AMERICAN TREE FARM SYSTEM®

LANDSCAPE MANAGEMENT PLAN

State of Florida

SOUTHERN FORESTRY CONSULTANTS

FLORIDA FOREST SERVICE
Agriculture & Consumer Services

Landscape Management Plan Creation

Plan Development and Composition

The American Forest Foundation (AFF), in conjunction with Southern Forestry Consultants, Inc., developed the original components, outlines, structure, and drafts of the Landscape Management Plan (LMP) and the associated geodatabase. AFF and SFC also worked cooperatively to evaluate and incorporate edits, comments, and modifications that resulted in the final LMP and geodatabase.

Natural Resource Professional Support Committee

AFF consulted regularly with a Natural Resource Professional Support Committee (Support Committee) to seek their input on various thematic, structural, and scientific components through multiple drafts of this LMP. Additionally, Support Committee members facilitated access to and procurement of publicly available geospatial data during the development of the geodatabase. The Support Committee was composed of representatives from various stakeholder groups within Florida. Support Committee members did not necessarily endorse all components of the LMP nor does AFF imply a consensus was reached by all members. Support Committee members included:

- Florida Forest Service (FFS)
- Florida Fish and Wildlife Conservation Commission (FWC)
- U.S. Fish and Wildlife Service

Additional Stakeholders

AFF also sought input from a variety of additional stakeholders with expertise in the natural resources, planning, certification, and regulatory disciplines. Like the Support Committee, these additional stakeholders did not necessarily endorse all components of the LMP, nor does AFF imply a consensus was reached. These additional stakeholders included:

- Westrock
- St. John's River Water Management District (SJRWMD)
- Alachua Conservation Trust (ACT)
- Wetland Preserve, L.L.C.
- United States Natural Resources Conservation Service (USDA-NRCS)
- University of Florida Institute of Food and Agricultural Sciences (UF/IFAS)
- United States Department of Agriculture Farm Service Agency (USDA-FSA)
- USDA Forest Service – Forest Stewardship Program leadership

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1 Introduction

1. INTRODUCTION

A landscape management plan (LMP) is a vital and innovative tool, offering a wide array of benefits and opportunities to landowners, foresters, and other natural resource professionals, state and federal agencies, conservation partners, and others. Specifically, this LMP can:

- Help family landowners overcome one of the biggest barriers to participating in forest certification and landowner assistance programs by eliminating the need for every landowner to develop and maintain an individual management plan.
- Support coordination of action on landscape-scale priorities across ownerships.
- Provide participating landowners with access to the benefits of the FSP and ATFS certification.
- Establish and strengthen relationships between landowners and their foresters.
- Be used by a diversity of forestry specialists, including FFS county foresters, consulting foresters, tree farm inspectors, FWC Landowner Assistance biologists, and industrial foresters.
- Be implemented adaptively across an array of conditions, landowner objectives, and ownerships. Although arranged as a single document, the chapters are designed both to support each other and to be used flexibly as forest conditions and objectives change.
- Illustrate practical silvicultural options to manage family woodlands sustainably, achieve landscape conservation goals, and conform to AFF Standards of Sustainability through a variety of strategies and approaches for forest ecosystems specific to Florida.
- Utilize the best available science and resources provided at the federal, state, and local levels through a program- developed and -maintained geospatial database.
- Support the efforts of foresters from across sectors to work with previously unengaged landowners and promote conservation initiatives.
- Optimize grant funding at the local, state, and national level for conservation initiatives on private land.
- Preemptively address threats to at-risk species through habitat protection and wildlife best management practices.
- Provide additional access to certified materials for timber industry partners.

This LMP is designed to complement and align with federal, state, and local laws. Resources in this LMP do not override local forestry regulations that may not be addressed directly in this plan.

Forest management plans have long been a principal component of traditional family woodland owner programs in the United States. Management plans are a requirement for forest certification and landowner assistance programming and, because the individual plans are costly for both landowners and foresters to develop, they are often the biggest barrier to family landowner engagement. In addition, recent research suggests that the development of individual landowner forest management plans have only moderate to minimal impact on family woodland owner behavior. Rather, it is the accompanying engagement with or receiving technical advice from a natural resource management professional that provides the motivation and support landowners need to act on the ground. Even more, individual management plans do not offer a means for inspiring, understanding and coordinating important conservation strategies across family ownerships. By setting motivating goals at the landscape level we are creating another call to action that allows us to engage more landowners. We know that values like wildlife are important to landowners and this allows us to set aspirational goals for the landscape that line up with that motivation.

The planning process remains critical to sustainable forest management. However, there is a need for a more cost-effective approach that reflects what is known to effectively encourage family landowner behavior and support coordinated efforts to address the critical landscape-scale conservation needs and opportunities. Drawing on emerging research, models used in Scandinavia and techniques used by some American consulting firms, the landscape plan is designed to reduce the management plan barrier that family landowners face to becoming involved in conservation activities and streamline the American Tree Farm System® (ATFS) certification process. This approach maintains the credibility required for ATFS certification while providing landowners with the essential technical support to ensure their long-term sustainable management. Finally, it also offers a mechanism for coordinating landscape scale priorities across small and family owners.

The American Forest Foundation (AFF), in conjunction with numerous natural resource partners, has therefore developed this Landscape Management Plan (LMP) to address landowner and landscape-level objectives within the state of Florida. More specifically, this plan incorporates and supports all portions of the following site-specific and landscape level considerations that are applicable to family woodland landowners:

- AFF 2015-2020 Standards of Sustainability for Forest Certification (Standards)
- Forest Stewardship Program (FSP) National Standards and Guidelines (Standards)
- Florida Forest Stewardship Program
- Florida's Forest Action Plan – National Priorities
- United States Department of Agriculture (USDA) National Woodland Owner Survey (NWOS) Results and Observations (Butler et al 2016)
- Florida Fish and Wildlife Commission (FWC) – Private Landowner Survey Results (Pienaar and Plate 2015)
- Florida Department of Agriculture (FDACS) Florida Forestry Wildlife Best Management Practices for State Imperiled Species (Wildlife BMPs)
- FDACS Best Management Practices for Silviculture (Silviculture BMPs) and Notice of Intent to Implement Form
- National Register of Historic Places (NRHP) and the Florida Division of Historical Resources (FDHR)

This LMP will be reviewed on an annual basis, and revised periodically to reflect changing dynamics with the specific forest resources and on the landscape broadly. Similarly, it is critical to monitor landowners' management to ensure congruence between the landscape management plan and continuity across the assemblage of landowners. This could be combined with routine monitoring, as required under certification, such as routine inspections.

1.1. Forest Resource Professionals

This LMP relies on the experience, skills, and thoughtful professionalism of foresters and other natural resource managers. The relationships they build with family woodland owners are central to the success of this LMP and to achieving the shared aims of delivering conservation impact.

As the Society of American Foresters (SAF) describes within the Preamble to its Code of Ethics:

> *"Service to society is the cornerstone of any profession. The profession of forestry serves society by fostering stewardship of the world's forests. Because forests provide valuable resources and perform critical ecological functions, they are vital to the wellbeing of both society and the biosphere." – SFC Code of Ethics*

The role of forest resource professionals includes passing along their experience and expertise regarding the complex relationships between air, water, climate and weather, trees, flora and fauna, ecosystem processes, and anthropocentric considerations. This consultation and advice provided by forest resource professionals is commonly provided to landowners and/or their agents interested in managing their forestland. Landowners can utilize the services of a forest resource professional to manage and monitor vendors and contractors performing silvicultural management activities on the land. Forestry resource professionals also can assist landowners with contracts and the maintenance and retention of appropriate records and documentation relating, to forest management activities and certification. Furthermore, landowners can gain advice regarding taxes, estate planning, and relevant laws, regulations, and ordinances under the guidance of a forest resource professional. This LMP was developed as a resource for these professional foresters to assist in landowner engagement, identification and characterization of landowner site specific features and objectives, and the identification and management of local forest types.

Various professional organizations and certification bodies, including state forester registration boards, SAF, the Association of Consulting Foresters (ACF), provide membership standards and requirements to ensure qualified, responsible, and ethical application of forestry principles is upheld. The ATFS also recognizes the importance of these forestry professionals by establishing specific eligibility requirements and recertification standards of all ATFS inspectors.

The NRCS Florida Vendor List for Services and/or Products Supporting Conservation Practice Implementation is a listing provided to assist landowners in finding forest management related service providers for implementation of forestry practices on their land. This database includes forest management consultants, tree seedling nurseries, and other vendors and forest product buyers.

1.2. **Adaptive Management**

All silvicultural options, management activities, and implementation measures provided in this LMP are predicated upon a narrow window of site, weather, time, and market conditions. Changes and variability associated with these conditions (especially weather and markets) can have significant impacts on the timing, feasibility, and success of all silvicultural implementation operations. For example, the decision of when and how to harvest timber could vary tremendously based on recent weather conditions and market conditions. A recent example of this need for adaptive management occurred in Florida and southern Georgia following the landfall of Hurricane Michael in 2018. An unprecedented storm for the panhandle of Florida and southern Georgia, Michael damaged an estimated 2.8 million acres of timber in Florida, 1 million acres in Georgia, and caused 95% damage to 34,000 acres within Bay, Calhoun, and Gulf counties in Florida, while the Georgia counties of Baker, Calhoun, Clay, Crisp, Decatur, Doughtery, Early, Grady, Laurens, Lee, Miller, Mitchell, Randolph, Seminole, Terrell, Thomas, Tift, Turner, and Worth all received individual federal assistance through the Federal Emergency Management Agency (FEMA); these damages amounted to approximately $1.289 billion dollars in losses (Etters 2019). As these types of events can devastate the local timber industry, landowners may need to investigate assistance toward their recovery efforts in the form of available cost share programs. For example, the Emergency Forest Restoration Program (EFRP) offered by the USDA's Farm Service Agency (FSA) inspects land for eligible damage and provides payments to owners of private forests to restore qualified forests damaged by disasters. One example of this occurred recently in South Carolina following Hurricane Florence; the flooding caused by the storm destroyed many recently planted pine forests and washed out forest roads, bridges, and culverts. Available EFRP funds were used to reforest these planted stands and assist in the repair of forest infrastructure. The Georgia Department of Revenue in 2019 also began offering a Timber Tax Credit for eligible timber owners impacted by Hurricane Michael; other states offer similar programs and initiatives in the wake

of natural disasters. Federal tax laws provide for casualty loss and income tax considerations/deductions as a result of natural disasters. State-specific programs should be sought to offset hurricane damage in every state affected.

Landowners must also be knowledgeable of the procedures to take following natural disasters that impact their forests. A timely salvage of the downed timber is essential to maintaining a healthy forest operation, as downed timber attracts harmful forest pests such as Southern Pine Beetle and Ips Beetle and also prevents future reforestation efforts (Managing Your Hurricane-Damaged Woods, South Carolina Forestry Commission). These forest pests, if attracted by the downed timber, could rapidly spread throughout a pine stand. If the timber stand is moderately (30-50% trees blown over or broken) or heavily (>50%) damaged, it may be necessary for affected trees to be removed for salvage. Another benefit of the removal of affected timber is the decrease in the risk of out-of-control wildfires due to the accumulated downed fuel load. In some states, such as Florida following Hurricane Michael (Florida Department of Agriculture and Consumer Services), additional prescribed burning requirements and regulations may be instituted to monitor and protect burning on sites with a high percentage of downed timber. These additional regulations can help prevent fires from reaching too high of a temperature due to the increased fuel load on the ground, protecting surrounding areas and populations. As Florida is squarely within the path of major Gulf or Atlantic hurricanes and has the potential for future similar levels of devastation through any number of various natural disasters, it is important for landowners to know how to manage their land in the event of such a disaster. Additional information concerning forestry cost share programs can be found below in Section 7.1.1 Conservation Incentives. There, you can receive guidance concerning evaluating damaged trees, forest health issues, tax issues/steps post-hurricane, and attempting to salvage timber already affected.

Likewise, forest landowner objectives could significantly impact both the target forest type and the silvicultural implementation methods needed to meet those goals and objectives. Inherently, silvicultural operations have some flexibility on the timing of implementation to more effectively meet the narrow window of conditions to achieve the desired result. Harvesting operations and regeneration efforts are also variable and could vary significantly when focused on meeting different landowner's objectives like maximizing revenue or conserving rare species. The tolerance to shift operations slightly increases the feasibility of meeting the established goals and objectives. Therefore, this management plan should not be viewed as an unchangeable text, but rather a living document dependent on its constant evaluation, refinement, and modification for success.

1.3. 2015-2020 ATFS Standards of Sustainability within the LMP

The AFF's Standards promote the health and sustainability of America's family forests. These Standards are designed as a tool to help woodland owners be effective stewards of the land as they adaptively manage renewable resources; promote environmental, economic and social benefits; and work to increase public understanding of sustainable forestry. The Standards are based on international sustainability metrics and North American guidelines for sustainable forest management and serve as the basis for the ATFS certification program. The ATFS certification program is internationally endorsed by the Programme for the Endorsement of Forest Certification (PEFC™). Landowners following these Standards are recognized as ambassadors for exemplary woodland stewardship.

Each of the eight Standards of Sustainability addresses aspects of sustainable forest management. Moving from general to specific, each Standard incorporates performance measures and indicators to illustrate conformance. All components of each Standard apply to every property certified under the ATFS Standards. A standard is an overarching principle of sustainability. A performance measure refines the Standard's intent and describes

considerations and pathways for conformance. An indicator identifies specific actions or activities that demonstrate conformance.

