- Forest research is lacking.
- Climate change impacts
- Invasive species that change ecosystem dynamics

SUPPORTING INFORMATION

- Americas Longleaf Conservation Plan
  - http://www.americaslongleaf.org/resources/2013-range-wide-accomplishment-report-and-executive-summary/
- Shortleaf Pine Restoration Plan
  - http://shortleafpine.net/shortleaf-pine-initiative/shortleaf-pine-restoration-plan/shortleaf-pine-restoration-plan
- Longleaf Alliance outreach and education
  - https://www.longleafalliance.org
- N.C. Wildlife Action Plan
  - See appendix.
- Americas Longleaf Restoration Initiative N.C. Accomplishments
  - http://www.americaslongleaf.org/media/qkkp5msv/2018-accomplishment-report.pdf
- USFS Forest Inventory Analysis Program database and analysis
  - https://www.fs.usda.gov/srsfia/states/north_carolina.shtml

PRIORITY AREAS

- Cape Fear Arch
- Sandhills Conservation Priority Area
- Greater Uwharrie
- Onslow Bight
- N.C. Sentinel Landscape
- Uwharrie-Sandhills Corridor
- National Forests of North Carolina
- NCWRC Game Lands
- N.C. State Parks
- N.C. State Forests
- Grandfather Restoration Project Area
- Southern Blue Ridge Escarpment
- Unaka-Great Smokies Conservation Area
- Central Escarpment
- South Mountains Conservation Area
- Northern Escarpment
- New River Headwaters
- Nantahala/Balsam Mountains Conservation Area
- NRCS Critical Conservation Areas

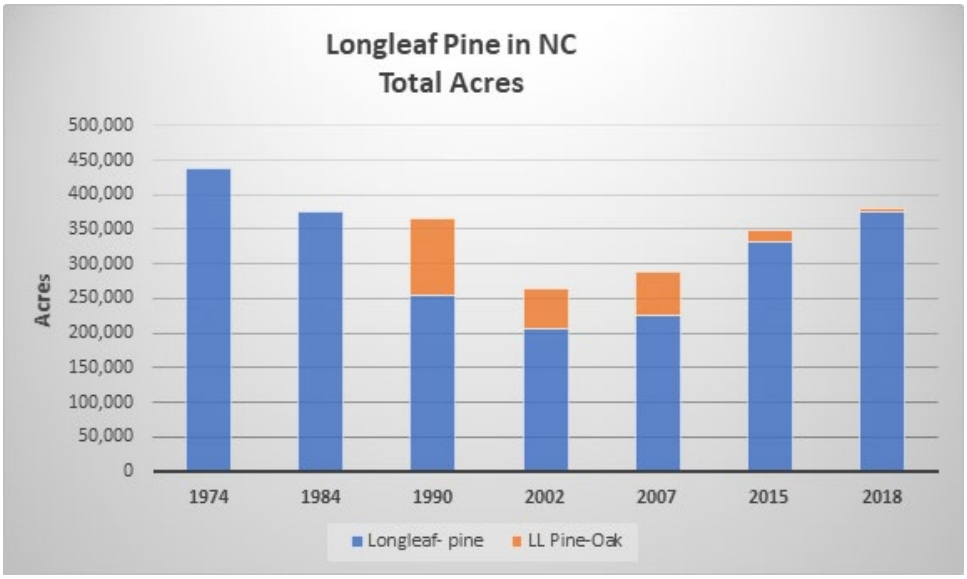
NOTABLE RESOURCES NEEDED

- Continued FDP cost share funding for longleaf and shortleaf establishment at a 60% rate
- Grant funding to support longleaf restoration efforts or projects
- Support funding for the NCFS longleaf and/or declining species coordinator position
- Many of the same resource needs identified under Objective 3.1

EXAMPLE METRICS

- Increase number of forest management plans that recommend fire management objectives
- Increase in acres for all categories of longleaf restoration accomplishments reported (See LPC Longleaf Accomplishment Report North Carolina.)
- Increase in acres burned for ecosystem restoration in all regions of North Carolina
- Increase in Condition Class data that quantify habitat quality
- Number and variety of workshops and other information and education efforts for fire adapted species
  Source: Americas Longleaf Accomplishment Report for NC

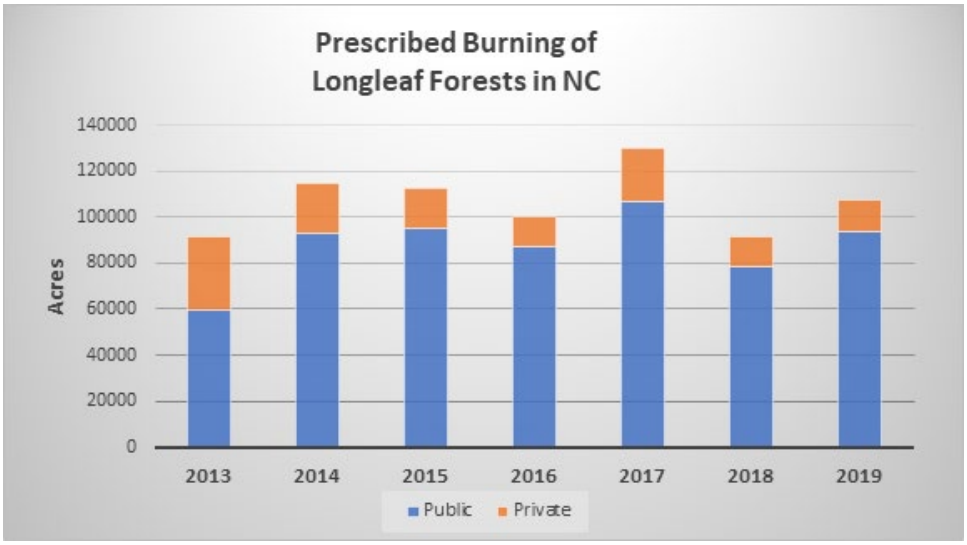
Figure 3.2.1. Total Acres of Longleaf Pine



In North Carolina, total acres of longleaf pine and longleaf pine–oak forest types have increased by 44% from 264,320 acres in 2002 to 375,372 acres in 2018. Because of the course data collection method employed by FIA, the total number of acres in North Carolina is likely to be higher.

Source: Forest Inventory and Analysis database

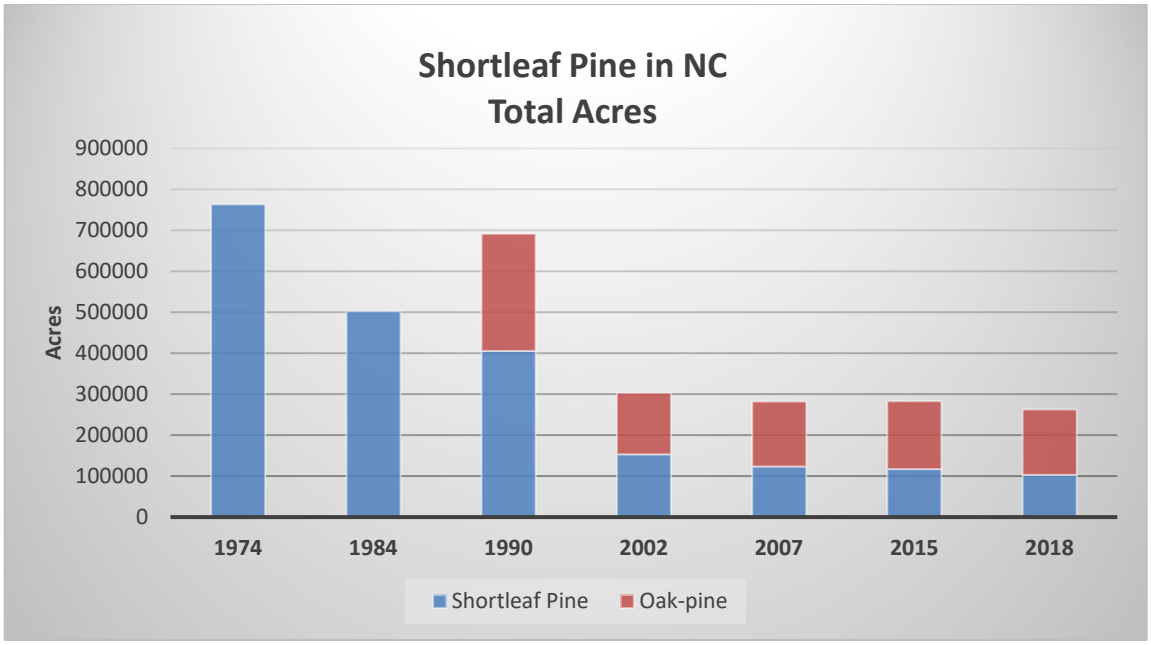
Figure 3.2.2. Prescribed Burning of Longleaf Forests



In North Carolina, longleaf forest is a significant ecosystem that is treated with prescribed fire, averaging 106,851 acres burned annually.

Source: LPC Longleaf Accomplishments for N.C.

Figure 3.2.3. Total Acres of Shortleaf Pine



Total acres of shortleaf pine and shortleaf pine forest types continue to decline in North Carolina. Since 2002, the decline has been slight with a shift to more mixed oak-shortleaf forest types.

Source: Forest Inventory and Analysis database

Figure 3.2.4. Ecozone Acres

Landscape	Pine-Oak Heath	Short leaf Pine	High Elevation Red Oak	Dry-Mesic Oak	Dry Oak	Mesic Oak	Fire mediated ecozones	Non-Fire ecozones	Total Acres	% Fire Adapted
Southern Blue Ridge Escarpment	14,261	81,207	1,044	109,674	37,493	19,593	263,272	64,091	327,363	80%
Unaka/Great Smokies	116,009	20,451	19,917	78,357	44,714	180,158	459,606	401,268	860,874	53%
Central Escarpment	41,403	15,136	1,336	17,627	17,022	30,451	122,975	87,907	211,152	58%
South Mountains	3,527	478	0	4,976	10,403	5,656	25,040	8,950	33,990	74%
Northern Escarpment	3,743	0	2,060	4,570	2,466	10,807	23,646	20,844	44,490	53%
New River Headwaters	413	0	1,631	37	89	3,084	5,254	7,470	12,724	41%
Nantahala/ Balsam Mountains	60,497	62,885	39,940	89,826	42,003	166,274	461,425	407,802	869,227	53%

Ecozone mapping of the Southern Appalachia region serves as a baseline and helps assess fire needs across the landscape. Approximately 58% of the 2.4 million acres mapped is identified as fire adapted. Fire mediated landscapes vary from 80% in the Southern Blue Ridge Escarpment to 41% in the New River Headwaters.

Source: SBRFLN database[8]

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KEY PARTNERSHIPS

America's Longleaf	N.C. Sentinel Landscapes
American Forest Foundation	N.C. Tree Farm Program
Cape Fear Arch Conservation Collaborative	N.C. Wildlife Resources Commission
Central Appalachian Association of Fire Managers	NCSU Extension Forestry
Consortium of Appalachian Fire Managers	Onslow Bight Conservation Forum
Greater Uwharrie Conservation Partnership	Quail Unlimited
Longleaf Alliance	Sandhills Conservation Partnership
National Fish and Wildlife Association	Sandhills Prescribed Burn Association
National Wild Turkey Federation	Sandhills-Uwharrie Corridor WG
Natural Resources Conservation Service	Shortleaf Initiative
N.C. Division of Air Quality	Southern Blue Ridge Fire Learning Network
N.C. Fire Environment Committee	Southern Fire Exchange
N.C. Longleaf Coalition	The Nature Conservancy
N.C. Prescribed Fire Council	U.S. Fish & Wildlife Service
N.C. State Climate Office	U.S. Forest Service
N.C. State Parks	

C. National Priority: Enhance Public Benefits from Trees and Forests

Goal 4. Manage and Conserve Forests for Clean Water

Five key points:

- Healthy Resilient Forests = Clean Reliable Water. Forests have a keystone role in protecting drinking water supplies, supporting diverse wildlife, providing water-based recreational and economic development, mitigating impacts from flood, and managing stormwater.
- Collaboration and active partnerships are needed for success. There remains a need for staffing, funding, and innovative markets associated with providing core forestry-water services to landowners, forestry practitioners and water managers.
- Forestry best management practices (BMPs) are the primary mechanism for addressing water resource sustainability. Forestry BMPs remain a prime example of 'adaptive management' and may need to address changes in environmental/climatological factors, policy governance, socio-cultural expectations and market dynamics.
- Ongoing training and education remain important. As the population of customers and operators diversify their interests, motivations and expectations, there may be a need to identify new messages or methods of delivering education/training to remain effective and relevant.
- Research, monitoring and assessments continue to require support. Funding to support long-term monitoring of water resources from current and alternative forest management regimes is needed for continuous improvement and adaptation.

Objectives:

4.1—Continue to identify and advance the drinking water, stormwater management, and related ecosystem services benefits that are derived from forests.

4.2—Strive for continuous improvement in the implementation of BMPs.

Strategies:

4.1.1—Incorporate forestry-related content into Source Water Area Protection Plans.

4.1.2—Foster the development of transparent and efficient markets for ecosystem services that are provided by forests, with an initial emphasis on water-related services.

4.1.3—Demonstrate silvicultural prescriptions that promote the nexus between forests and water resources.

4.1.4—Foster the deployment of forestry-related practices to manage stormwater.

4.1.5—Focus additional research, outreach, monitoring and forestland conservation in priority areas.

4.1.6—Retain and/or expand forestland cover in priority watersheds.

4.2.1—Establish, enhance or supplement cost share programs for forestry/water resource objectives.

4.2.2—Sustain critical habitat for listed threatened and endangered aquatic species.

4.2.3—Continued education, outreach and information delivery.

NCFS Water Quality Forester Richard Cockerham, inspecting a harvesting operation to ensure compliance with North Carolina's Forest Practice Guidelines Related to Water Quality (FPGs). Photo credit: Ethan Matherly, NCFS 2019.

Water Resources

Objective 4.1—Continue to identify and advance the drinking water, stormwater management and related ecosystem services benefits that are derived from forests.

CURRENT CONDITIONS AND TRENDS

- Recent studies estimate the degree at which surface drinking water originates from forests in North Carolina.[1,2] See Figure 4.1.1.
    - Approximately 45% from state- and privately-owned forestlands
    - More than 700,000 people in North Carolina receive approximately 20%, or more, of their water from national forests.
- The N.C. Forest Service (NCFS) commissioned an analysis study to examine the upper reach of the Yadkin-Pee Dee River Basin, and two key findings included[3]:
    - Watersheds with at least approximately 50% forest cover exhibited more robust and diverse populations of benthic macroinvertebrate aquatic life, which is a widely recognized indicator of good water quality and stream health.
    - Watersheds with at least approximately 70% forest cover demonstrated a trend of lower costs to treat drinking water.
- More active participation by some water supply authorities in renewed forest management planning or actual on-the-ground implementation of silvicultural practices upon their watershed lands
- Expanding consensus among a diversity of stakeholders supporting the value and need for sustaining forests on the landscape is a key component in achieving goals for water resource quality and supply, both for human use and ecological function. Since 2010, many interdisciplinary watershed-based stakeholder groups have convened and sought-out participation from the forestry sector, and this trend is expected to continue. Two notable areas of multistate interest are the Catawba-Wateree River Basin and the Yadkin-Pee Dee River Basin.
- Continuing interest in integrating urban forestry with stormwater management and identifying how it can meet policy goals while being functional, operationally viable and fiscally responsible (See Figure 4.1.2.)
- Emerging recognition that forest resiliency can produce mutually beneficial outcomes for certain aspects of water resource resiliency; but, as climate-based influences continue to vary, there is a need to address and mitigate forestry-related impacts to and from water resources.

NOTABLE THREATS

- Loss or fragmenting of traditional contiguous forests upon the landscape, contributing to subsequent increases in impervious surface runoff and negative effects on downstream forests and water resources
- Unknown or undesirable effects on hydrology due to widespread changes in the composition of forest species
    - Examples include the loss of hemlocks and resulting increased rhododendron in the mountains, the loss of redbay and ash in the Coastal Plain, and the ongoing general mesification of forests, trending toward plant species that use water more intensively, including nonnative/exotics.

SUPPORTING INFORMATION

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    - https://www.fs.usda.gov/sites/default/files/fs_media/fs_document/Urban-Forest-Systems-GSI-FS-1146.pdf

PRIORITY AREAS

- Public water supply areas (surface waters and groundwaters)
- Areas of transitioning land cover

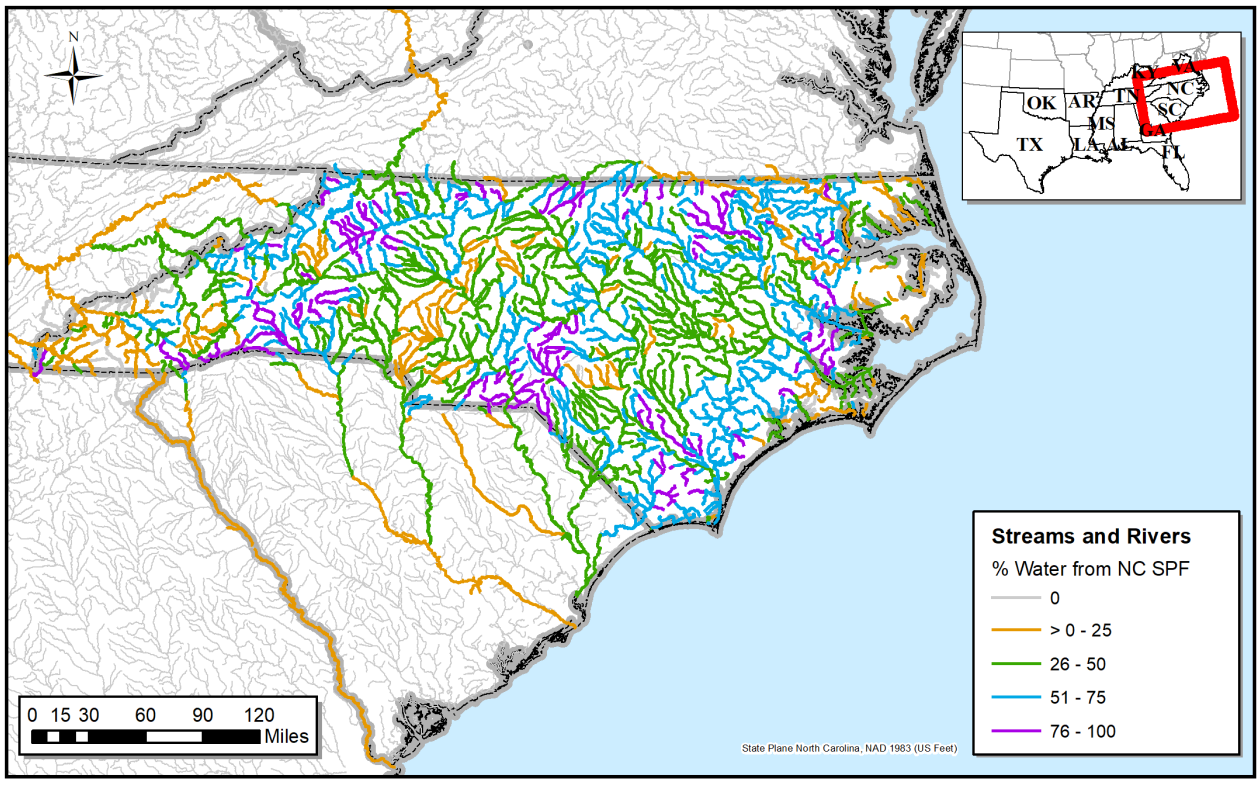
NOTABLE RESOURCES NEEDED

- Multisector (public, private) markets/mechanisms for forestry ecosystem services
- Robust, diverse, and consistent markets for traditional forest products as a financial incentive for forest owners to invest in sustaining their forests for the future as a financially viable alternative
- Management options for landowners on the coastal fringe who are losing forested land due to subsidence and/or saltwater intrusion
- Continued investment to acquire/protect forestlands in locally focused priority watersheds

EXAMPLE METRICS

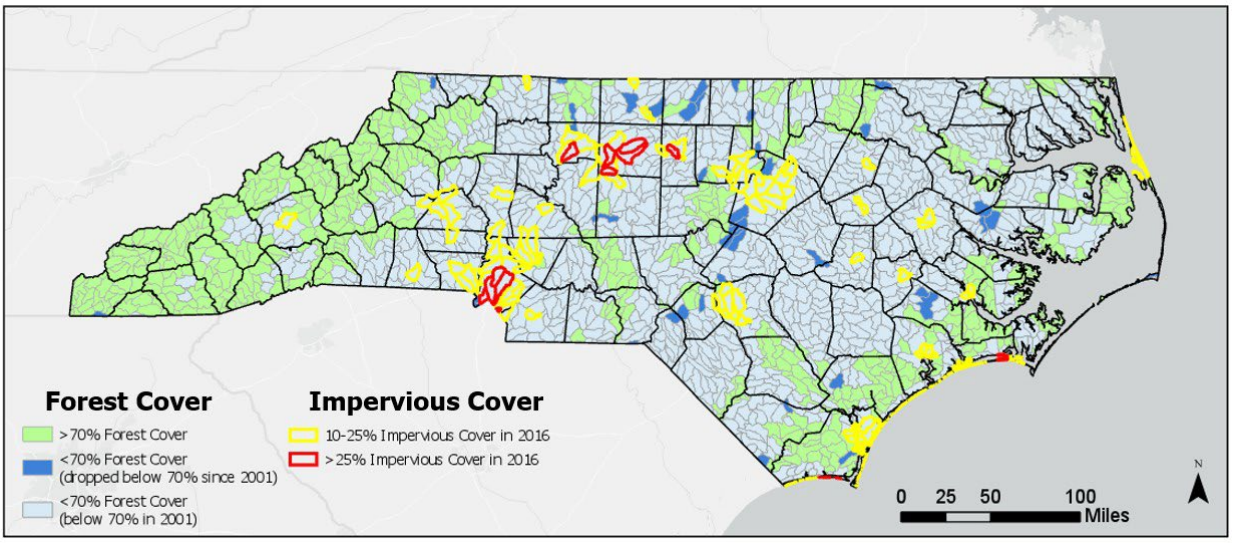
- Amount of drinking water that originates from forestland
- Acres of forest retained, protected, or restored in water supply watersheds
- Monetization of forestry-related ecosystem services (ex: dollars invested by water supply or stormwater users/entities into forestry practices and forestland conservation)

Figure 4.1.1. Streams Receiving Water from State and Private Forests



This map was created by and provided courtesy of the USDA Forest Service Southern Research Station. It is Figure A.NC.5(B) in: "*Quantifying the Role of State and Private Forest Lands in Providing Surface Drinking Water Supply for the Southern United States*," USDA Forest Service General Technical Report SRS-248, by Ning Liu, et.al., 2020. The map shows an estimate of how much stream water comes from state- and privately-owned forests, illustrating the connections between healthy forests and clean water.

Figure 4.1.2. Changes in Land Cover, 2001-2016



Different land cover requires different strategies to address water resource goals. In areas with more impervious cover, urban forestry and green infrastructure solutions are best to be explored. In areas with substantial forest cover, traditional methods may prove enough to address water goals. In areas that are transitioning below 70% forest cover, incremental addition of forests back into the landscape in targeted watersheds may be an option to keep those areas from reaching a 'tipping point.'

Figure 4.1.3. Priority Forested Watersheds, Statewide Overview

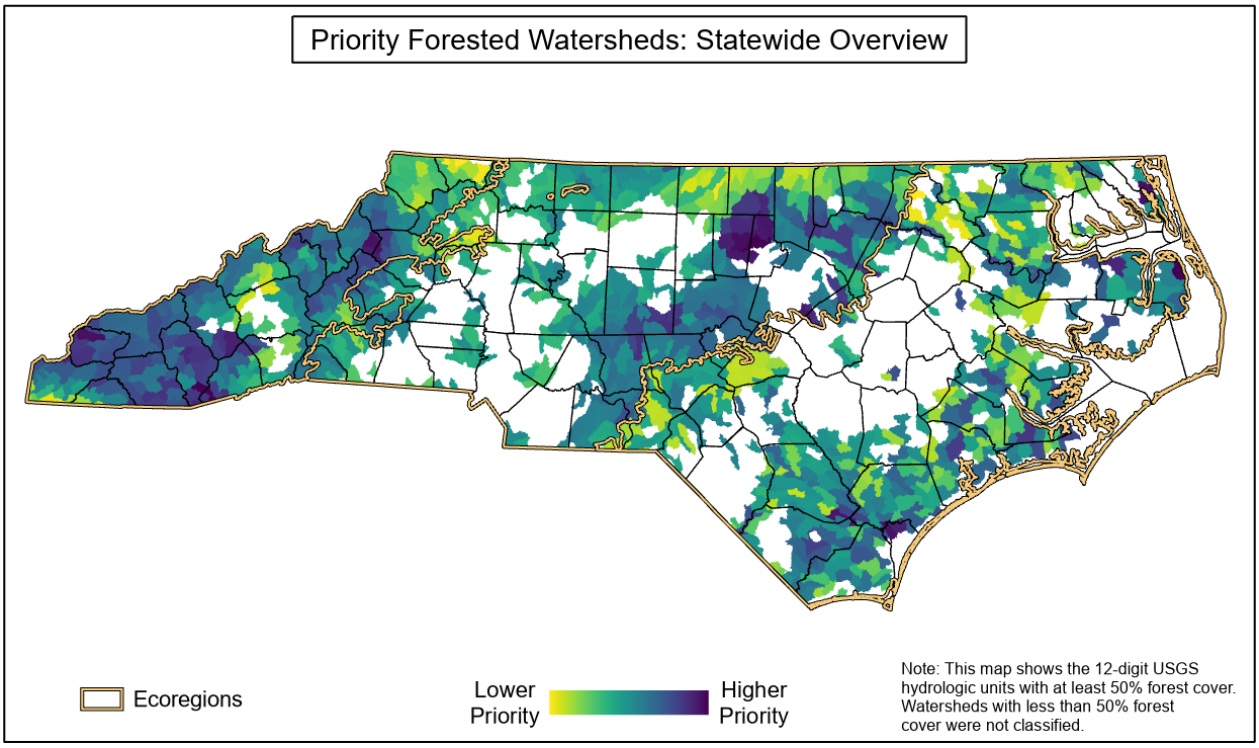


Figure 4.1.4. Priority Forested Watersheds, Mountain Focus

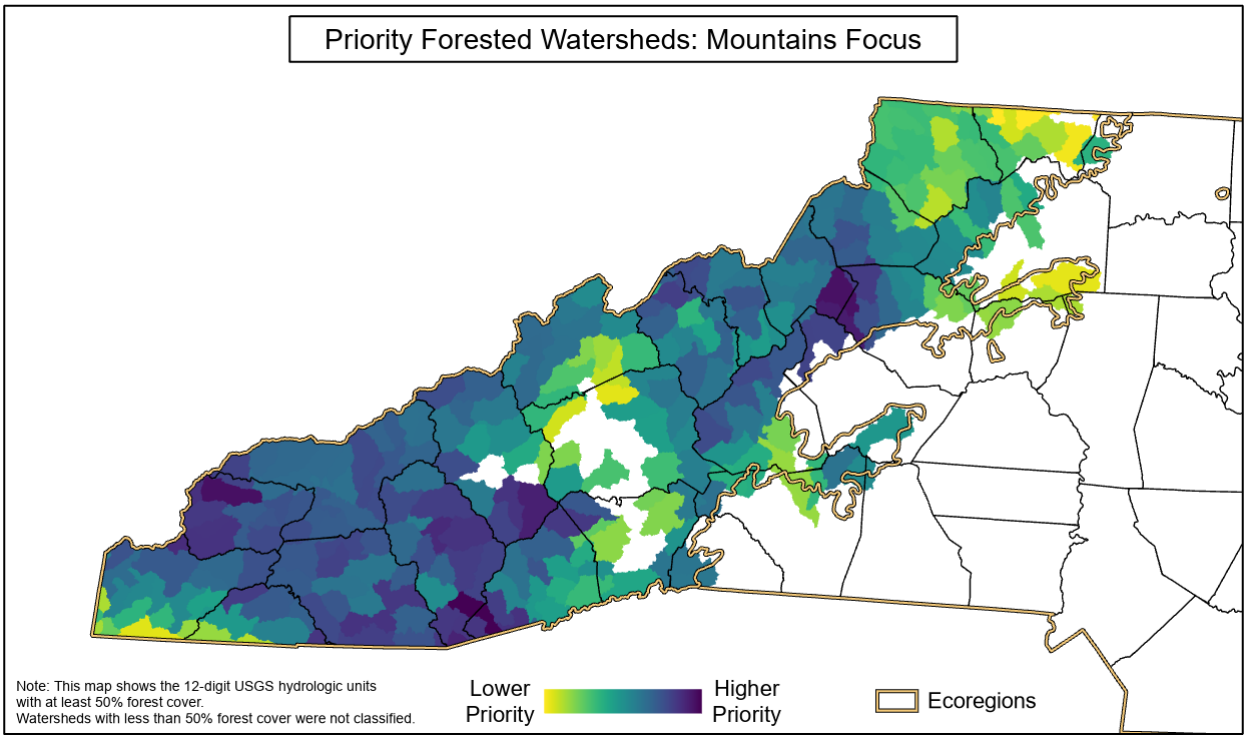


Figure 4.1.5. Priority Forested Watersheds, Piedmont Focus

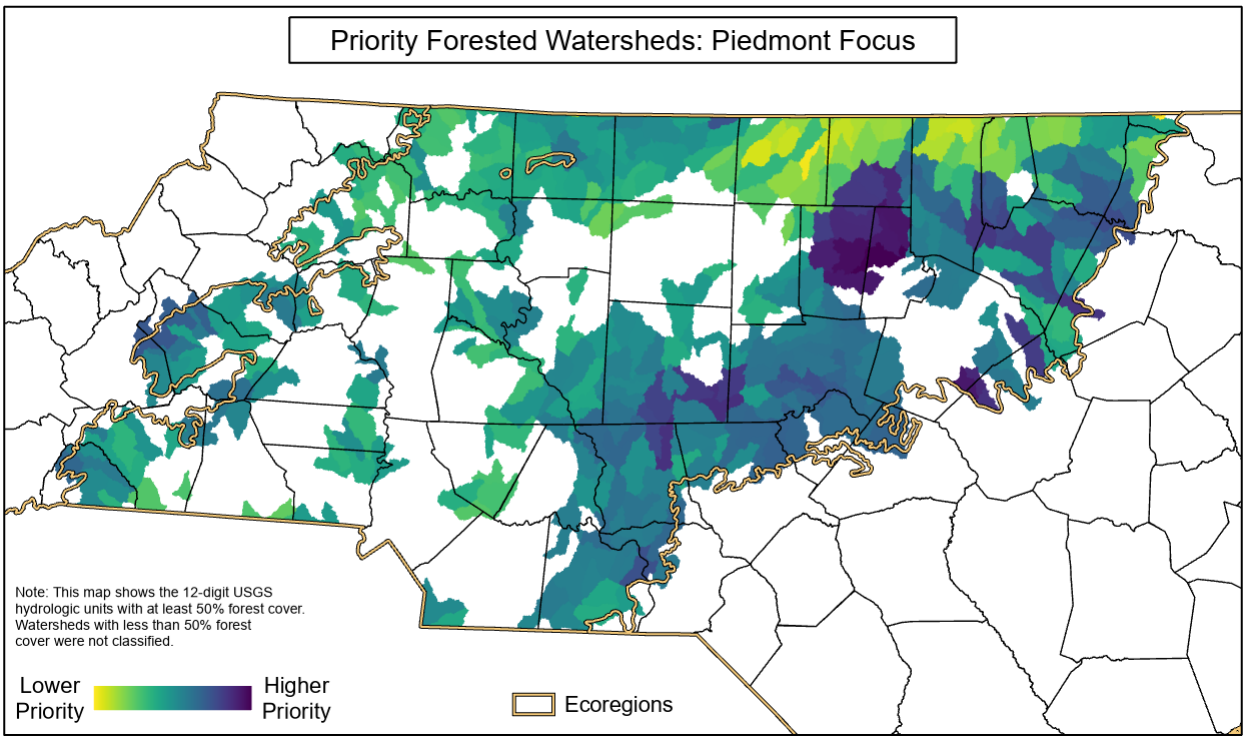
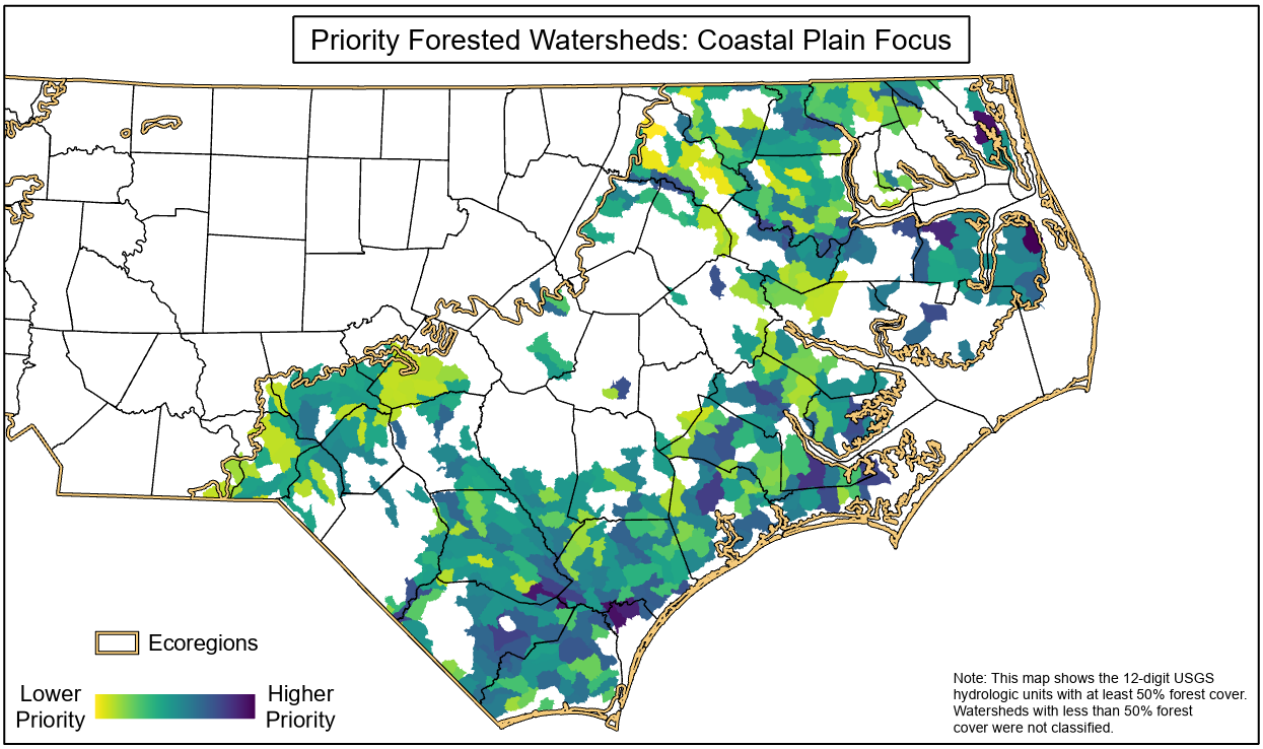


Figure 4.1.6. Priority Forested Watersheds, Coastal Plain Focus



Explaining the Priority Forested Watershed Maps

Figures 4.1.3 through 4.1.6 were produced from custom analyses by the NCFS. Based on the 2016 NLCD, only 12 HUCs that contain 50% or more of forest cover were included. The foundational dataset for these maps came from the USDA-Forest Service "Forests to Faucets 2.0" analysis related to drinking water: https://www.fs.fed.us/ecosystemservices/FS_Efforts/forests2faucets.shtml.