These standards, Performance Measures and indicators are presented below with links to the specific section of the LMP where they are addressed:

STANDARD 1 Commitment to Practicing Sustainable Forestry

Performance Measure 1.1 Landowner shall have and implement a written forest management plan consistent with the size of the forest and the scale and intensity of the forest activities.

- **Indicator 1.1.1** Management plan shall be active, adaptive and embody the landowner's current objectives, remain appropriate for the land certified and reflect the current state of knowledge about natural resources and sustainable forest management.
- **Indicator 1.1.2** (a) Management plans shall describe current forest conditions, landowner's objectives, management activities aimed at achieving landowner's objectives, document a feasible strategy for activity implementation and include a map accurately depicting significant forest-related resources.
- **Indicator 1.1.2** (b) The forest management plan shall demonstrate consideration of the following resource elements: forest health, soil, water, wood and fiber production, threatened or endangered species, special sites, invasive species, and forests of recognized importance. Where present and relevant to the property, the plan shall describe management activities related to these resource elements.
- **Indicator 1.1.2** (c) Where present, relevant to the property and consistent with landowner's objectives, the plan preparer should consider, describe and evaluate the following resource elements: fire, wetlands, desired species, recreation, forest aesthetics, biomass and carbon.
- **Indicator 1.1.3** The landowner should monitor for changes that could interfere with the management objectives as stated in the management plan. When problems are found, reasonable actions are taken.

How the LMP Covers this Section:

- This LMP serves as the written management plan for all participating landowners in state of Florida. This plan provides the necessary flexibility to be active and adaptive to the variety of landowner objectives and related management activities available to the landowners in this state, regardless of the size and scale of their property. As noted in the links included throughout this section, this LMP addresses each of the ATFS Standards.
- A secure database was developed to include all the necessary spatial information to support sustainable forest management in the area. In addition to general information of the region (soils, hydrologic information, the presence or absence of T&E species, etc.), each landowner participating in this program can have specific information to their Tree Farm stored on this database by a forester or an ATFS Inspector. Maps can be generated from this database by a forester or ATFS Inspector, or upon request by the landowner or a third-party assessor.

STANDARD 2 Compliance with Laws

Performance Measure 2.1 Landowner shall comply with all relevant federal, state, county and municipal laws, regulations and ordinances governing forest management activities.

- **Indicator 2.1.1** Landowner shall comply with all relevant laws, regulations and ordinances and will correct conditions that led to adverse regulatory actions, if any.
- **Indicator 2.1.2** Landowner should obtain advice from appropriate qualified natural resource professionals or qualified contractors who are trained in, and familiar with, relevant laws, regulations and ordinances.

How the LMP Covers this Section:

- All landowners certified under this LMP agree to meet all federal, state, and local regulations. Understanding that while mistakes may occur in carrying out forest management activities, landowners must be committed to correcting inadvertent violations. A pattern of willful violation of relevant laws, regulations or ordinances is not acceptable. If there is evidence of past nonconformance, then the landowner must show proof of a good-faith effort to remedy the nonconformance. If the matter is tied up in court, then the landowner is only disqualified when a final adverse judgment is rendered and the landowner refuses to comply with the ruling.
- Compliance with all relevant (applicable) laws can be verified by a three-tiered process:
  - Step 1 – Observation of conditions on the subject property
  - Step 2 – The landowner's verbal or written claim of legal compliance
  - Step 3 – Research with the state Department of Environmental Protection, Water Management District, Florida Fish and Wildlife Conservation Commission, local Natural Resources Conservation Service office or State Forest Service offices
  - If Step 1 and Step 2 do not raise any issues, then the qualified ATFS inspector or third-party assessor is not required to employ Step 3.

STANDARD 3 Reforestation and Afforestation

Performance Measure 3.1 Reforestation or afforestation shall be achieved by a suitable process that ensures adequate stocking levels.

- **Indicator 3.1.1** Harvested forest land shall achieve adequate stocking of desired species reflecting the landowner's objectives, within five years after harvest, or within a time interval as specified by applicable regulation.

How the LMP Covers this Section:

- Under each of the forest types outlined in this LMP, information is provided on the different strategies to achieve success in reforestation and afforestation efforts. The state of Florida does not specify a specific required stocking level, post-harvest activity, so landowners operating under this LMP agree to achieve adequate stocking of desired species based on their objectives within five years after harvest. ATFS Inspectors will document these efforts within the 004 inspection form to ensure conformance.

STANDARD 4 Air, Water and Soil Protection

Performance Measure 4.1 Landowner shall meet or exceed practices prescribed by State Forestry BMPs.

- **Indicator 4.1.1** Landowner shall implement specific state forestry BMPs that are applicable to the property.
- **Indicator 4.1.2** Landowner shall minimize road construction and other disturbances within riparian zones and wetlands.

Performance Measure 4.2 Landowner shall consider a range of forest management activities to control pests, pathogens and unwanted vegetation.

- **Indicator 4.2.1** Landowner should evaluate alternatives to pesticides for the prevention or control of pests, pathogens and unwanted vegetation to achieve specific management objectives.
- **Indicator 4.2.2** Pesticides used shall be approved by the Environmental Protection Agency (EPA) and applied, stored and disposed of in accordance with EPA-approved labels and by persons appropriately trained, licensed and supervised.

Performance Measure 4.3 When used, prescribed fire shall conform with landowner's objectives and pre-fire planning.

- **Indicator 4.3.1** Prescribed fire shall conform with the landowner's objectives and state and local laws and regulations

How the LMP Covers this Section:

- All landowners certified under this LMP agree to meet or exceed all state forestry BMPs, even those that are voluntary, which are applicable to the property. When planning management activities that will cause any soil disturbance or require chemical application, the Forestry BMPs should be consulted and applicable BMP methods employed. No field evidence of BMP implementation is expected where no management activity has occurred. However, if the property shows evidence of water quality impairment originating on the property that is not caused by the landowner's or designated representative's actions, the landowner is strongly encouraged to have plans for remediation. Some BMPs, such as those that are guidelines to enhance a desired species, should only apply where relevant to the property. Activities in riparian zones and wetlands shall comply with applicable BMPs. BMP manuals are generally quite detailed on recommended practices for road construction and other disturbances of riparian zones. If there is a point of confusion, the landowner or designated representative is advised to consult with a qualified natural resource professional who is experienced in forest road design and installation. Landowners should specify with qualified contractors that BMPs must be adhered to. In all cases, the primary concern is to avoid contaminating watercourses that are adjacent to the forest activity.

STANDARD 5 Fish, Wildlife, Biodiversity and Forest Health

Performance Measure 5.1 Forest management activities shall protect habitats and communities occupied by threatened or endangered species as required by law.

- **Indicator 5.1.1** Landowner shall confer with natural resource agencies, state natural resource heritage programs, qualified natural resource professionals or review other sources of information to determine occurrences of threatened or endangered species on the property and their habitat requirements.
- **Indicator 5.1.2** Forest management activities shall incorporate measures to protect identified threatened or endangered species on the property.

Performance Measure 5.2 Landowner should address the desired species and/or desired forest communities when conducting forest management activities, if consistent with landowner's objectives.

- **Indicator 5.2.1** Landowner should consult available and accessible information on management of the forest for desired species and/or forest communities and integrate it into forest management.

Performance Measure 5.3 Landowner should make practical efforts to promote forest health.

- **Indicator 5.3.1** Landowner should make practical efforts to promote forest health, including prevention, control or response to disturbances such as wildland fire, invasive species and other pests, pathogens or unwanted vegetation, to achieve specific management objectives.

Performance Measure 5.4 Where present, forest management activities should maintain or enhance forests of recognized importance (FORI).

- **Indicator 5.4.1** Appropriate to the scale and intensity of the situation, forest management activities should incorporate measures to contribute to the conservation of identified FORI.

How the LMP Covers this Section:

- The LMP database provides valuable information about the fish, wildlife, biodiversity and forest health of the program area. The database includes spatial information about where there are known occurrences of threatened and endangered species, the regional soil types, and documented areas of invasive species incursion. Foresters and ATFS Inspectors can also use the database to include information specific to a Tree Farm regarding forest health, such as additional species composition information or treatment information.
- The LMP provides information concerning the Wildlife Best Management Practices (WBMPs) of Florida. These practices give the most current and beneficial management practices to conserve Florida's imperiled species. The WBMPs also guide silviculture's contribution to the conservation and management of freshwater aquatic life and wildlife within the state, and to provide guidance to landowners and others who choose to implement these important practices.
- In addition to the information available in the LMP database, landowners operating under this LMP should walk their property with a qualified natural resource professional to identify occurrences of threatened and endangered species on or near their property. Landowners are also encouraged to work with natural resource professionals to identify possible occurrences of any disease, invasive species or pest outbreak on their property and discuss the range of recommended management techniques to address these issues. This LMP also

outlines the variety of native and exotic pest species that landowners may interact with in this region, as well as tactics to address these issues.

- Integrated pest management (IPM) is an excellent approach to controlling, suppressing or preventing pests and can take many forms. Preventative measures, efforts to improve forest health or, in some other way, protect the property from injurious organisms are often the most practical and effective approaches. Pesticide applications may be used when other control measures are ineffective or impractical. While landowners and designated representatives are urged to take feasible actions to address pests, pathogens and unwanted vegetation, third-party assessors are advised that, in some cases, there may be no feasible options for controlling a pest or outbreak due to severity, scale and timing of onset. When herbicides are used, landowners are required to follow EPA regulations.
- When conducting prescribed burns, landowners operating under this LMP shall follow all state regulations and are encouraged to work with qualified professionals. Additional information about burning based on forest type is included in the following sections.
- Landowners are encouraged to maintain records of forestry related activities for at least three years.

STANDARD 6 Forest Aesthetics

Performance Measure 6.1 Landowner should manage the visual impacts of forest management activities consistent with the size of the forest, the scale and intensity of forest management activities and the location of the property.

- **Indicator 6.1.1** Forest management activities should apply visual quality measures compatible with appropriate silvicultural practices .

How the LMP Covers this Section:

- Forest aesthetics considerations can be incorporated into management planning with little cost to the landowner. Employing forest aesthetics considerations into the management plan can produce a much more visually appealing experience on property visits for owners, their guests and passers-by using nearby public roads. This LMP addresses aesthetic issues relevant to each of the common forest types in the region in their respective sections.

STANDARD 7 Protect Special Sites

Performance Measure 7.1 Forest management activities shall consider and maintain any special sites relevant on the property.

- **Indicator 7.1.1** Landowner shall make a reasonable effort to locate and protect special sites appropriate for the size of the forest and the scale and intensity of forest management activities.

How the LMP Covers this Section:

- Special sites of biological and geological significance may be identified through consultation undertaken related to the identification of FORIs and threatened or endangered species and communities (within Standard 5). In addition to publicly recognized special sites, landowners may designate sites of personal significance to them, such as a spot their grandparents cherished.

- Landowners or designated representatives shall identify special sites on management plan maps and, where appropriate, on the ground. However, some landowners may choose not to identify some special sites on a map or on the ground to protect these sites from vandalism or overuse. Landowners or designated representatives shall make efforts to protect any known special sites especially during forest management activities. These efforts may include creating a vegetation buffer, fencing the area or otherwise distinguishing it from surrounding areas. Because special sites are often in the ground, measures may be taken to control erosion and limit soil disturbance. Landowners and designated representatives are advised to review their special sites map and protection plan with qualified natural resource professionals and qualified contractors assisting in forest management activities. After harvests, landowners and designated representatives are encouraged to follow up to ensure adequate protection.

STANDARD 8 Forest Product Harvest and Other Activities

Performance Measure 8.1 Landowner should use qualified natural resource professionals and qualified contractors when contracting for services.

- **Indicator 8.1.1** Landowner should seek qualified natural resource professionals and qualified contractors.
- **Indicator 8.1.2** Landowner should engage qualified contractors who carry appropriate insurance and comply with appropriate federal, state and local safety and fair labor rules, regulations and standard practices.
- **Indicator 8.1.3** Landowners should retain appropriate contracts or records for forest product harvests and other management activities to demonstrate conformance to the Standards

Performance Measure 8.2 Landowner shall monitor forest product harvests and other management activities to ensure they conform to their objectives.

- **Indicator 8.2.1** Harvest, utilization, removal and other management activities shall be conducted in compliance with the landowner's objectives and to maintain the potential of the property to produce forest products and other benefits sustainably.

How the LMP Covers this Section:

- When conducting forestry activities, landowners must ensure that their actions and those taken on their behalf are in conformance with both the landowner's objectives and the ATFS Standards. To safeguard landowners from liability risks and protect their assets, landowners are encouraged to work with qualified natural resource professionals and contractors and review the Standards before planning management activities. There is a website (http://floridaforest.org/programs/master-logger/master-logger-search-tool/) that provides landowners with loggers certified as "Master Loggers" by the Florida Forestry Association in order to protect landowners from liabilities while also providing a quality service. If the landowner's objectives do not specify directives as to harvest, utilization and removals, regional norms and accepted practices are expected.
- Examples of forestry activities requiring review for AFF Standards compliance:
  - Harvest operations including timber and nontimber products
  - Site preparation and reforestation
  - Forest road construction and maintenance
  - Mineral extraction

- Hunting and fishing
- Invasive species control
- Pest management

- Landowners are encouraged to discuss liability issues with their insurance agent and their attorney to gain a perspective on appropriate insurance minimums that they might require of contractors. When agreeing upon the terms of the contract, landowners and designated representatives are encouraged to stipulate that contractors must follow all relevant laws and regulations and should specify that appropriate state forestry BMPs must be adhered to. A qualified natural resource professional can help with this process.
- Other contract specifications might include:
  - Protection of special sites or habitats
  - Adherence to labor laws
  - Requirements for adequate insurance
    - Protection of soil and water integrity
    - Residual tree damage
    - Forest road maintenance and restoration
    - Fence and gate protection and/or restoration
    - Litter control
    - Hazardous material spill prevention and clean-up
  - Generally, landowners are encouraged to retain contracts or records for management activities for three years.