Additional data was incorporated.

- Multiple datasets associated with special water designations tied to wildlife conservation attributes
    - U.S. Fish and Wildlife Service Critical Habitat (statewide)
    - Wild and Scenic Rivers (statewide)
    - Division of Water Resources trout waters (Mountains only)
    - Wildlife Resources Commission trout waters (Mountains only)
    - Anadromous fish waters (Coastal Plain only)
    - Shellfish waters (Coastal Plain only)
- Natural Heritage occurrences
- Historical rainfall intensities

Other data specific to each ecoregion were then combined with the statewide data to generate each regional map. The regionally specific attributes were land slope in the Mountains, average soil hazard ratings for forest operability as classified by the USDA Natural Resources Conservation Service (NRCS) in the Piedmont, and proportion of the watershed in the 100-year floodplain in the Coastal Plain. Outlined below is the weighting model that we used to generate the regional priority maps.

- 40%: Forests-to-Faucet 2.0
- 25%: Special waters, natural heritage and wildlife attributes (combined)
- 25%: Regionally specific attributes
- 10%: Rainfall intensities

The three regional focus priority maps were stitched together to produce the statewide overview. More details will be provided in the mapping metadata section of the forest action plan's final edition.

REFERENCES

1. Caldwell, P.; Muldoon, C.; et.al. "Quantifying the Role of National Forest System Lands in Providing Surface Drinking Water Supply for the Southern United States." USDA Forest Service, Southern Research Station General Technical Report SRS-197. 135pp. 2014.
   https://www.srs.fs.usda.gov/pubs/gtr/gtr_srs197/gtr_srs197.pdf
2. Liu, N.; Dobbs, G.R.; et.al. "Quantifying the Role of State and Private Forest Lands in Providing Surface Drinking Water Supply for the Southern United States." USDA Forest Service, Southern Research Station General Technical Report SRS-248. 405pp. 2020.
   Entire Report: https://www.srs.fs.usda.gov/pubs/59637
   North Carolina's excerpt: https://www.srs.fs.usda.gov/pubs/59645
3. North Carolina Forest Service. "Assessment of Forest Cover in the High Rock Lake Watershed of North Carolina." Unpublished presentation. 2015. Accessed June 9, 2020.
   https://www.ncforestservice.gov/water_quality/pdf/ForestsWaterQualityHighRockLakeWatershed.pdf

Best Management Practices & Water Quality

Objective 4.2—Strive for continuous improvement in the implementation of best management practices (BMPs).

CURRENT CONDITIONS AND TRENDS

- The most recent BMP assessments for North Carolina[1,2] indicate an overall statewide average implementation rate of approximately 84%. Opportunities for improvement were noted in certain geographic regions and for certain forestry practices statewide. A renewed emphasis on streamside management zones (SMZs)/riparian buffers is warranted, given an increased number of state riparian buffer rule violations observed in recent years. See Figure 4.2.1.
- Reported final site compliance with forest practice guideline (FPG) standards remains high, exceeding 95%; but, the 10-year trends continue to show that stream crossings, waterway obstructions, SMZs, and site rehabilitation are most in need of improvement statewide. See Figure 4.2.2. Over the past 10-year period, the trend of the number of initial FPG inspections conducted by the NCFS has remained relatively constant, averaging approximately 3,600 per year. Since the FPGs were adopted in 1990, the NCFS has recorded more than 100,000 initial site inspections through state fiscal year 2019.[3,4]
- North Carolina had an increased number of aquatic species listed as federally Threatened or Endangered (T&E), along with designations of more waterways as Critical Habitat and/or implementation of associated 4(d) rules. This trend is expected to continue with the ongoing review of several aquatic species for listing consideration.
- In recent years there have been more observations of inadequate use of BMPs related to an apparent uptick in the aggressive harvesting of timber from SMZs; the persistent trend of substandard stream crossings; and, the need for prompt, effective and widespread groundcover stabilization on bare soil areas.[1,2]
- There has been reinvigorated scrutiny of silvicultural practices in wetlands of the South, including North Carolina, related to potential impacts of intensive pine silviculture on the status and extent of wetlands; questions regarding if or how the harvesting of timber in bottomland swamps contributes to algal blooms or windthrow in coastal rivers/waters, particularly in the Albemarle-Pamlico system of Virginia and North Carolina; and, how silviculture along the coastal fringe can adapt to saltwater intrusion.
- The ongoing uncertainty of water quality governance, as it relates to the waters of the U.S. Clean Water Act, brings about potential unforeseen consequences. In general, the forestry sector may be entering an era of renewed policy deliberations on legacy and emerging environmental issues that may require adjustments to forestry BMPs (ex: T&E, floodplains, water quantity, nutrient management, ecological flows, stormwater permitting, wetlands, etc.). A long-lasting review of the state's numerous nutrient management strategies has also led to uncertainty regarding its effects on forestry, and this review invites the opportunity to examine how overall governance could be made more efficient while maintaining enough levels of water quality protection.

NOTABLE THREATS

- Expanding variability of weather, especially with precipitation patterns and intensities, influencing the need for increased deployment of BMPs to address intense rainfall; how forestry can mitigate—or at least not worsen—flooding impacts; and, actual/perceived impacts of forests on water availability during a prolonged drought
- An apparent uptick in activity by unscrupulous or uninformed parties that seem to circumvent environmental permitting during questionable land disturbance activities by asserting a claim of silvicultural land-use
- Loss of institutional knowledge within private sector forestry practitioners, forest landowners and affiliated forestry/environmental/water agencies
    - There is a need to transfer knowledge to a new generation of practitioners and policy administrators regarding the foundations upon which current practices and policies are based; and, to generally continue improving overall interagency cooperation and incorporate BMPs into forestry college curriculums.

SUPPORTING INFORMATION

- "Implementation of Forestry Best Management Practices 2018 Southern Region Report." Southern Group of State Foresters. 14pp. 2018.
    - https://www.southernforests.org/resources/publications/SGSF%20Water%20BMP%20Report%20FINAL.pdf/at_download/file
- "Species Status Assessment Report." U.S. Fish and Wildlife Service, Southeast Region. (Various dates. Multiple species: Atlantic Pigtoe, Carolina Madtom, Neuse River Waterdog, Yellow Lance).
    - https://www.fws.gov/southeast/endangered-species-act/species-status-assessments/
- "Status and Trends of Wetlands in the Conterminous United States 2004-2009." U.S. Fish and Wildlife Service. 2011.
    - https://www.fws.gov/wetlands/documents/Status-and-Trends-of-Wetlands-in-the-Conterminous-United-States-2004-to-2009.pdf
- "Timber Harvest Effects on Water Quantity and Quality in the North Carolina Piedmont: Paired Watershed Study Summary." N.C. Forest Service and USDA-FS. 2015.
    - https://www.ncforestservice.gov/water_quality/pdf/PairedWatershedStudyReport.pdf

PRIORITY AREAS

- T&E Critical Habitat waterways
- Water supply areas
- Highly erodible soils
- Steep slopes
- Riparian zones and wetlands

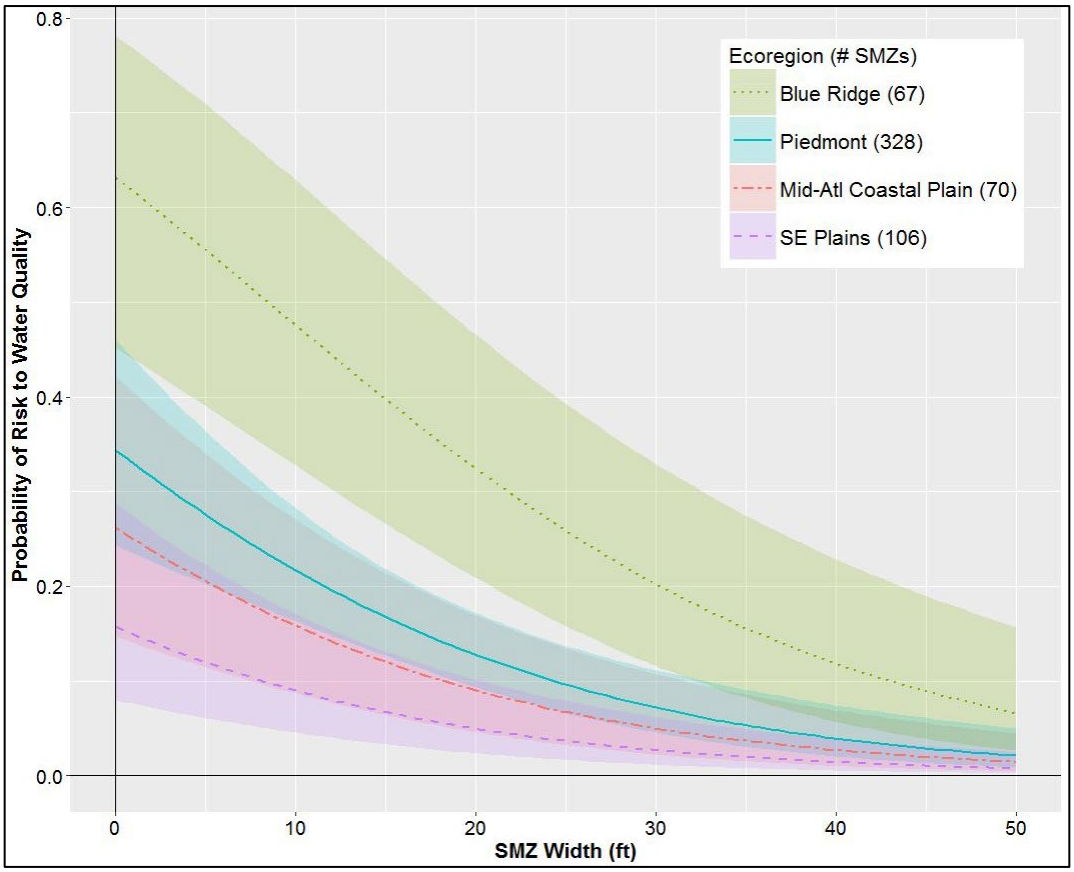
NOTABLE RESOURCES NEEDED

- Financial assistance for improving waterway crossings on forestland.
- Clarity, consistency and simplification of effective policy governance to provide long-term visibility for forest owners, operators and ecosystem services investors; while accounting for natural disaster impacts.
- Targeted research on direct/indirect and temporary/cumulative effects on water quality from silvicultural practices; especially in coastal-influenced forest swamp systems.
- Sustainable investment in developing and maintaining a robust FPG compliance monitoring data management/reporting system to provide more timely information delivery, value-added services to customers, and improved abilities to measure performance in full context

EXAMPLE METRICS

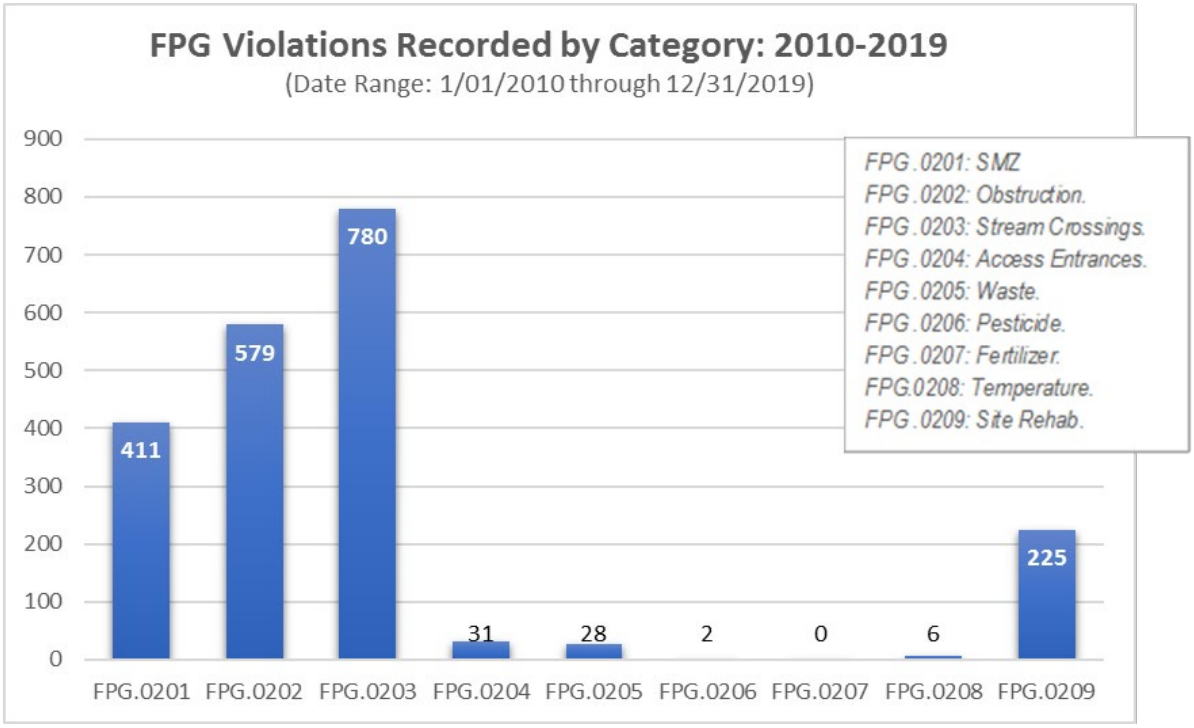
- Compliance levels with water quality rules
- Rates of BMP implementation and corresponding estimates of soil erosion reductions
- Number of substandard stream crossings removed or renovated
- Number of logging jobs that use bridgemats for waterway crossings
- Average widths of SMZs/stream buffers on timber harvests
- Utilization of the N.C. Forest Preharvest Planning Tool

Figure 4.2.1. Predicted Water Quality Risk by SMZ Width, 2012-2016



This graph illustrates the predicted probability of a risk to water quality for each ecoregion by SMZ width, with a 95% confidence interval. As SMZ widths approach 50 feet, the predicted risk to water quality decreases. The numbers in parentheses are the number of SMZs in each region that were assessed and analyzed to produce this graph. This data was recorded by the N.C. Forest Service during the 2012 to 2016 statewide BMP Implementation Survey on active and recently completed timber harvests. For reference, the "Mid-Atl. Coastal Plain" is more commonly known as the 'lower Coastal Plain', nearest to the coast; and the "SE Plains" is more commonly known as the 'upper Coastal Plain', nearest to the Fall Line. Also, see Figure 3 in the NCFS publication, *An Assessment of Forestry Best Management Practices in North Carolina 2012-2016*.

Figure 4.2.2. Statewide FPG Violations Recorded by Category, 2010-2019



Statewide data trends from this 10-year period mirror those for the entire duration, since 1990, the FPGs have been in place. Note, some of the recorded stream obstruction violations are believed to have been associated with a stream crossing, thus some double counting may have resulted. Stream crossings introduce the most frequent and widespread level of water quality risk and should be avoided when possible.

REFERENCES

1. North Carolina Forest Service: A. Coats: "An Assessment of Forestry Best Management Practices in North Carolina 2012-2016." 46pp. 2016. https://www.ncforestservice.gov/water_quality/pdf/BMP_Assessment_Report_2012-2016.pdf
2. North Carolina Forest Service: D. Jones. "North Carolina Forestry BMP Implementation Survey Results 2006-2008." 56pp. 2011. https://www.ncforestservice.gov/water_quality/pdf/nc_bmp_imp_survey_2011_full_report.pdf
3. North Carolina Forest Service: A. Coats and T. Gerow. "Annual FPG Inspection Summary Report." Unpublished staff report. 17pp. August 2019.
4. North Carolina Forest Service: T. Gerow. "A 30-Year Review of FPG Inspections by the N.C. Forest Service." Unpublished staff report. 7pp. February 2020.

KEY PARTNERSHIPS

Water resource protection, supply and management planners, practitioners and advisers	Interagency public sector cooperators at all levels (federal, state, local), particularly soil and water conservation districts / resource conservation districts
Forestry-affiliated environmental nongovernmental organizations, including land conservation organizations	Engaged and motivated landowners
Academia	Forest industry
Engaged, motivated landowners who are local influencers	Agencies that administer water- and wetland-related regulations.

Goal 5. Conserve and Enhance the Benefits and Sustainable Management of Urban Forests

Five key points:

- Institutional urban forest management at the local level is key to conserving and growing North Carolina's urban forests.
- Proper planning, policy and legislation will work to mitigate the impacts of urbanization on urban canopy cover and urban forest health.
- Current and standardized statewide and local urban forest inventory and canopy cover data facilitates measuring changes in the urban forest resource and the impact of urban forest management efforts.
- Minimizing the impacts of natural and human-made events on urban canopy cover work to realize the benefits of an ecologically balanced urban forest: ecosystem services, economic and human health benefits.
- Adequate federal, state and local funding, public and private sector urban and community forestry expertise, and coordinated efforts among partners combine to advance urban forest management in North Carolina.

Objectives

5.1—Increase the level of local urban forest management as well as public and private sector local, regional and statewide leadership, expertise and capacity.

5.2—Foster the integration of urban forestry into all scales (local, regional and state) of planning, policy development, and legislation to prevent and mitigate the loss of urban canopy cover due to urbanization and other human actions.

5.3—Foster the completion of Urban Forest and Inventory Analysis (Urban FIA) inventories, regional and local tree inventories and urban tree canopy cover assessments (UTCAs) and other urban and community forestry resource assessments to facilitate community, regional and statewide-scale urban & community forestry analysis and management.

5.4—Reduce and mitigate the impacts of biotic and abiotic threats to urban forest health and benefits through monitoring, intervention and reforestation.

5.5—Increase statewide public and partner participation and coordination of urban and community forestry efforts.

Strategies

5.1.1—Provide urban and community forestry technical assistance to communities and the public.

5.1.2—Provide urban and community forestry benefits and management educational messaging, programming and media products to municipalities, incentivizing and guiding communities up the urban forest management development pyramid tailored to the respective community N.C. Forest Service (NCFS) management designation, ranging from "No Management" to "Managing." See Figure 5.1.1.

5.1.3—Promote and support partner urban and community forestry management initiatives, programs and tools to enhance sustainable management and realize the environmental and economic benefits.

5.1.4—Promote and support community involvement, urban and community forestry advocacy groups and volunteerism in urban forest management.

5.1.5—Promote and increase participation in urban forestry recognition programs.

- N.C. Champion Tree Program
- Arbor Day programs
- Tree City USA, Tree Campus Higher Education and Tree Line USA recognition programs
- Promote other Arbor Day Foundation (ADF) programs such as Tree K-12 and Tree Campus Health Care.

5.1.6—Provide professional urban and community forestry educational and job training to partner service providers to promote urban and community forestry economic growth and to increase expertise and capacity.

5.2.1—Provide policy messaging, educational programming and media products to increase expertise and capacity and incentivize and guide communities up the urban forest management development pyramid tailored to the respective community NCFS management designation, ranging from "No Management" to "Managing." See Figure 5.1.1.

5.2.2—Provide policy messaging, educational programming and media products on the benefits of urban and community forestry policy in conserving and enhancing the benefits of urban forests.

5.2.3—Develop and provide North Carolina-centric municipal best management practices (BMPs) ordinance and work specification templates for urban forest policy and management activities.

5.3.4—Promote ecosystem services, green infrastructure, low impact development and conservation development policies and BMPs.

5.3.1—Provide messaging, educational programming and media products on the types, value and application of tree inventories and canopy cover assessments tailored to the respective community NCFS management designation, ranging from "No Management" to "Managing." See Figure 5.1.1.

5.3.2—Develop standardized tree inventory and canopy cover assessment BMPs to facilitate local, regional and statewide urban forestry analysis that guides the audience up the urban forest management pyramid from “No Management” to “Managing.” See Figure 5.1.1.

5.3.3—Develop educational programming and media products to provide job training and to foster building public and private sector tree inventory and canopy cover assessment expertise and capacity.

5.3.4—Promote the value of lower cost sample inventories and canopy cover assessments as well as complete inventories and Urban FIA as tools to enhance urban forest management, policy development and implementation, reforestation, forest health mitigation and storm preparation, response and recovery.

5.4.1—Provide forest health threat and reforestation messaging, educational programming and media products.

5.4.2—Promote forest health partner efforts in monitoring and mitigating forest insect, disease and nonnative invasive plant threats.

5.4.3—Support and collaborate with nonprofit organizations’ tree planting efforts, leveraging public and private sector funding and community involvement.

5.4.4—Develop educational programming and media products providing forest health and reforestation business growth and job training to foster building private sector expertise and capacity.

5.4.5—Promote storm preparedness, response and restoration through planning, inventories and assessments to minimize the impacts of events, assess damages and guide recovery efforts.

5.4.6—Advocate for private and public reforestation and forest health funding, utilizing positive public sentiment toward these sustainable issues.

5.5.1—Hold an annual working meeting of key members from each of the key partners, led by the NCFS Urban and Community Forestry program and the N.C. Urban Forest Council, to review current urban and community forestry issues and collaborate in the implementation of the N.C. Urban and Community Forestry Forest Action Plan.

5.5.2—Collaborate on partner delivery of urban and community forestry programs and services.

5.5.3—Collaborate with partners to grow urban & community forestry, leadership, green industry jobs, expertise and capacity through partner activities, plans and initiatives.

5.5.4—Collaborate with partners to provide products and multimedia marketing campaigns focused on urban and community forestry management and benefits educational programs.

5.5.5—Target the delivery of urban and community forestry services and programs to municipalities based on priorities that conserve and enhance the benefits and sustainable management of urban forests.

5.5.6—Advocate for federal, state and local urban and community forestry funding, policies and legislation to conserve and enhance the benefits and sustainable management of urban forests.

5.5.7—Seek and capture urban and community forestry opportunities to engage and serve underserved communities and diversify the urban and community forestry community, ensuring that all partner activities and messaging embrace diversity and inclusion of all North Carolinians.

Nash County Ranger Bill Lewis presenting the Tree Campus USA recognition to Nash Community College at a joint Nash County Arbor Day Celebration. Photo credit: Heather Newsome, NCFS 2019.

Increase Urban Forest Management, Expertise and Capacity

Objective 5.1—Increase the level of local urban forest management as well as public and private sector local, regional and statewide leadership, expertise and capacity.

CURRENT CONDITIONS AND TRENDS

- Approximately 36% of the 2.8 million acres of urban lands in North Carolina, comprising 553 communities, are classified by the USFS Urban and Community Forestry Community Accomplishment Reporting System (CARS) as "Managing" communities.[1]
- Approximately 83% of the 553 North Carolina municipalities lack institutional urban forest management policy and proactive urban forest management.[1]
- Thirty-one of the 553 North Carolina municipalities are classified as "Managing," by the NCFS Urban and Community Forestry program and using the CARS definition.[1] See Figure 5.1.1.
- Forty of the 553 NC municipalities are classified as "Developing," by the NCFS Urban and Community Forestry program and using the CARS definition.[1] See Figure 5.1.1.
- Eighty-one communities, or 14.6% of the 553 North Carolina municipalities, achieved Tree City USA designations for the year 2019.[2] See Figure 5.1.4.
- Eighteen of 85 universities and colleges in North Carolina achieved Tree Campus USA designations for the year 2019.[2] See Figure 5.1.2.
- Four of 87 utility distribution companies in North Carolina achieved Tree Line USA designations for the year 2020. See Figure 5.1.2.
- The estimated percentage of urban land grew from 9.5% in 2010 to 11.5% in 2020.[2]
- Urban wood utilization is a growing management practice and industry in North Carolina.
- The number of consultants specializing in urban forest management and serving North Carolina is unknown.
- The number of urban and community forestry services provided by the NCFS has been steadily increasing each year since reporting began in 1998. Figure 5.1.3.
- The number of consultants specializing in urban forest management and serving North Carolina is unknown. See Figure 5.1.3.
- There are 501 ISA Certified Arborists serving North Carolina as of 2020.[3]
- There are 15 TCIA Accredited tree service companies in North Carolina.[4]
- From 2017 through 2020, federal urban and community forestry funding decreased by $65,500.[2]
- There are 24 NCFS ISA Certified Arborists.[2]
- The North Carolina Urban Forest Strike Team (UFST) roster includes 21 individuals.[2]

NOTABLE THREATS

- Growing urbanization and population growth are increasing the demand for urban forest management.
- Lack of institutional urban forest management in 83% of North Carolina municipalities
- Lack of private sector consulting expertise in urban forest management
- Decreasing federal funding and the absence of state appropriated urban and community forestry funding threatens state leadership, urban forest management and the availability of urban and community forestry grant funding.

SUPPORTING INFORMATION

- Vibrant Cities Lab
  - www.vibrantcitieslab.org
- iTree Tools
  - https://www.itreetools.org/
- International Society of Arboriculture
  - www.isa-arbor.com
- Tree Care Industry Association
  - www.tcia.org
- NASF Forest Action Plan 10-Year Revisions: Resources of Urban & Community Forestry

PRIORITY AREAS

- 2020 NCFS Urban and Community Forest Management in North Carolina (Figure 5.1.1) – Formative to Managing
- 2020 North Carolina Projected Urbanization Level Map (Figure 5.2.1) – Moderate to Highest Level Counties

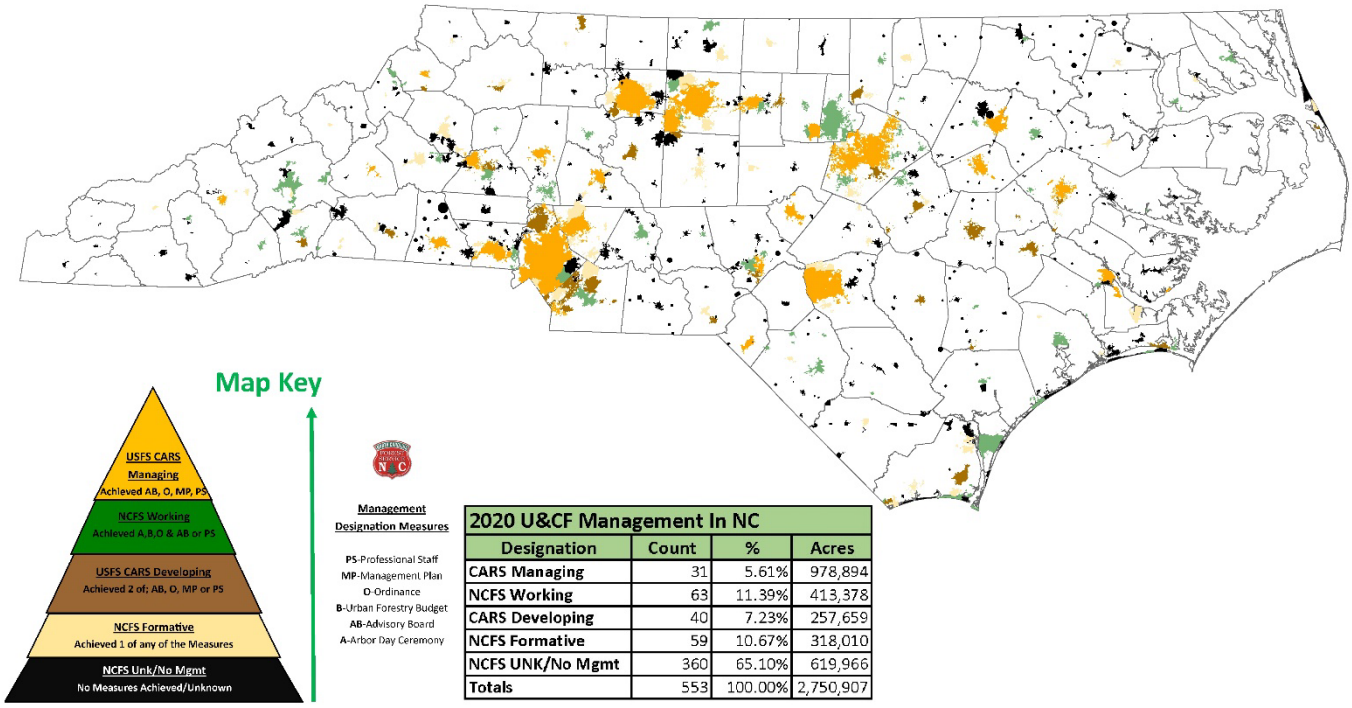
NOTABLE RESOURCES NEEDED

- Key stakeholder list and partner contact list.
- Federal, State and local U&CF funding.
- Increased state & local level U&CF expertise and capacity.

EXAMPLE METRICS

- Managing Communities
- Tree City USA Communities and municipalities
- Developing Communities
- Communities with Urban Forest Management Plans
- NCFS Urban and Community Forestry services provided
- Tree Campus Higher Education USA
- Percentage of Tree Line USAs
- Percentage of Tree K-12 Campuses
- Percentage of Tree Health Care Campuses
- TCIA-accredited companies
- Number of ISA Certified Arborists / Municipal Specialists
- Urban forestry demonstration sites

Figure 5.1.1. 2020 NCFS Urban and Community Forest Management in North Carolina

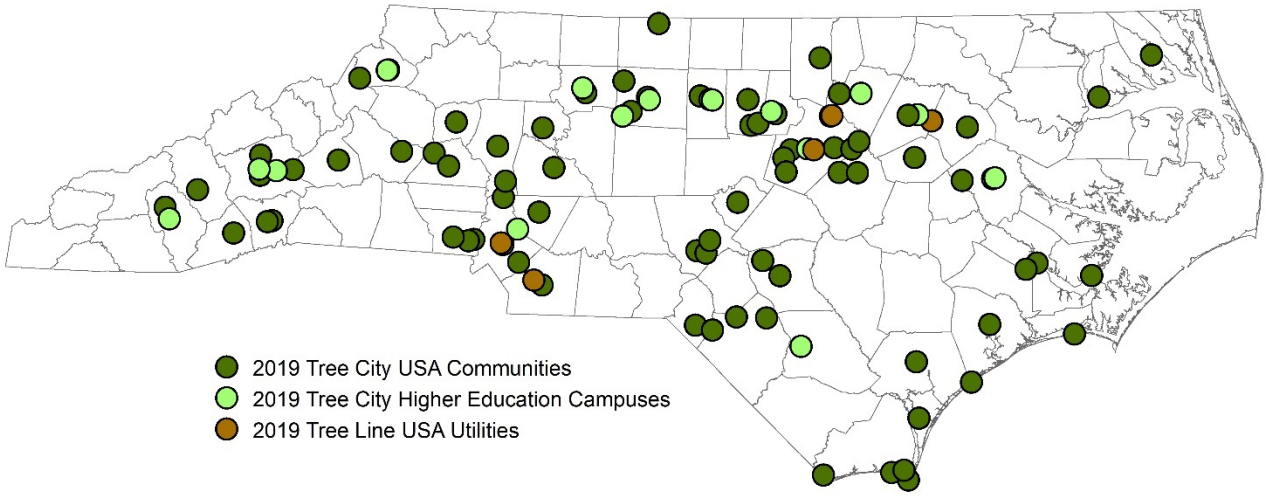


2020 U&CF Management In NC			
Designation	Count	%	Acres
CARS Managing	31	5.61%	978,894
NCFS Working	63	11.39%	413,378
CARS Developing	40	7.23%	257,659
NCFS Formative	59	10.67%	318,010
NCFS UNK/No Mgmt	360	65.10%	619,966
Totals	553	100.00%	2,750,907

This figure presents the urban forest management status of communities based on achievement of NCFS Urban and Community Forestry and USFS Community Accomplishment Reporting System (CARS) management measures.