1.4. Forest Stewardship Program Standards within the LMP

The Forest Stewardship Program (FSP) encourages long-term stewardship of important State and private forest landscapes, by assisting landowners to more actively manage their forest and related resources. The Program aids owners of forest land and other lands where good stewardship, including agroforestry applications, will enhance and sustain the long-term productivity of multiple forest resources and produce healthy, resilient forest landscapes. Special attention is given to landowners in landscape areas identified by State Forest Action Plans and those new to, or in the early stages of managing their land in a way that embodies multi-resource stewardship principles. The program provides landowners with professional planning and technical assistance they need to keep their land in a productive and healthy condition. Assistance offered through the FSP also provides landowners with enhanced access to other USDA conservation programs, forest certification programs, and forest product and ecosystem service markets. Participation in the FSP is open to any non-industrial private forest landowners who are committed to the active management and stewardship of their forested properties for at least ten years. The FSP is not a cost share program. Cost-share assistance for plan implementation may be available through other programs. A supplemental document with objectives, operation table and map can be provided. The FSP Standards were addressed and evaluated during the completion of this LMP.

1.5. A Forester's Field Guide for Using the Landscape Management Plan with Landowners

This guide is designed as a resource for foresters in using the landscape management plan to effectively support landowners, while streamlining administrative and related elements of landowner engagement.

The landscape management plan is designed as a tool that foresters and other natural resource professionals may use to support landowners in their on-the-ground engagement that allows for economical access to programs that provide recognition of their stewardship and technical assistance and resources. While coordination with a landowner will likely be structured organically in a conversational tone and format, this field guide provides forest resource professionals a more structured approach to ensure all components of the LMP are addressed to meet certification standards. For instance, in some scenarios the initial meeting may occur anywhere (e.g. on the phone, in the office, on another landowner's property). It is important to capture as much pertinent information about the property, it's history, size and location, and the general goals and objectives of the landowner. Using the information you obtain during this initial conversation, you will be more prepared for your meeting on the landowner's property.

Step 1 Preparing to Meet the Landowner

- Use the current LMP geodatabase to locate and characterize the landowner's property
  - Develop location and soils maps (NOTE: this may also be used to aid determination of applicable forest types)
  - ID additional property characteristics (e.g. special sites, listed species potential, invasive concerns)
  - Determine current forest type(s) and acreage – may be verified during onsite consultation
- Review Typical Landowner and Landscape Objectives for the existing forest types anticipated on the property

Step 2 Meeting the Landowner

- Identifying Objectives:
  - Discuss the objectives of the landowner (during initial conversation and/or during onsite follow-up)
  - Probe each objective identified by the landowner to ensure you understand the underlying motivations and goals for the property. The landowner may have multiple objectives or difficulty articulating the objectives as they are described in the LMP. A clear understanding of the landowner's objectives streamlines the options needed to meet those objectives.
  - Review and suggest other objectives and how they may also meet the landowner underlying goals. This may initiate a re-evaluation of landowner objectives.
- Review and discuss potential landscape objectives (if applicable) to determine if any correlations or commonalities exist with the landowner's objectives to support wider conservation goals. The landowner may be unaware of or gain interest in specific landscape objectives, creating a re-evaluation of landowner objectives. Some landowners may not be interested in or have objectives that share commonalities with landscape objectives. In either scenario, landowners are not required to commit to any landscape objectives or requirements.

- Based on the review of the landowner and potential landscape objectives, and the analysis of current site conditions, determine a target forest type(s) and the forest resources available to landowner. This forest type(s) could be different or the same as the current forest type on the property.
- Based upon landowner objectives, potential landscape objectives, target forest type(s) and the geodatabase review, identify an actionable strategy using the silvicultural options identified in the LMP (by forest type) to meet the objectives.
- Provide advice, contacts, and technical support to the landowner of the implementation of the identified silvicultural options. Encourage or aid the landowner to document and retain records of the activities occurring on the property.

Step 3 After the Visit

- Contact the landowner and provide answers to any questions you were unable to answer during the visit. Additionally, prompt the landowner if they had any additional questions or comments arise following the last meeting. Provide additional support and encouragement for implementing the activities identified during the meeting. This follow-up is encouraged to occur between one week and one moth following the meeting.
- Complete and process any paperwork or certification submittals required following the meeting.
- Using a landscape management tool makes follow-up support to landowners even more important. With no written plan, the LMP depends on the relationship and engagement of the landowner and forest resource professional to meet the criteria for certification. This LMP allows landowners the flexibility to adaptively manage the property based on the results of silvicultural operations, gaining additional information (e.g. listed species), changing ecological (e.g. sea level rise) or market conditions (e.g. timber markets), and especially changing landowner (and landscape) objectives. Therefore, following up with the landowner not only promotes their engagement in active management but also allows them to modify their management strategies to meet these other dynamic conditions.
- Make a note in the relevant system of when follow-up should occur.
- Contact the landowner within a reasonable time period to schedule a visit, assess activities implemented, determine if any changes have occurred to objectives, determine if personal circumstances and/or the property have changed; this type of follow-through, is encouraged. Provide additional advice and technical support to the landowner, as needed, such as a potential supplemental document with objectives, an operations table, and a map of the property. Depending on the forest type and the silvicultural options selected, a longer period between contact with the landowner may occur. Optimistically, landowner should be contacted annually to promote and foster their engagement in the active management of their property.

This guide also can be utilized for landowners with existing and/or outdated plans. The same process should be followed when replacing the existing or outdated plan, although much of the information needed for the initial step (1) may have already been completed. Additionally, the existing plan can be used during a review of the landowner's objectives, forest types and resources, and implementation activities. The additional information found in this LMP and the geodatabase will then be used to supplement and replace the existing plan.

1.6. A Landowner's Field Guide for Using the Landscape Management Plan

This section is meant as a guide and resource for landowners in using the landscape management plan to effectively interact with foresters, while streamlining administrative and related elements of engagement.

The landscape management plan is designed as a tool that foresters and other natural resource professionals may use to support landowners in their on-the-ground engagement that allows for economical access to programs that provide recognition of their stewardship and technical assistance and resources. While a landowner's interaction with a forester will likely be structured organically in a conversational tone and format, this field guide provides landowners additional knowledge of the process and a more structured approach to ensure all components of the LMP are addressed to meet certification standards. For instance, in some scenarios the initial meeting may occur anywhere (e.g. on the phone, in the office, on another landowner's property). Using the information you obtain during this initial conversation, you will be more prepared for the meeting with the forester on your property.

Step 1 Preparing to Meet the Forester

- Use the current LMP geodatabase to locate and characterize the natural features present on your property
  - Identify additional property characteristics (e.g. special sites, listed species potential, invasive concerns) that may need to be discussed with the forester
  - Determine current forest type(s) and acreage
- Review Typical Landowner and Landscape Objectives for the existing forest types anticipated on your property

Step 2 Meeting the Forester

- Identifying Objectives:
  - Discuss the objectives you have for the future management of your property (during initial conversation and/or during onsite follow-up)
  - Develop a method to communicate your objectives clearly to the forester. You may have multiple objectives or may need to phrase the objectives as they are described in the LMP.
- Review and discuss potential landscape objectives with the forester (if applicable) to determine if any correlations or commonalities exist with the objectives to support wider conservation goals. The forester may suggest possible landscape objectives that would be applicable to your specific situation or the properties/location of your land.
- Based on the review of your personal and potential landscape objectives, and the analysis of current site conditions, work with the forester to determine a target forest type(s) and the forest resources needed and available for this/these specific objectives(s). This forest type(s) could be different or the same as the current forest type on the property.
- Based upon the objectives you have for your land, potential landscape objectives to may be applicable, target forest type(s), and the geodatabase review, work with the forester to identify an actionable strategy using the silvicultural options identified in the LMP (by forest type) to meet the objectives.

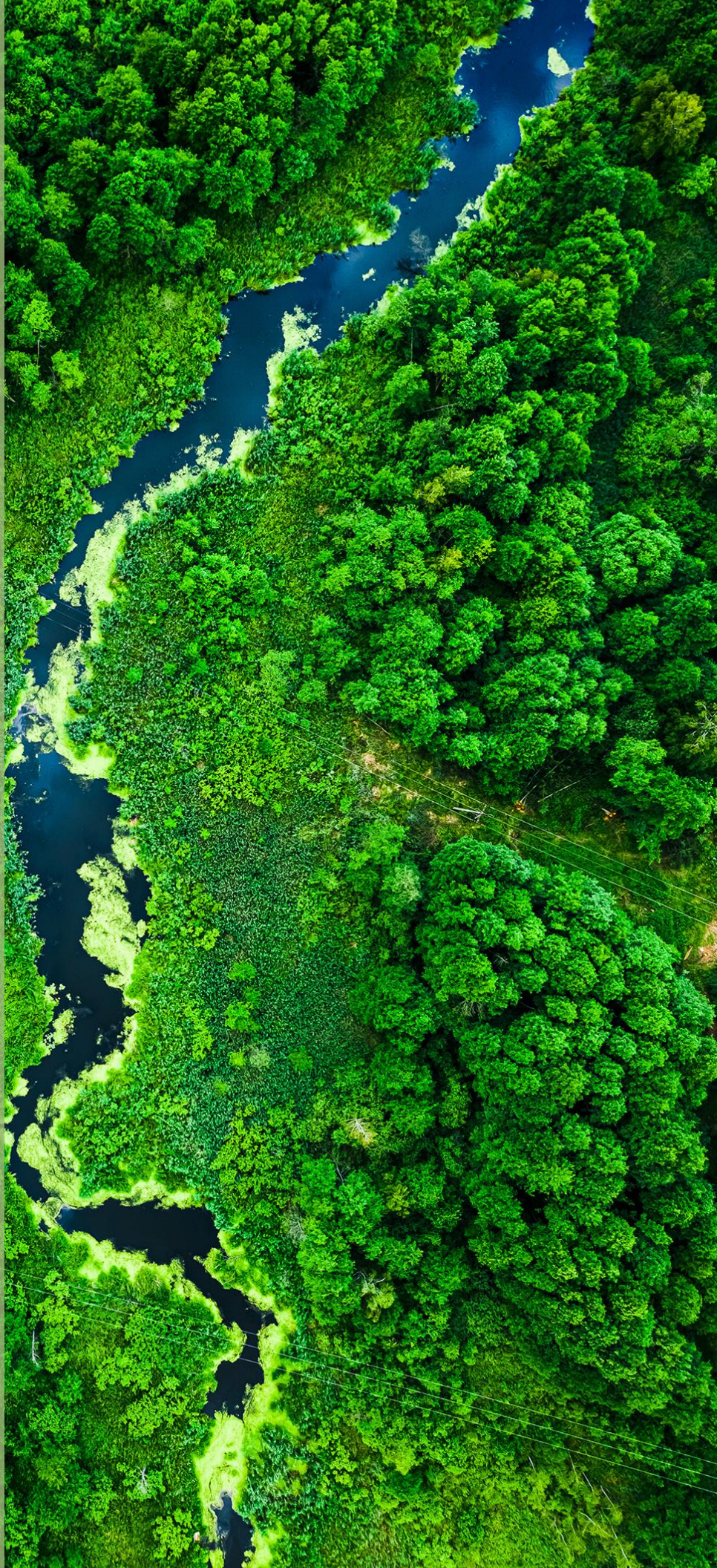
Step 3 After the Visit

- Contact the forester with any questions that may have been unanswered during the visit or that may have arisen since last communication with the forester. This follow-up is encouraged to occur between one week and one month following the meeting.
- The LMP method depends on the relationship and engagement of the landowner and forest resource professional to meet the criteria for certification. This LMP allows landowners the flexibility to adaptively manage the property based on the results of silvicultural operations, gaining additional information (e.g. listed species), changing ecological (e.g. sea level rise) or market conditions (e.g. timber markets), and especially changing landowner (and landscape) objectives. Therefore, following up with the forester resource professional not only promotes engagement in active management but also allows modification of management strategies to meet these other dynamic conditions.
- Expect the forester to be in contact to schedule a follow-up visit, assess any activities implemented, determine if any changes have occurred to objectives, and determine if personal circumstances and/or the property have changed. This type of follow-through is highly valuable to ensuring completion of any land management goals. Ask any additional questions and bring up any new concerns to the forester, as needed. A supplemental document with objectives, operation table and map can be provided. Depending on the forest type and the silvicultural options selected, a longer period between contact with the forester may be appropriate. This level of contact should occur at least annually to encourage active, thoughtful management of the property.

This guide also can be utilized for landowners with existing and/or outdated plans. The same process should be followed when replacing the existing or outdated plan, although much of the information needed for the initial step (1) may have already been completed. Additionally, the existing plan can be used during a review of the landowner's objectives, forest types and resources, and implementation activities. The additional information found in this LMP and the geodatabase will then be used to supplement and replace the existing plan.