Source: NCFS Urban and Community Forestry Program[2]

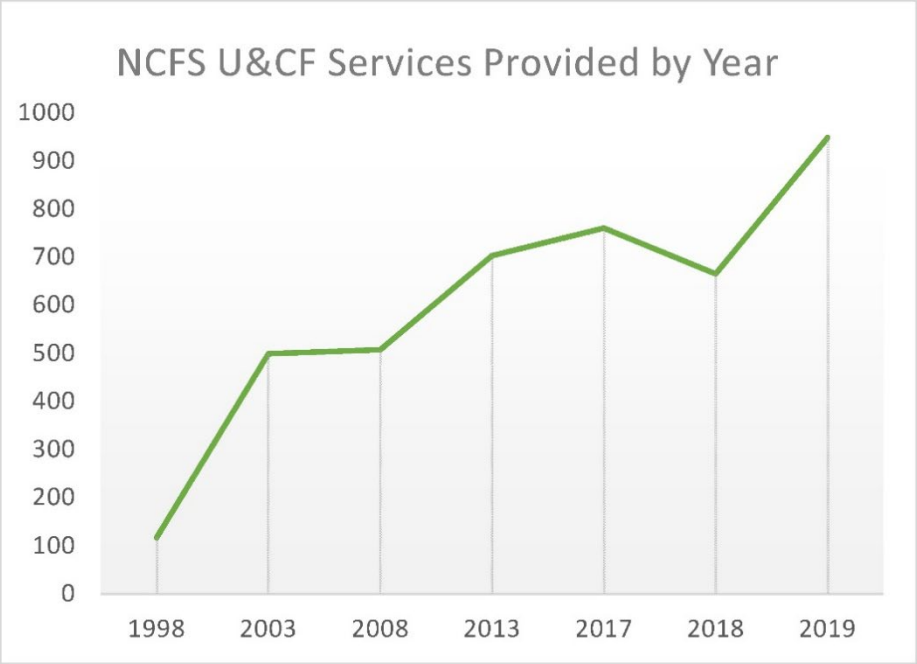
Figure 5.1.2. State Distribution of 2019 Arbor Day Foundation Award Programs Awardees



These designations are awarded annually to communities, higher education campuses and utility companies that meet minimum standards of urban forest management. The awardees market this accomplishment, fostering sustainable urban and community forestry management in their locality and statewide.

Source: NCFS Urban and Community Forestry Program[2]

Figure 5.1.3. N.C. Forest Service Urban and Community Forestry Services Provided, 1998-2019



This figure presents the number of urban forestry services provided by NCFS staff, as reported in the NCFS Forest Management Accomplishment Reporting database. Services provided include arboricultural assessments and plans for landowners and residents as well as urban forestry consultations and plans for municipalities. The steady increases in services can be attributed to population growth, growing urbanization in North Carolina, and NCFS urban and community forestry leadership.

Source: NCFS Urban and Community Forestry Program[2]

REFERENCES

1. USFS and NCFS. Community Accomplishment Reporting System. 2019
2. North Carolina Forest Service Urban and Community Forestry Program.
3. International Society of Arboriculture. *Arborist Search*. Retrieved May 5, 2020 from https://www.treesaregood.org/findanarborist.
4. Tree Car Industry Association. *Find Accredited Residential & Commercial Tree Care Company.* Retrieved May 5, 2020 from https://tcia.org/TCIA/Directories/FindQualifiedTreeCare.aspx?Accreditation=1&HideRB=1&hkey=77d2247e-39d4-413a-b839-b777f445afed.

Protect the Urban Forest — Policies

Objective 5.2—Promote the integration of urban forestry into all scales (local, regional and state) of planning, policy development, and legislation to prevent and mitigate the loss of urban canopy cover due to urbanization and other human actions.

CURRENT CONDITIONS AND TRENDS

- The estimated percentage of urban land in North Carolina grew from 9.5% in 2010 to 11.5% in 2020.[3]
- North Carolina is losing approximately 4,510 acres of urban canopy cover per year.[4]
- Approximately 31.5% of North Carolina municipalities have some legislation designating the management of urban forests.[1,2]
- Data identifying the actual number of municipalities with public tree and/or tree conservation and development ordinances is dated and limited.[1,2]
- Deforestation and forest fragmentation are increasing due to urbanization, and effective management and policy can be utilized to sustain urban forest health.[4]
- Decreasing federal funding and the absence of state appropriated urban and community funding limits leadership and capacity at the state level.[2]

NOTABLE THREATS

- Urbanization in communities that do not have the policies, policy expertise and capacity to balance growth and protect the urban forest resource
- Loss of urban canopy cover and forestlands due to urbanization
- Forest fragmentation due to urbanization
- Degradation of soil and ecosystem quality due to urbanization
- Loss of ecosystem services, human health and economic benefits due to canopy cover loss and ecosystem degradation
    - Increased heat island effect, resulting in increased energy demand, cost and emissions
    - Increased storm management issues and flooding
    - Increasing poor air quality
    - Decreased carbon sequestration
    - Reduced property values
    - Lost increases in economic activity
- Decreasing federal funding and the absence of state appropriated urban and community forestry funding threatens leadership and capacity at the state level.

SUPPORTING INFORMATION

- NASF Forest Action Plan 10-Year Revisions: Resources of Urban and Community Forestry
- Vibrant Cities Lab
    - www.vibrantcitieslab.org

PRIORITY AREAS

- 2020 NCFS Urban and Community Forestry Management Map (Figure 5.1.1) – No Management to Managing
- 2020 North Carolina Projected Urbanization Level Map (Figure 5.2.1) – Moderate to Highest Level

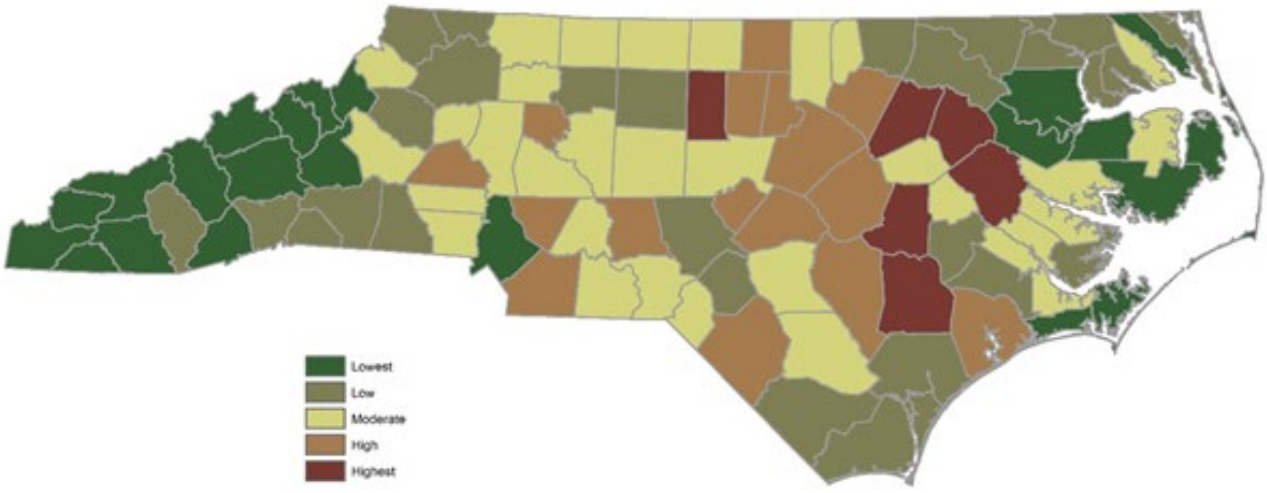
NOTABLE RESOURCES NEEDED

- Key stakeholder list and partner contact list
- North Carolina-centric urban forestry ordinance templates
- State appropriated urban and community forestry funding
- Increased urban and community forestry expertise and capacity at the state level

EXAMPLE METRICS

- Municipalities with a public tree ordinance
- Municipalities with a site plan development ordinance
- Municipalities with a conservation development ordinance
- Urban forest canopy cover
- North Carolina acreage classified as urban versus forestland

Figure 5.2.1. North Carolina Projected Urbanization Level, by County, 2010-2040



This map utilizes the Integrated Climate and Land Use (ICLUS) Version 2 model, averaging the values by county and then assigning them to five urbanization levels. The model uses data like estimated population growth, transportation capacity and increase, demand for housing and land-use conversion. The resulting map shows where the most significant changes are likely to occur based on the recent past (2000-2010).

Source: NCFS Urban and Community Forestry Program2

REFERENCES

1. USFS and NCFS. Community Accomplishment Reporting System. 2019
2. North Carolina Forest Service Urban & Community Forestry Program.
3. Nowak, David J. and Greenfield, Eric J. 2018. "*US Urban Forest Statistics, Values, and Projections*." Journal of Forestry, 116(2):164-177.
4. Nowak, David J. and Greenfield, Eric J. 2018. "*Declining urban and community tree cover in the United States.*" Urban Forestry & Urban Greening, 32:32-55.

Urban Forest Inventory, Assessments and Analysis

Objective 5.3—Support the completion of Urban Forest and Inventory Analysis (FIA) inventories, regional and local tree inventories and urban tree canopy cover assessments (UTCAs) and develop standardized minimum inventory data protocols to facilitate statewide and landscape-scale urban forestry analysis.

CURRENT CONDITIONS AND TRENDS

- In 2015, North Carolina's urban tree canopy cover was estimated to be 54.2%.[3]
- North Carolina is losing approximately 4,510 acres of urban canopy cover per year.[3]
- North Carolina is gaining 4,510 of acres of impervious cover in urban areas.[3]
- There are 319.8 million urban trees, sequestering 2.1 million tons of carbon and capturing 50,300 tons of air pollutants per year.[2]
- The value per year of: carbon sequestered is $2.8 million; air pollution captured is $192,000; energy use avoided is $150.3 million; and, emissions avoided is $86.3 million.[2]
- The economic contribution of urban and community forestry in North Carolina is unknown.
- The volume of urban wood generated in North Carolina is unknown.
- No cities in North Carolina have completed an Urban FIA inventory.[1]
- The total number of local tree inventories, types and management data collected is unknown.[1]
- The total number of canopy cover assessments, features collected, and the resolution is unknown.[1]
- The variability in tree inventory and canopy cover assessment methodology and data collected limits statewide and landscape-scale urban forestry analysis and benchmarking.
- At the expense of less costly, equally valuable sample and canopy cover inventory methodologies, complete tree inventories are being completed without enough local expertise and capacity to maintain.
- There is limited private and public sector expertise to perform tree inventories and canopy cover assessments.
- The North Carolina Urban Forest Strike Team (UFST) roster includes 21 individuals.[1]
- Decreasing federal funding and the absence of state appropriated urban and community forestry funding limits leadership and capacity at the state level.[1]

NOTABLE THREATS

- The lack of statewide and local urban forest inventory and canopy cover data limits the measuring of changes in the urban forest resource and the impact of urban forest management efforts.
- The variability in tree inventory and canopy cover assessment methodology and data collected limits statewide and landscape-scale urban forestry analysis and benchmarking.
- At the expense of less costly, equally valuable sample and UTCA inventory methodologies, complete tree inventories are being completed without enough local expertise and capacity to maintain.
- There is limited private and public sector expertise to perform tree inventories and canopy cover assessments.
- There is insufficient funding to complete and maintain inventories and UTCAs at the local, regional and state levels.
- Decreasing federal funding and the absence of state appropriated urban and community forestry funding threatens leadership and capacity at the state level.

SUPPORTING INFORMATION

- USDA Forest Service Forest Inventory and Analysis
  - https://www.fia.fs.fed.us/program-features/urban/
- NASF Forest Action Plan 10-Year Revisions: Resources of Urban & Community Forestry
- Vibrant Cities Lab
  - www.vibrantcitieslab.org
- iTree Tools
  - www.itreetools.org

PRIORITY AREAS

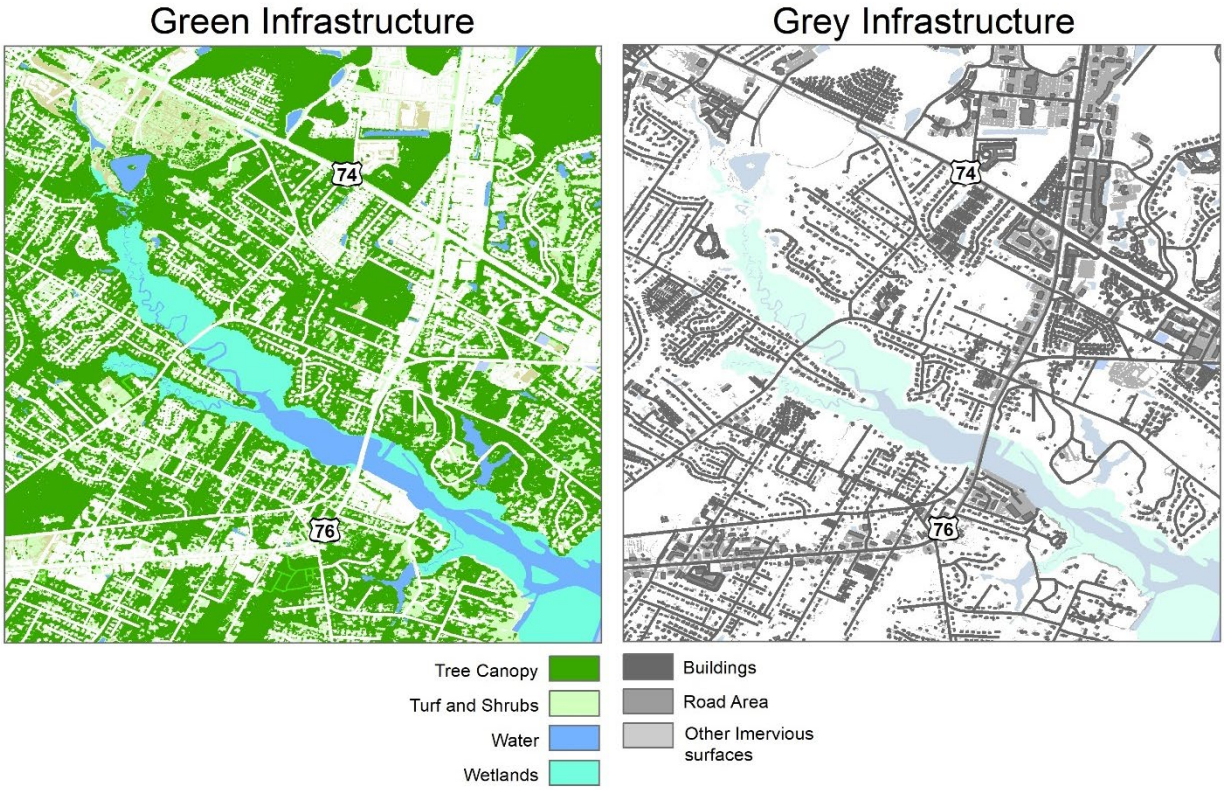
- USFS Urban FIA target cities: Charlotte, Fayetteville, Greensboro, Raleigh, Winston-Salem
- 2020 NCFS Urban and Community Forestry Management Map (Figure 5.1.1) – No Management to Managing
- 2020 North Carolina Projected Urbanization Level Map (Figure 5.2.1) – Lowest to Highest Level

NOTABLE RESOURCES NEEDED

- Funding for Urban FIA inventories
- State appropriated urban and community forestry funding
- Funding for tree inventories and UTCAs
- Urban and community forestry capacity and expertise

EXAMPLE METRICS

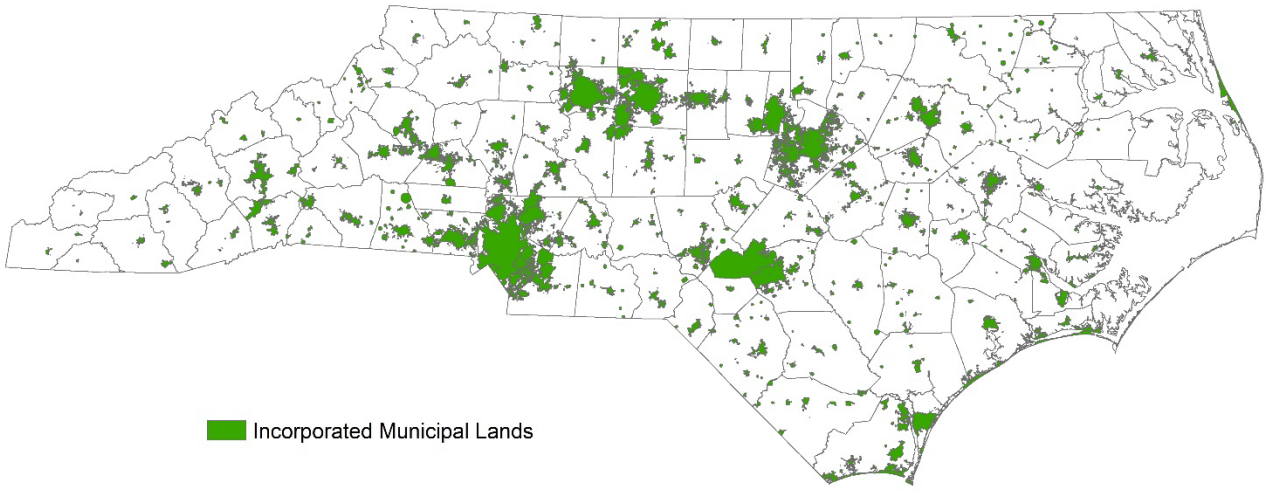
- Urban FIA inventories completed
- Communities with sample and complete inventories
- Canopy cover assessments
- Communities with current/active UTCAs
- Urban forestry consultants



Urban tree canopy cover assessments provide information to quantify tree canopy cover, calculate ecosystem services and identify opportunities for tree planting efforts assist in urban and community forestry as well as other natural resource planning and management efforts.

Source: Apex, NC 2017, Courtesy Green Infrastructure Center

Figure 5.3.1. Incorporated Municipal Lands in North Carolina, 2020



Map created by NCFS, 2020

Urban lands in North Carolina total 3.9 million acres or 11.5% of North Carolina's 34.4 million acres. North Carolina's urban tree canopy cover is 54.2%.[2]

REFERENCES

1. North Carolina Forest Service Urban and Community Forestry Program.
2. Nowak, David J. and Greenfield, Eric J. 2018. "*US Urban Forest Statistics, Values, and Projections*." Journal of Forestry, 116(2):164-177.
3. Nowak, David J. and Greenfield, Eric J. 2018. "*Declining urban and community tree cover in the United States.*" Urban Forestry & Urban Greening, 32:32-55.

Protect the Urban Forest – Urban Forest Health, Storms and Reforestation

Objective 5.4—Reduce and mitigate the impacts of biotic and abiotic threats to urban forest health and benefits through monitoring, intervention and reforestation.

CURRENT CONDITIONS AND TRENDS

- In 2015, North Carolina's urban tree canopy cover was estimated to be 54.2%.[3]
- North Carolina is losing approximately 4,510 acres of urban canopy cover per year.[3]
- North Carolina is gaining 4,510 of acres of impervious cover in urban areas.[3]
- There are 319.8 million urban trees, sequestering 2.1 million tons of carbon and capturing 50,300 tons of air pollutants per year.[2]
- The value per year of: carbon sequestered is $2.8 million; air pollution captured is $192 K; energy use avoided is $150.3 million; and, emissions avoided is $86.3 million.[2]
- There are 21 major insects, disease and invasive plant threats present in North Carolina. See Objective 2.2.
- There are 6 imminent insects, disease and invasive plant threats to North Carolina. See Objective 2.2.
- The climate and weather trends over the last 10 years indicate an increasing threat to urban forest health. See Objective 2.3.
- There is no Urban FIA data for North Carolina to facilitate risk assessment and assist in developing mitigation strategies.[1]
- Decreasing federal funding and the absence of state appropriated urban and community forestry funding limits leadership and capacity at the state level.[1]

NOTABLE THREATS

- Abiotic
    - Climate Change and Weather (See Objective 2.3)
        - Increasing air temperatures
        - Increasing severe storm frequency and intensity
        - Increasing urban heat island effect
        - Sea-level rise
        - Flooding
        - Drought
    - Urbanization
    - Degradation of soil and ecosystem quality due to urbanization
- Biotic
    - Invasive, nonnative insect pests, disease and plants. See Objective 2.2.
- Urban tree removal is exceeding tree planting.
- The absence of Urban FIA data in North Carolina limits monitoring and measuring urban forest health threats.
- Lack of urban forest species diversity
- Limited tree species diversity offered in commercial tree nurseries
- Lack of management
- Decreasing federal funding and the absence of state appropriated urban and community forestry funding threatens leadership and capacity at the state level.

SUPPORTING INFORMATION

- NASF Forest Action Plan 10-Year Revisions: Resources of Urban & Community Forestry
- iTree Tools
- N.C. Department of Environmental Quality Climate Resiliency Plan
- N.C. Natural and Working Lands Plan

PRIORITY AREAS

- 2020 NCFS Urban and Community Forest Management in North Carolina (Figure 5.1.1)
- 2020 North Carolina Projected Urbanization Level Map (Figure 5.2.1)
- 2.1, 2.2 and 2.3 Forest Threats Maps

NOTABLE RESOURCES NEEDED

- Increased professional expertise and capacity at the local, regional and state levels
- Funding for urban and community forestry leadership at the state level
- Funding to develop contact list of key partners
- Funding for equipment, training and the development of urban forest strike teams (UFSTs)
- Funding to support local, regional, state governments and organizations on forest health issues, mitigation and reforestation strategies
- Funding for the development, production and delivery of multimedia educational products

EXAMPLE METRICS

- Major and notable threats (See Objectives 2.1, 2.2 and 2.3.)
- Urban tree canopy cover
- Change in urban tree canopy cover
- Impervious cover
- Total number of urban trees in North Carolina
- Tons per year of carbon sequestered: NO2, O3, PM
- Dollar value of tons per year carbon sequestered: NO2, O3, PM, energy and emissions avoided

REFERENCES

1. North Carolina Forest Service Urban and Community Forestry Program.
2. Nowak, David J. and Greenfield, Eric J. 2018. "*US Urban Forest Statistics, Values, and Projections*." Journal of Forestry, 116(2):164-177.
3. Nowak, David J. and Greenfield, Eric J. 2018. "*Declining urban and community tree cover in the United States.*" Urban Forestry & Urban Greening, 32:32-55.

Collaboration, Education and Outreach

Objective 5.5—Increase state-wide public and partner participation and coordination of urban and community forestry efforts.

CURRENT CONDITIONS AND TRENDS

- There are at least 11 statewide professional organizations that are involved in activities related to urban and community forestry.
- There are local organizations that provide urban and community forestry education and outreach services to the community.
- Federal urban and community forestry funding is decreasing, and there is no state appropriated funding for urban and community forestry.[1]
- The N.C. Forest Service (NCFS) Urban and Community Forestry program is a federally funded program that provides statewide urban and community forestry leadership and grant funding for education and outreach.
- The N.C. Urban Forestry Council (NCUFC) is the primary provider of statewide urban and community forestry educational and outreach services in North Carolina.
- The N.C. State University Extension provides statewide urban and community forestry educational services in North Carolina.
- Climate change and the ecosystem and the economic and human health benefits that trees provide to our communities offer an opportunity to capture public opinion about the value of trees and sustainable funding for urban and community forestry.

NOTABLE THREATS

- Decreasing federal funding and the absence of state appropriated urban and community forestry funding threatens leadership and capacity at the state level.
- Limited capacity level to provide and coordinate educational and outreach efforts at the state level
- Mixed and uncollaborated urban and community forestry messaging

SUPPORTING INFORMATION

- NASF Forest Action Plan 10-Year Revisions: Resources of Urban & Community Forestry
- USDA Forest Service Urban and Community Forestry Program
  - www.fs.usda.gov/managing-land/urban-forests/ufc
- U.S. Forest Service Urban and Community Forestry South
  - www.urbanforestrysouth.org
- Southern Group of State Foresters Urban and Community Forestry
  - www.southernforests.org/urban
- N.C. Forest Service Urban and Community Forestry
  - www.ncforestservice.gov/urban/urban_forestry
- N.C. Urban Forest Council
  - www.ncufc.org
- Healthy Trees Healthy Lives Campaign
  - www.southernforests.org/urban/healthy-trees-healthy-lives

- N.C. Department of Environmental Quality Climate Resiliency Plan
- N.C. Natural and Working Lands Plan

PRIORITY AREAS

- 2020 NCFS Urban and Community Forestry Management Map (Figure 5.1.1) – No Management to Managing
- 2020 North Carolina Projected Urbanization Level Map (Figure 5.2.1) – Lowest to Highest Level

NOTABLE RESOURCES NEEDED

- Funding to identify key stakeholders and manage education and outreach efforts
- Funding for the development and distribution of multimedia educational products and campaigns
- Funding for regional and local urban and community forestry demonstration sites

EXAMPLE METRICS

- Educational products and campaigns produced
- Urban and community forestry demonstration sites
- Educational training and workshops provided for the public and professionals
- Professional educational training, workshops and certification opportunities
- Underserved communities served

REFERENCES

1. North Carolina Forest Service Urban & Community Forestry Program.

KEY PARTNERSHIPS

American Association of Planners, N.C. Chapter	N.C. State University Extension
American Public Works Association, N.C. Chapter	American Society of Consulting Arborists
American Society of Landscape Architects, N.C. Chapter	International Society of Arboriculture, Southern Chapter
Arbor Day Foundation	N.C. APPA
Local urban forestry and environmental organizations	N.C. Board of Registered Foresters
N.C. Association of County Commissioners	N.C. Forestry Association
N.C. Bar Association	N.C. Nursery and Landscape Association
N.C. Department of Environmental Quality	N.C. Urban Forest Council
N.C. League of Municipalities	N.C. Wildlife Resources Commission
N.C. Regional Council of Governments	Society of American Foresters
N.C. Utilities Commission	

Summary

We appreciate the collaboration that went into developing this 2020 North Carolina Forest Action Plan, and we hope the result is both relevant and useful. North Carolina is fortunate to have such a strong forestry community, and some of the challenges and opportunities outlined in this plan will require many stakeholders across a wide spectrum to work together. We ask that your organization consider this plan and incorporate the applicable strategies into your strategic plans and ongoing efforts.

APPENDICES

Appendix Item I: 2020 NCFAP Goals, Objectives and Strategies

National Priority: Conserve and Manage Working Forests for Multiple Values and Uses

Goal 1. Increase the Sustainable Management and Conservation of Forests

Objectives:

1.1—Promote forest sustainability and forest market viability, current and future, for consumers and producers.

1.2—Conserve high-priority forest ecosystems and landscapes.

1.3—Assist landowners with actively and sustainably managing forests for economic and social benefits.

1.4—Strengthen and develop outside partnerships with public and private entities at federal, state, and local levels to improve and coordinate services and service delivery.

1.5—Restore and conserve priority forest, aquatic and wildlife habitat.

Strategies:

1.1.1—Promote forest sustainability and support favorable business environments for forest-based industries.

1.1.2—Promote favorable tax structures and financial incentives that support the retention of working forests.

- Advocate for the reinstatement of the North Carolina Conservation Tax Credit Program and continued support for the Present Use Valuation Program.

1.1.3—Provide technical assistance, information and outreach to forestland owners, partnering agencies and forest-based industries regarding forest sustainability and forest-market opportunities.

1.1.4—Identify and promote the retention and recruitment of domestic and export markets for biomass, underutilized species and low-grade materials, and traditional forest products.

1.2.1—Collaborate with other natural resource organizations to identify high-priority forest ecosystems and landscapes.

1.2.2—Assist land management professionals with the delivery of programs and services that conserve high-priority forest ecosystems and landscapes.

1.2.3—Promote restoration and conservation strategies that address declining tree species and forest ecosystems.

- Educate the public on the benefits, ecological importance, and value of restoring and conserving declining tree species and forest ecosystems.

1.3.1—Educate natural resource professionals, policymakers, the general public, landowners and schoolchildren about forests, markets, wildlife and the social, ecological and economic benefits they provide.

1.3.2—Provide increased technical and professional assistance to forest landowners that results in more active and sustainable management of their forestland.

- Promote awareness of conservation programs, such as stewardship, tree farm, etc., and priority focus areas.

1.3.3—Seek increased funding for forestry cost share programs as well as forest nursery and tree improvement programs.

1.4.1—Assess, evaluate, and develop new technical services and programs to effectively reach nontraditional, underserved and traditional forest landowners.

1.5.1—Support the goals and strategies outlined in the 2016 North Carolina Wildlife Action Plan (NCWAP), and coordinate with agencies regarding aquatic conservation priorities.

1.5.2—Restore and conserve forestland with priority terrestrial and aquatic habitat by promoting conservation initiatives, partnerships and shared goals.

1.5.3—Increase and expand wildlife habitat conservation and restoration training for natural resource professionals, agency personnel and consultants that work with private landowners.

1.5.4—Increase local government and public participation in programs intended to restore critical terrestrial and aquatic habitats at risk.

National Priority: Protect Forests from Threats

Goal 2. Reduce Negative Impacts from Forest Threats

Objectives:

2.1—Minimize the impacts of wildfire on forests, citizens and communities.

2.2—Minimize negative impacts to forest health caused by major, locally significant or imminent insects, diseases and nonnative invasive plants.

2.3—Identify impacts and develop long-term approaches that minimize negative influences on forests caused by climate change, air quality and weather events.

Strategies:

2.1.1—Increase resources and capacity to respond to and manage wildland fires.

2.1.2—Educate the public, land management professionals and government officials on WUI fire risks, issues and mitigation techniques.

2.1.3—Encourage interorganizational planning, policymaking and collaboration that lead to the use of wildfire mitigation principles in construction and community planning.

2.1.4—Increase decision support tools regarding fire danger, weather products and fire response planning.

2.1.5—Encourage preparation and implementation of Community Wildfire Protection Plans (CWPPs).

2.1.6—Develop fire prevention and response plans, as well as training, for areas with increased fuel loading.

2.2.1—Train natural resource professionals to better identify, understand, report and respond to forest health threats.

2.2.2—Develop diverse information and education materials for the public to address identification and management of forest insect, disease and nonnative invasive threats.

2.2.3—Promote the use of local or treated firewood to prevent the spread of invasive pests.

2.2.4—Survey and monitor outbreaks and spread of major and locally significant forest insect and disease threats.

2.2.5—Monitor the spread and movement (early detection) of imminent and future introduced nonnative invasive species.

2.2.6—Promote interorganizational policymaking, collaboration, and rapid response planning and implementation to address introduction and containment of forest health threats.

2.2.7—Use integrated pest management practices including sound silviculture and urban forest/arboriculture practices to mitigate forest health risks and minimize damage from threats.

2.3.1—Promote research and knowledge sharing targeted toward better understanding of potential direct impacts to trees and forests from climate change and air quality.

2.3.2—Develop and promote forest management practices specifically for areas most likely to be affected by sea-level change and saltwater intrusion.

2.3.3—Increase tree planting and use of silviculture practices to expand carbon storage capacities.

2.3.4—Promote interorganizational preplanning to include response planning, policymaking and collaboration that leads to coordinated responses for managing forest resources affected by damaging weather events.

Goal 3. Increase the Beneficial Use of Prescribed Fire

Objectives:

3.1.—Increase the number of acres burned and promote greater acceptance of prescribed fire to benefit forest health, wildlife habitat, fuel reduction and fire adapted ecosystems.

3.2.—Restore and conserve fire adapted species, habitats and forest ecosystems with a continued emphasis on longleaf pine, shortleaf pine, Table Mountain/pitch pine, pine-oak heath and oak forests (dry, dry mesic and montane) and their associated plant communities.

Strategies:

3.1.1.—Conduct applied fire and ecological research to better understand and manage the fire environment.

3.1.2.—Increase the resource capacity of trained and qualified personnel to conduct prescribed burning on private land.

3.1.3.—Educate the public on the importance, value and benefits of prescribed fire.

3.1.4.—Support the efforts of prescribed burners to acquire adequate and affordable liability insurance.