2

Site Specific Character-ization Through Geodatabase Tools



2. SITE SPECIFIC CHARACTERIZATION THROUGH GEODATABASE TOOLS

To adequately determine the existing conditions present on any reference site evaluated using this LMP, a GIS-based evaluation tool was developed for this process. This geodatabase represents the accumulation and organization of the most site-specific geospatial characterization tools that are publicly available within the LMP. The strategic goal of this geodatabase is to provide forest resource professionals with a geospatial tool that presents tabular data helpful in developing forest management goals and recommendations.

2.1. Instructions for Use

This geodatabase will require a geographic information system (GIS) to view, summarize and manipulation both the geospatial and tabular data included. Numerous fee-based and free shareware style geospatial applications are available and accessible for natural resource professionals.

The geodatabase is designed to allow the user to calculate and summarize data for each geodatabase layer on the landowner's parcel of property. By selecting the landowner's tract location (Parcels10) using publicly available county tax records, the exact location of the reference parcel can be identified. Multiple parcels can also be selected simultaneously if landowner property boundaries encompass multiple tax parcels. After identifying the referenced property, users can toggle and select between individual and/or multiple geospatial resource layers that will present summarized tabular data for the selected location. For instance, a user could determine the haul distance to specific product mills and develop detailed soil and potential hydrologic impact maps to determine harvesting operations. Likewise, users could quickly determine which potential threatened and endangered species or nearby invasive species could be present on their referenced site.

2.2. Geodatabase Layer Descriptions

The following 23 geospatial layers and aerial imagery layers comprise the LMP geodatabase used for site specific characterization of subject landowner properties. Each layer is referenced by its name within the geodatabase and information is provided about the source layers' name, location, and a brief description of the content found within the layer.

1. Historical Structures

- Layer Source Name: Historical Structure Locations in Florida-July 2016, FGDL
- Description: This dataset contains historic structure locations and attributes as recorded at the Florida Master Site File.
- Layer Source Location: http://www.fgdl.org/metadataexplorer/explorer.jsp

2. Cemeteries

- Layer Source Name: U.S. Geographic Names Information System Cemeteries, 2018, ESRI
- Description: This dataset contains historic cemetery boundaries and basic cemetery attributes as recorded at the Florida Master Site File. The points represent physical and cultural geographic features located throughout the United States and its Territories.
- Layer Source Location: http://www.fgdl.org/metadataexplorer/explorer.jsp

3. Wetlands

- Layer Source Name: USFWS National Wetlands Inventory-Polygons-October 2014, FGDL
- Description: This data set represents the extent, approximate location and type of wetlands and deepwater habitats in the conterminous United States. These data delineate the areal extent of wetlands and surface waters as defined by Cowardin et al. (1979). Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and near shore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery. By policy, the Service also excludes certain types of "farmed wetlands" as may be defined by the Food Security Act or that do not coincide with the Cowardin et al. definition. Contact the Service's Regional Wetland Coordinator for additional information on what types of farmed wetlands are included on wetland maps
- Layer Source Location: http://www.fgdl.org/metadataexplorer/explorer.jsp

4. Hydrologic Units

- Layer Source Name: Watershed Boundary Dataset – 2018, USGS
- Description: The Watershed Boundary Dataset (WBD) is a nationally consistent watershed dataset that is subdivided into 6 levels (12-digit HUCs) and is available from the USGS and USDA-NRCS-National Cartographic and Geospatial Center's (NCGC).
- Layer Source Location: https://water.usgs.gov/GIS/huc.html

5. Hydrology

- Layer Source Name: National Hydrography Dataset – 2018, USGS
- Description: National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD data was originally developed at 1:100,000-scale and exists at that scale for the whole country. This high-resolution NHD, generally developed at 1:24,000/1:12,000 scale, adds detail to the original 1:100,000-scale NHD. (Data for Alaska, Puerto Rico and the Virgin Islands was developed at high-resolution, not 1:100,000 scale.) Local resolution NHD is being developed where partners and data exist. The NHD contains reach codes for networked features, flow direction, names, and centerline representations for areal water bodies. Reaches are also defined on waterbodies and the approximate shorelines of the Great Lakes, the Atlantic and Pacific Oceans and the Gulf of Mexico. The NHD also incorporates the National Spatial Data Infrastructure framework criteria established by the Federal Geographic Data Committee. The NHD is a national framework for assigning reach addresses to water-related entities, such as industrial discharges, drinking water supplies, fish habitat areas, wild and scenic rivers. Reach addresses establish the locations of these entities relative to one another within the NHD surface water drainage network, much like addresses on streets. Once linked to the NHD by their reach addresses, the upstream/downstream relationships of these water-related entities--and any associated information about them--can be analyzed using software tools ranging from spreadsheets to geographic information systems (GIS). GIS can also be used to combine NHD-based network analysis with other data layers, such as soils, land use and population, to help understand and display their respective effects upon one another. Furthermore, because the NHD provides a nationally consistent framework for addressing and analysis, water-related information linked to reach addresses by one organization (national, state, local) can be shared with other organizations and easily integrated into many different types of applications to the benefit of all.

- Layer Source Location: https://viewer.nationalmap.gov/basic/?basemap=b1&category=nhd&title=NHD%20View#productGroupSearch

6. Federally-Listed Species

- Layer Source Name: U.S. FISH AND WILDLIFE SERVICE ENVIRONMENTAL CONSERVATION ONLINE SYSTEM (ECOS) FEDERALLY LISTED SPECIES-2016, FGDL
- Description: This data set represents federally listed species known to be present in each of the counties that make up the North Florida, Panama City, and South Florida Ecological Services Areas of the U.S. Fish and Wildlife Service. The Environmental Conservation Online System (ECOS) is a gateway web site that provides access to data systems in the U.S. Fish and Wildlife Service (Service) and other government data sources. This central point of access assists Service personnel in managing data and information, and it provides public access to information from numerous Service databases. As of 02/13/2015 the data in this report has been updated to use a different set of information. Results are based on where the species is believed to or known to occur. The FWS feels utilizing this data set is a better representation of species occurrence. Note: there may be other federally listed species that are not currently known or expected to occur in this state but are covered by the ESA wherever they are found; Thus if new surveys detected them in this state they are still covered by the ESA. The FWS is using the best information available on this date to generate this list. The data is not meant as a substitute for site-specific surveys. The code key below and in the User Notes denotes the species designation. Code Key: E=Endangered, T=Threatened, PE=Proposed Endangered, PT=Proposed Threatened, C=Candidate, BGEPA=Bald and Golden Eagle Protection Act.
- Layer Source Location: http://www.fgdl.org/metadataexplorer/explorer.jsp

7. State-Listed Species

- Layer Source Name: Critical Wildlife Areas Florida – 2019, FWC
- Description: Critical Wildlife Areas (CWAs) are established by the FWC under a Florida Administration Code rule to protect important wildlife concentrations from human disturbance during critical periods of their life cycles, such as nesting or migration. For each CWA, the boundaries and periods of time when portions of the area may be posted are defined in the CWA establishment order. Public access is prohibited within CWAs if posted, "Closed to public access." Dogs, vehicles and vessels are also prohibited from posted areas. The boundary may be larger than the posted area due to the dynamic nature of habitat structure and use. Thus, the area closed each year may change.
- Layer Source Location: http://geodata.myfwc.com/datasets/critical-wildlife-areas-florida

8. Critical Habitat

- Layer Source Name: U.S. FWS Threatened & Endangered Species Active Critical Habitat Report
- Description: Spatial data for active proposed and final critical habitat for threatened and endangered species.
- Layer Source Location: http://ecos.fws.gov/ecp/report/table/critical-habitat.html

9. Sea Level

- Layer Source Name: Sea Level Rise
- Description: These layers show the rise of sea level from 0-6 feet.
- Layer Source Location: https://coast.noaa.gov/slrdata/

10. EDDMaps

- Layer Source Name: EDDMaps
- Description: Point data of invasive species collected by EDDMaps users.
- Layer Source Location: https://www.eddmaps.org/tools/

11. Counties

- Layer Source Name: Florida County Boundaries – September 2015, FGDL
- Description: This dataset contains the boundaries of Florida's 67 counties. The interior county boundaries are from the U.S. Census Bureau's TIGER data. The coastal boundaries are from the previous version of Florida County Boundaries (CNTBND) and are used by Florida Department of Transportation's Efficient Transportation Decision Making (ETDM) process for display purposes. GeoPlan maintains three county boundary layers: COUNTYSHORE_ AREAS, CNTBND, and COUNTY. These three layers will all have the same interior boundaries and different coastal boundaries. The interior boundaries come from the MAF/TIGER Database that is updated yearly by the U.S. Census Bureau. The coastal boundaries differ in the following way: 1) COUNTYSHORE_AREAS - FWRI's detailed shoreline layer (updated periodically); 2) CNTBND - moderately generalized shoreline designed for ETDM display, sourced from historic U.S. Census Bureau data; 3) COUNTY - highly generalized shoreline designed for ETDM display, sourced from historic U.S.Census Bureau data.
- Layer Source Location: http://www.fgdl.org/metadataexplorer/explorer.jsp

12. Roads

- Layer Source Name: State Roads

- Description: The State Roads feature class shows State Road locations as derived from event mapping Feature 111, characteristics STROADNO and STRDNUM2 from the FDOT Roadway Characteristics Inventory data. This data represents the information collected and reported as of the most recent inventory performed and may not reflect the current conditions.
- Layer Source Location: https://gis-fdot.opendata.arcgis.com/datasets/d8ce6b8eee2646e6a0b534281e0391a0_0

13. Soil

- Layer Source Name: Soil Survey Spatial and Tabular Data
- Description: This dataset contains the boundaries and descriptions of soil types.
- Layer Source Location: https://gdg.sc.egov.usda.gov/GDGOrder.aspx

14. Parcels > 10 acres

- Layer Source Name: Florida Parcel Data by County – 2018, FGDL
- Description: This dataset contains parcel boundaries for each county in Florida, with each parcel's associated tax information from the Florida Department of Revenue's tax database.
- Layer Source Location: http://www.fgdl.org/metadataexplorer/explorer.jsp

15. Mills

- Layer Source Name: Florida Mills_2016
- Description: Point location data of mills available in the State of Florida.
- Layer Source Location: Primary Forest Products Network https://primary.forestproductslocator.org/mill-map

16. Imagery: World Imagery

- Layer Source Name: ESRI World Imagery, 2019
- Description: This map service presents satellite imagery for the world and high-resolution imagery for the United States and other areas around the world.
- Layer Source Location: http://www.esri.com/software/arcgis/arcgisonline

17. Florida Statewide Land Use Data

- Layer Source Name: Florida Statewide Land Use Land Cover
- Description: This dataset (2012-2017) is a compilation of the Land Use/Land Cover datasets created by the 5 Water Management Districts in Florida based on imagery -- North West Florida Water Management District (NWFWMD) 2015-2016, Suwannee River Water Management District (SRWMD) 2016-2017, St. John's River Water Management District (SJRWMD) 2013-2016, 2013 (Dec 2012 – Mar 2013) - Duval, Bradford, 2014 (Dec 2013 – Mar 2014) - Alachua, Baker, Clay, Flagler, Lake, Marion, Nassau, Osceola, Polk, Putnam, St. John's, 2015 (Dec 2014 – Mar 2015) - Brevard, Indian River, Okeechobee, Seminole, Volusia, 2016 (Dec 2015 – Mar 2016) - Orange, South West Florida Water Management District (SWFWMD) 2017 and South Florida Water Management District (SFWMD) 2014-2016. Codes are derived from the Florida Land Use, Cover, and Forms Classification System (FLUCCS-DOT 1999) but may have been altered to accommodate region differences.
- Layer Source Locations: https://geodata.dep.state.fl.us/datasets/2f0e5f9a180a412fbd77dc5628f28de3_3

18. Florida Managed Areas

- Layer Source Name: Florida Natural Areas Inventory. Florida Managed Areas. 2019.
- Description: The Florida Natural Areas Inventory is the primary source for information on Florida's conservation lands. The Inventory database includes boundaries and statistics for more than 2,600 federal, state, local, and private managed areas, all provided directly by the managing agencies. National parks, state forests, wildlife management areas, local and private preserves are examples of the managed areas included. The shapefile is called FLMA for Florida Managed Areas; updated versions are published quarterly.
- Layer Source Locations: https://www.fnai.org/gisdata.cfm

19. Critical Lands and Waters Identification Project

- Layer Source Name: CLIP Version 4.0. 2019.
- Description: In 2006, the Century Commission for a Sustainable Florida called for an identification of those lands and waters in the state that are critical to the conservation of Florida's natural resources. In response, the Florida Natural Areas Inventory, University of Florida Center for Landscape Conservation Planning, and Florida Fish & Wildlife Conservation Commission collaborated to produce CLIP - the Critical Lands and Waters Identification Project. CLIP is a GIS database of statewide conservation priorities for a broad range of natural resources, including biodiversity, landscape function, surface water, groundwater, and marine resources. CLIP is now being used to inform planning decisions by the Peninsular Florida Landscape Conservation Cooperative, coordinated by the U.S. Fish and Wildlife Service.
- Layer Source Locations: https://www.fnai.org/clip.cfm

20. Wildland Urban Interface

- Layer Source Name: Florida Wildland Urban Interface_1990 to 2010
- Description: The wildland-urban interface (WUI) is the area where houses meet or intermingle with undeveloped wildland vegetation. This makes the WUI a focal area for human-environment conflicts such as wildland fires, habitat fragmentation, invasive species, and biodiversity decline. Using geographic information systems (GIS), we integrated U.S. Census and USGS National Land Cover Data, to map the Federal Register definition of WUI (Federal Register 66:751, 2001) for the conterminous United States from 1990-2010. These data are useful within a GIS for mapping and analysis at national, state, and local levels. Data are available as a geodatabase and include information such as housing and population densities for 1990, 2000, and 2010; wildland vegetation percentages for 1992, 2001, and 2011; as well as WUI classes in 1990, 2000, and 2010.
- Layer Source Locations: http://silvis.forest.wisc.edu/data/wui-change/

21. Fire Boundaries - 2018

- Layer Source Name: 2018_perimeters_dd83
- Description: The Geospatial Multi-Agency Coordination Group, or GeoMAC, is an internet-based mapping tool originally designed for fire managers to access online maps of current fire locations and perimeters in the US. Perimeters are submitted to GeoMAC by field offices. The GeoMAC team attributes the perimeters using the IRWIN (Integrated Reporting of Wildland-Fire Information) system, and then posts them on the GeoMAC website and to an HTTP site for downloading. This file contains all fire perimeters that were processed by the GeoMAC team in 2018. The projection is geographic and the datum is NAD83.
- Layer Source Locations: https://rmgsc.cr.usgs.gov/outgoing/GeoMAC/historic_fire_data/

22. Fire Boundaries - 2019

- Layer Source Name: 2019_perimeters_dd83
- Description: The Geospatial Multi-Agency Coordination Group, or GeoMAC, is an internet-based mapping tool originally designed for fire managers to access online maps of current fire locations and perimeters in the US. Perimeters are submitted to GeoMAC by field offices. The GeoMAC team attributes the perimeters using the IRWIN (Integrated Reporting of Wildland-Fire Information) system, and then posts them on the GeoMAC website and to an HTTP site for downloading. This file contains all fire perimeters that were processed by the GeoMAC team in 2019. The projection is geographic and the datum is NAD83.
- Layer Source Locations: https://rmgsc.cr.usgs.gov/outgoing/GeoMAC/historic_fire_data/

23. Red-cockaded Woodpecker Observation Locations - 2019

- Layer Source Name: Red-cockaded_Woodpecker_Observation_Locations
- Description: This shapefile contains location information on the Red Cockaded Woodpecker collected by various state and federal agencies including the Florida Fish and Wildlife Conservation Commission. There is no attribute data for these RCW locations. Data were compiled by requesting information from a variety of federal, state, and local biologists, RCW researchers, and area managers who provided the information they had on hand. None of the data were collected in any standardized format nor under any certain protocol. Similar data, e.g., date recorded, location accuracy level, active/inactive status, were not collected or maintained between sites. The data set includes locations of active and inactive nest trees and centroids of cluster locations. The best description of those data would be as general locations of where RCWs have previously occurred. We urge caution against their use as definitive representation of RCW occurrence.
- Layer Source Locations: http://geodata.myfwc.com/datasets/606024ebee054e4f89d90fa1a456292f_10

24. Basin Management Action Plans - 2019

- Layer Source Name: BMAP_AREA_APR19
- Description: This dataset contains Basin Management Action Plan (BMAP) areas for the State of Florida. A BMAP (Basin Management Action Plan) is a water quality restoration plan prepared pursuant to Section 403.067(7), Florida Statutes. BMAPs are designed to reduce pollutant loadings to achieve the limitations identified in an adopted Total Maximum Daily Load (TMDL) through a comprehensive set of management strategies --permit limits on wastewater facilities, urban and agricultural best management practices, conservation programs, etc. These broad-based plans are developed with local stakeholders--they rely on local input and local commitment--and are adopted by Secretarial Order and are enforceable. This is an update to the FGDL layer BMAP_AREA_JUN18.
- Layer Source Locations: https://www.fgdl.org/metadataexplorer/explorer.jsp

25. Forests of Recognized Importance

- Layer Source Name: Forests of Recognized Importance Layer
- Description: This dataset contains different component datasets that combine to form an overall FORI spatial layer. The information that composes this FORI layer is State of Florida (Florida Forest Service) and National ()Forests, State of Florida (Florida Department of Environmental Protection) and National (National Park Service) Parks, Florida Wildlife Management Areas (Florida Fish and Wildlife Conservation Commission), National Wildlife Refuges (US Fish and Wildlife Service), Florida Outstanding Waters (FL Department of Environmental Protection), and Special Florida Outstanding Waters (FL Department of Environmental Protection).

3
Ecoregions (Level III)

3. ECOREGIONS (LEVEL III)

The Environmental Protection Agency (EPA) has developed ecoregions to group the continental United States into areas where the type and quality of environmental resources, including biotic and abiotic factors, are generally similar. These resources can include patterns and similarities between geology, soils, vegetation, climate, hydrology, wildlife, and other comparative categories. This division of resources is generated from the research of Omernik (1987) as well as mapping created from collaboration between EPA regional offices, other federal agencies, and state agencies.

Ecoregions are classified into a 4-level Roman numeral scheme, with Level I being the broadest ecoregion category with 12 ecoregion divisions and Level IV being the most specific with 967 ecoregion divisions nationwide. For the purpose of this LMP, the 105 ecoregions contained in the Level III classification were deemed to be specific enough to address the management requirements across the state.

Florida contains 3 Level III and 20 Level IV ecoregions within its borders. From north to south, these Level III ecoregions and their associated Level IV ecoregions are: Southeastern Plains (Southern Pine Plantations and Hills, Dougherty Plain, Tifton Upland, Tallahassee Hills/Valdosta Limesink, Southeastern Floodplains and Low Terraces), Southern Coastal Plain (Gulf Coast Flatwoods, Floodplains and Low Terraces, Gulf Barrier Islands and Coastal Marshes, Southwestern Florida Flatwoods, Central Florida Ridges and Uplands, Eastern Florida Flatwoods, Okefenokee Swamps, Sea Island Flatwoods, Okefenokee Plains, Sea Islands/Coastal Marsh, Big Bend Coastal Marsh), and Southern Florida Coastal Plain (Everglades, Big Cypress, Miami Ridge/Atlantic Coastal Strip, Southern Coast and Islands). It was determined that, while at times certain Level IV ecoregions may exhibit an important distinction in ecology of Florida, the Level IV ecoregions provided too high of a degree of specificity for a LMP designed to focus on landscape-level functions and difference; thus, the Level III ecoregions were selected as the main focus of the LMP.

While the majority of Florida is composed of varying levels of coastal plains and sandy flatwoods, the northern portion of the state begins to transition to rolling tertiary uplands and hills. A brief description of characteristics for each Level 3 ecoregion will be given below. Also, in combination with these descriptions, geospatial analysis of the geodatabase layers listed above in section 2 will provide insight into features that are or may be present within a landowner's parcel. The boundaries of each ecoregion can be displayed with all natural/environmental features shown overlaid in order to give the landowner information about their land as well as the surrounding ecoregion. This information will alert the landowner to any potential listed species or sensitive forest features present in or around their property.

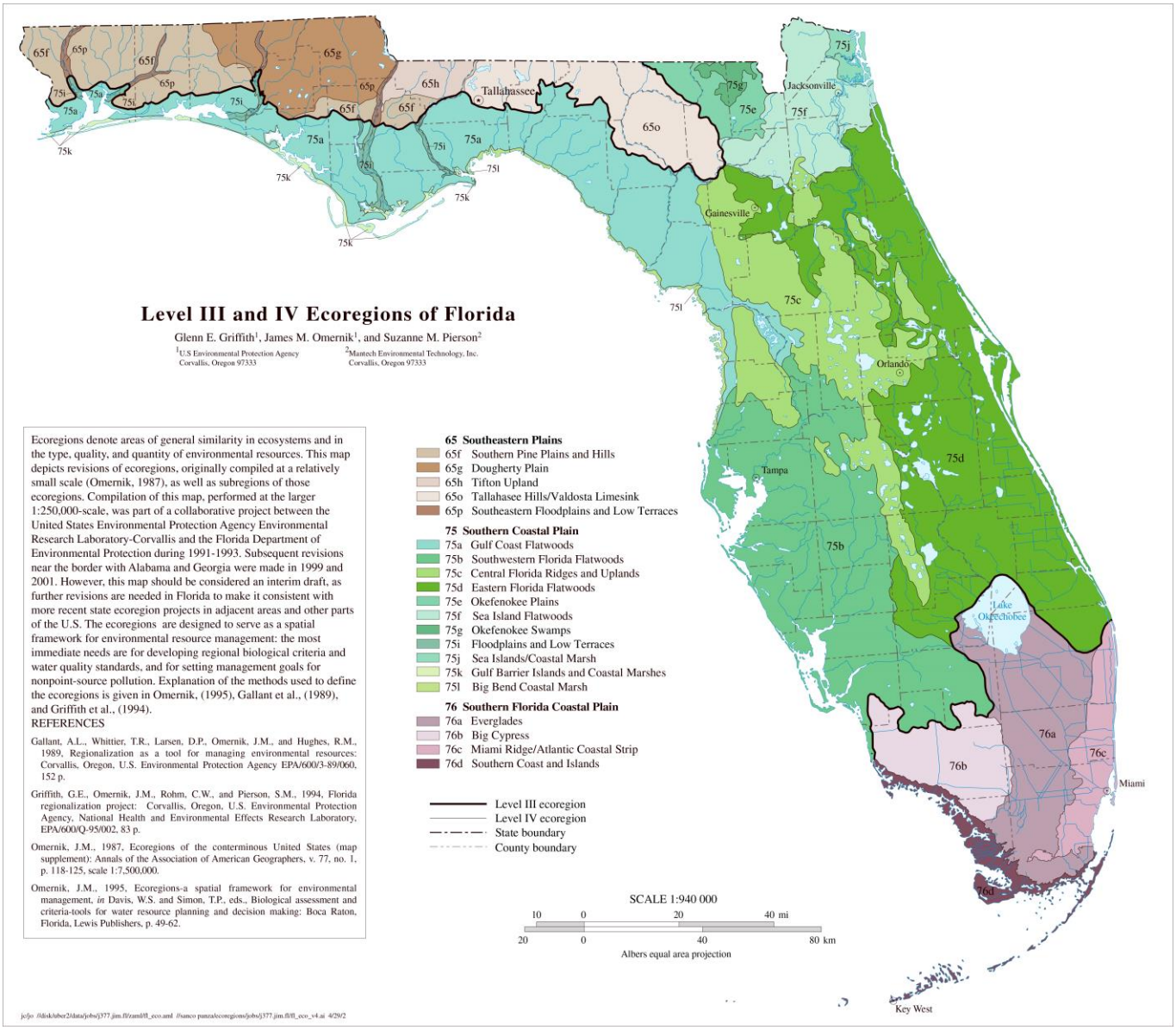


Figure 1 Level III Ecoregions of Florida

3.1. Southeastern Plains

The Southeastern Plains (SP) ecoregion consists of a mixture of cropland, natural woodland, pasture, and forests, with the majority of it covered by trees of some variety. In Florida, the Southeastern Plains is comprised of parts of Alachua, Bay, Calhoun, Columbia, Escambia, Gadsden, Gilchrist, Hamilton, Holmes, Jackson, Jefferson, Lafayette, Leon, Liberty, Madison, Okaloosa, Santa Rosa, Suwannee, Union, Walton, and Washington counties. Within the state of Florida, this ecoregion is predominantly comprised of longleaf and slash pine forest, although pine-oak and mixed hardwood forests exist to a lesser extent. Soils in this ecoregion are mainly acidic sandy loams, silt loams, and sandy clay loams. Topography in the Southeastern Plains differs more widely than both the Southern Coastal Plain and

Southern Florida Coastal Plain, due to this ecoregion being further removed from the coast and the plains associated with the Gulf of Mexico and Atlantic dune systems. Commercial pine plantations are prevalent and extensive, as timber and cattle farming are the predominant land uses in the ecoregion. See Table 1 for the Federally listed species present within the Southeastern Plains. Species ranges were taken from USFWS species range data through map graphics. Information regarding the forest types inhabited by these species can be found below in Section 5.2.3 Wildlife and Habitat Conservation.