3.1.5—Provide training on advanced topics for experienced burners, such as atmospheric dispersion modeling (ADM), growing season burning, reintroduction of fire into unburned stands and smoke management.

3.2.1.—Identify, evaluate and support management and conservation opportunities or initiatives for fire adapted species, habitats and forest ecosystems.

3.2.2.—Promote and publicize restoration efforts and the ecological importance of restoring fire to fire-dependent ecosystems.

3.2.3.—Promote ecological research and techniques to restore and manage fire adapted species, habitats and ecosystems.

3.2.4.—Support organizations and partners with programs and efforts to restore longleaf pine, shortleaf pine, Table Mountain/pitch pine and fire adapted oak ecosystems through continued participation and funding.

National Priority: Enhance Public Benefits from Trees and Forests

Goal 4. Manage and Conserve Forests for Clean Water

Objectives:

4.1—Continue to identify and advance the drinking water, stormwater management, and related ecosystem services benefits that are derived from forests.

4.2—Strive for continuous improvement in the implementation of BMPs.

Strategies:

4.1.1—Incorporate forestry-related content into Source Water Area Protection Plans.

4.1.2—Foster the development of transparent and efficient markets for ecosystem services that are provided by forests, with an initial emphasis on water-related services.

4.1.3—Demonstrate silvicultural prescriptions that promote the nexus between forests and water resources.

4.1.4—Foster the deployment of forestry-related practices to manage stormwater.

4.1.5—Focus additional research, outreach, monitoring and forestland conservation in priority areas.

4.1.6—Retain and/or expand forestland cover in priority watersheds.

4.2.1—Establish, enhance or supplement cost share programs for forestry/water resource objectives.

4.2.2—Sustain critical habitat for listed threatened and endangered aquatic species.

4.2.3—Continued education, outreach and information delivery.

Goal 5. Conserve and Enhance the Benefits and Sustainable Management of Urban Forests

Objectives

5.1—Increase the level of local urban forest management as well as public and private sector local, regional and statewide leadership, expertise and capacity.

5.2—Foster the integration of urban forestry into all scales (local, regional and state) of planning, policy development, and legislation to prevent and mitigate the loss of urban canopy cover due to urbanization and other human actions.

5.3—Foster the completion of Urban Forest and Inventory Analysis (Urban FIA) inventories, regional and local tree inventories and urban tree canopy cover assessments (UTCAs) and other urban and community forestry resource assessments to facilitate community, regional and statewide-scale urban & community forestry analysis and management.

5.4—Reduce and mitigate the impacts of biotic and abiotic threats to urban forest health and benefits through monitoring, intervention and reforestation.

5.5—Increase statewide public and partner participation and coordination of urban and community forestry efforts.

Strategies

5.1.1—Provide urban and community forestry technical assistance to communities and the public.

5.1.2—Provide urban and community forestry benefits and management educational messaging, programming and media products to municipalities, incentivizing and guiding communities up the urban forest management development pyramid tailored to the respective community N.C. Forest Service (NCFS) management designation, ranging from “No Management” to “Managing.” See Figure 5.1.

5.1.3—Promote and support partner urban and community forestry management initiatives, programs and tools to enhance sustainable management and realize the environmental and economic benefits.

5.1.4—Promote and support community involvement, urban and community forestry advocacy groups and volunteerism in urban forest management.

5.1.5—Promote and increase participation in urban forestry recognition programs.

- N.C. Champion Tree Program
- Arbor Day programs
- Tree City USA, Tree Campus Higher Education and Tree Line USA recognition programs
- Promote other Arbor Day Foundation (ADF) programs such as Tree K-12 and Tree Campus Health Care.

5.1.6—Provide professional urban and community forestry educational and job training to partner service providers to promote urban and community forestry economic growth and to increase expertise and capacity.

5.2.1—Provide policy messaging, educational programming and media products to increase expertise and capacity and incentivize and guide communities up the urban forest management development pyramid tailored to the respective community NCFS management designation, ranging from “No Management” to “Managing.” See Figure 5.1.

5.2.2—Provide policy messaging, educational programming and media products on the benefits of urban and community forestry policy in conserving and enhancing the benefits of urban forests.

5.2.3—Develop and provide North Carolina-centric municipal best management practices (BMPs) ordinance and work specification templates for urban forest policy and management activities.

5.3.4—Promote ecosystem services, green infrastructure, low impact development and conservation development policies and BMPs.

5.3.1—Provide messaging, educational programming and media products on the types, value and application of tree inventories and canopy cover assessments tailored to the respective community NCFS management designation, ranging from “No Management” to “Managing.” See Figure 5.1.

5.3.2—Develop standardized tree inventory and canopy cover assessment BMPs to facilitate local, regional and statewide urban forestry analysis that guides the audience up the urban forest management pyramid from “No Management” to “Managing.” See Figure 5.1.

5.3.3—Develop educational programming and media products to provide job training and to foster building public and private sector tree inventory and canopy cover assessment expertise and capacity.

5.3.4—Promote the value of lower cost sample inventories and canopy cover assessments as well as complete inventories and Urban FIA as tools to enhance urban forest management,

policy development and implementation, reforestation, forest health mitigation and storm preparation, response and recovery.

5.4.1—Provide forest health threat and reforestation messaging, educational programming and media products.

5.4.2—Promote forest health partner efforts in monitoring and mitigating forest insect, disease and nonnative invasive plant threats.

5.4.3—Support and collaborate with nonprofit organizations' tree planting efforts, leveraging public and private sector funding and community involvement.

5.4.4—Develop educational programming and media products providing forest health and reforestation business growth and job training to foster building private sector expertise and capacity.

5.4.5—Promote storm preparedness, response and restoration through planning, inventories and assessments to minimize the impacts of events, assess damages and guide recovery efforts.

5.4.6—Advocate for private and public reforestation and forest health funding, utilizing positive public sentiment toward these sustainable issues.

5.5.1—Hold an annual working meeting of key members from each of the key partners, led by the NCFS Urban and Community Forestry program and the N.C. Urban Forest Council, to review current urban and community forestry issues and collaborate in the implementation of the N.C. Urban and Community Forestry Forest Action Plan.

5.5.2—Collaborate on partner delivery of urban and community forestry programs and services.

5.5.3—Collaborate with partners to grow urban & community forestry, leadership, green industry jobs, expertise and capacity through partner activities, plans and initiatives.

5.5.4—Collaborate with partners to provide products and multimedia marketing campaigns focused on urban and community forestry management and benefits educational programs.

5.5.5—Target the delivery of urban and community forestry services and programs to municipalities based on priorities that conserve and enhance the benefits and sustainable management of urban forests.

5.5.6—Advocate for federal, state and local urban and community forestry funding, policies and legislation to conserve and enhance the benefits and sustainable management of urban forests.

5.5.7—Seek and capture urban and community forestry opportunities to engage and serve underserved communities and diversify the urban and community forestry community, ensuring that all partner activities and messaging embrace diversity and inclusion of all North Carolinians.

Appendix Item II: Acronym List

APNEP	Albemarle-Pamlico National Estuary Partnership
BMP	Best Management Practice
CLA	Carolina Loggers Association (formerly NC Assoc. of Professional Loggers)
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CWPP	Community Wildfire Protection Plan
DEMLR	N.C. Division of Energy, Mineral and Land Resources, DEQ
DEQ	N.C. Department of Environmental Quality
DOC	N.C. Department of Commerce
DOT	N.C. Department of Transportation
DSWC	N.C. Division of Soil and Water Conservation, NCDA&CS
DWR	N.C. Division of Water Resources, DEQ
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program, NRCS
FDP	Forest Development Program
FIA	Forest Inventory and Analysis Program
FPGs	N.C. Forest Practices Guidelines Related to Water Quality
FSA	Farm Service Agency, USDA
FSP	Forest Stewardship Program
ISA	International Society of Arboriculture
LLA	The Longleaf Alliance
NCACF	N.C. Chapter of the Association of Consulting Foresters
NCASWCD	N.C. Association of Soil and Water Conservation Districts
NCDA&CS	N.C. Department of Agriculture and Consumer Services
NCEM	N.C. Emergency Management
NCFA	N.C. Forestry Association
NCFAP	N.C. Forest Action Plan
NCFS	N.C. Forest Service
NCPFC	N.C. Prescribed Fire Council
NCSU	N.C. State University
NCTFP	N.C. Tree Farm Program (American Tree Farm System)
NCUFC	N.C. Urban Forest Council
NCWAP	N.C. Wildlife Action Plan
NCWRC	N.C. Wildlife Resources Commission
NGO	nongovernmental organization
NHP	N.C. Natural Heritage Program, DNCR
NPS	National Park Service
NRCS	Natural Resources Conservation Service, USDA
NWS	National Weather Service
NWTF	National Wild Turkey Federation
OSFM	N.C. Office of State Fire Marshal, DOI
PPE	personal protective equipment
PSA	public service announcement
RC&D	N.C. Resource Conservation and Development Program
REIT	Real Estate Investment Trust

SAF	Society of American Foresters
SECH	Southeast Climate Hub, USDA
SFI	Sustainable Forestry Initiative
SMA	Society of Municipal Arborists
SMZ	Streamside Management Zone
SPB	Southern Pine Beetle
SWRAP	Southern Wildfire Risk Assessment Portal
T&E	Threatened and Endangered Species (includes candidate and listed species)
TIMO	Timberland Investment Management Organization
TNC	The Nature Conservancy
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOD	U.S. Department of Defense
USFS	United States Forest Service
USFWS	U.S. Fish and Wildlife Service
WUI	wildland urban interface

Appendix Item III: Forests of North Carolina, 2019

USDA United States Department of Agriculture

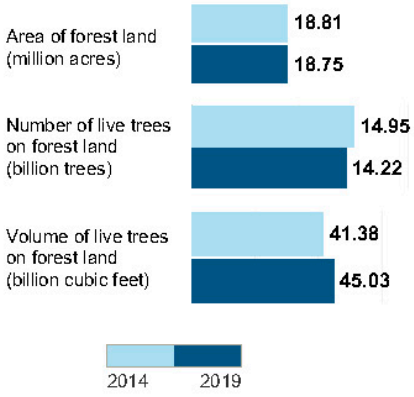
Forests of North Carolina, 2019

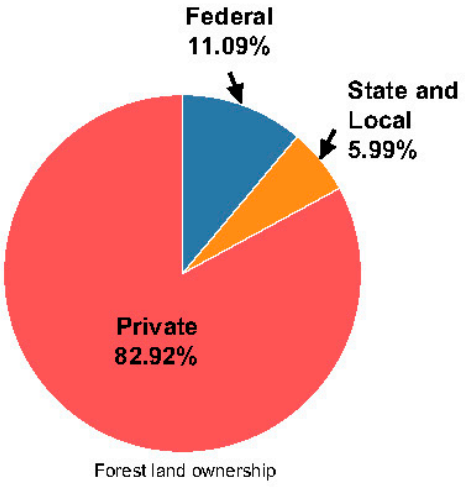
North Carolina has an estimated **18,750,216** acres of forest land.

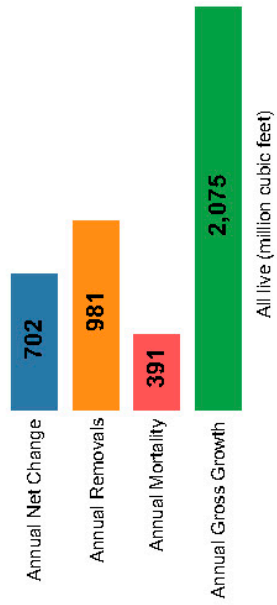
* Percent forest is forest area/total area. Percent forest with water removed from total area is 61%.

This resource update is a brief look at some of the basic metrics that describe the status of and changes to forest resources in North Carolina. This information is based on field data collected using the USDA Forest Service Forest Inventory and Analysis (FIA) annualized sample design, and it is updated yearly.

North Carolina has 5,726 sample plots across the State, of which 3,648 are currently forested. Each year, about 10-20 percent of these plots are visited and measured by field crews. Data used in this update were accessed from the FIA database on 07/22/2020.







57,534 acres of nonforest revert back to forest annually*

62,573 acres of forest land convert annually* to nonforest

399,490 acres of forest land are treated by cutting (harvest, thinning, etc.) annually*

111,431 acres of forest land are disturbed annually* by fire

78,581 acres of forest land are disturbed annually* by weather events

USDA Forest Service - Forest Inventory & Analysis

The estimates presented are based on data retrieved from the FIA database (07/22/2020) and may not reflect the most recent data available from the FIA program. Note – this publication does not include estimates of uncertainty. The most current data and sampling error for the estimates above can be found by visiting https://www.fia.fs.fed.us/.

* Average annual estimates are based on data collected across 5-10 years and may not be indicative of the nominal year presented in the title by itself.

USDA

United States Department of Agriculture

Forests of North Carolina, 2019

How to cite this publication

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Archived Versions

This report and archived past versions can be found on the USDA Forest Service publication database, Treesearch using keywords "Forest Inventory" and "North Carolina" here: https://www.fs.usda.gov/treesearch/.

National Woodland Owner Survey

The National Woodland Owner Survey (NWOS) collects and reports on multiple attributes of forest land ownership. Details of the NWOS program can be found here: https://www.fia.fs.fed.us/nwos/.

The most recent NWOS Factsheet for North Carolina can be found here: https://www.nrs.fs.fed.us/pubs/52411/.

Additional Resources

The application that produced this resource update was developed using data from the USDA Forest Service Forest Inventory and Analysis database (FIADB): https://apps.fs.usda.gov/fia/datamart/datamart_excel.html .

Tables for North Carolina, 2019 can be found here: https://doi.org/10.2737/FS-RU-259-Tables

The FIA one-click application can be found here: https://doi.org/10.2737/FIA-One-Click-State-Report-v1.2

Bechtold, W.A.; Patterson, P.L., eds. 2005. The enhanced Forest Inventory and Analysis program—national sampling design and estimation procedures. Gen. Tech. Rep. SRS–80. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 85 p. https://doi.org/10.2737/SRS-GTR-80 .

NOTE: Some of the above links will not be active until the resource update has been approved for official publication.

USDA Forest Service. 2019. Forests of North Carolina, 2019. Resource Update FS-259. Asheville, NC. U.S. Department of Agriculture, Forest Service. 2p. https://doi.org/10.2737/FS-RU-259

Appendix Item IV: Jobs and Income; Economic Contributions in 2016; National Forests in North Carolina

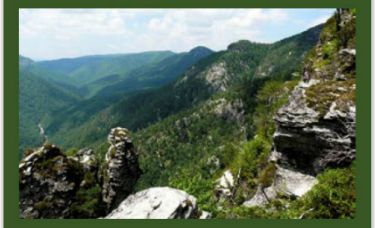
Jobs and Income

Economic Contributions in 2016 At A Glance

National Forests In North Carolina

In 2016, the National Forests In North Carolina supported:

- An estimated **6,330 jobs** (annual average of part time, full time, temporary and seasonal), and
- Around **$225,176,000** of **labor income** in local communities.



For More Information:

Economics for Planning website (https://www.fs.fed.us/emc/economics/index.shtml)

How do National Forests and Grasslands Contribute to Economies?

National Forests and Grasslands provide multiple benefits to the American people and to local communities. They provide clean air and water, preserve cultural resources, and conserve lands for the enjoyment of present and future generations.

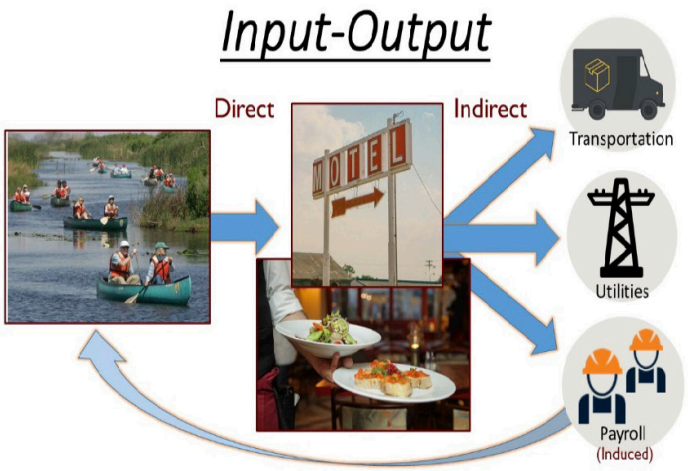
They also support local economies through recreation, timber, energy, minerals, and livestock grazing. In addition, counties with national forests or grasslands receive funds to support schools, road maintenance, and stewardship projects. The Forest Service also invests in such things as the construction and maintenance of infrastructure, environmental restoration, and forest health. In 2016, the sum of these activities on the National Forests In North Carolina supported approximately 6,330 local jobs and $225,176,000 in local labor income.

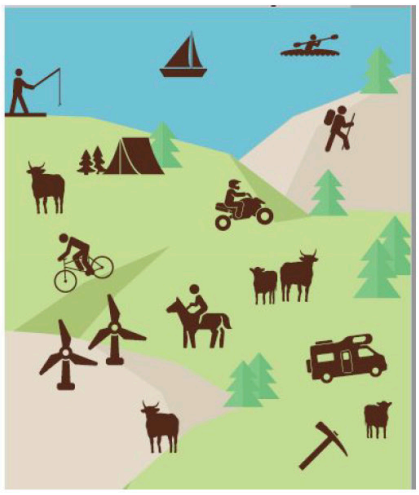
Why Report Jobs and Income?

Residents and local government officials in surrounding communities have interest in how management of the National Forests and Grasslands affects local economies.

Analysis Methods: How a contribution analysis is constructed

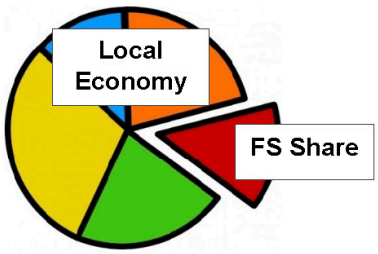
1 A software and data package called IMPLAN (www.implan.com) is used to characterize the structure of the local economy and how the different pieces of the economy interact (an "Input-Output" model).





2 Forest Service data for Program outputs from the National Forests In North Carolina is added to the model: recreation (including fish and wildlife related), livestock grazing, forest products, energy, minerals, payments to states, and the Forest Service budget.

3 The model then estimates the economic links between natural resource management on the National Forests In North Carolina and local jobs and income.



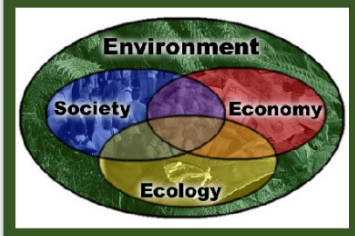
Resource Management Outputs from Forest Service Lands

National Forests and Grasslands are managed for multiple uses. Table 1 shows the Program outputs which were used to estimate the tie between management actions and economic activity in communities around the National Forests In North Carolina.

***Table 1*: Forest Service Resource Outputs by Program for the National Forests In North Carolina during 2016 (for data sources, see page 8).**

Program	Activity	Units of Measure	Output in 2016
Recreation	Wildlife and Fish - Locals	Visits	503,703
		Expenditures (Thousands of $2016)	$15,533
	Non-residents	Visits	103,168
		Expenditures (Thousands of $2016)	$18,336
	Downhill ski/snowboarding - Locals	Visits	0
		Expenditures (Thousands of $2016)	$0
	Non-residents	Visits	0
		Expenditures (Thousands of $2016)	$0
	All Other Rec Activities - Locals	Visits	3,998,253
		Expenditures (Thousands of $2016)	$52,789
	Non-residents	Visits	1,554,876
		Expenditures (Thousands of $2016)	$329,266
Grazing	Cattle, Horses, Sheep, Goats	AUMs	0
Timber	Sawtimber	CCF	16,116
	Fuelwood	CCF	2,406
	Pulp, Poles, All Other	CCF	5,446
Value of Minerals & Energy Produced	Energy (coal, oil, gas, geothermal)	(Thousands of $2016)	$0
	Minerals	(Thousands of $2016)	$4
Payments to States/Counties	25% fund, Secure Rural Schools, Royalties.	(Thousands of $2016)	$1,591
	Payments in Lieu of [property] Taxes	(Thousands of $2016)	$3,115

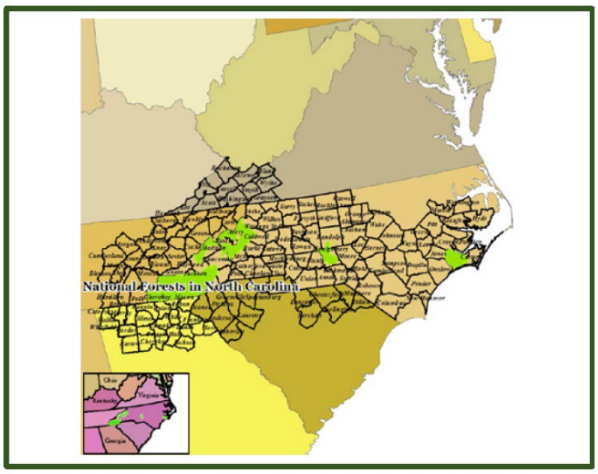
The counties selected to form a National Forest or Grassland's economic area of influence are chosen based on where FS management decisions have a direct effect on economic activity. This group of counties is also referred to as the "study area" or "impact area." The contributions of natural resource management on the National Forests and Grasslands ripple through the local economy, supporting jobs and income in many different sectors of the economy.



The values presented in this report are the best estimates to date, however they are subject to change as new data become available. The estimates for 2016 were last revised in September, 2018.

Economic Area of Influence

Economic areas of influence oftentimes differ by the resource under investigation, surrounding geography, and overall analysis objectives. The estimates in this report are generated for the area around the National Forests In North Carolina where direct Forest Service related expenditures occur. Other objectives, i.e. for forest planning, NEPA project analysis, etc. often focus on a different geography. The map below shows where Forest Service related direct expenditures occur, including: recreation and wildlife visitor spending, the location of grazing permit holders, the location of logging and restoration firms, mills processing FS wood products, the counties receiving returns to states funds and payments in lieu of taxes, the location of Forest Service budget expenditures, and the salary spending by Forest Service employees.



Note: To avoid double counting, the results for individual forests and grasslands in an area cannot simply be summed together to get meaningful regional or state contribution results because of overlapping economic areas of influence.

The presentation of data by Program (recreation, timber, etc.) provides a convenient way of displaying the economic contributions of Forest Service activities. It does not mean that the economic contributions can be fully attributed to individual program areas, nor that economic contributions can be compared across programs. Joint cost and joint production complicate programmatic comparisons. For example, an increase in timber harvest would support an increase in local economic contributions from logging and the forest products industry. However, there are associated effects such as fire mitigation, wildlife habitat restoration, recreation access, and so on that share production costs and are not individually captured in the calculation of economic contributions.

Job Contributions by Program

Jobs supported by the National Forests and Grasslands are often in small, rural communities and are therefore an important contribution to economic and social sustainability. Employment is the estimate of average annual full-time, part-time, temporary, and seasonal jobs. In 2016, the National Forests In North Carolina supported an estimated 6,330 jobs in the local area. Direct job contributions come from economic activity associated with a Forest Service Program. Secondary job contributions are the ripples of economic activity stimulated by the direct economic activity. Total job contributions are the sum of direct and secondary contributions.

Table 2: **Direct and Total jobs supported by the National Forests In North Carolina in 2016.**

Program	Direct Jobs (Avg Annual)	Total Jobs (Avg Annual)
Recreation by Local Visitors	590	850
Recreation by Non-Local Visitors	3,340	4,830
Minerals and Energy	0	0
Forest Products	40	90
Livestock Grazing	0	0
FS Resource Mgt Investments	270	450
Payments to States/Counties	80	120

The estimates for Recreation (including wildlife related), Minerals & Energy, Forest Products, and Livestock Grazing estimates include the jobs supported by these programs in the private sector. Non-local recreation visitors bring new money into the economy. Local recreationists spend money that is already counted in the economic statistics for the area so they are tracked independently.

Forest Service Resource Management Investments capture the spending of the National Forest or Grassland's budget on such things as infrastructure construction and maintenance, ecosystem restoration, fuels treatments, salaries, etc.

The Payments to States/Counties estimates the jobs supported by local government investment in such things as roads and schools via funding from programs like the 25% Fund, Payments in Lieu of Taxes and minerals royalties.

NOTE: What is a "job"? **One "job" does not always equal one person**. The job estimates reported here represent the average annual SUM of portions of jobs - part time, full time, seasonal and temporary – that are supported by management of the National Forests In North Carolina.

Keeping the Focus Local

Labor Income is directly associated with local jobs and business owners. Other measures of income such as Household Income and Total Income include things like investments, rents, and transfer payments that are not tied to Forest Service management decisions so they are not reported here.

As direct and secondary contributions ripple through the economy, Labor Income is supported in a wide variety of sectors not directly affected by resource management decisions.

Labor Income Contributions by Major Program

Labor income is the value of wages, salaries and benefits for wage earners plus income to local business owners. In 2016 National Forests In North Carolina contributed an estimated $225,176,000 in labor income to the local area, with 86% going to wages and benefits for local wage earners and 14% going to local business proprietors and partnerships.

***Table 3*: Direct and Total Labor Income supported by the National Forests In North Carolina in 2016.**

Program	Direct Labor Income (Annual, 1,000 $2016)	Total Labor Income (Annual, 1,000 $2016)
Recreation by Local Visitors	$16,886	$28,351
Recreation by Non-Local Visitors	$91,810	$158,041
Minerals and Energy	$1	$1
Forest Products	$2,008	$4,091
Livestock Grazing	$0	$0
FS Resource Mgt Investments	$21,057	$28,786
Payments to States/Counties	$4,203	$5,905

Job and Labor Income Contributions by Major Economic Sector

Jobs and labor income supported by the National Forests and Grasslands are spread across many local economic sectors. Note that sectors that have the highest employment may not generate the highest labor income and vice versa. Jobs and income are important, but there is a range of other benefits from the national forests and grasslands.

Table 4: **Total Jobs and Labor Income supported by the National Forests In North Carolina in 2016 with local economic area of influence totals for context.**

Major Economic Sector	FS Supported Jobs (Avg. annual)	FS Supported Labor Income (1,000 $2016)	Area of Influence Jobs (Avg. annual)	Area of Influence Labor Income (1,000 $2016)
Total	6,330	$225,176	8,581,172	$434,619,656
FS Percent of Area of Influence	0.1%	0.1%		
Accommodation & Food Servs	2,940	$77,338	693,723	$15,431,374
Admin, Waste Mgt & Rem Servs	250	$8,131	619,195	$20,783,237
Agriculture	50	$1,666	127,093	$4,516,403
Arts, Entertainment, and Rec	350	$7,402	166,856	$3,909,336
Construction	50	$2,394	499,043	$24,085,516
Private Educational Services	130	$3,196	162,469	$5,529,190
Finance & Insurance	120	$8,051	363,253	$25,023,484
Health Care & Social Assistance	210	$12,200	814,658	$46,149,909
Information	50	$3,532	129,204	$10,704,183
Local, State, & National Gov't	240	$21,991	1,109,707	$72,318,888
Manufacturing	90	$5,200	832,785	$56,931,983
Mining	10	$77	16,707	$593,283
Mgt of Companies	40	$4,732	115,955	$12,964,346
Other Services	190	$8,128	568,102	$22,059,977
Prof, Scientific, & Tech Services	220	$12,585	552,586	$39,665,942
Real Estate & Rental & Leasing	160	$3,788	345,493	$8,053,648
Retail Trade	910	$24,893	273,353	$13,744,819
Transportation & Warehousing	160	$7,457	860,710	$25,762,420
Utilities	10	$1,222	22,307	$2,935,661
Wholesale Trade	150	$11,193	307,974	$23,456,057

Additional Information

Contact Us:
For general inquiries, contact the Washington Office EMC social scientists and economists: (socioeconomics@fs.fed.us).

For local inquiries, please see the list of regional social science and economics contacts (https://www.fs.fed.us/emc/economics/contactus.shtml).

Useful Links:
Additional information on economic contributions and benefits to people is available on the Economics for Planning website (http://www.fs.fed.us/emc/economics/index.shtml).

- General information about the use of economics in the Forest Service.
- At a Glance reports and Story Maps for all national forests and grasslands covering Jobs and Income and Benefits to People.
- Frequently Asked Questions and a Glossary are also available.

The National Visitor Use Monitoring Program has detailed information on recreation visitation (https://www.fs.fed.us/recreation/programs/nvum/).

The "Headwaters Economics" website (http://www.headwaterseconomics.org/) maintains several useful reports including National Forest Socioeconomic Indicators (www.headwaterseconomics.org/tools/forest-indicators) - area profiles that can be consulted for a deeper dive into the social and economic characteristics of the area. There are also reports which include important information for consideration of outreach and effects to Environmental Justice populations.

Data Sources:

- Recreation data are from the National Visitor Use Monitoring Survey (https://www.fs.fed.us/recreation/programs/nvum/), Round 4.
- Grazing Animal Unit Months (AUM) data are found in the Rangeland Management Reports (https://www.fs.fed.us/rangeland-management/reports/index.shtml)
- Timber Harvest data are found in the Forest Service Forest Management Cut and Sold Reports (https://www.fs.fed.us/forestmanagement/products/cut-sold/index.shtml)
- Minerals and Energy Revenues are reported by the Office of Natural Resources Revenue (https://www.onrr.gov/)
- Federal Revenues which are returned to the States and Counties are found on the Payments to States website (https://www.fs.usda.gov/pts) and Payments in Lieu of Taxes website (https://www.doi.gov/pilt/)

USDA Forest Service. 2019. Jobs and Income; Economic Contributions in 2016; National Forests in North Carolina. Information accessible at: https://www.fs.fed.us/emc/economics/index.shtml

Appendix Item V: National Forests in North Carolina: Recreation Public Benefits

United States Department of Agriculture
Forest Service

National Forests in North Carolina
Recreation Public Benefits

Congress began conserving these lands back in 1891 for all of us after the creation of the Forest Reserve Act. 125 years later, this gift continues to inspire, restore, and provide. Now totaling **193 million acres** of National Forest System land nationwide, the National Forests and Grasslands provide the greatest diversity of outdoor recreation opportunities in the world, connecting people with nature in an unmatched variety of settings, activities, and traditional beliefs.

North Carolina is home to approximately **1.25 million acres** of National Forests managed by the USDA Forest Service. These forests are some of the most beautiful in the nation, and celebrated by **6.2 million visitors a year**.

From downhill mountain biking to family outings at picnic areas, millions of visitors are drawn to North Carolina each year in pursuit of a wide variety of recreational activities on Forest Service lands. Not only is the land an emblem in the outdoor world but it generates business and provides employment in North Carolina.

6.2 Million Visitors to North Carolina in 2016

on National Forest lands brought in a great wealth of opportunity for gateway communities that provide access to public lands and services.

Jobs, Income and GDP Contributions to North Carolina in 2016

Recreation and wildlife activities on Forest Service lands substantially contributes to not only the health and well-being of citizens but also to GDP, income, and employment. In 2016, recreation on Forest Service lands in North Carolina provided **5,680 jobs**, approximately **$416 million in economic activity**, and **$186 million to employee income**.

Economic Contributions of Forest Service Recreation to North Carolina, 2016

Activity	Units of Measure	Output in 2016
Wildlife and Fish Locals	Visits	503,703
	Expenditures	$15,533,000
Wildlife and Fish Non-residents	Visits	103,168
	Expenditures	$18,336,000
All Other Rec Activities Locals	Visits	3,998,253
	Expenditures	$52,789,000
All Other Rec Activities Non-Residents	Visits	1,554,876
	Expenditures	$329,266,000

Data source: Forest Service National Visitor Use Monitoring Program and Ecosystem Management Coordination
https://www.fs.fed.us/emc/economics/contributions/at-a-glance.shtml

United States Department of Agriculture
Forest Service

National Forests in North Carolina
Regional and National Contributions

National Forest Contributions

Recreation on Forest Service lands offer visitors a diverse range of activities such as hiking, camping, picnicking, skiing, hunting, fishing, horseback riding, wildlife watching, visiting cultural sites and visitor centers, or just viewing the scenery and driving for pleasure.

Over 512 recreation sites and 1,900 miles of trails to explore in North Carolina

Connecting People to NC's Outdoors

According to one recent survey, **more than half of American voters have visited a National Forest or Grassland in the past year,** and nearly 90% of avid visitors (those who have gone three or more times in the last year) plan to visit again next year.

Public Benefit

Along with providing jobs and income for many Americans, the physical and mental benefit of recreation in the outdoors is unmistakable. With more and more of America living in urban environments, the importance of our public lands as natural refuges has never been greater.

Forest Service recreation programs support over 143,300 jobs nationally, the vast majority of which are in gateway communities. Outdoor recreation is the single greatest employer in the National Forest System, and provides the single greatest stimulus for local economies. Ski areas on National Forest lands alone contribute $2.7 billion to the GDP and represents around 41,200 full and part-time jobs.

Gateway communities provide access to public lands and services to the many millions of Americans who visit them each year. These towns' distinguishing feature is proximity to public lands; the vitality of their social and economic structure often depend on the management decisions being made on and for these public lands.