Table 1 Federally Threatened and Endangered Species Present Within the Florida Level III Ecoregions

Species	Listing Designation	Southeastern Plains	Southern Coastal Plain	Southern Florida Coastal Plain
Amphibians				
Frosted flatwoods salamander	Threatened	✘	✘	
Reticulated flatwoods salamander	Endangered	✘	✘	
Birds				
Audubon's Crested Caracara	Threatened		✘	✘
Bachman's Wood Warbler	Endangered	✘		
Cape Sable Seaside Sparrow	Endangered			✘
Eskimo Curlew	Endangered			✘
Everglade Snail Kite	Endangered		✘	✘
Florida Grasshopper Sparrow	Endangered		✘	
Florida Scrub-Jay	Threatened		✘	
Ivory-Billed Woodpecker	Endangered	✘	✘	✘
Kirtland's Warbler	Endangered	✘	✘	✘
Piping Plover	Threatened	✘	✘	✘
Red-cockaded woodpecker	Endangered	✘	✘	✘
Roseate Tern	Threatened	✘	✘	✘
Rufa Red Knot	Threatened			✘
Wood Stork	Threatened	✘	✘	✘
Fish				
Atlantic Sturgeon	Endangered	✘	✘	✘
Gulf Sturgeon	Threatened	✘	✘	
Okaloosa Darter	Threatened	✘		
Shortnose Sturgeon	Endangered		✘	
Mammals				
Anastasia Island Beach Mouse	Endangered		✘	
Choctawhatchee Beach Mouse	Endangered	✘		
Florida Bonneted Bat	Endangered		✘	✘

Species	Listing Designation	Southeastern Plains	Southern Coastal Plain	Southern Florida Coastal Plain
Florida Panther	Endangered	✘	✘	✘
Florida Salt Marsh Vole	Endangered		✘	
Gray Bat	Endangered	✘		
Indiana Bat	Endangered	✘		
Key Deer	Endangered			✘
Key Largo Cotton Mouse	Endangered			✘
Key Largo Woodrat	Endangered			✘
Lower Keys Rabbit	Endangered			✘
Perdido Key Beach Mouse	Endangered	✘		
Red Wolf	Endangered	✘	✘	✘
Rice Rat	Endangered	✘	✘	✘
Southeastern Beach Mouse	Threatened		✘	✘
St. Andrew Beach Mouse	Endangered	✘		
Reptiles				
American Alligator	Threatened	✘	✘	✘
American Crocodile	Threatened			✘
Atlantic Salt Marsh Snake	Threatened		✘	✘
Bluetail Mole Skink	Threatened		✘	
Eastern Indigo Snake	Threatened	✘	✘	✘
Sand Skink	Threatened		✘	

3.1.1. Forest Types Within Ecoregion

The SP supports a wide range of different forest types and natural communities. The flat topography and fertile soils of the region make good habitat for both upland and bottomland forest types, with the bottomland forests occurring mainly in riparian areas. Pine forest types are the most abundant forest throughout the SP, although all Florida forest types, with the exception of tropical hardwoods, can be found within this ecoregion.

3.2. **Southern Coastal Plain**

The Southern Coastal Plain (SCP) ecoregion is an extensive portion of land, stretching from southern South Carolina west through Florida, Alabama, and Mississippi before stopping at Eastern Louisiana. In Florida, the Southern Coastal Plains is comprised of parts of Alachua, Baker, Bay, Bradford, Brevard, Broward, Calhoun, Charlotte, Citrus, Clay, Collier, Columbia, Dade, DeSoto, Dixie, Duval, Escambia, Flagler, Franklin, Gadsden, Gilchrist, Glades, Gulf, Hamilton, Hardee, Hendry, Hernando, Highlands, Hillsborough, Holmes, Indian River, Jackson, Jefferson, Lafayette, Lake, Lee, Leon, Levy, Liberty, Madison, Manatee, Marion, Martin, Monroe, Nassau, Okaloosa, Okeechobee, Orange, Osceola, Palm Beach, Pasco, Pinellas, Polk, Putnam, Santa Rosa, Sarasota, Seminole, St. Johns, St. Lucie, Sumter, Suwannee, Taylor, Union, Volusia, Wakulla, Walton, and Washington counties. Along with the coastal plains and lowlands, this

ecoregion also encompasses barrier islands, coastal lagoons, marshes, and swampy lowlands along the coast. This low, flat ecoregion supports a variety of habitats that thrive on its sandy soil, which once included longleaf pine flatwoods and savannas in addition to a variety of other pine and hardwood species tolerant of wet, sandy soils. Current land cover in this ecoregion now mainly consists of mainly loblolly and slash pine with scattered instances of hardwood forests, bottomland hardwoods, and pastureland, especially in the interior peninsula of Florida. See Table 1 for the Federally listed species present within the Southern Coastal Plains.

3.2.1. Forest Types Within Ecoregion

The SCP supports a wide range of different forest types and natural communities and represents a transition in forest types from the more northern SP. While the SCP has flat topography similar to the SP, the soils of this ecoregion are sandier due to an increased proximity to the Gulf of Mexico and Atlantic Ocean. These depleted, infertile soils are more suitable for predominantly longleaf and slash pine forest types, although the other pine forest types may be found to some degree. All the other Florida forest types are found within the SCP to a varying degree, with their locations dependent mostly on topography and proximity to the coast.

3.3. **Southern Florida Coastal Plain**

The Southern Florida Coastal Plain (SFCP) ecoregion is largely a continuation of the Southern Coastal Plain that encompasses the far southern portion of the Florida peninsula into the Florida Keys. The SFCP is comprised of parts of Broward, Collier, Dade, Glades, Hendry, Lee, Martin, Monroe, Okeechobee, and Palm Beach counties. As opposed to all other ecoregions within the conterminous United States, the Southern Florida Coastal Plain has a frost-free climate. Like the Southern Coastal Plain, this ecoregion contains relatively flat topography and sandy substrate due to its proximity to the coast. The soils of the SFCP are typically wet and sandy, and the habitat present within this ecoregion include mostly marsh, swamp, glades, and palmetto prairies. Some very sparse scattered forest lands can be found in the Miami Ridge/Atlantic Coastal Strip Level IV ecoregion within the SFCP. The majority of this ecoregion has undergone extensive hydrological and biological alteration due to widespread urban development. See Table 1 for the Federally listed species present within the Southern Florida Coastal Plain.

3.3.1. Forest Types Within Ecoregion

The SFCP is mainly devoid of Florida forest types due to its small percentage of forest habitat. Aside from the coastal marsh, palmetto prairies, and Everglades habitat that comprises the majority of the SFCP, upland hardwood forest types (in the form of Tropical Hardwood forest types or coastal live oak forests) represent the majority of upland forest types while scattered tupelo-cypress mixed forest types represent the majority of hydric forest types. Pines are largely absent from the SFCP due to soil salinities and the hydric nature of the habitat.

3.4. **Ecoregions Application to Landscape Management Plan**

Ecoregions are an important and distinct division of the landscape that takes into consideration geographical landforms, natural features (soils, vegetation, etc.), species populations, climate, and other environmental factors. It is important for landowners to realize the properties of the ecoregion in which they are located, as these features will be more or less applicable to certain landscape and/or landowner objectives and may drive the consideration of how to manage one's property.

While landowner objectives are somewhat standard across the different ecoregions, as a landowner will have similar goals independently of their location, some landscape objectives vary more greatly depending on the ecoregion. For

example, if the landscape objective identified by the landowner is to support healthy forest products, the ecoregion where the landowner resides will have an effect on what types of forest products to develop on their land. While pine forest products and the mills that process them are more prevalent in the SP and to an extent the SCP ecoregions, the SFCP ecoregion and its landscape does not support this industry.

The protection of wildlife populations and species, if it is the goal of the landowner, differs by ecoregion as well. As seen in Table 1, species have a certain niche and preferred environment where they are found. For instance, a landowner interested in preserving and enhancing habitat for the frosted flatwood salamander should have land located in the SP and SCP where the landscape provides the vernal wetlands surrounded by pine forest needed for this species to exist; trying to provide habitat for this species within the SFCP would provide no benefit as it is out of their range. In addition to landowners' independent efforts to protect species and their related habitats, Conservation Initiatives have a geographic range where they can be applied. The National Bobwhite Conservation Initiative (NBCI) is most applicable in the northern ecoregions of Florida due to the abundance of potential bobwhite habitat.

The landscape objective of Ecological Restoration also varies by ecoregion. The longleaf pine and wiregrass community is a good restoration example. Many landowners in the SP and to a lesser extent the SCP ecoregions own land with deep, well-drained sandy soils that were historically populated by native longleaf pine communities. Since longleaf pine also can meet aesthetic, recreation, legacy planning, and revenue objectives, many landowners are interested in its restoration. Landowners in the SFCP ecoregion, however, would not have this option of longleaf restoration due to their location outside of longleaf habitat within the state. Other restoration opportunities may be available in these ecoregions, however, such as shortleaf pine initiatives. It is important to understand the restoration opportunities available to landowners within each ecoregion in the state.

4

Hydrologic Categories

4. HYDROLOGIC CATEGORIES

The United States Geological Survey (USGS) has developed the hierarchical system of Hydrologic Unit Codes (HUCs) in order to categorize and group waterbodies and watersheds of the U.S. There are four main levels of HUCs within the United States, ranging from the broad, 2-digit regions to the 8-digit cataloging unit, more commonly known as sub-basins. Sub-basins can then be further subdivided into 10-digit watersheds and 12-digit subwatersheds. For the purpose of this LMP, the 4-digit subregions were deemed appropriate to address the management requirements and landscape differences across the state.

Florida contains all or part of eight 4-digit subregions (Figure 2): 0307-Altamaha – St. Marys, 0308-St. Johns, 0309-Southern Florida, 0310-Peace – Tampa Bay, 0311-Suwannee, 0312-Ochlockonee, 0313-Apalachicola, and 0314-Choctawhatchee – Escambia. Within these 4-digit subregions, Florida has 53 distinct 8-digit watersheds. These 8-digit HUCs, as mentioned above, represent too specific an area for a Landscape Management Plan due to no large-scale landscape differences existing within these divisions. These 8-digit HUCs can be viewed through the geodatabase tool (see Section 2.2.3). Also, geospatial analysis of the geodatabase layers listed above in section 2 will provide insight into features that are or may be present within a landowner's parcel. The boundaries of each HUC, 2-to-16-digit, can be displayed with all natural/environmental features shown overlaid in order to give the landowner information about their land as well as the surrounding watershed.

There are various watershed improvement and protection programs within the state of Florida. Within the Withlacoochee River drainage basin, there exists the Withlacoochee River Watershed Initiative (WRWI). This initiative was started by the Southwest Florida Water Management District (SWFWMD) and strives to study the Withlacoochee and its surrounding basin from the Green Swamp in Central Florida to the Gulf of Mexico (SJRWMD 2019). This watershed has experienced a number of manmade alterations to its multiple different natural habitats that have affected its overall behavior. Goals of the program are to perform field investigations coupled with hydrology/hydraulics studies of the river to understand how the Withlacoochee River system functions; this data will then be used to develop a computer model of the entire river that predicts how varying scenarios affect its flow and dynamics.

Another initiative that involves multiple watersheds within Florida is the Gulf of Mexico Initiative (GoMI) through the Natural Resources Conservation Service (NRCS). The GoMI helps producers in Florida as well as other gulf-bordering states improve water quality and ensure sustainable production of crops and timber. This initiative was established following the 2010 Deepwater Horizon oil spill and focuses efforts on key areas of concern among water quality, wetland restoration, and wildlife habitat improvement in two areas in Florida: the Middle Suwannee River Watershed and the Escambia/Blackwater River Watershed. Interested participants must apply to the program through the Environmental Quality Incentives Program (EQIP).

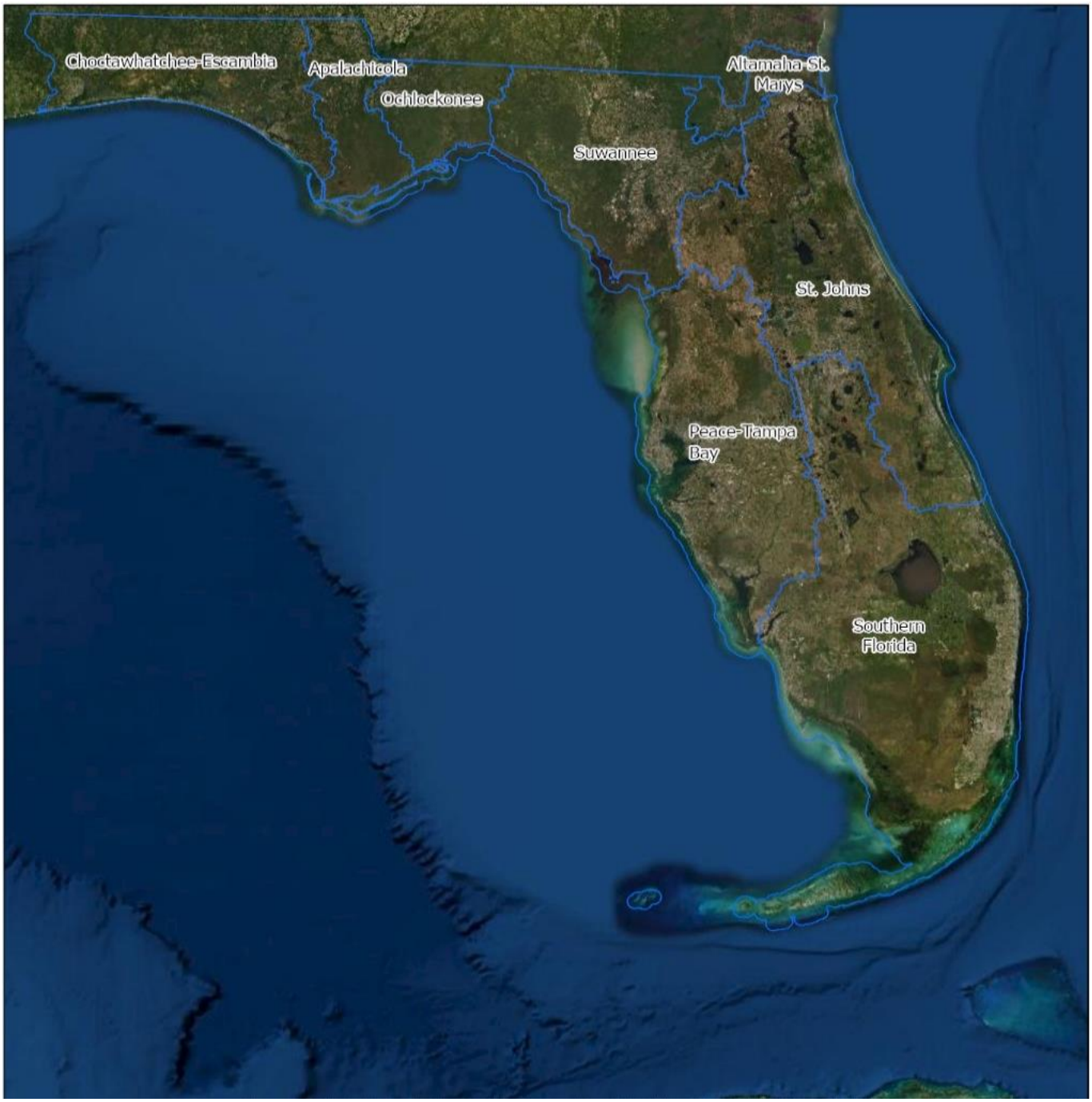


Figure 2 The 4-Digit Hydrologic Unit Codes (HUCs) of Florida

5
Objectives

5. OBJECTIVES

Forest management objectives generally fall into two major levels of classification: Landowner and Landscape Objectives. Landowner objectives are those considerations important to individual landowners upon which achievement measures the relative success or failure of the management in their perspective. These objectives can be used by forest resource professionals to provide, design, and implement services important to the landowner. Landowner objectives are often easily determined because they are also considered forest resources common to all forest types (e.g., aesthetics and recreation). Landscape objectives are those objectives identified on a national and/or ecoregional level that provide the greatest benefit towards forested ecosystem restoration, maintenance, and enhancement. Landowner objectives may also change or adapt after becoming aware of landscape objectives.

Generally following the determination of a landowner's objectives, forest resource professionals can identify the landscape level objectives that the landowner objectives support. Landowner and landscape level objectives can be the same (e.g., hydrologic protection and conservation) or provide opportunities to support and enhance each other. For example, a landowner may consider their primary objectives Wildlife Management and Ecological Restoration. Through forest management activities to promote these objectives, the landowner could also be supporting landscape objectives like Wildlife Habitat Management, Rare Plant and Animal Protection, Non-native and Invasive Species Management, and in some cases Utilization of Prescribed Fire and/or Longleaf Pine Restoration.

5.1. Landowner Objectives

The following common landowner objectives considered under this LMP were derived from the USDA NWOS Results and Observations (Butler et al 2016) and the Florida Forest Stewardship Program. A general description of each potential landowner objective is discussed relative to its application towards forest management.

5.1.1. Aesthetics

One of the top objectives identified by forestland owners is aesthetics. Landowners seek a certain "look and feel" from the visual appearance of their forests. Forest aesthetics spark a sense of personal landowner pride, stewardship, privacy, and even adventure. Many landowners maintain and enhance their forest aesthetics for their family, community, neighbors and passers-by to enjoy. Forest management activities consistent with the size of the forest, the scale and intensity of forest management activities, and the location of the property tend to increase the aesthetic value. Forest resource professionals can assist landowners with implementing and managing silvicultural options in a manner that increases aesthetic value of the property.

Over the course of time, a wide range of aesthetic objectives can be accomplished with the suite of silvicultural tools within this LMP. Even though many silvicultural tools may produce immediate and temporary results that begin with a decreased aesthetic value, the consistent application and/or long-term results of these operations produce enhanced overall aesthetic value of the forest. For example, the short-term visual conditions produced following a prescribed fire may have minimal aesthetic value, however the resultant functional and aesthetic changes in species composition and midstory and/or nuisance species control becomes evident in just weeks following the burn. Furthermore, the aesthetic condition of consistently burned forestlands increases rapidly with each subsequent prescribed fire event. Likewise, the long-term aesthetic value gained from performing timber thinning operations far

outweighs the short-term optics following harvesting operations. Landowners are rewarded with a sense of pride when their hard work and investment in management activities results in aesthetic accomplishments.

5.1.1.1. Pine Forest Aesthetics

Well managed pine forests often meet some landowner's objective for aesthetics. Mature stands that have been prescribed burned and/or thinned have an open, low-understory structure with large, well-formed pines and little to no midstory. Stands with native groundcover typically have lush green grasses, herbs and shrubs in the spring following prescribed fire and a sea of wildflowers or, in longleaf pine stands, wiregrass in the Fall. Some loblolly, shortleaf, or longleaf pine stands are so open you can see through these rolling forests for a mile or more. Young stands with quality groundcover managed with the LMP's appropriate silvicultural tools have the potential for the same stand structure and aesthetics with time.

Silvicultural tools can be used to maintain and enhance aesthetics. Forest operations can be planned with aesthetics in mind to ensure these objectives are met. For example, when clearcutting a pine stand, a strip of pines can be left as a buffer against adjacent high visibility areas such as roadways or neighboring homes. Or during thinning operations, logging decks can be placed within the stand interior, away from roadways.

5.1.1.2. Hardwood Forest Aesthetics

Hardwood forests have high quality, varying aesthetics across the different forest types that compose this category. The overstory diversity of hardwood forests provides character and variety compared to the pine-dominated forests. Most upland hardwood and mixed floodplain forest types provide rare opportunities in Florida, especially the Panhandle, for Fall foliage colors. While upland Panhandle slope forests provide relatively steep topography and vegetation that are indicative of the Piedmont or Ozark regions of the United States, the aesthetic qualities of mixed floodplains mainly exist in the rivers, creeks, and streams that punctuate mixed floodplain forest types' overstory diversity and uneven-aged structure. Tupelo-cypress mixed forests have their own high-quality aesthetics, with both having a unique form with buttress-based stems and cypress extending knees from their roots. They are often draped with Spanish moss. This gives them a pleasantly eerie and prehistoric look that is quite unique across the landscape. Cypress is one of the few deciduous conifers in the world and turns a stunning auburn in the Fall before dropping its' needles. Swamp tupelo also changes to red, providing some color in a relatively bland Florida Fall.

Most upland forests in Florida are pine dominated and even-aged, and provide their own type of beauty, but these hardwood forests are less common, natural, uneven-aged and possess a lot of character. These aesthetic characteristics often provide Florida landowners incentives to exclude silvicultural management in these forests, especially those presently in desired future condition. Thus, upland hardwood forests are often preserved for their unique character and beauty.

Silvicultural tools can be used to maintain and enhance aesthetics. Forest operations should be planned with aesthetics in mind to ensure these objectives are met. For example, when clearcutting hardwood stands, a strip of hardwoods can be left as a buffer against adjacent high visibility areas such as roadways or neighboring homes. These forested strips can be managed as an even-aged forest on a cutting cycle that ensures the adjacent stand they are buffering is forested before they are clear-cut, or they can be managed as an uneven-aged forest and passively managed on the same cutting cycle as the even-aged stand they are buffering.

5.1.2. Wildlife Management and Protection

Florida is rich with both game and non-game wildlife species. Many landowners are interested in managing, conserving and protecting these species and their habitat. Simply conserving forestland is a form of wildlife habitat protection. Some landowners wish to take a more active wildlife management role by maintaining, enhancing and restoring wildlife habitat and its components: food, cover, water and space.

Private lands in the state of Florida provide valuable habitat to imperiled species such as red-cockaded woodpecker, Eastern indigo snake, gopher tortoise, pine barrens tree frog, and frosted flatwoods salamander. Many silvicultural tools are available to maintain, enhance and restore habitat for game and non-game species including prescribed fire, timber harvests, groundcover restoration, food plots and wildlife openings.

Florida also has some of the best hunting opportunities in the Southeast in terms of acreage and game quality and quantity. Hunting and revenue from hunting leases are particularly popular landowner management objectives. White-tailed deer, wild turkey, bob-white quail, duck, and feral hog are commonly hunted and managed. Wildlife conservation practices may include managing healthy game species populations through hunting programs such as Quality Deer Management and hunt leases. Landowners often lease their land to hunting clubs or individuals as a form of revenue. This revenue can be used to improve and protect habitat.

The Wildlife BMPs manual compiles strategies and considerations for managing and protecting state-listed species and their habitat during silvicultural operations. The Wildlife BMPs are voluntary practices that are applied at the discretion of the landowner or other person or entity responsible for conducting activities on the property. Landowners and others are not specifically required to enroll in the FDACS Water Quality BMP programs to participate in the Wildlife BMP program; however, water quality BMPs applicable to specified State Imperiled Species must be implemented as indicated on the Wildlife BMP Notice of Intent (NOI). In addition, applicants who enroll by completing a Wildlife BMP NOI and implement the applicable practices are not required to obtain a permit to authorize the incidental take of the 16 State Imperiled Species associated with their operations. The natural resource professional and landowner can survey the land to locate and protect any imperiled species and their habitat prior to some silvicultural activities. The LMP Geodatabase and associated resources can be used to locate any known imperiled species occurrences on a property. Contact a Florida Forest Service BMP Forester or County Forester to discuss the NOI for the wildlife BMPs. It is recommended to get a NOI signed which may protect the landowner with issues that may arise with state listed species.

Although not an exhaustive list, if imperiled species and/or their habitats are located, the following protection measures may be used:

- Limited or seasonal mechanical entry
- Increased management activity (prescribed fire, thinning, etc.)
- Pesticide use considers impacts on listed species
- Residual tree maintenance
- Buffer zone establishment and maintenance
- Hunting or fishing limitations
- Signage or marking of the habitat area
- Communicate sensitive habitat/species locations in contracts; discuss with contractors

In addition to the above-mentioned protection measures, the landowner may also choose to enhance habitat where the species is found. If choosing to participate in ecological restoration or protection, sites that demonstrate a high conservation value, as well as representative areas of the forest types that are found in the forest management unit, should be identified, protected, and, where possible, enhanced. The sites may contain one or more of the following values: diversity of species, ecosystems and habitats, ecosystem services, ecosystems at landscape level, and cultural values. Conservation of the particular type(s) of forest areas found within the forest management unit is essential in protecting the forest's natural resources for this and future generations. Locating these high conservation value sites is aided through utilization of NatureServe Explorer, a GIS-based tool that provides locations of rare and protected plants, animals, and ecosystems of the United States.

Efforts to attempt enhancement of habitat species may include removing nuisance and invasive species or, depending on the species preferred habitat, participating in ecological restoration efforts. State and federally-listed plant species are not legally required for protection unless there is a federal funding nexus on the site or additional landowner objectives require. While it is recognized that protection of endangered or threatened plants may not be legally required, many landowners actively choose to do so as a part of their land management. Also, foresters that assist the landowners make note of these T & E species as a standard practice.

Once a high conservation value or representative forest area are determined to occur within a landowner's property, strategies and actions to maintain these areas using the existing local and national laws and legislations are essential to the protection of these assets. The Wildlife BMPs manual compiles some of these strategies and considerations for managing and protecting these species as well as their habitat during silvicultural operations. A facet of utilizing these strategies should be the periodic monitoring/evaluation of their effectiveness. Although landowners are encouraged to conduct their own periodic monitoring of the high conservation areas on their property, their assessments as a whole are not entirely valid or effective in determining the efficacy of such measures. As the scale of monitoring high value conservation areas is quite large, the applicable local, regional, or federal entities hold responsibility for this task.

The natural resource professional and landowner should plan and implement silvicultural activities with regard to known and visibly apparent species and their habitats. Additionally, guidelines for the protection of certain USFWS Threatened and Endangered (T&E) species can be found through the Environmental Protection Agency's (EPA) threatened and endangered pesticide use guidelines, as well as the USFWS's Landowner Tools site. The LMP Geodatabase and associated resources can be used to locate any known imperiled species occurrences on a property. Although not an exhaustive list, if imperiled species and/or their habitats are located, the following protection measures can be used:

- Conservation zones (or protected areas). Size and location of the conservation zones should conform to national and local legislation and be sufficient to guarantee the continuing presence of the identified species. Conservation zones should be identified and marked on maps and, where necessary, on the ground in a way that is visible when entering the zone; and

- Reduced harvesting methods to protect nesting and breeding sites.

5.1.2.1. Pine Forest Wildlife Habitat Management and Protection

The pine forest types, and their associated natural communities, provide excellent wildlife habitat management and protection opportunities. Many game and imperiled species can be found within pine forests. Game species are more commonly actively managed on private lands while non-game species are managed to a lesser extent.

Hunting is a common wildlife management objective in the pine forest types, particularly for wild turkey, bob white quail, and white-tailed deer. These species benefit from a frequently fire-maintained open, grassy groundcover, with low shrubs and little to no midstory. They also prefer a relatively lower overstory density. Hunting leases are used to manage healthy game populations while also generating revenue to help pay for pine management activities such as prescribed fire.

Pine habitat objectives can be met with various silvicultural options. For example, thinning planted pine stands to a lower overstory density can be more favorable to wildlife or creating small clearcuts through rotational mowing for wildlife openings to diversify habitat and create edge both increase adequate wildlife habitat. Many game and non-game species of pine forests will benefit from these activities including white-tailed deer, wild turkey, bob white quail, gopher tortoise, fox squirrel and red cockaded woodpecker.

Wildlife habitat protection objectives can be met through preservation practices. The more hands-off preservation approach can be used to protect non-game species in healthy, fully functioning pine forests. However, active management with prescribed fire at minimum is required to maintain this forest type and its habitat components.

5.1.2.2. Hardwood Forest Wildlife Habitat Management and Protection

The hardwood forest types, and their associated natural communities, provide excellent wildlife habitat management and protection opportunities. Many game and imperiled species utilize hardwood forest types for mast, browse, or cover throughout the year. Game species are actively managed on private lands while non-game species are managed to a lesser extent.

Hunting is a common wildlife management objective in the hardwood forest types, particularly for white-tailed deer, wild turkey, feral hogs, and gray squirrel. Hunting leases are used to manage healthy game populations while also generating revenue to help pay for management activities such as Non Native Invasive Species (NNIS).