Outdoor recreation opportunities and amenities is consistently ranked as one of the top reasons people move to rural towns, and is a leading force in many small town revivals, especially in the West.

USDA Forest Service. 2019. National Forests in North Carolina: Recreation Public Benefits. Information accessible at: https://www.fs.fed.us/emc/economics/at-a-glance/index.shtml

Appendix Item VI: Growth and Removals on North Carolina Timberlands

Growth and Removals on Timberland

A comparison of net growth and removals provides insight on the sustainability of the resource. Inventory levels are expected to increase over time when net growth exceeds removals. Inventory levels are expected to decrease over time when removals exceed net growth.

Growth estimates are average annual net growth of live trees at least 5.0 inches diameter at breast height on timberland. Net growth estimates are gross growth minus mortality. It is possible for net growth to be negative. For example, net growth may be negative when mortality exceeds gross growth as may happen after a hurricane or other major disturbance. Removal estimates are average annual removals of live trees at least 5.0 inches diameter at breast height on timberland.

Figure a. Growth and Removals of All Live Trees on Timberland in North Carolina, 2019

All Live Trees

Growth and removals of all live trees on all timberland in North Carolina, 2019

	Softwood	Hardwood	All
Net Growth	956.6	713.0	1,669.6
Removals	620.8	360.6	981.4
Ratio (G:R)	1.54	1.98	1.70

Volume in million cubic feet per year.

Figure b. Growth and Removals of Pulpwood on Timberland in North Carolina, 2019

Pulpwood

Growth and removals of pulpwood on all timberland in North Carolina, 2019

	Softwood	Hardwood	All
Net Growth	158.8	138.3	297.1
Removals	136.7	112.7	249.4
Ratio (G:R)	1.16	1.23	1.19

Volume in million cubic feet per year.

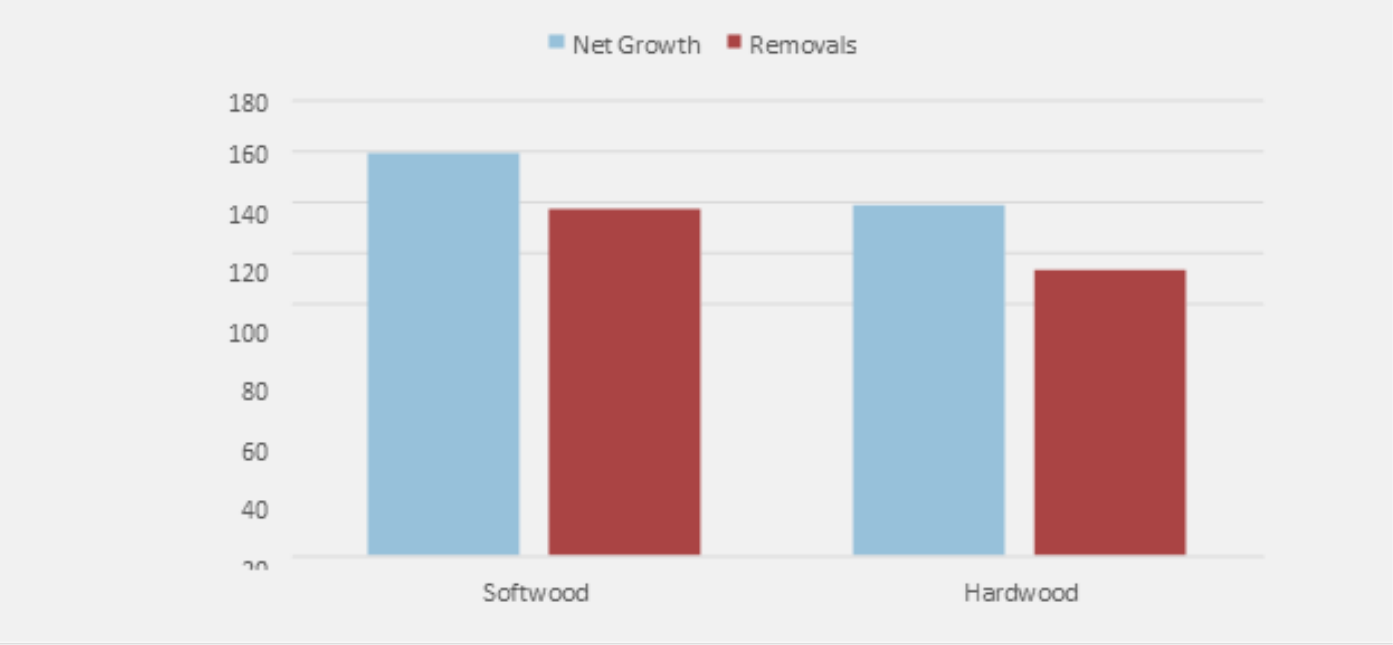


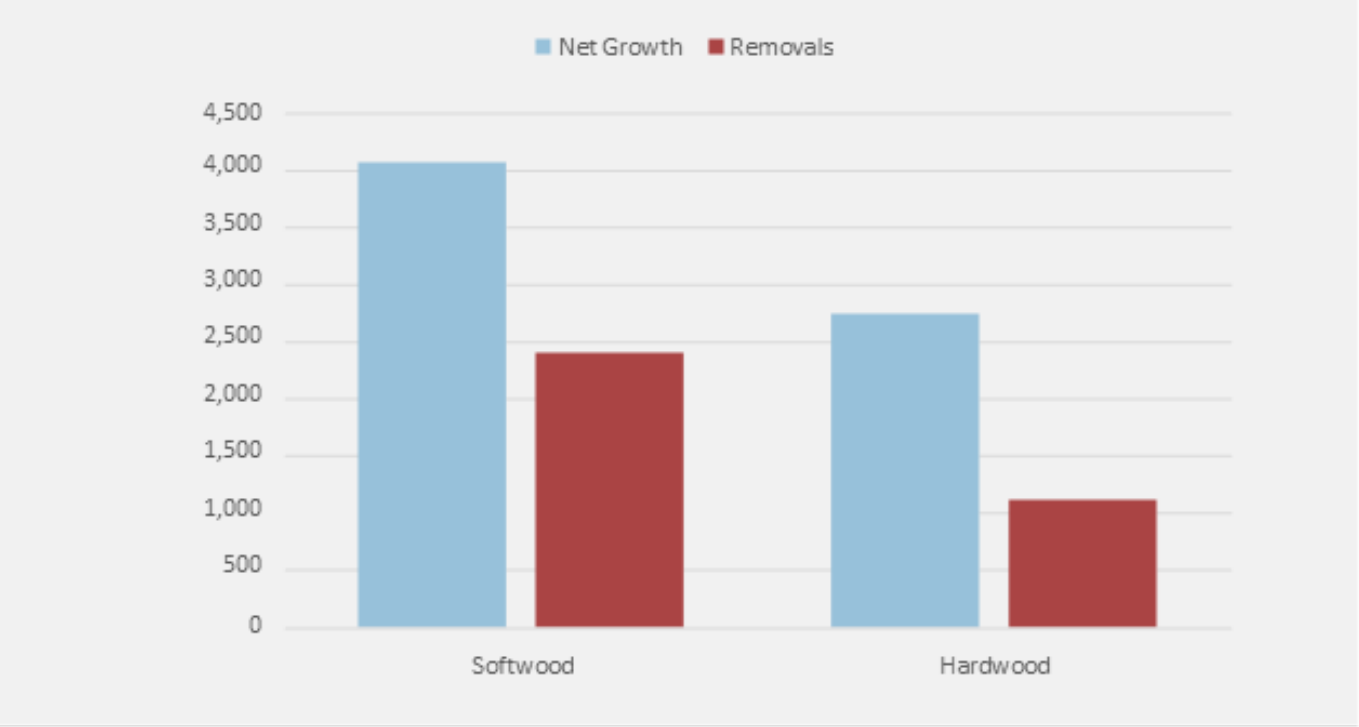
Figure c. Growth and Removals of Sawtimber on Timberland in North Carolina, 2019

Sawtimber

Growth and removals of sawtimber on all timberland in North Carolina, 2019

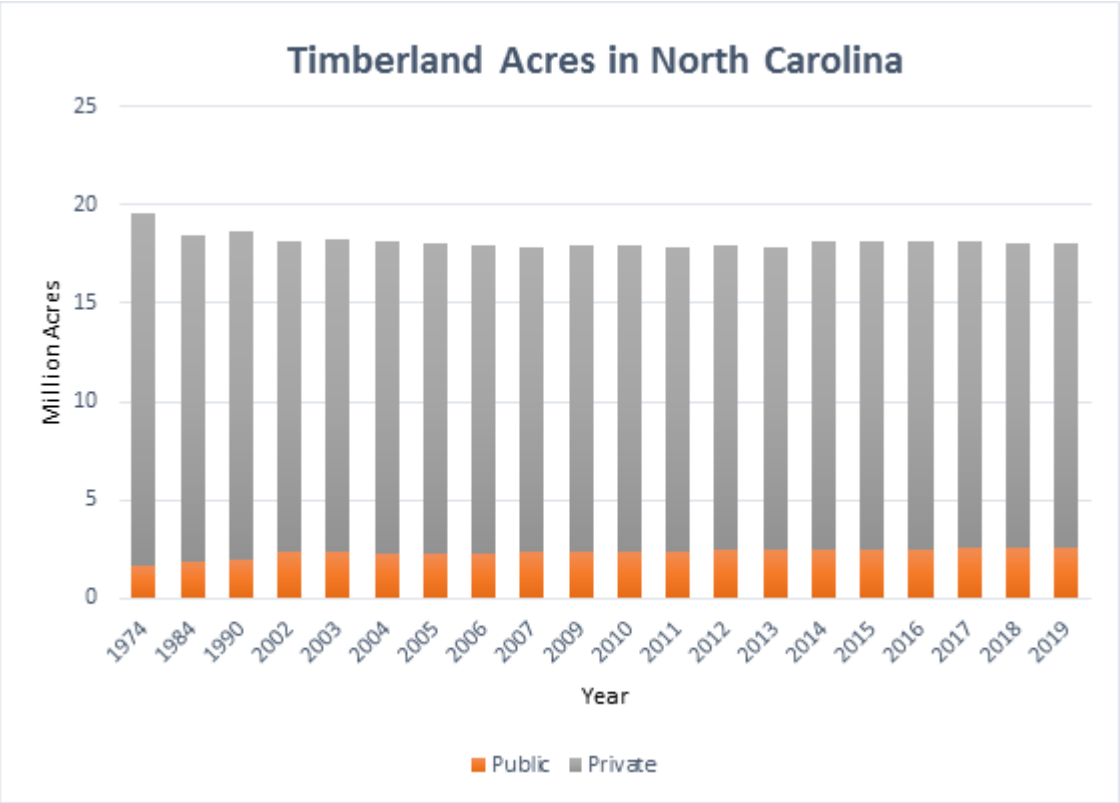
	Softwood	Hardwood	All
Net Growth	4,052.0	2,736.3	6,788.4
Removals	2,392.3	1,114.4	3,506.7
Ratio (G:R)	1.69	2.46	1.94

Volume in million board feet per year, International 1/4-inch rule.



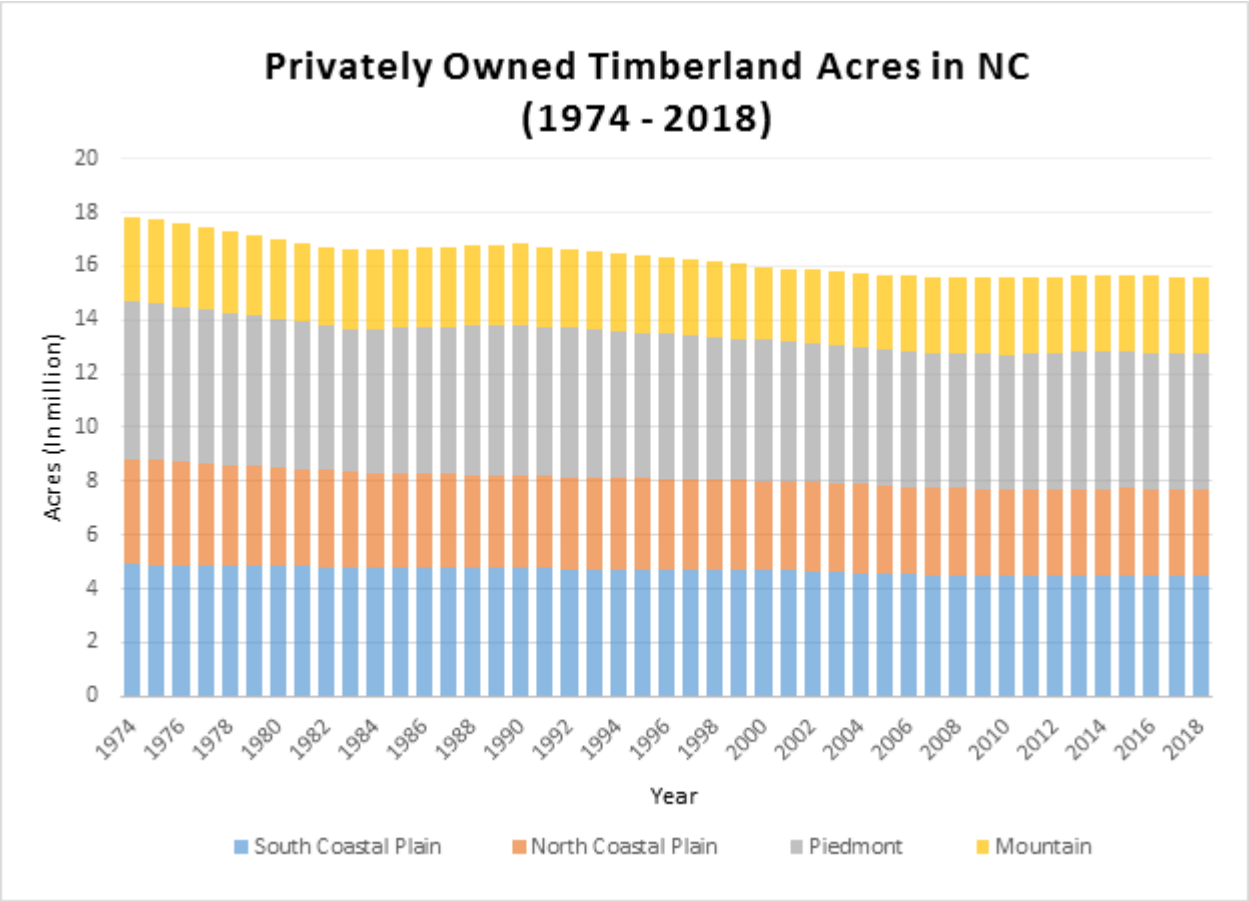
Timberland Trends

Figure d. Timberland Ownership in North Carolina



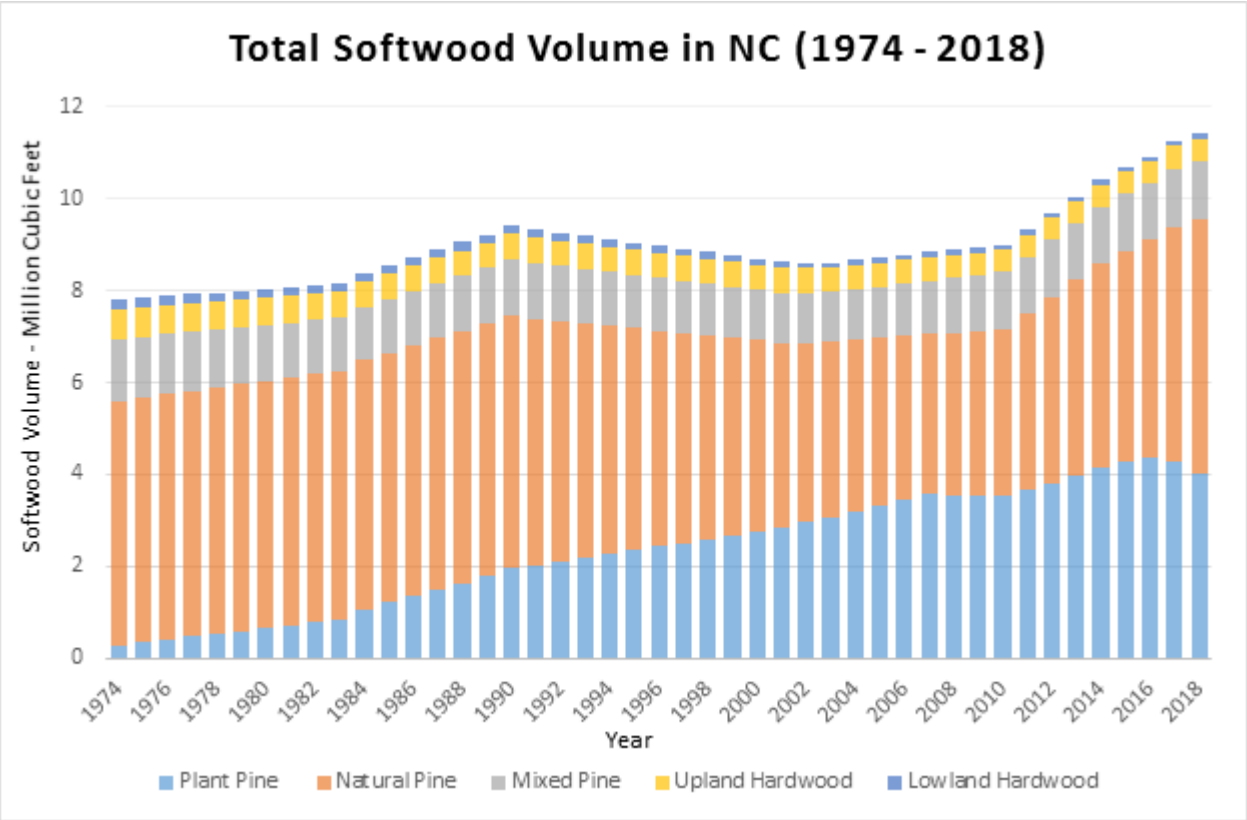
The total timberland acres in North Carolina declined from around 19.5 million acres in 1974 to about 17.8 million acres in 2011, and from 2012, it experienced a steady growth reaching 18.1 million acres in 2019. While total acres of privately-owned timberland decreased in North Carolina, acres of publicly owned timberland increased in recent years. In 2019, total acres of public and private timberland in North Carolina were 2.5 million acres and 15.5 million acres, respectively.

Figure e. Privately-Owned Timberland Acres in North Carolina



The total privately-owned timberland in North Carolina has been slightly declining over the years. In 2018, total acres of private timberland sum about 15.5 million acres, down 3% since 2000. In terms of region, the Piedmont region has more than 5 million acres of timberland, followed by the Southern Coastal Plain with 4.4 million acres, the Northern Coastal Plain with 3.2 million acres, and the Mountains region with 2.8 million acres.

Figure f. Total Softwood Volume in North Carolina



According to the Forest and Inventory Analysis data (1974-2018), the total softwood growing stock volume has increased steadily in North Carolina. It continued to rise in the last decade, reaching a total growing stock volume of over 11.4 million cubic feet as of 2018. In terms of major species types, the volume of planted pine continued to increase over the years. In the early 2000s, natural pine volume declined slightly while the planted pine volume rose substantially. However, in the last few years, the volume of planted pine species is in the downward trend.

Figure g. Total Softwood Volume by Survey Units in North Carolina

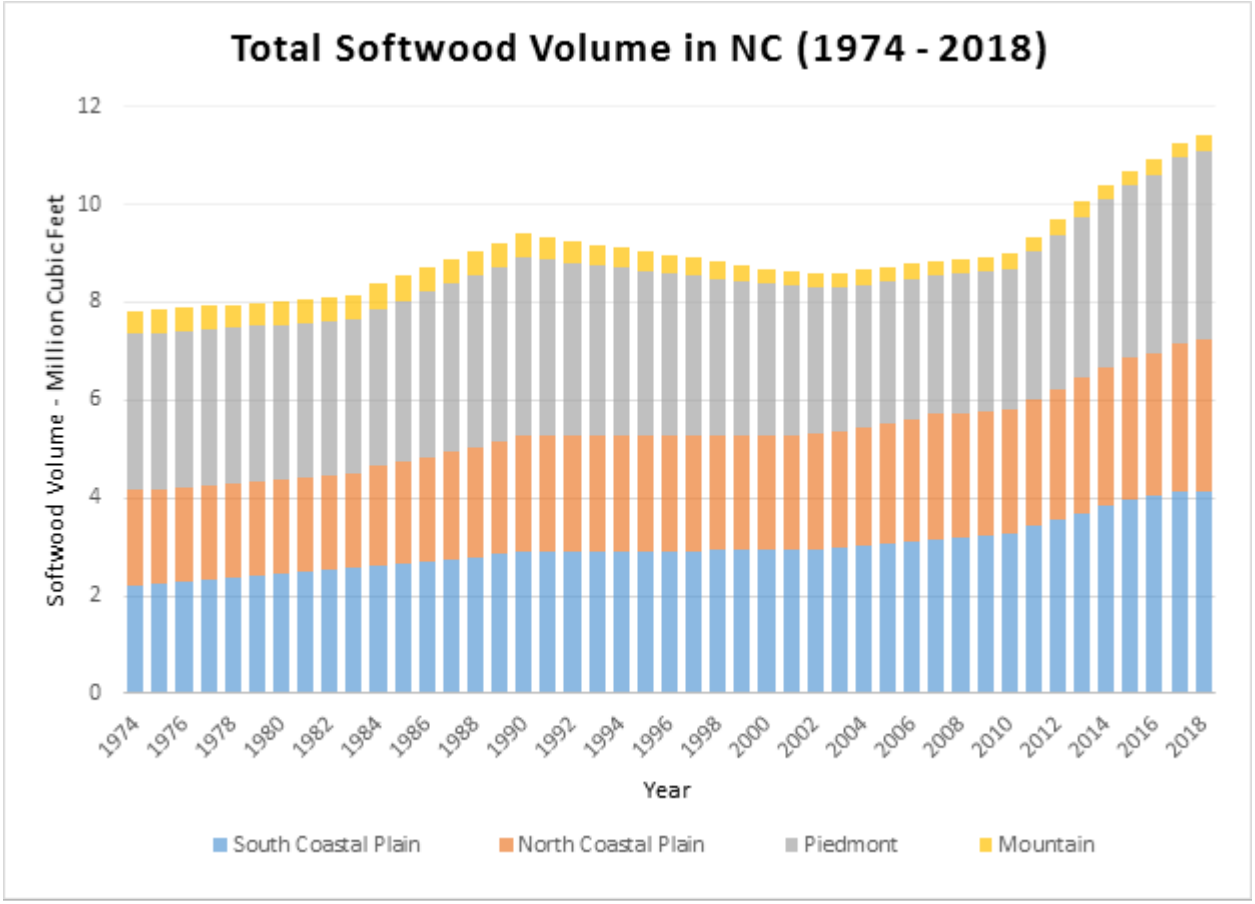
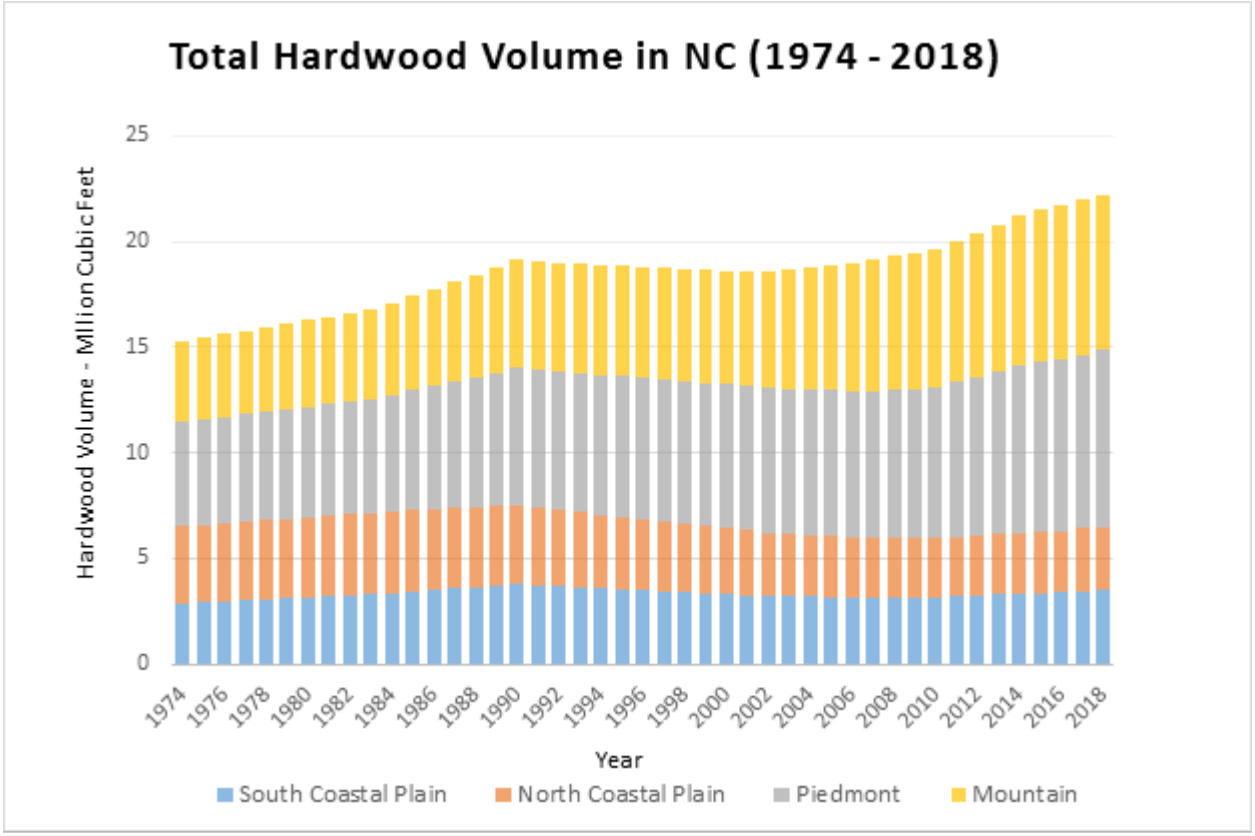


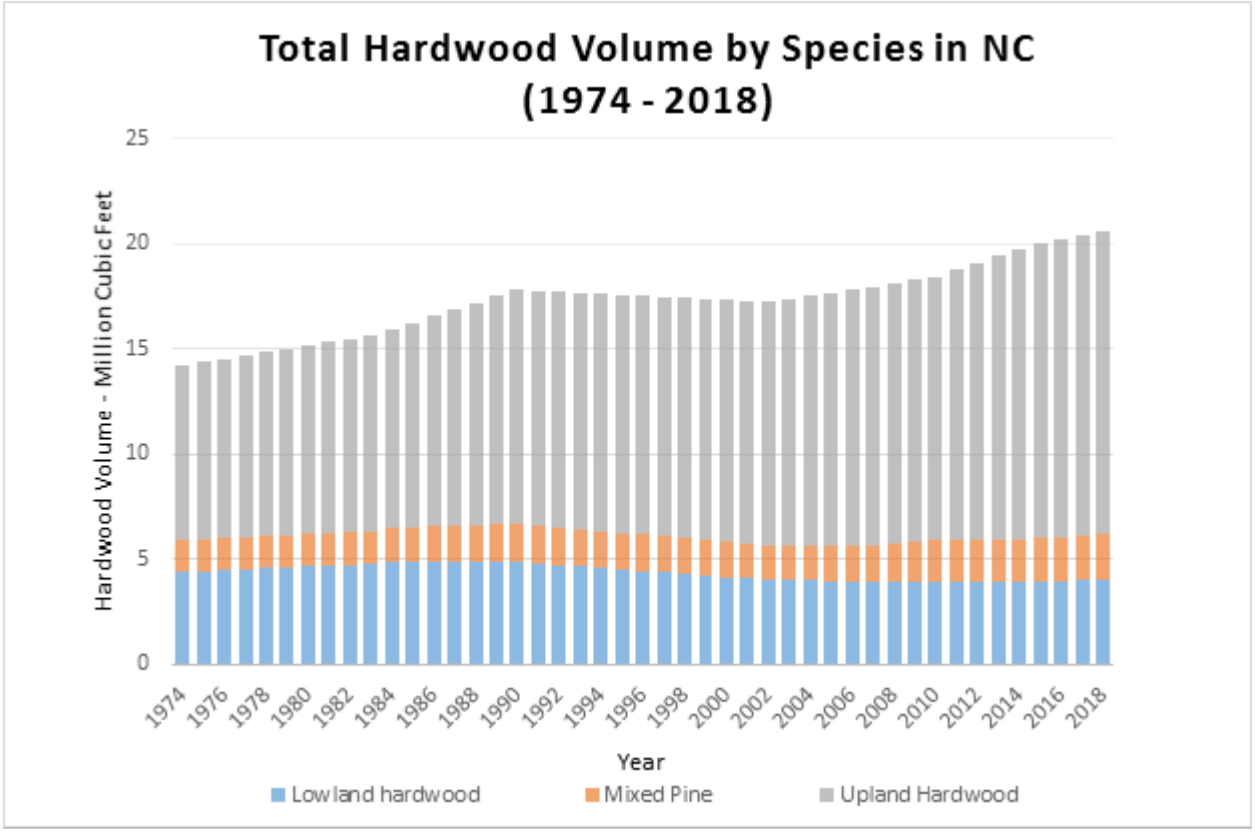
Figure g presents the historical trends of softwood growing stock by North Carolina survey units. The softwood volume in the coastal plains increased over the years whereas it remained quite unstable and continued increasing in the Piedmont and Mountain regions.

Figure h. Total Hardwood Volume in North Carolina



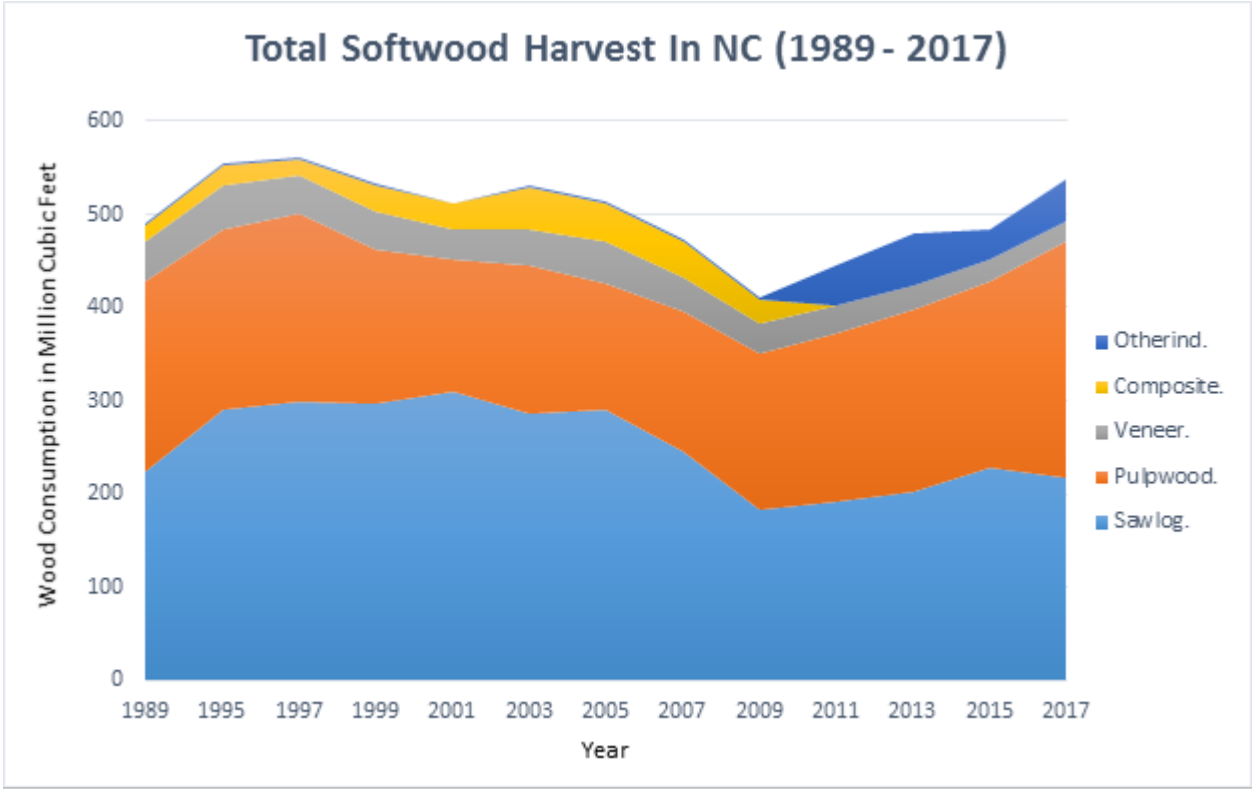
The total hardwood growing stock volume by survey units has been increasing steadily in North Carolina. It continued to rise in the last decade with a total growing stock volume of more than 22.1 million cubic feet as of 2018. The Piedmont region has the highest volumes of hardwood, followed by the Mountain region. While the South Coastal Plain experienced a slight rise in total hardwood volume, increasing from 2.8 million cubic feet to 3.5 million cubic feet, the hardwood volume in the North Coastal Plain dropped slightly from 3.8 million cubic feet to 3 million cubic feet between 1974 and 2018, respectively.

Figure i. Total Hardwood Volume by Species Types in North Carolina



In terms of species types, upland hardwood increased continuously from about 8.3 million cubic feet in 1974 to around 14.1 million cubic feet in 2018. Also, the volume of lowland hardwood increased slightly from around 4.3 million cubic feet in 1974 to a peak of about 4.8 million cubic feet in 1990, then began to fall gradually to a low of 4.0 million cubic feet in 2018. The volume of mixed pine hardwood fluctuated slightly and remained consistently below 2.2 million cubic feet between 1974 and 2018.

Figure j. History of Softwood Harvest by Survey Units in North Carolina



Source: USFS TPO

The overall softwood harvests, based on the type of primary processing and end product across the survey units, are depicted in Figure j. In terms of softwood sawlog consumption from 1989 to 2001, the quantity of sawlog harvests rose from 225 million cubic feet to a peak of about 310 million cubic feet, before dropping to 180 million cubic feet in 2009. It is in a slight increasing trend in recent years.

The annual softwood pulpwood consumption was higher in the 1990s, before it dropped to a lowest trough in 2005. Since then, softwood pulpwood harvests have been in a continuous upward trend with an annual consumption value of about 253 million cubic feet in 2017. However, pine veneer harvests remained low over the years and is declining recently to an annual value of about 23 million cubic feet in 2018.

Other industrial products, which cover the wood consumed by bioenergy mills, continued to climb up in North Carolina since 2009. It was about 44 million cubic feet in 2017, slightly lower than the 2015 consumption level.

Figure k. Softwood Harvest in South Coastal Plain Region

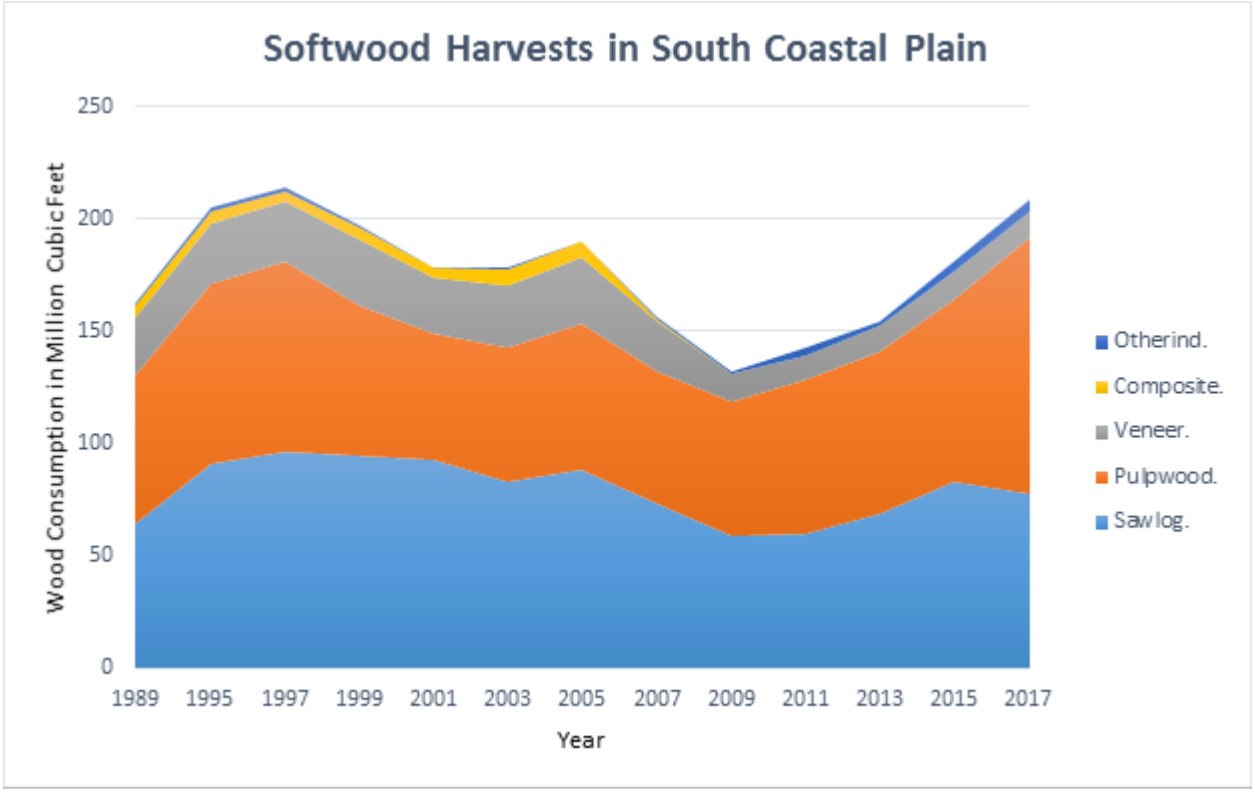
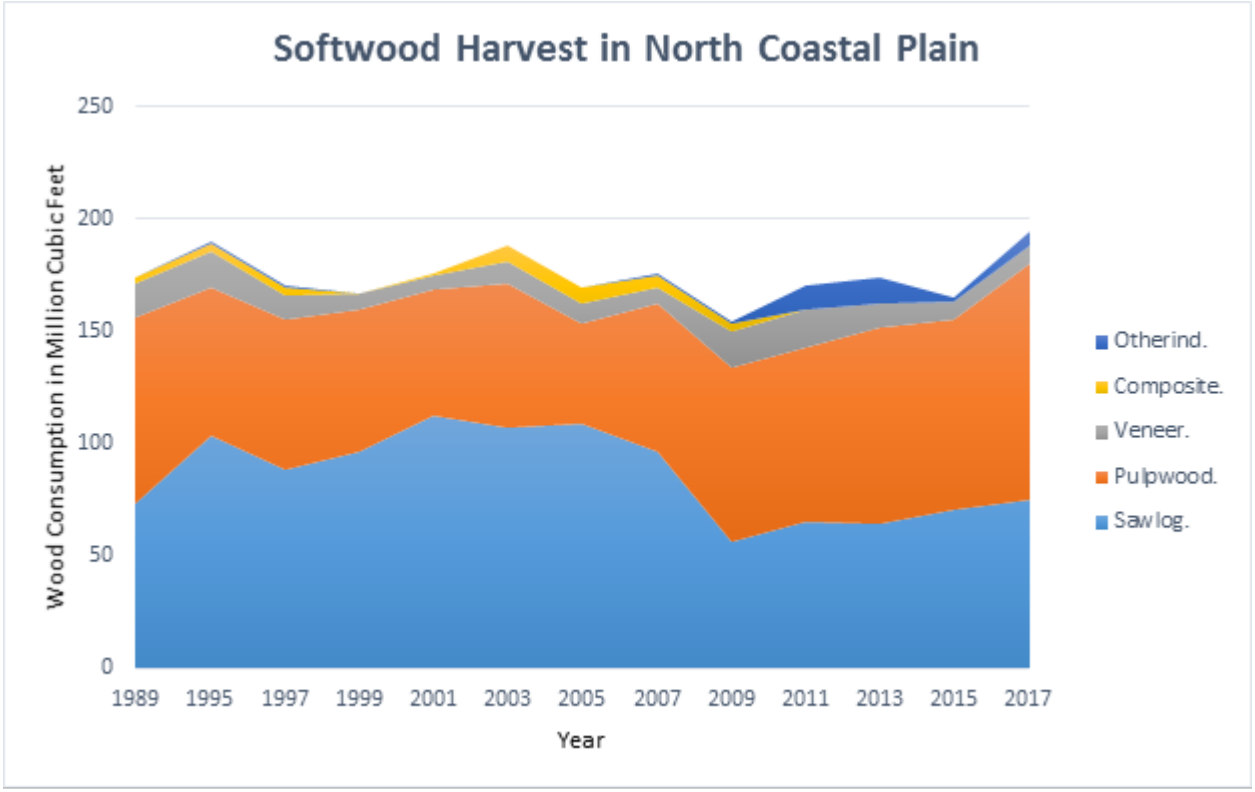


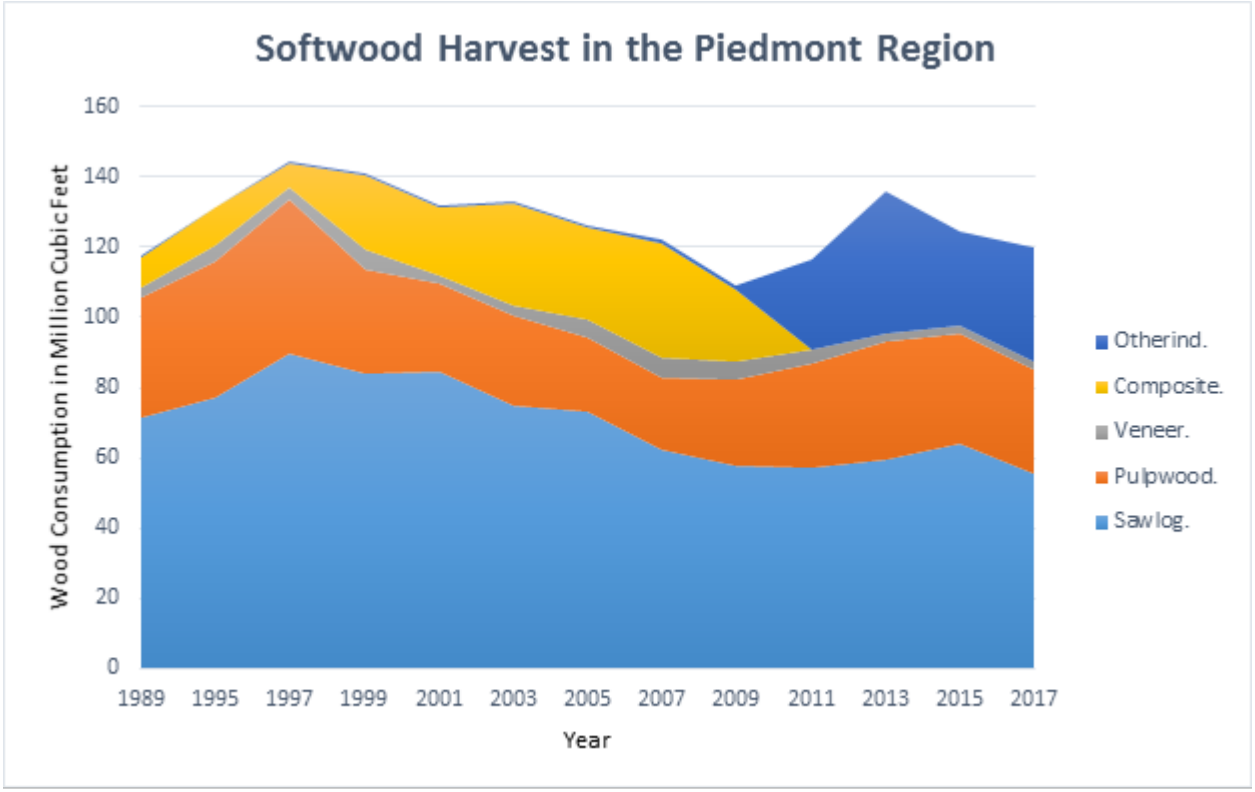
Figure k shows the softwood harvested based on the type of primary processing and resulting end product in the South Coastal Plain. In this region, pine wood consumption declined sharply during the 2008 recession, but since then, it has been experiencing an upward trend. Annual pine sawlog harvests were about 77 million cubic feet in 2017, slightly lower than the consumption in 2015. Annual pine pulpwood consumption, however, continued to rise to an annual value of 113 million cubic feet in 2017. The other industrial uses category, covering bioenergy and wood pellet uses, was about 5 million cubic feet in 2017.

Figure l. Softwood Harvest in North Coastal Plain Region



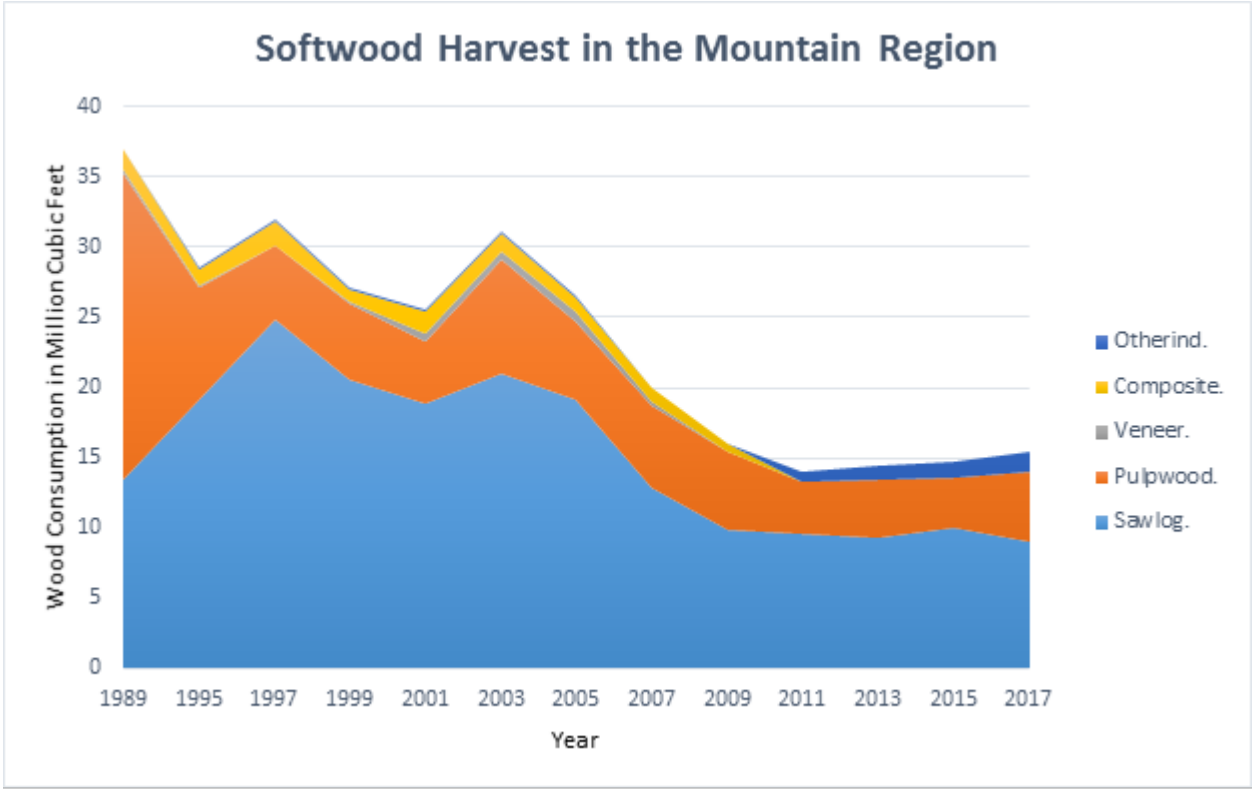
In the North Coastal Plain region, pine pulpwood is the most harvested category, which is continuously rising since 2009. The other industrial uses category was about 5 million cubic feet in 2017, which summed 11 million cubic feet in 2011 and 2013.

Figure m. Softwood Harvest in Piedmont Region



In the Piedmont survey unit, the quantity of sawlog harvests fell from 90 to 55 million cubic feet between 1997 and 2017. After peaking in 1997, the quantity of pulpwood harvests began to fall further below the quantity of composite harvested between 2003 and 2007. This fall was followed by a season of rising and falling again between 2008 and 2017. Other industrial harvests rose up notably between 2009 and 2017, peaking in 2013 with an annual value of 40 million cubic feet.

Figure n. Softwood Harvest in Mountain Region



Sawlog is the main softwood timber product harvested in the Mountain region, which has been in a declining trend since 2003. Pine pulpwood consumption remained flat in recent years. The other industrial uses category was about an annual value of 1 million cubic feet in 2017.

Figure o. Overall Hardwood Harvest by Timber Products in North Carolina

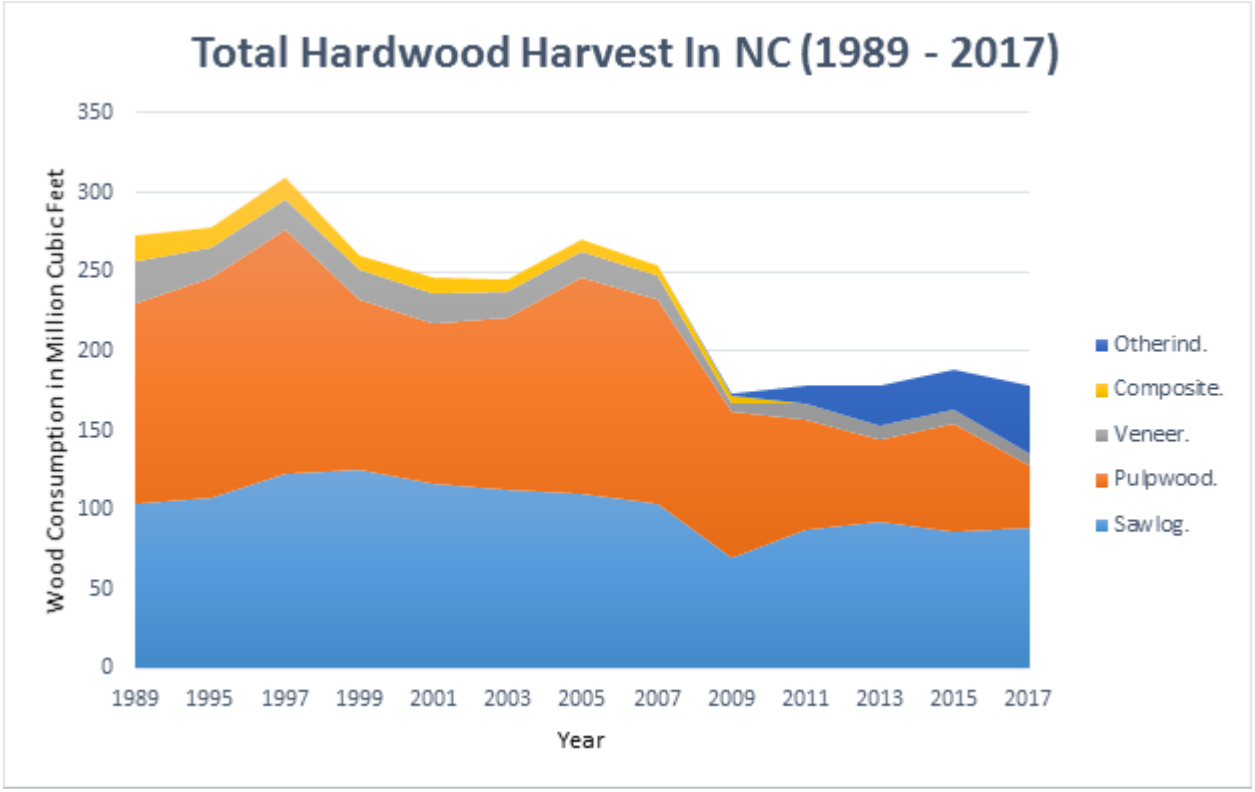
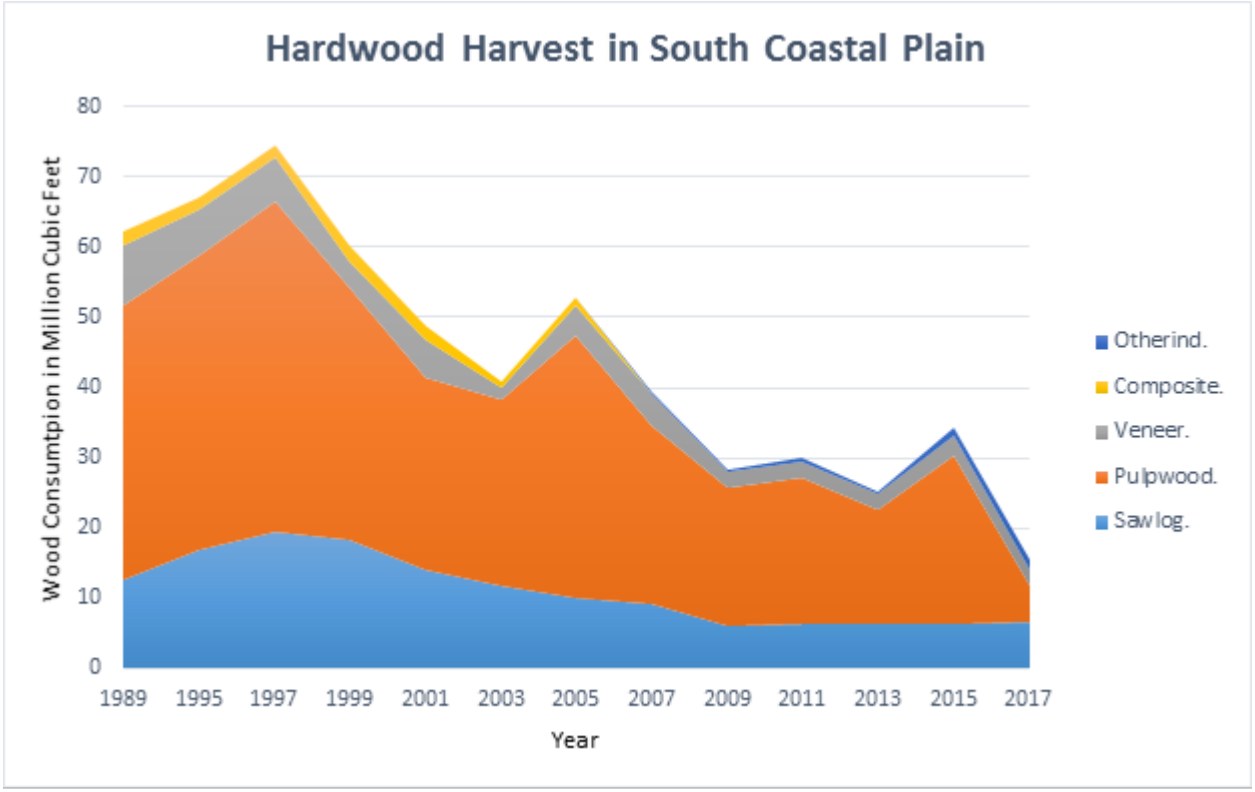


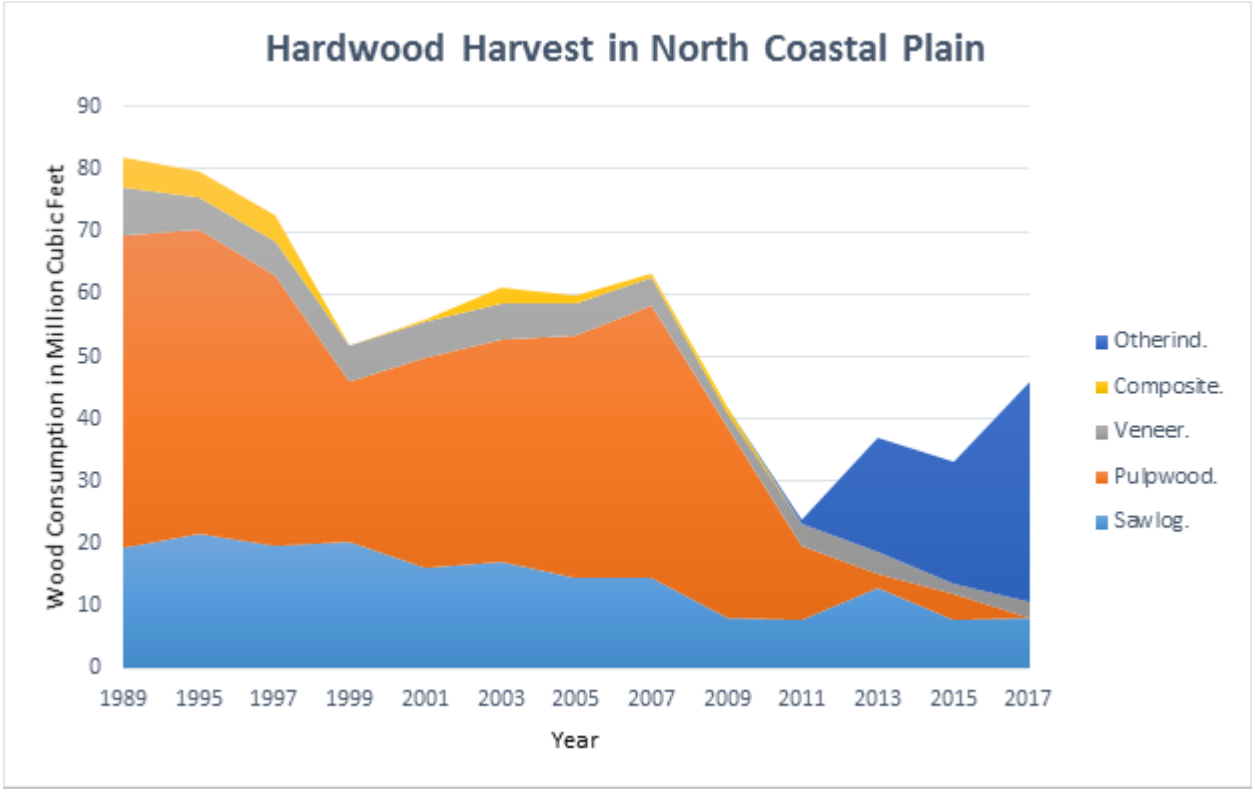
Figure 11 depicts that hardwood timber product harvests in North Carolina is in a declining trend. The hardwood sawlog consumption remained flat over the years. Hardwood pulpwood consumption declined in recent years to an annual value of about 38 million cubic feet in 2017. Hardwood timber used in the other industrial uses category, which included bioenergy uses, increased from 1 million cubic feet in 2009 to 42 million cubic feet in 2017.

Figure p. Total Hardwood Harvest in South Coastal Plain Region



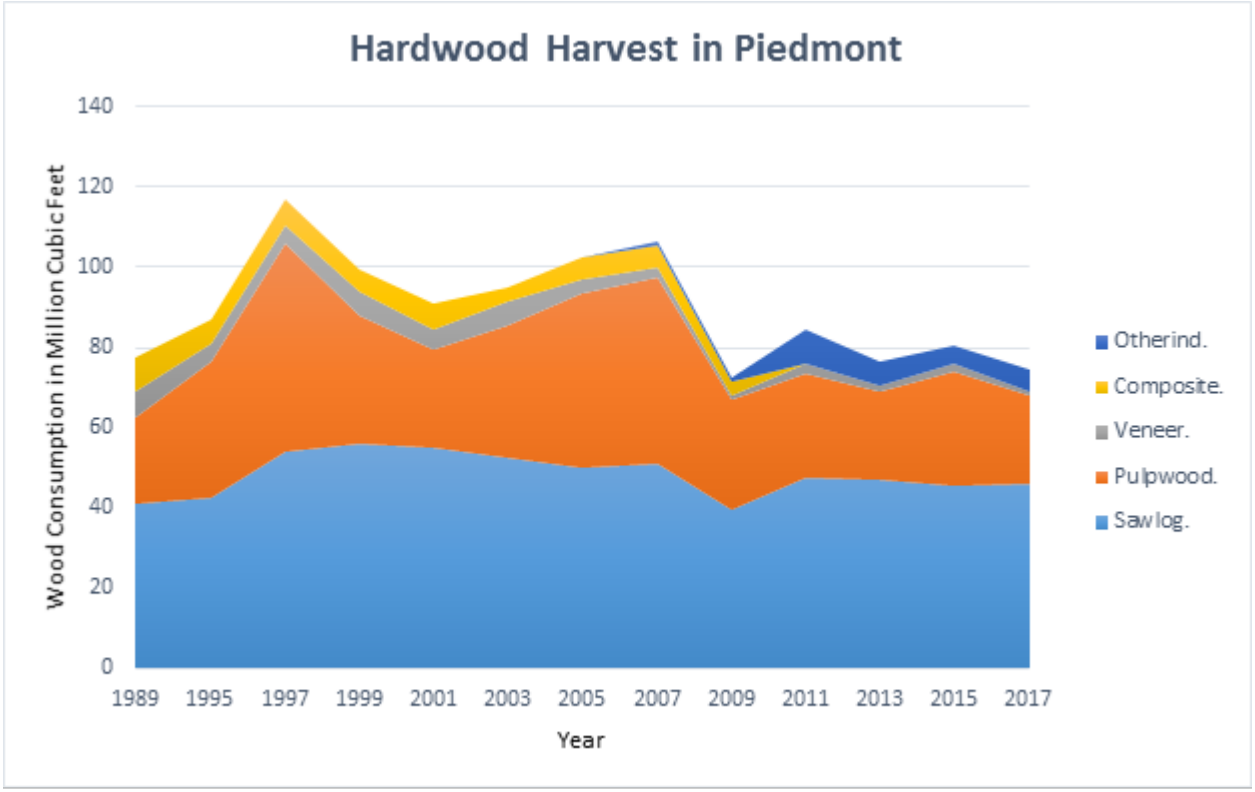
Like the statewide trend, hardwood timber harvests in the South Coastal Plain decline across the board. Hardwood pulpwood harvest was about an annual value of 47 million cubic feet in 1997 but dropped substantially to about 5 million cubic feet in 2017. The other industrial uses category summed to 1.3 million cubic feet in 2017.

Figure q. Hardwood Harvest in North Coastal Plain Region



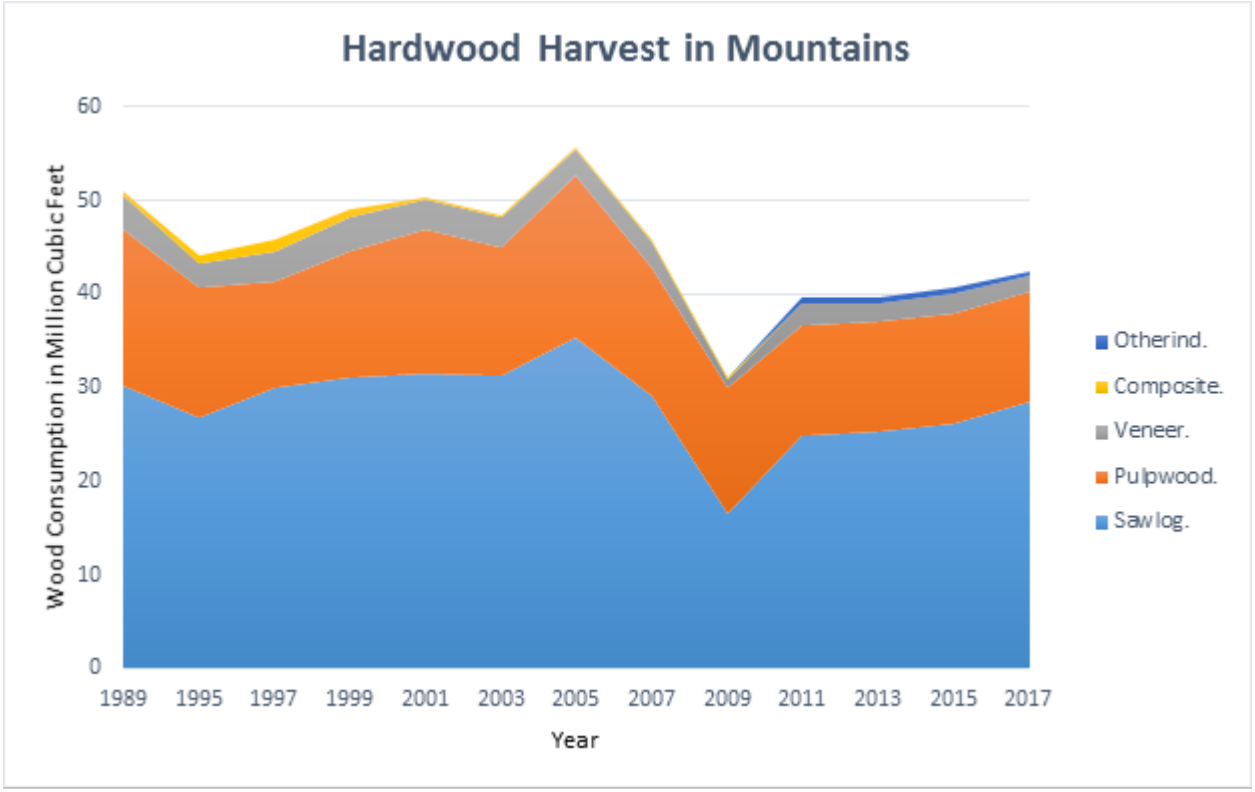
Like the South Coastal Plain survey unit, the quantity of pulpwood harvested in the North Coastal Plain declined continuously from 50 million cubic feet in 1989 to 4.3 million cubic feet in 2015. A noticeable change was a surge in timber harvests in the other industrial uses category, primarily resulting from harvests going to bioenergy mills. The surge was 35 million cubic feet in 2017.

Figure r. Total Hardwood Harvest in Piedmont Region



In the Piedmont survey unit, hardwood sawlog harvests remained flat at around 45 million cubic feet every year. Hardwood pulpwood harvests fluctuated in the 1990s and averaged about 21 million cubic feet in recent years. The other industrial uses category had an annual harvest quantity of about 5.3 million cubic feet in 2017.

Figure s. Hardwood Harvest in the Mountain Region



In the Mountain survey unit, both hardwood sawlog and pulpwood harvests remained flat over the years, and both categories declined significantly during the 2008 recession period.

Texas A&M Forest Service. (2020, September 2). *Southern Timber Supply Analysis*. http://southerntimbersupply.com/

Sodiya, O, R. Parajuli, and B. Abt. 2020. Historical trends in forest resources in North Carolina. A project report submitted for the fulfillment of the wood supply assessment in North Carolina. Unpublished. 18p.

Appendix Item VII: Economic Contribution of the Forest Sector in North Carolina, 2018

Economic Contribution of the Forest Sector in North Carolina, 2018

NC STATE EXTENSION

- North Carolina has about **18.1 million** acres of timberland covering about 58 percent of the state's total land area.
- In 2018, the forest sector in North Carolina—including forestry and logging operations, sawmills, furniture mills, and pulp and paper industries—**directly** contributed **$20.8 billion** in industry output, which was just about 2 percent of the statewide economic output. The forest sector employed about 75,000 people with a payroll of $4.2 billion and a value added (gross state product) of $6.3 billion.
- Including direct, indirect, and induced effects, the forest sector in North Carolina had a **total** contribution of **$33.6 billion** in industry output to the North Carolina economy, supporting more than **150,400** full-time and part-time jobs with a payroll of about $8.3 billion.
- Compared to 2017, **total economic output** in 2018 was **up 2.6** percent, but total **employment dropped** slightly less than **0.4 percent**. While forestry operations gained about 400 jobs, primary solid wood mills and paper and paperboard mills lost about 5,300 jobs collectively.
- The forest sector was the **top** employer among manufacturing sectors in the state.
- Every job created in the forest sector resulted in another **1.01** jobs in North Carolina.

- On average, every dollar generated in the forest sector contributed an additional **61 cents** to the rest of the North Carolina economy.
- The forest sector in North Carolina directly generated about **$274.2 million** in state and local taxes and **$850.4 million** in federal taxes. Compared to 2017, both state and local taxes and federal taxes increased by 6.1 percent and 0.2 percent, respectively.
- Primary solid wood mills directly generated about **$35.7 million** in state and local taxes and more than **$100 million** in federal taxes. Compared to 2017, both state and local taxes and federal taxes from the primary solid wood industry decreased by 12 percent and 0.6 percent, respectively.
- International exports from the North Carolina forest sector totaled about **$1.44 billion**.

Economic Contribution of the North Carolina Forest Sector, 2018[1]

	Employment[2] (jobs)	Labor Income[3] (million $)	Gross State Product[4] (million $)	Industry Output[5] (million $)
Direct Contribution[6]				
Forestry operations	704	37.61	41.43	54.30
Logging	6,171	258.16	272.02	478.76
Primary solid wood mills[7]	8,267	473.27	918.09	2,885.53
Secondary solid wood mills[8]	42,806	2,092.32	2,845.49	8,070.47
Primary paper and paperboard mills	3,977	411.50	777.37	3,106.87
Secondary paper and paperboard mills	13,051	949.44	1,471.89	6,236.39
Total	**74,975**	**4,222.31**	**6,326.28**	**20,832.33**
Total Contribution[9]				
Forestry operations	926	47.89	60.12	87.07
Logging	8,271	360.74	452.55	798.43
Primary solid wood mills	17,395	967.26	1,761.95	4,462.81
Secondary solid wood mills	77,332	3,951.29	5,911.68	13,775.83
Primary paper and paperboard mills	14,664	1,004.01	1,797.00	5,030.23
Secondary paper and paperboard mills	31,829	1,948.47	3,184.15	9,444.15
Total	**150,417**	**8,280**	**13,167**	**33,599**
Change in Total Contribution from 2017				
Forestry operations	77.1%	96.6%	10.0%	22.5%
Logging	1.9%	-0.8%	-1.2%	12.4%
Primary solid wood mills	-10.2%	-9.5%	3.1%	-3.7%
Secondary solid wood mills	5.7%	8.7%	10.5%	7.6%
Primary paper and paperboard mills	-11.1%	-7.1%	-4.1%	-3.4%
Secondary paper and paperboard mills	-4.5%	-2.9%	-3.5%	1.2%
Total	**-0.4%**	**1.2%**	**3.3%**	**2.6%**

Values, based on multi-industry contribution analysis, are reported in 2018 dollars.

[1] Economic contribution numbers, based on multi-industry contribution analysis, are reported in 2018 dollars. The method of internal adjustments to the IMPLAN software (IMPLAN 2018) was used. More details about the contribution analysis method can be found at **https://bit.ly/2LajYIL**. IMPLAN sectors included 15, 16, 19 (partial), 132, 133, 134, 135, 136, 137, 138, 139, 140, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 365, 366, 367, 370, 371, and 373.

[2] Employment includes both full-time and part-time jobs.

[3] Labor income includes all forms of employment income, including employee compensation (wages and benefits) and proprietor income.

[4] Gross State Product (value added) is the difference between industry output and the cost of intermediate inputs. It consists of compensation of employees, taxes on production and imports less subsidies, and gross operating surplus.

[5] Industry output is the total annual value of production by industry.

[6] Direct contribution is a series of production changes or expenditures made by producers and consumers as a result of an activity.

[7] Primary mills, such as sawmills and pulp mills, consume wood in a round or log form before producing a value added product.

[8] Secondary mills, such as furniture and paper mills, use wood-based products to produce value added products.

[9] Total contribution is the sum of direct, indirect, and induced contribution effects generated by the sector.

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Published by: NC State Extension

NC STATE UNIVERSITY College of Natural Resources

Photos by Robert Bardon

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Parajuli, Rajan and Robert Bardon. Economic Contribution of the Forest Sector in North Carolina, 2018. N.C. State University AG-844. https://content.ces.ncsu.edu/economic-contribution-of-the-forest-sector-in-north-carolina

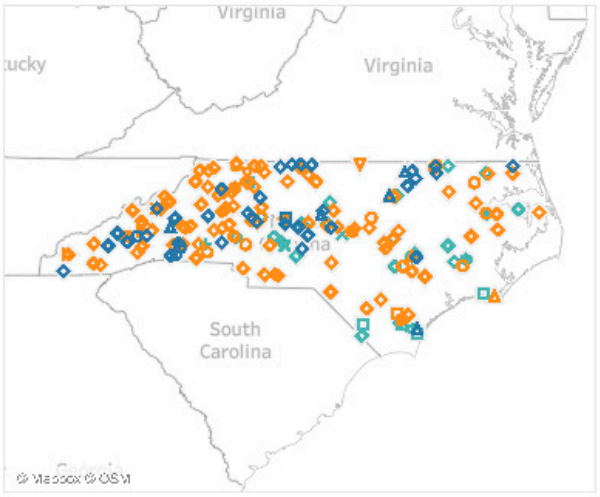
Appendix Item VIII: Timber Product Output and Use, North Carolina, 2018

USDA United States Department of Agriculture

Timber Product Output and Use
North Carolina, 2018

North Carolina forests accounted for a total of 832,522 thousand cubic feet (MCF) of timber products while the forest products industry produced a total of 810,608 MCF within the State.

This resource update contains the findings of a canvass of all primary wood-using plants in North Carolina. It complements the Forest Inventory and Analysis (FIA) annual inventory of volume and removals. The canvass was conducted to determine the amount and source of wood receipts and annual timber product imports/exports. Only primary wood-using mills were canvassed. Primary mills are those that process roundwood in log or bolt form or as chipped roundwood. Examples of industrial roundwood products are saw logs, pulpwood, veneer logs, poles, and logs used for composite board products. Mills producing products from residues generated at primary and secondary processors were not canvassed. Data used in this update were accessed from the FIA Timber Product Output database (see back page).



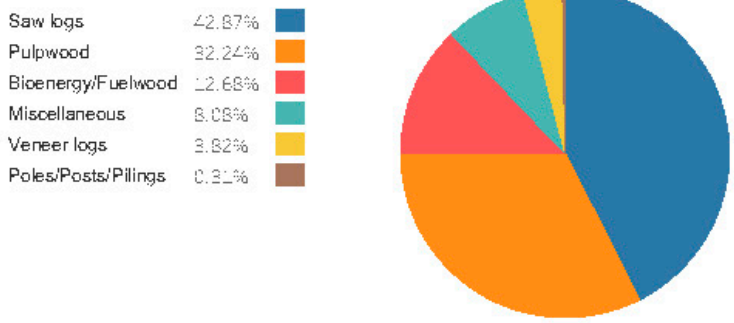
- Biomass/energy ..
- Composite Panel..
- Misc - Bark/mulc..
- Misc - Concentra..
- Miscellaneous mill
- Pole mill
- Post mill
- Pulp/Paper mill
- Saw mill (include..
- Veneer/plywood ..

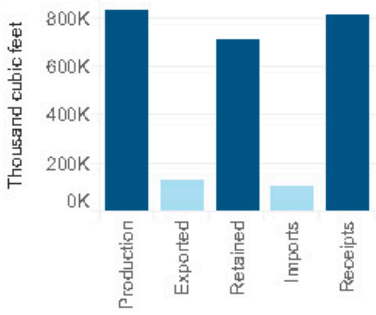
H
H/S
S

North Carolina had a total production of 832,522 MCF in 2018.

There are about 201 primary wood processing mills accounting for production in the State.

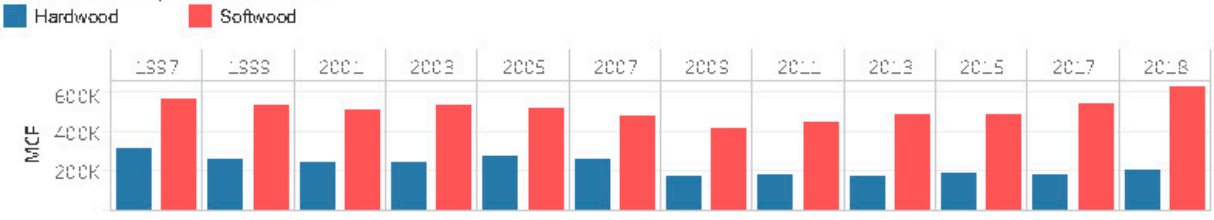
Statewide roundwood production (% of total) by product





North Carolina imported 105,045 MCF into the State and exported 126,959 MCF out of the State making them a net exporter of roundwood.

Total roundwood production over time



USDA Forest Service - Forest Inventory & Analysis

USDA

United States Department of Agriculture

Timber Product Output and Use for North Carolina, 2018

How to cite this publication

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Archived Versions

This report can be found on the USDA Forest Service publication database (Treesearch at: https://www.fs.usda.gov/treesearch).

Archived versions of resource updates can be found by searching Treesearch using keywords "Forest Inventory," "Timber products," and "North Carolina"

Timber Product Output

The National Timber Product Ouput (TPO) section of the FIA program collects and reports estimates of industrial and nonindustrial uses of roundwood. Details of the TPO section and TPO data can be found here: https://www.fia.fs.fed.us/program-features/tpo/

Additional Resources

The application that produced this resource update was developed using data from the USDA Forest Service Forest Inventory and Analysis TPO database:https://public.tableau.com/views/TPOREPORTINGTOOL/MakeSelection?:showVizHome=no

Tables for North Carolina, 2018 can be found here: https://doi.org/10.2737/FS-RU-288-Tables

The FIA TPO one-click application can be found here:https://public.tableau.com/views/FIATPOOneClickFactsheet/StateSelection?:showVizHome=no

Detailed information about the FIA program can be found HERE: Bechtold, W.A.; Patterson, P.L., eds. 2005. The enhanced Forest Inventory and Analysis program—national sampling design and estimation procedures. Gen. Tech. Rep. SRS–80. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 85 p. https://doi.org/10.2737/SRS-GTR-80 .

Note: Some of the above links will not be active until the resource update has been approved for official publication.

USDA Forest Service. 2020. Timber Product Output and Use for North Carolina, 2018. Resource Update FS-288. Asheville, NC. U.S. Department of Agriculture, Forest Service, 2 p. https://www.fs.usda.gov/treesearch/pubs/61617

Appendix Item IX: North Carolina Forest Legacy Assessment of Need

Assessment of Need (AON) for the North Carolina Forest Legacy Program

Revised / Approved by USFS R8 Staff 2020

The Forest Legacy Program authorizes the USDA Forest Service or state governments to purchase permanent conservation easements on private forest lands. The program acquires certain land-use rights that promote effective forest land management, while protecting the land from conversion to non-forest uses. Priority lands are those that will support continuation of traditional forest uses yet also contain scenic, cultural, and recreation resources, fish and wildlife habitats, water resources, and other ecological values that are regionally and nationally significant. Participating landowners must follow a management plan designed for their forest. Activities consistent with the management plan--including timber harvesting and recreational activities such as hunting, fishing, and hiking--may be permitted.

For the State of North Carolina to continue to participate in the Forest Legacy Program, the state is required to produce and maintain a document assessing need for the program. The North Carolina Forest Legacy Assessment of Need (AON) establishes a factual and procedural foundation for program implementation.

The AON document identifies four Forest Legacy Areas (FLAs) where the protection efforts, hence funds, provided under the Forest Legacy Program should be applied. For each of the four FLAs, the document:

(1) identifies the FLA's general characteristics and environmental values at risk

(2) describes kinds of threats to those values in the FLA,

(3) identifies entities that will work together for conservation within the region defined by the FLA, and

(4) specifies the FLA's geographic boundaries within which properties may be considered for the program. The document presents evaluation criteria and scoring that will be used to rate potential parcels on which acquisition of property development rights will be pursued.

Procedures Used to Identify Priority Forest Legacy Areas (FLA's)

Legacy Priority Area Delineation using GIS – 2020 Update

Justification:

The North Carolina Division of Forest Resources is required to revise priority areas for the Forest Legacy program utilizing new priority area delineation techniques, and information on the importance of forests. One source used in the current forest legacy assessment is the Southern Forest Land Assessment, updated in 2019. The Southern Forest Land Assessment was developed by the Southern Group of State Foresters to prioritize lands for inclusion in the Forest Stewardship Program and to identify areas under threat from development, fire, insects and disease.

Thirteen GIS data information layers mapped and scored and had direct application to establishing the Forest Legacy priority areas. The new Forest Legacy Priority Areas and ecological boundaries were summarized by sub-watershed, using the National Watershed Boundary dataset (developed by NRCS). North Carolina's 1,795 sub-watersheds, which scored highly for Forest Legacy program suitability, were grouped to create four Forest Legacy priority areas.

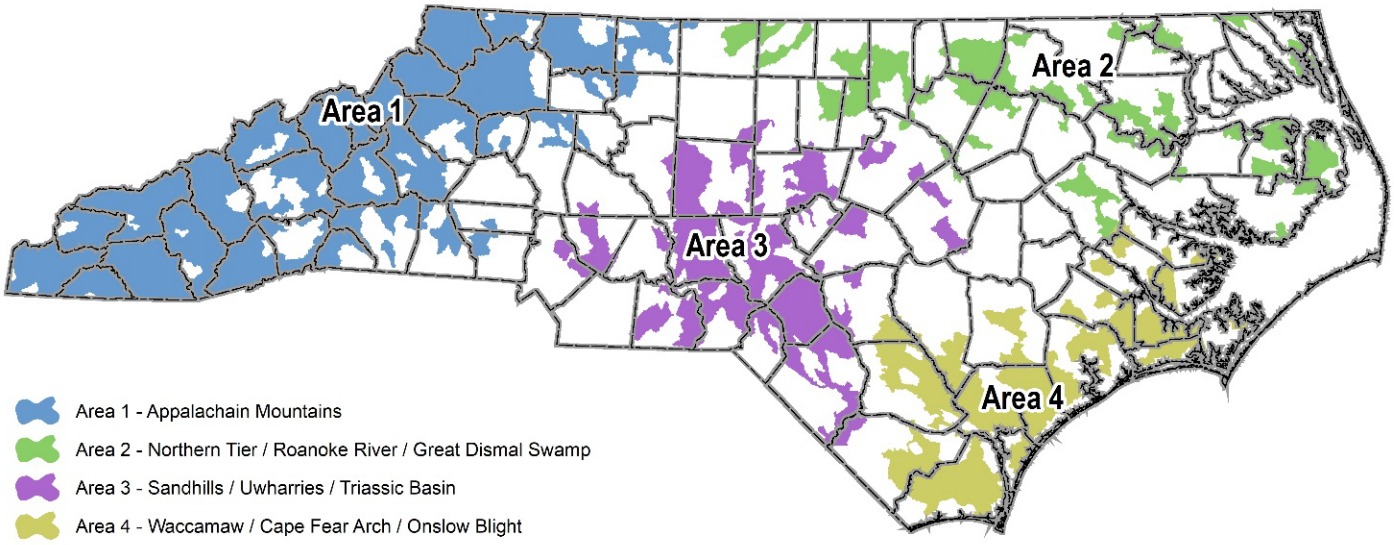
Process:

A. The GIS input layers from the Southern Forest Land Assessment were evaluated to determine which layers would best display the guiding principles of the Forest Legacy program.
B. Five layers are utilized to create the Priority Forest Legacy Areas. They include:

- **Forest Land** – shows the presence of forest land. All pixels representing forest and shrubland are scored 100, and all other land cover types are scored 0.
- **Forest Patches** –contiguous patches of forest are given higher scores as forest patch size increases. Patches were scored on a scale from 0 (<500 acres) to 100 (>5000 acres).
- **Threatened and Endangered Species** – The state was divided into quarter-quads, and each quarter-quad was classified 0, 25, 50, or 100 based on how many threatened or endangered (T&E) species occurrences were found in the quarter-quad. T&E Species data is from NC Natural Heritage Program.
- **Development Threat** – Based on the Integrated Climate and Land-Use Model (V2) categorizing land classification changes from 5 levels of residential plus commercial and industrial. The data incorporates transportation capacity and growth, growth in commercial and industrial land uses, and population density-driven demands for residential housing as well as commercial and industrial development. Scores increase from 0 – 100 as the magnitude of expected development between 2010 and 2040 increases. Areas that are most likely to change from rural to developed are scored 100, while areas that are either built out completely or likely to remain rural are scored 0.
- **Excellent Biological Classification Watersheds** – all sub-watersheds that contain waters sampled by the Division of Water Quality and found to have excellent/natural indicators for high water quality were scored 100, and other areas scored 0 **(**this layer was developed to capture watersheds with outstanding water quality characteristics and high conservation value). Data is current as of 2016.

C. The five layers listed above were summed. For example, a pixel that scored 100 for Forest Land, 50 for Forest Patches, 20 for T&E Species, 70 for Development Threat, and 100 for Excellent Biological Classification Watersheds would have a total score of 340. A pixel with the highest value (100) in each layer would be scored 500.
D. Pixels on federally owned lands were removed from the dataset, since federal land is not eligible for the Forest Legacy program.
E. Score statistics were calculated by sub-watershed, and the mean score for each sub-watershed was used to determine which sub-watersheds should be included as Legacy program priority areas. The top 50% of the sub-watersheds in NC were chosen as the core of the Forest Legacy priority areas.

North Carolina Forest Legacy Priority Areas Map (updated 2020)



Four Regional Priority Forest Legacy Areas were identified for parcel/property consideration. They include the following:

1) Appalachian Mountains/Foothills
2) Northern Tier / Roanoke River / Great Dismal Swamp
3) Sandhills / Uwharries / Triassic Basin
4) Waccamaw / Cape Fear Arch / Onslow Bight

Eligibility Criteria Identification for Forest Legacy Program Consideration

A proposed project's eligibility to be included in the Forest Legacy Program (FLP) is determined by both the Federal requirements as outlined in USDA Forest Legacy Program Implementation Guidelines plus any requirements identified within the State's Forest Action Plan or other pertinent State law.

- It is within, or partially within, a designated FLA (some part of the parcel must be within the priority layer when mapped using an online viewer or tool);
- It has a minimum of 75 percent forestland or a documented plan that includes enough landowner capacity to reforest to at least 75 percent forestland;
- It can be managed consistent with the purpose for which it was acquired by FLP;
- The landowner is willing to sell or donate the interest in perpetuity; and
- The landowner acknowledges that the conservation easement will be held by a government entity if Federal funds are used for the acquisition

Priority Forest Legacy Areas (FLA's) within North Carolina

Area 1 - Appalachian Mountains and Foothills

Description of Forest Legacy Area and Important Environmental Values

The Appalachian Highlands and Foothills FLA extend from the Virginia and Tennessee borders to the South Carolina and Georgia borders along the Blue Ridge Escarpment and outlying foothill ranges. Mountain hardwood forests dominate most of the area, but the high elevation spruce-fir and acid-cove mix of yellow poplar, hemlock and rhododendron are two very important forest types also found here. In addition, pine forests occupy lands abandoned by farmers. This area is a significant resource base for the forest products industry. The timber resource has long been a vital part of local economies and still sustains an industry dependent on quality hardwood production as well as lower quality fiber. A critically important factor is that many communities have become dependent on tourism geared to the beauty and ecological integrity of the land.

Relatively large tracts in both public and private hands consisting of deed gorges and steep mountains covered with mixed hardwood exist in this FLA. Pisgah National Forest and Nantahala National Forest occupies much of the higher elevation land throughout this FLA, but many thousands of acres of corporately owned forest land and smaller privately-owned forests are adjacent to the national forests. Crescent Resources LLC alone owns 25,000 acres in the Upper Catawba Basin along the river, lakes and tributaries. Wildlife habitat conservation is represented by the Nantahala and Pisgah Gamelands. Water quality protection is important because of Nantahala Lake, river-based recreation on the Nantahala and Tuckasegee Rivers, and abundant trout streams with both native and stocked populations. Water quality restoration is a hope for the Upper Little Tennessee River and would contribute to the effort to maintain downstream habitat for the endangered spotfin chub and Appalachian elktoe.

The Blue Ridge Parkway, a major factor in the region's economy, spans the western portion of this FLA that includes some of the highest mountains in the state. Tourism drives concerns for maintenance of scenic beauty and recreational values. Forest-based recreation is also extraordinarily important to the economy of this region. South Mountains (35,000 acres publicly owned) and Green River Gorge (10,000+ acres publicly owned park and game lands are in the southern portions of the FLA. Several nationally significant Natural Heritage sites are in the southern portion of this FLA, including the South Mountains and the Hickory Nut Gorge State Park areas.

Scenic beauty and solitude are important values particularly associated with the Appalachian Trail, which traverses this FLA from the Nantahala River to the South Carolina border. Culturally important sites include the Coweeta Hydrologic Laboratory and Cradle of Forestry in America.

The Appalachian Mountains FLA is the largest of North Carolina's FLAs. It includes Burke, Caldwell, McDowell, and Polk, Rutherford and Wilkes Counties and parts of Ashe, Alleghany, Avery, Catawba, Cleveland, Gaston, Henderson, Jackson Lincoln, Haywood, Macon, Mitchell, Surry, Swain, Transylvania, Watauga, and Yancey Counties. It includes headwaters of the Broad, Catawba, New and Yadkin river basins, sub-basins in the Little Tennessee River basin, headwaters of the Savannah River, and parts of western parts of the French Broad River basin, as well as headwaters of the Ivy River in the French Broad watershed.

Current and Future Conversion Pressures

This area has long been a tourist and recreation destination and is convenient for weekend escapes from more urbanized settings to the east and south. As a result, conversion to residential development has led to encroachment on the boundaries of national forest, state forest and state park lands. Upward price pressure on private forest tracts is leading to tract liquidation especially by large corporate landowners. Property tax increases are exacerbating the temptation to sell lands for development. Ridgetop development is a particularly problematic phenomenon wherever land is privately owned, but while large-scale development has been specifically addressed by legislation, individuals are not constrained, and panoramic views are highly desirable.

In the northern part of this FLA, development in recent years has intensified with growth of the ski industry. Both second home and resort community development are therefore accelerating. In the south, the Charlotte/Hickory/Spartanburg-Greenville metro areas are among the fastest growing in the Southeast, driving suburban and second home development in this region. Land prices are escalating rapidly. Large corporate landowners are actively selling their lands--primarily to development interests--making the next few years critical. Residential, second home, and resort communities are intruding as development pressure from the Atlanta area, only 2.5 hours south from some North Carolina counties, is accelerating and as refugees from northern and eastern cities retire to this region. Many coves throughout this FLA are already entirely developed as golf course and retirement communities.

In the past decade, land prices were escalating, and either property taxes or inheritance taxes were prompting sales of lands to development interests. Many families that historically earned their living on the land were rapidly losing that ability or facing financial pressures that prompt sales to development interests. Suburbanization reduced opportunities for traditional forest uses, further inciting landowners to convert their properties to non-forest uses. However, the current economic slowdown has deterred many developers from buying land. This may offer opportunities to protect key areas if the funding and political will is there.

Goals and Objectives for Public Benefit

- Maintain large contiguous blocks of working forest lands.
- Encourage protection of scenic vistas from Blue Ridge Parkway.
- Enhance protection of water quality in the Broad, New, Upper Catawba and Upper Yadkin Rivers.
- Restore water quality in the Upper Little Tennessee River watershed and protect water quality for trout populations and in tributaries to critical habitat for the Spotfin chub (LTR)
- Buffer national forest, state forest and state park lands from encroachment.
- Buffer the Appalachian Trail, Mountains to Sea Trail and other scenic or recreational trails and routes.
- Provide habitat corridors for wildlife populations.

Potential Partnering Entities

Blue Ridge Rural Land Trust
Carolina Mountain Land Conservancy
Foothills Conservancy of North Carolina
High Country Conservancy
Land Trust for Central North Carolina
Land Trust for the Little Tennessee
National Committee for the New River
Southern Appalachian Highlands Conservancy
North Carolina Department of Agriculture and Consumer Services
North Carolina Division of Parks and Recreation
North Carolina Wildlife Resources Commission
USDA Forest Service
Highlands-Cashiers Land Trust
Highlands Biological Station
Little Tennessee Watershed Association
Western North Carolina Alliance
Blue Ridge Parkway
The Conservation Fund
Local Governments and Municipalities

Area 2 - Northern Tier /Roanoke River / Great Dismal Swamp

Description of Forest Legacy Area and Important Environmental Values

The Piedmont Northern Tier FLA extends along the state's border with Virginia and includes all or parts of Alamance, Bertie, Beaufort, Tyrrell, Dare, Hyde, Caswell, Camden, Chowan, Currituck Edgecombe, Franklin, Halifax, Hertford, Gates Nash, Pitt, Person, Rockingham, Stokes, Durham, Granville, Martin, Orange, Pasquotank, Perquimans Stokes, Surry, Vance, Warren, Yadkin, Washington and Wake Counties.

Water resources of note include Dan River, Bellews Lake, Mayo Reservoir, Roxboro Reservoir/ Hyco Lake, Lake Michie, and Falls Lake. The FLA incorporates much of the Roanoke River basin in North Carolina west of US15, small portions of the Cape Fear and Yadkin-Pee Dee river basins and headwaters of the Neuse and Tar Rivers. Several headwater areas and downstream segments contain freshwater mussel populations of regional and national importance. The areas in the vicinity of the Tar and Roanoke River basins have extremely productive sites and soils for high quality hardwood production and high-quality habitat for wild turkey, white-tailed deer, and many non-game species. The Tar and Roanoke river basins contains some of the highest quality waters in the region, and both the striped bass recovery program and viable runs of anadromous fish species (e.g., white and hickory shad) depend on high quality water protected by forests in this FLA. The FLA includes the headwaters drainages of the Tar River, which are noted for populations of freshwater mussels. Potential exists for development of eco-tourism, as significant expansion of natural heritage presence and existing conservation easements is possible in the Lower Roanoke.

The Upper Chowan and Dismal Swamp region within this FLA is the oldest settled area in the state yet contains a diversity of forest types from bottomland hardwood swamps (tupelo-cypress) to upland mixed hardwoods and mixed-pine and hardwoods. Wetter sites are typically remnants of the Great Dismal Swamp and often include Atlantic whit cedar. Relatively undisturbed and remote swamplands include large sections of bottomland hardwood swamp and significant natural heritage areas associated with the Great Dismal Swamp. The Chowan River Game Lands consist of several thousand acres that serve as a centerpiece for the western part of this FLA. Timber company lands (Union Camp) and the Great Dismal Swamp National Wildlife Refuge as well as the Merchants Millpond State Park are important components of this area.

Significant Natural Heritage Areas include Chowan Sandbanks, Chowan/Bennets Creek, Catherine Creek Swamps, Chowan River White Cedar Swamp, Dismal Swamp Megasite, Holiday Island, Horsepen Pocosin, Meherrin River Macrosite, Merchants Millpond, The Pot Holes, Union Camp/Chowan River Natural Areas, Upper Wiccacon River Swamp, Warwick Creek Oak Flats and Slopes, Wiccacon River Freshwater Marsh, Wyanoke Sandhills.

Several NCWRC Gamelands, State parks, and University land is present in this FLA. State owned public Gamelands throughout this FLA are a major environmental benefit and value. Butner-Falls of the Neuse Gamelands, Caswell Game Lands, Sauratown Plantation Game Lands support large white-tail deer and wild turkey populations that use extensive areas as home ranges. The forests in this area provide habitat for the black bear, bobcat, wild turkey, prothonatary warbler, osprey, and bald eagle.

State parks in this large FLA include Eno River, Pilot Mountain, Hanging Rock, Medoc Mountain, Merchants Millpond and Dismal Swamp are several of the of the recreational sites in this FLA that would benefit from protection on their park perimeters. NC State University's Hill Forest, north of Durham, serves as a key educational and research resource of historic importance. The Duke Forest is proximal to this FLA and serves research, teaching and recreational functions like the Hill Forest.

Current and Future Conversion Pressures

Residential and commercial development from the Piedmont Triad and Research Triangle urban complexes is rapidly eroding southern margins of the large contiguous blocks of rural land in this area. All along the I-85/I-40 corridor from Durham to Burlington to Greensboro and Winston-Salem, urbanization is creating extensive development pressure. Urban workers seeking less congested areas are quite willing to commute from this region, and developers have already made inroads, seeking less expensive land for future development. Rural development threatens the connectivity and utility of the numerous areas of game lands in this FLA. Water quality in proximity to headwaters of several rivers that support native freshwater mussel populations is threatened by sedimentation and polluted runoff from increasing development.

Properties such as Eno River State Park and NC State University's Hill Forest, north of Durham, are already being surrounded by residential development that threatens their ability to function effectively. The Duke Forest, proximal to this FLA, is already experiencing changing land use and development pressures throughout its scattered properties.

In Northeastern North Carolina, creasing population south of the Virginia line is largely coming from suburban Tidewater Suffolk and Virginia Beach to the northeast. This movement is encroaching on the rural character of this area. All areas along the northern shore of Albemarle Sound have been platted for potential development, especially expanding waterfront development.

A poor agricultural economy results in farmers cutting timber that in many cases leads to conversion to non-forest uses. While most of the bottomland area along the Chowan River is presently timber company land, new industry has been proposed, which would lead to new development

Goals and Objectives of FLA for Public Benefit

- Maintain large contiguous blocks of working forest lands.
- Create and maintain landscape-scale corridors connecting large designated areas of managed habitat.
- Contribute to population interchanges between the Coastal Plain and foothills of the Appalachians.
- Protect water quality and habitat for freshwater mussels.
- Enhance protection of water quality supplies and protect headwaters of the Neuse and Tar Rivers.
- Buffer Chowan River Game Lands, Great Dismal Swamp National Wildlife Refuge, Merchants Millpond State Park and other Natural Heritage Areas
- Conserve bottomland hardwood swamp forests and promote effective forest regeneration.
- Enhance protection of the Chowan River's Nutrient Sensitive Waters

Potential Partnering Entities

Land Trust for Central North Carolina
North Carolina Coastal Land Trust
Foothills Conservancy of North Carolina
North Carolina Department of Agriculture and Consumer Services
North Carolina Division of Parks and Recreation
North Carolina Wildlife Resources Commission
The Nature Conservancy
Triangle Land Conservancy
Tar River Land Conservancy
Piedmont Land Conservancy
African American Sustainable Forestry Initiative
Black Family Land Trust
Eno River Association

Area 3 – Sandhills / Uwharries / Triassic Basin

Description of Forest Legacy Area and Important Environmental Values

This area encompasses important lands extending east and south from the Uwharrie National Forest, including the Birkhead Wilderness Area, through the Sandhills region. This FLA is located in the south-central portion of North Carolina, occupying all of Lee, Montgomery, Moore, and Richmond

Counties. It also includes parts of Alamance, Anson, Chatham, Cumberland, Davidson, Harnett, Hoke, Orange, Durham, Randolph, Rowan, Robeson, Scotland, Stanley, and Wake Counties.

This FLA incorporates the central and upper Cape Fear river basin, the upper Lumber river basin, upper Neuse river basin, and the lower Yadkin-Pee Dee river basin. Water quality is important, and the included portion of the Cape Fear is designated critical habitat for the Cape Fear shiner. Headwaters of blackwater river systems are found here, and associated botanical communities are considered especially important.

The Yadkin-Pee Dee river basin contains several rare, threatened, or endangered aquatic species (i.e., robust redhorse, Carolina redhorse, highfin carpsucker). The red-cockaded woodpecker, St. Francis' satyr butterfly, and three plant species (American chaffseed, rough-leaved loosestrife, and Michaux's sumac) are federally listed species inhabiting this area. About a dozen more species are candidates for future federal listing. Recreation and scenic beauty are very important components of desirable sites for golf courses and retirement communities that have existed historically and have increased in prominence in this region.

The Sandhills has long been recognized as a biologically distinct area, with a complex of plant and animal species requiring special attention. Transitional between the Coastal Plain and Piedmont, the Sandhills supports species of both physiographic regions. The Sandhills is recognized as one of the last large remaining pockets of longleaf pine. In addition to Uwharrie National Forest, which includes more than 700 historic and cultural resource sites, the Fort Bragg Military Reservation and Sandhills Game Lands are significant managed properties within this area. NC State University's Goodwin Forest is in the center of this FLA. The Triangle Land Conservancy owns a tract at the confluence of the Deep and Rocky Rivers. Open space and recreation are important considerations in the vicinity of the Uwharrie National Forest, the Yadkin lakes and the NC Zoological Park. Alcoa and Progress Energy own lands along the Yadkin/Pee Dee. Wildlife habitat conservation is represented by the Uwharrie Gamelands

Natural communities of particular interest in the Sandhill areas include Sandhill seeps, Small depression pocosins, Streamhead Atlantic white cedar forest, Streamhead pocosin, and Piedmont transitional longleaf. An effort to develop Habitat Conservation Planning and Safe harbor agreements under USFWS leadership seeks to enhance recovery potential of RCW populations and associated species occurring in the same habitat. Longleaf restoration efforts have been initiated on several sites throughout this FLA.

The upper cape Fear River includes Triassic Basin areas and associated flood plains. Steep north facing slopes occur especially along the margins of the Triassic Basin, due to the sharp drop in elevation and consequent increased stream cutting. These areas now harbor remnant or relict communities that are rare in the Piedmont. Another feature associated with the Triassic Basin is diabase outcrops. These diabase areas provide habitat for unique natural communities. While such geologic formations are found mostly in Durham and Granville counties, several exposures of diabase occur near Orange County's eastern border.

The Natural Communities most commonly found in the Triassic Basin include Piedmont/Mountain Bottomland Forests, Piedmont/Mountain Levee Forests, and associated slopes, especially Basic Mesic Forest. Diabase sills and dikes are nutrient rich uplands associated with the Triassic Basin, and they also support several rare plant species.

The rare species include: Cardamine dissecta (Significantly Rare – SR), Cardamine douglassii (SR), Carex jamesii (SR), Corallorhiza wisteriana (SR), Dirca palustris (Watch List), Enemion biternatum (SR), Hexastylis lewisii (Watch List), Hybanthus concolor (Watch List), Phacelia covillei (SR + FSC), Philadelphus hirsutus (Watch List), Philadelphus inodorus (Watch List), Gillenia stipulata (SR), Ptelea trifoliata (Watch List), Quercus muehlenbergii (Watch List).

The primary remaining natural areas include: (1) sites such as north-facing bluffs and slopes with Mesic Mixed Hardwood Forest (predominantly, but not exclusively, in the northern two-thirds of the county), (2) river floodplains supporting somewhat disturbed Piedmont/Low Mountain Alluvial Forest (and occasionally Piedmont Bottomland Forest), (3) uplands supporting secondary Dry-Mesic Oak-Hickory Forest, and (4) Streamhead Pocosins and Streamhead Atlantic White Cedar Forests at headwaters of small streams. Equally important, but occurring with less frequency, are examples of (5) Basic Mesic Forest, (6) Pine/Scrub Oak Sandhill and Xeric Sandhill Scrub, and (7) Rocky Bar and Shore.

Current and Future Conversion Pressures

Golf course and retirement communities economically dominate developed portions of the FLA. As connecting roads such as NC87 and US1 near Sanford are upgraded, increasing development pressure is coming from the north as Research Triangle and Piedmont Triad commuters seek exurban housing. Changes in tax rates as a result of proximal development is leading to liquidation of large tracts and loss of forested lands. Subdividing large tracts for individual and community residential development is increasing in all parts of this FLA. Proximity of residences and commercial properties to managed forests is creating problematic conditions for necessary burning prescriptions that the native vegetation communities need in order to be perpetuated.

Goals and Objectives of FLA for Public Benefit

- Maintain large contiguous blocks of working forest lands.
- Restore and conserve longleaf pine communities.
- Maintain and establish corridors connecting large managed wildlife areas.
- Provide habitat for the red-cockaded woodpecker, St. Francis' satyr butterfly, and three plant species (American chaffseed, rough-leaved loosestrife, and Michaux's sumac). All the protected species require some degree of forest disturbance or manipulation for suitable habitat to be maintained.
- Enhance protection of water supply segments of the Cape Fear, Neuse, Yadkin-Pee Dee and Lumber Rivers.
- Protect habitat for the Cape Fear Shiner (Notropis mekistocholas) and Robust Redhorse **(***Moxostoma robustum*)
- Enhance protection of Nutrient Sensitive Waters in the Cape Fear, Neuse, Lumber and Yadkin – Pee Dee River Basins.

Potential Partnering Entities

Black Family Land Trust
Land Trust for Central North Carolina
Lumber River Conservancy
Eno River Association
NC State University College of Forest Resources
North Carolina Department of Agriculture and Consumer Services
North Carolina Division of Parks and Recreation
North Carolina Wildlife Resources Commission
Piedmont Land Conservancy
Sandhills Area Land Trust
USDA Fish and Wildlife Service
The Nature Conservancy
Triangle Land Conservancy
Triangle Greenways Council
Local Governments and Municipalities

Area 4 – Waccamaw / Cape Fear Arch / Onslow Bight

Description of Forest Legacy Area and Important Environmental Values

Historically dominated by longleaf pine and its associated plant and animal communities or by bottomland hardwood swamp communities, the Waccamaw/Cape Fear/Onslow Bight FLA includes some of North Carolina's most extensive forest expanses. This spans Robeson, Bladen, Columbus, Brunswick, Sampson, Pender Onslow, Carteret, Craven, Duplin, Pender, Pamlico, Pitt, Beaufort, Robeson, Hoke, Cumberland, Sampson Lenoir, and New Hanover Counties. This area contains much of the geographically important Carolina Bay complex. Much of the area has been converted to modern pine plantations, but within these expanses, the variety of natural plant community types is still extraordinary, including such unique plants as the carnivorous Venus fly trap. Black bear habitat exists in immense blocks including virtually inaccessible swamplands.

From the Lumber River State Park on the west to extensive forest industry lands on the east, this FLA incorporates a full range of partners engaged in sustaining values of working forests in North Carolina. The Nature Conservancy manages the Green Swamp to preserve its unique natural features systems, and International Paper Company manages extensive lands primarily for timber and paper production. The NC Division of Forest Resources manages Bladen Lakes State Forest on the northern boundary of this area. Linking large public holdings, from Angola Bay and Holly Shelter Game Lands to the Croatan National Forest and the Hofmann Forest, this FLA includes immense pocosins, Carolina bays, riverine habitats and significant red-cockaded woodpecker habitat. Camp Lejeune Marine Corps Base and the New River estuary are central to this FLA. Some natural longleaf pine communities remain intact, but significant acreages have been planted in loblolly pine. The size of contiguous forest areas in this FLA is remarkable. Both intensively managed and relatively unmanaged areas exist. Features of interest found in this area include Great Dover Swamp, several large pocosins, estuaries of the White Oak and New Rivers, red-cockaded woodpecker colonies concentrated on Camp Lejeune and the Croatan National Forest,

Natural communities of particular interest found in this area include Coastal Fringe Evergreen forest, Maritime evergreen forest, Maritime deciduous forest, Small depression pond, Vernal pool, Pine savanna, Wet pine flatwoods, Small depression pocosin, Bay forest, Peatland Atlantic white cedar forest, Pond pine woodland, High pocosin, and Low pocosin. Natural Heritage Areas that have been identified in the FLA include Lower Buck Landing Swamp, Piney Island Swamp, Net Hole Swamp, Bluff Swamp, Princess Anne Swamp, Big Sandy Ridge, Fair Bluff Swamp, Boiling Spring Lakes.

Current and Future Conversion Pressures

Historically, agricultural conversion led to drainage in extensive areas of pocosins and associated natural communities. Forests returned or were planted on much of the abandoned land. Temporary drainage and conversions of low production areas to pine plantations increased the acreage of forested land.

Now, along the coast, this area is among the fastest growing in North Carolina. Suburban sprawl surrounds Wilmington. Golf course and retirement communities are expanding at a tremendous rate on the mainland along the southern coast in Columbus and Brunswick Counties. Proximity to barrier islands and beaches prompts commercial development to take advantage of the seasonal influx of vacationers. Federal and state wetland regulations have placed a premium value on upland forested sites where development can occur. Development in the small urban centers of New Bern, Kinston, and Jacksonville has been progressively faster over recent decades and is expected to continue to accelerate. Morehead City, Havelock, and Newport are expanding in response to the growth of the beach and retirement influx. Beach related and retirement community development in this area, as elsewhere along the North Carolina coast is predicted to continue at current or higher levels for some time into the future.

Tax burdens on working forest lands proximal to advancing development are driving the conversion process. Already forest products companies are abandoning silviculture on lands along the urban-rural interface and in some cases are developing such lands themselves rather than persist in traditional forest management in areas where congestion and proximal neighbors are likely to create adverse conditions for effective forestry.

Goals and Objectives of FLA for Public Benefit

- Maintain large contiguous blocks of working forest lands.
- Buffer unique natural areas (such as the Green Swamp, pocosins and Carolina bays) from encroaching subdivision and development.
- Connect Angola Bay and Holly Shelter Game Lands, Camp Lejuene, Hofmann Forest, and Croatan NF with viable corridors enabling wildlife population interactions among these large contiguous blocks.
- Connect designated preserves and reduce landscape fragmentation.
- Buffer key habitat blocks from secondary development effects.
- Enhance protection of Nutrient Sensitive Waters and forested wetlands in the Neuse and White Oak River Basins
- Enhance protection of the Cape Fear River's Nutrient Sensitive Waters.
- Provide habitat for black bears, RCWs, and other protected species found in the region.
- Encourage prescribed burning and management for early successional species.

Potential Partnering Entities

Lumber River Conservancy
Northeast New Hanover Conservancy
North Carolina Coastal Land Trust
North Carolina Department of Agriculture and Consumer Services
North Carolina Division of Parks and Recreation
North Carolina Wildlife Resources Commission
The Nature Conservancy
North Carolina State University Forestry Foundation
USDA Forest Service
US Marine Corps
Sentinel Landscape Partners
TIMO's and REIT's
Local River Associations

Forest Legacy Project Evaluation and Prioritization Procedures

Owners of forestland properties within the designated Forest Legacy Areas will be eligible to apply for NC Forest Legacy program funding provided candidate projects meet eligibility requirements and property attributes can provide environmental, social, and economic public benefits through the protection and management of the property and its resources.

Only landowners who are interested in permanently selling their development rights and accept that future use and value of their property may be should apply. Priority will be given to properties that provide environmental benefits and will be maintained as working forest.

Under the North Carolina criteria, a parcel must be large enough to be sustainable as a forest. This varies from area to area but rarely is less than 10 acres. Because of their unique values and scarcity, very large forest ownerships (250+ acres) may receive higher priority than smaller parcels with the same qualities.

North Carolina Forest Service accepts project applications in the spring each year unless otherwise notified. The Forest Legacy Application Review Committee (FLARC) will review all projects submitted during the annual application period and rank them based on their ability to meet the criteria and required objectives of the Forest Legacy program.

The FLARC will review and score any submitted project applications and rank it relative to other North Carolina applications received during the application period each year. The application and recommendations of the FLARC will then be submitted to the North Carolina Forest Stewardship State Coordinating Committee for their review and approval of priority projects.

North Carolina Forest Service will then submit approved projects for consideration by the Forest Legacy National Review Panel which will perform a final ranking of all statewide projects and submit a prioritized list of nationwide FLP projects for submission to the Office of Management and Budget for consideration in the President's Budget.

Interested applicants can apply by using agency application forms and procedures that are updated annually and available on the agency website at https://www.ncforestservice.gov/fsandfl/what_is_forest_legacy.htm

All applications must contain the required components that include the following:

- Cover Page
  - Applicant Information
  - Property Information
  - Funding Information
- Forest Legacy Application Checklist
  - Landowner Goals & Objectives
  - Landowner's Comments
  - Forest Stewardship Plan Prepared
  - Traditional Forest Values
  - Retention or Relinquishment of Select Property Rights
- Forest Legacy Parcel Evaluation
  - Importance
  - Threat
  - Strategic
- Signature and Disclaimer Page
- All Property and Legal Descriptions, Photos, Maps, and Supporting Documentation

Forest Legacy Project Evaluation and Important Attributes to Consider

Individual Forest Legacy Program (FLP) projects will be evaluated within the framework of three core national criteria that include Importance, Threatened, and Strategic.

I. Importance

This criterion focuses on the attributes of the property and the environmental, social, and economic public benefits gained from the protection and management of the property and its resources. This criterion reflects the ecological assets and the economic and social values conserved by the project and its level of significance.

National significance of a project is demonstrated in two ways: First, a project that solidly represents many of the attributes outlined below is viewed as nationally significant because of its strong alignment with the purposes and strategic direction of the Forest Legacy Program.

Second, national significance can be demonstrated by a project that supports Federal laws, such as the Endangered Species Act, Safe Drinking Water Act, and Clean Water Act, contributes to Federal initiatives, or contains or enhances Federal designations such as Wild and Scenic Rivers, National Scenic Byways, National Recreation Trails, and cultural resources of national importance. When determining Federal importance, interstate/international resources (such as migratory species, or trail and waterways that cross state boundaries) should also be considered.

Where appropriate, regional and state significance of property attributes and locations should also be highlighted when they align with and support national significance. Property attributes to consider for evaluating Importance for Forest Legacy Program may include the following:

The descriptions listed represent good projects for FLP consideration.

Economic Benefits from Timber and Potential Forest Productivity - This category includes three independent components: (1) Landowner demonstrates sustainable forest management in accordance with a management plan or land that is third party certified (such as Sustainable Forestry Initiative, Forest Stewardship Council, and American Tree Farm System). (2) Forestry activities contribute to the resource-based economy for a community or region. (3) The property contains characteristics (such as highly productive soils) to sustain a productive forest.

Economic Benefits from Non-timber Products - Provides non-timber revenue to the local or regional economy through activities such as hunting leases, ranching, non-timber forest products (maple syrup, pine straw, ginseng collection, etc.), guided tours (fishing, hunting, birdwatching, etc.), and recreation and tourism (lodging, rentals, bikes, boats, outdoor gear, etc.).

Threatened or Endangered Species Habitat - The site has documented threatened or endangered plants and animals or designated habitat. Documented occurrence and use of the property should be given more consideration than property without any documented occurrence or use. Federally listed species should be given more consideration than state-only listed species when evaluating the significance of this attribute.

Parcels nominated for the Forest Legacy Program should be inventoried for such natural habitats that may contain imperiled species (on State list as Endangered, Threatened or of Special Concern. Factors to consider:

- Parcel provides habitat supporting occurrence of rare, threatened or endangered species.
- Parcel is within a designated North Carolina Natural Heritage Area.
- Parcel provides suitable habitat for reoccupation by rare, threatened or endangered species (either naturally or through translocation).
- Parcel adjoins or is proximal to forests included in a Habitat Conservation Plan or Safe Harbor agreement and would thereby contribute to species conservation goals.

Fish, Wildlife, Plants, and Unique Forest Communities - The site contains unique forest communities and/or important fish or wildlife habitat as documented by a formal assessment or wildlife conservation plan or strategy developed by a government or a non-governmental organization. The importance of habitat to international initiative to support and sustain migratory species can be viewed as national importance if conserving the property will make a significant contribution.

Preventing fragmentation of forest tracts into smaller units is crucial to maintaining viable populations of wildlife species. Factors to consider:

- Parcel contains desirable habitat and other ecologically recognized criteria for one or more species that include: forest interior nesting birds, significant populations of resident species, neotropical migratory birds, areas for resting and feeding of migratory species, forest inhabiting mammals, reptiles, amphibians and invertebrates.

- Parcel exhibits connective habitats, corridors, habitat linkages and areas that reduce biological isolation

Water Supply and Watershed Protection - One of the most important "products" of forest areas is water. Proper management of forest lands through institution of a Forest Legacy Area can increase the quality and quantity of water for residents of North Carolina. When evaluating a project, consideration of the importance of the resource and the scale of the contribution of the project should be considered.

- Property has a direct relationship with protecting the water supply or watershed, such as provides a buffer to public drinking water- supply, contains an aquifer recharge area, or protects an ecologically important aquatic or marine area, and/or
- the property contains important riparian area, wetlands, shorelines, river systems, or sensitive watershed lands.

Public Access - Protection of the property will maintain or establish access by the public for recreation; however, restrictions on specific use and location of recreational activities may exist. Existing or potential recreational use (especially public access) of a proposed parcel is an important component to be weighed. The following factors must be considered:

- water based recreation
- trail based and/or day use recreation
- natural resource-based recreation
- adjacent land is protected

Scenic - The site is located within a viewshed of a government designated scenic feature or area (such as trail, river, or highway). Federal designation should be given more consideration than state-only designations when evaluating the significance of this attribute.

The scenic aspects of a natural resource area may often be subjective, but there are several means of measuring the special qualities that make a given parcel stand out. In identifying scenic amenities of a parcel, these factors may be considered:

- includes locally important panoramic views and/or exceptional short view, and/or
- is situated along a designated scenic river, road or trail corridor.

Historic/Cultural/Tribal - The site contains features of historical, cultural, and/or tribal significance, formally documented by a government or a non-governmental organization. A Federal designation should receive greater consideration.

Material evidence of earlier human occupation in North Carolina comprises a unique and irreplaceable resource, as do historical or archeological features on a particular property or across a landscape. Factors to consider:

- Parcel contains forest related cultural resources (i.e., historic forest, historic mill or other historical sites or features.)
- other historic or archeological resources (native American sites)

Other Ecological Values - In addition to the property attributes already outlined, a parcel may exhibit additional or exceptional conditions that are important and add to the quality of the Forest Legacy Area, such as:

- parcel is part of a large block of contiguous forest land,
- will provide a corridor between other large contiguous blocks,
- includes ecological communities which are dwindling in North Carolina, and/or
- contains late successional growth forests (natural area).

II. Threatened

This criterion estimates the likelihood for conversion to non-forest uses. Various kinds and degrees of threat to valuable forested areas exist, such as encroaching housing development, improved roads, sewer and power line extension into undeveloped areas, and fragmentation of land ownership in smaller parcels. In determining the threat to a parcel, factors to consider include, but are not limited to the following:

- is in danger of conversion to non-forest use within 5 years,
- may remain wooded, but will become further fragmented,
- is currently on the open market/listed by realtors (securing one or more sites now will stem further development),
- is remote, but vulnerable,
- remnant of a unique or significant forest type, and/or
- others

Third Party Ownership - If property has been acquired by a third party at the request of the State, threatened will be evaluated based on the situation prior to the third-party acquisition.

Legal Protection - The degree of legal protections that currently exists on the property (e.g. current zoning or existing easements), whether these protections remove the threat of conversion, and to what extent.

Land and Landowners Circumstances - land and landowner circumstances such as property held in an estate, aging landowner, future property by heirs is uncertain, property is up for sale or has a sale pending, landowner anticipates owning property for a short duration, landowner has received purchase offers, land has an approved subdivision plan, landowner has sold subdivisions of the property, etc.

Adjacent Land Use - adjacent land use characteristics such as existing land status, rate of development growth and conversion, rate of population growth (percent change), rate of change in ownership, etc.

Ability to Develop - physical attributes of the property that will facilitate conversion, such as access, buildable ground, zoning, slope, water/sewer, electricity, etc.

III. Strategic

This criterion reflects the project's relevance or relationship to conservation efforts on a broader perspective. When evaluating strategic, three considerations should be made: 1) the scale of a conservation plan, 2) the scale of the project's contribution to that plan, and 3) the placement of the parcel within the plan area. Property attributes to consider:

Conservation Strategy - How the project fits within a larger conservation plan, strategy, or initiative as designated by either a government or non-governmental entity.

Compliment Protected Lands - How the project is strategically linked to enhance already protect lands including past FLP projects, already protected Federal, State, or non-- governmental organization lands, or other Federal land protection programs (NRCS, FSA, USFWS, Military Lands).

Note: The N.C. Forest Service Forest Legacy (AON) was reviewed and approved by USFS Region 8 Forest Legacy Coordinator in November 2020.

Forest Legacy Program Project Selection Cycle

Action	Timeframe
Forest Legacy Program (FLP) landowner application submission deadline to the State to accommodate project proposal preparation for State Forest Stewardship Coordinating Committee (SFSCC) meeting	State determines date according to planned SFSCC meeting time – Year Generally Spring (March-May)
SFSCC approves/evaluates project proposal(s) and provides recommendations to the State Lead Agency	Summer through Fall, the SFSCC meeting date varies by State – Year
State Lead Agency assigns priority (if any) and submits to USFS Region 8 Forest Legacy program manager	Submission to USFS Region 8 is determined by each Region – Year
USFS Region 8 program manager submits all projects to the National Review Panel	November – Year
National Review Panel meets and recommends project ranking and grant amounts for the President's Budget release	January for National Review Panel – March for President's Budget – Year plus 1
Congressional Action	Summer through Fall – Year plus 1
Federal Budget enacted and USDA Forest Service successful project award notification	Fall through Winter – Year plus 1 or Year plus 2
Successful project grant agreement processing (successful States and Forest Service)	Spring – Year plus 2
Successful project grant funds available to States for closing	Spring through Summer – Year plus 2

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Appendix Item X: Urban Forests and Climate

Urban Forests & Climate

Forests are the most cost-effective tool to buffer North Carolina from the effects of climate change.

Extreme Weather Impacts

Climate change will primarily bring unpredictable weather, with hotter hots and colder colds. It also means that precipitation will be more extreme – including flash floods and droughts.

Trees & Climate Resiliency

Trees are one of the most effective ways to mitigate the impacts of climate change. They absorb pollution, shade communities from heat, and physically buffer the impacts of extreme weather.

Building a Climate-Resilient North Carolina

An increase in tree cover throughout the state - but especially cities - will have large benefits, reducing energy use, conserving water, and reducing greenhouse gas emissions, ensuring the region is a place families can call home for years to come.

North Carolina is home to 9.5 million people and will grow to 12.4 million in the next 20 years. Climate change will bring significant changes to the region, namely extreme weather events. By planning for these changes, North Carolina can build a resilient future.

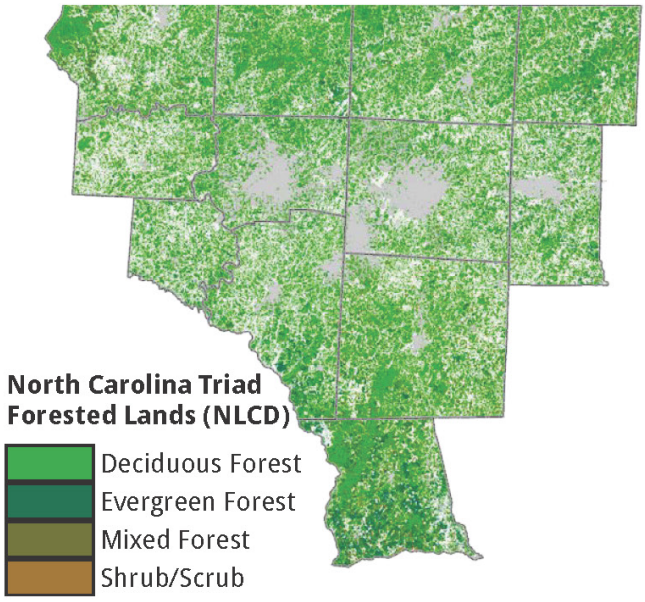
Using Forests to Create a Resilient State

North Carolina is growing quickly. Due to global climate change, its weather is also changing quickly. Trees are one of the most cost-effective ways to absorb these changes and ensure it is a healthy and appealing place for young families.

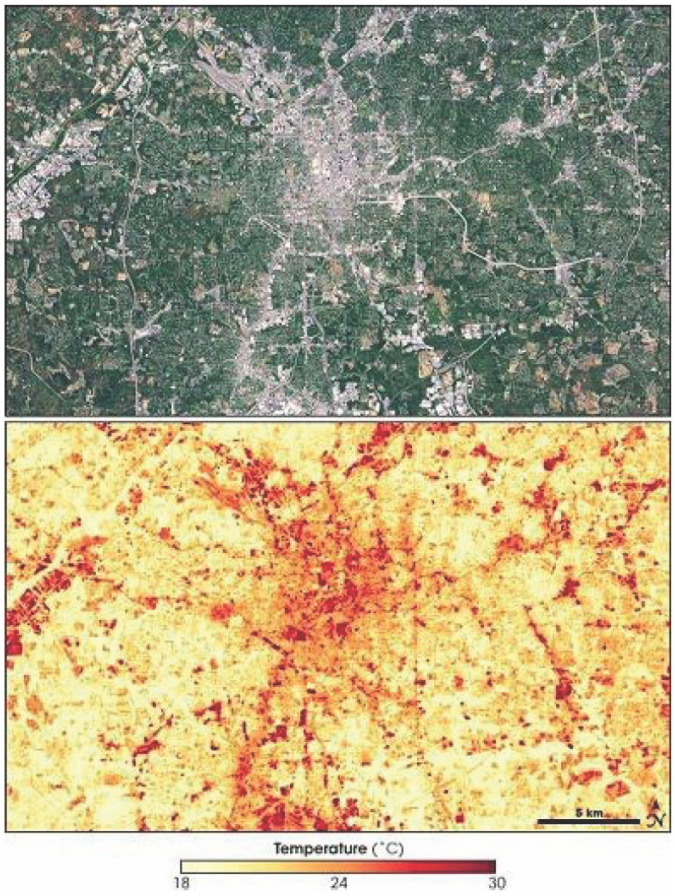
North Carolina is projected to grow from about 9.5 million people in 2010 to 12.4 million in 2030. These people will all need homes and jobs that could stress our air, water, open spaces, and ecology. Market studies show that most of these new families want to move to towns and cities, straying from the historic trend in suburban lifestyles that made the state one of the most sprawling areas in the United States, consuming over 100,000 acres of land every year. This is great news for our forests and farms, but it makes the need to develop sustainable energy policies and practices imperative.

The Southeast is also going to experience many changes to local weather conditions due to global climate change. While the impacts of climate change to the region will not be as extreme as those seen in most of the world, they will establish a new normal of wetter years with drier summers and falls, more extreme and violent summer and winter storms, more regular droughts and heat waves, and less predictable seasons. These conditions will stress the region's crops, ecosystems, and urban communities, as well as exacerbating the effects of air and water pollution.

Trees have been shown to reduce and prevent some of these impacts, absorbing water and air pollutants, providing shade cover to reduce the intensity of heat in urban centers, buffering the impacts of storms on farms and in homes, and reducing energy consumption and greenhouse gas emissions through shade cover. Through the thoughtful use of trees and forests in urban and rural communities, North Carolina can plan ahead for a future that can absorb these changes, building a resilient economic, environment, and society.



NC'S FORESTS CONTRIBUTE NEARLY $24 BILLION TO THE ECONOMY ANNUALLY, WITH >$60 MILLION GENERATED EVERY YEAR IN THE TRIAD ALONE. HOWEVER, ALL OF THESE BENEFITS ARE RURAL: MOST NC TOWNS AND CITIES HAVE SLIM TO NO CANOPIES.

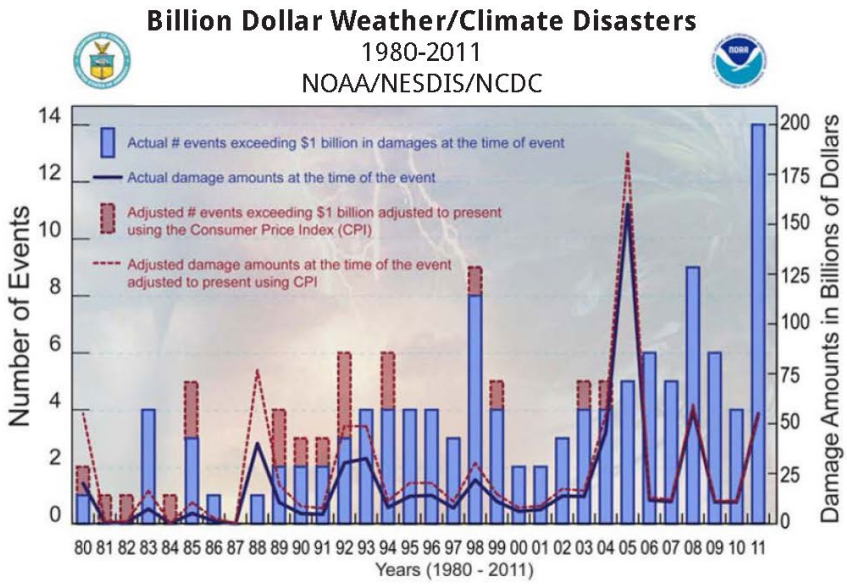


THE URBAN HEAT ISLAND EFFECT IS ONE OF THE BIGGEST HEALTH RISKS FACING URBAN RESIDENTS.

Using shade trees to reduce energy consumption will better ensure sustainable water supplies.

Forested buffers of all sizes provide enormous value for streams and rivers.

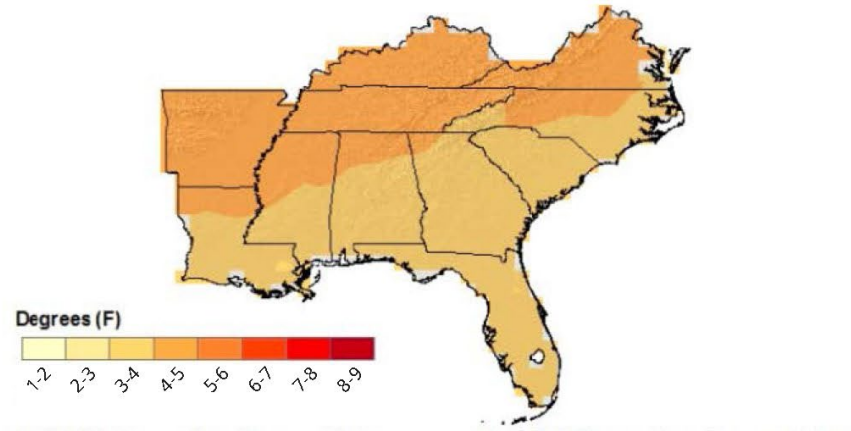
Urban trees reduce air and water pollution, as well as cool cities and increase property values. Charlotte's most valuable urban trees return $150 in services for every $1 spent.



INGRAM, ET AL, 2013

Climate change will transform the North Carolina's weather. Trees already protect communities from intense weather events and can continue to do so in the future if invested in now.

Projected Change in Annual Temperatures for US Southeast



PROJECTED INCREASE IN AVERAGE ANNUAL TEMPERATURE CHANGE, INGRAM, ET AL., 2013

The region is likely to get warmer year-round, with hotter summers and falls and fewer days with freezing temperatures. The map above shows the difference between the average annual temperature of 1971-2000 and the projected annual temperature from of 2041-2070. Increases in the frequency and severity of regional heatwaves will affect the state's quality of life, including fundamental concerns like health care costs.

PIEDMONT
together
Community Choices. Regional Solutions.

In 2011, the Piedmont Triad Regional Council and the Piedmont Authority for Regional Transportation received a $1.6 million grant from the US Department of Housing and Urban Development. With key support from agencies such as the NCFS, they produced Piedmont Together, a sustainable communities plan for the twelve-county Triad region. It features all of the information in this booklet and more. Please visit us at: www.piedmonttogether.org.

Building a Climate Resilient North Carolina

North Carolina is growing and changing in many ways: it is getting older and more diverse with increasingly unpredictable weather. The investments we make today will impact how these weather events will change our way of life. Urban forestry practices in our rural and urban communities are one of the most cost-effective investments these communities can make. We can shade our homes and business, reducing energy use and lowering bills; have street trees that add to property values and absorb water and air pollutants; mitigate weather events such as ice storms and flash floods; and provide rural communities with economic engines in ecotourism and forest products like biofuels. Perhaps the most effective investment is using local ordinances to protect existing trees and incentivize new tree plantings.

Top Recommendations:

- Create local ordinances that protect and incentivize trees for new development.
- Address air and water quality issues with forest canopies of at least 40% in every North Carolina town and city.

NORTH CAROLINA FOREST SERVICE NC

PIEDMONT TRIAD REGIONAL COUNCIL

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