Hardwood habitat objectives can be met with various silvicultural tools. For example, creating small group selection clearcuts for wildlife openings to diversify habitat and create edge. Many game and non-game species will benefit from these activities including white-tailed deer, wild turkey, and within more hydric environments, wood stork.

Wildlife habitat protection objectives can be met through preservation practices. The more hands-off preservation approach can be used to protect non-game species in healthy, fully functioning hardwood forests. However, active management with NNIS monitoring and treatment at minimum is required to maintain this forest type and its habitat components.

5.1.3. Recreation

Many landowners enjoy a variety of active and passive outdoor recreation. From simply hiking their woods and wildlife viewing to hunting and off highway vehicles. Those that live onsite may recreate on their forests daily, others may live across the state or country and only visit during hunting season.

Pine forests and hardwood forests alike are popular recreational areas in Florida, especially in the cooler, drier months. The open, park-like stand structure of pine forests provides a scenic backdrop for a variety of recreational activities. Hardwood forests also provide similar activities, especially when the biting insects subside in cooler months. Below is a table (Table 2) that provides examples of these various forest-related recreational activities.

Table 2 Various Forest-Related Recreational Activities

Hunting and leases	Geocaching
Bicycling	Off-highway vehicles (OHV) and leases
Equestrian	Wildlife viewing and birding
Camping	Hiking
Environmental education	Various Water sport activities

5.1.4. Conservation

For this LMP, conservation is defined as the process of maintaining a natural resource (e.g. forested ecosystem) for perpetual use. This definition inherently associates conservation with the proper use of ecological processes to maintain the forested ecosystem. The term conservation is generally credited to Gifford Pinchot, who served as President Teddy Roosevelt's head of the US Forest Service in the early 20th century (Trefethen 1975).

Some landowners have a conservation objective because they would like to see their forest ownership remain intact and capable of being passed down between generation. Landowners with a conservation objective may utilize other consumptive use objectives like revenue generation or hunting and fishing recreation.

Conservation and legacy planning are both founded upon the desire to ensure future use of a natural resource. Many landowners seek to achieve a balance between conservation and legacy planning objectives by utilizing silvicultural tools to mimic ecological processes (conservation) and restricting human activities outside their interests (legacy planning).

All forest types can be managed in a conservation-oriented manner. This can be accomplished using multiple-use management by balancing utilization and protection of timber, wildlife, rare plants, recreation and hydrology. Pine forests in particular are fire dependent and require frequent application of prescribed fire at minimum for ecological maintenance; hardwood forest types do not require these fire-related management techniques, although some may benefit from them.

Sites within the forest being managed that demonstrate a high conservation value (like Forests of Recognized Importance (FORIs) or critical habitat), as well as representative areas of the forest types that are found in the forest management unit, should be identified, protected, and, where possible, enhanced. The sites may contain one or more of the following values: diversity of species, ecosystems and habitats, ecosystem services, ecosystems at landscape level, and cultural values. Conservation of the particular type(s) of forest areas found within the forest management unit is essential in protecting the forest's natural resources for this and future generations. Locating these high conservation value sites is aided through utilization of the LMP Geodatabase and the NatureServe Explorer, a GIS-based tool that provides locations of rare and protected plants, animals, and ecosystems of the United States.

Once a high conservation value or representative forest area are determined to occur within a landowner's property, strategies and actions to maintain these areas should meet the existing local and national laws and legislations. One component of active management may be the periodic monitoring or evaluation of the landowner strategies' effectiveness. Although landowners are encouraged to conduct their own periodic monitoring of the high conservation areas on their property, their assessments as a whole are not authoritative or effective in determining the efficacy of such measures. As the scale of monitoring high value conservation areas is quite large, the applicable local, regional, or federal entities hold ultimate responsibility for this task.

5.1.5. Legacy Planning

Some landowners have a legacy planning objective because they would like to see their forest ownership remain intact and capable of being passed down between generations. The protection of the forested ecosystem from conversion to development, fragmentation, and/or degradation from alternate uses (e.g. mining) is a benefit of the legacy planning objective, yet it could also be a benefit of the conservation objective.

Landowners that treat their forestland as an untouched "preserve" and do not actively manage their forest will observe changes in forest type more quickly. However, many of Florida's forest types (i.e. pine) are fire dependent and at a minimum require active management with prescribed fire (or equivalent successional and fuel reduction measures) for ecological maintenance.

Conservation and legacy planning are both founded upon the desire to ensure future use of a natural resource. Many landowners seek to achieve a balance between conservation and legacy planning objectives by utilizing silvicultural tools to mimic ecological processes (conservation) and restricting human activities outside their interests (legacy planning).

Pine forests are fire dependent and require frequent application of prescribed fire at minimum for ecological maintenance. These forests are not conducive to legacy planning-oriented, single-use management. Preservation of pine forests will result in long-term succession to hardwood forest due to lack of prescribed fire application.

Some hardwood forest types are more conducive to legacy planning-oriented, single-use management than upland pine and other fire-dependent forest types. However, without active management and landowner engagement this may cause ATFS de-certification.

5.1.5.1. Ownership

5.1.5.1.1. Filing Types

The different ownership forms in which forest property is held is important from a tax standpoint. Additionally, if the forest property is counted as a business, the type of business chosen can also affect the tax structure of the property. Nontax factors can also influence the business type chosen, such as forest management goals, the property's size, consideration of the owner's family, and the potential income needed from the property. The final decision of which ownership form a property should take is dependent on an analysis of these and other factors. Some characteristics of selected ownership types are discussed below, while an overview of the different types available can be found through the Forest Landowners Guide to the Federal Income Tax's Form of Forest Land Ownership and Business Organizations.

Basic Ownership Types

Sole Ownership

Sole ownership is the most basic form of timber property ownership and is composed of one owner controlling every aspect of the property management. This provides the greatest amount of control over the property. A benefit of this ownership type is profit or loss from the business endeavors can be accounted separately from the owner's other income sources.

Co-Ownership

Co-ownership represents the undivided ownership of property by two or more persons. This form of ownership is often used as a simpler form of more complex business arrangements, and transfer of a co-ownership at death can often be completed easily and inexpensively. A potential disadvantage to this ownership type is that business transactions must have the approval of both parties, as one owner does not have autonomy and control. The most common types of co-ownership are Tenancy in Common, Joint Tenancy, and Tenancy by the Entirety.

Business Ownership Types

LLC

A way that forest owners can create a preserved property to pass down through generations is the creation of a corporation (including Limited Liability Company [LLC]). Having forest land under an LLC reduces tax liability from the IRS and strives to ensure that the property is less likely to be divided by heirs in the future. There are four different mechanisms to keep properties intact and in the family for future generations: a family partnership, closely-held S-corporation, qualified trust for conservation purposes, or, as discussed here, an LLC (McEvoy 2003). LLCs offer a level of flexibility to landowners, as the LLC can be dedicated to any purpose (investment, business, conservation, or any combination of motives). LLCs can also offer the benefits similar to the three other aforementioned mechanisms for property ownership: the liability protection of a corporation, pass-through taxation aspects of a partnership, and the ability to limit ownership in the family forest provided by a closely-held S-corporation. Also, LLCs can grow as a family does, as the founders of the LLC can set either fractional family membership, having more than one membership class, or having no limitations with regard to the number of owners.

With this ability of an LLC to set membership classes to distribute responsibility within a family, it is less likely that the property will be split by heirs over time. If a property is split once, the likelihood of it being further split and developed is much greater than if the entire property remains intact under the LLC mechanism. The LLC can allow family members to share in the receipt of both tangible and intangible forest benefits, but without the strain of any one family member feeling the burden to continue the family's property legacy. In essence, the LLC treats the family not as separate entities with one member bearing the majority of the responsibility, but as a company that leaves generations to enjoy the benefits of forests with less hassles. An LLC also provides the added benefit of qualifying for different cost-share programs that require a single Employer Identification Number (EIN) for tax purposes.

Further information for creating and registering a business in Florida for a property can be found at the Florida Division of Corporations website.

Partnerships

Partnerships are in their most basic form an association of two or more people that conduct a business for profit as co-owners. States have developed their own legality as to what constitutes a partnership, as oral partnership agreements are not considered legally binding everywhere; therefore, it is important to have all details of the agreement in writing. The contributions of the partners to the partnership do not have to be equal. Assets that enter the partnership or are purchased within the partnership become property of the partnership. Some common considerations within partnerships are unlimited liability, minors as partners, and taxation of partnerships.

Corporations

A corporation is a separate legal entity that has most of the rights of an individual, while being owned by its shareholders and governed by a stakeholder-elected board of directors. The most notable feature of a corporation is the limited liability falling to the shareholders, as legal actions against a corporation are covered through the corporate assets while shareholder assets are protected. Subchapter S Corporations are a form of corporation that is restricted by various limitations, including the limiting of members to 100.

5.1.5.1.2. Forest Legacy Challenges

Estate Planning

Most nonindustrial private forest land in the United States is owned by individuals, married couples, family estates and trusts, or other types of family groups (Siegel et al. 2009). Within private forest land ownership, the estate tax structure is in a constant state of flux; this presents potential danger for estates with substantial forest land holdings. If estate planning is not conducted properly, risks such as forced liquidation of family forest landholdings or the severe fragmentation or disruption of forest land are a real possibility.

As a private forest landowner approaches retirement or faces the possibility of death, certain issues regarding the future of their land must be addressed. There are multiple costs and aspects to consider if retiring or dying with an unprepared future for forest landholdings, such as transfer costs, unexpected heirs, the continuity of forest land management, and keeping forested land from becoming liquidated or parcelized. The US Forest Service developed the publication Estate Planning for Forest Landowners: What Will Become of Your Timberland? to provide guidelines for nonindustrial private forest owners concerning the application of estate planning techniques to their forest properties.

5.1.6. Ecological Restoration

Ecological restoration has been defined as the intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity, and sustainability (Society of Ecological Restoration 2004). These activities are performed on ecosystems that have been degraded, damaged, transformed, or destroyed as the result of direct or indirect anthropogenic activities (Society of Ecological Restoration 2004). The enhancement and restoration of native ecosystems is often a complex and iterative process that requires adaptation and engagement. Integrated natural resource management planning, including forest management, is essential for the successful attainment of ecosystem restoration and biodiversity objectives in many South and Western Gulf Coastal Plain ecosystems.

Longleaf pine (https://longleafalliance.org/) and wiregrass community is a good restoration example. Many landowners in the northern portion of Florida in the Southeastern Plains and Southern Coastal Plain ecoregions own land with deep, well-drained sandy soils that were historically populated by native longleaf pine communities. Since longleaf pine also can meet aesthetic, recreation, legacy planning, and economic return objectives, many landowners are interested in its restoration. Through a combination of active forest management activities, overstory and understory conditions can be restored to natural historic levels. Through frequent and consistent application of these activities, especially prescribed fire, endemic (and often imperiled) fauna species can begin to repopulate the site. Some of these species, like the gopher tortoise (*Gopherus polyphemus*) that digs deep, winding burrows that support over 350 documented animal and insect species, are considered “keystone species” in this natural community (Ashton and Ashton 2004). Certain species can even be translocated to recolonize a site. For example, gopher tortoises and red-cockaded woodpeckers (*Picoides borealis*) can be relocated through various federal and state programs and partnerships, through the help of natural resource professionals. Restoration tools are further discussed within silvicultural options sections.

The different pine species are major components in a variety of natural communities. Slash and longleaf pine are dominant overstory components in mesic and wet flatwoods, while loblolly, longleaf, and shortleaf pine are overstory components in the upland pine natural community. These pines can be replanted as a step in restoring their

respective natural communities. Also, steps may be taken to protect and restore understories of these forests (https://mylandplan.org/content/restoring-forest-ecosystems-0).

Restoration among hardwoods can be accomplished in a variety of ways. Natural regeneration and hydrological restoration can be conducted to assist in ecological restoration of all the upland forest types. Additionally, small-scale artificial restoration can be implemented in the restoration of mixed floodplain, tupelo-cypress mixed, and cottonwood, sycamore, and birch forest types. Large-scale artificial regeneration of these forest types is usually unnecessary and economically unviable for most Florida landowners.

5.1.6.1. Mitigation Banking

One way that a landowner can ensure the conservation of their land for future use is the development of a mitigation bank. Mitigation banking is a process where a public agency or private landowner establishes a tract of land dedicated for environmental preservation or enhancement to provide mitigation for unavoidable wetland impacts within a surrounding region (the mitigation service area). The entity whose activity is impacting nearby wetlands buys credits from the mitigation bank (tract of land); the cost of a credit represents the wetland ecological value equivalent to the restoration of one acre. Permitting agencies such as the Florida Department of Environmental Protection and the statewide Water Management Districts are responsible for determining the number of potential credits allowed for the bank as well as the amount of credits to be purchased for wetland impacts. In determining the purpose of a mitigation bank, restoration and enhancement of degraded wetlands as well as preservation of uplands take precedent over the creation of wetlands.

The Mitigation Bank Statute, 373.4136, and Mitigation Bank Rule, 62-342, provide the necessary information for permitting and creating mitigation banks. Since these banks are used to offset wetland impacts with the preservation/restoration of other wetland habitat, mitigation banking may not be a viable landowner objective for landowners with strictly upland forest types on their property. However, all the Bottomland Hardwood forest types (Mixed Floodplain, Tupelo-Cypress Mixed, and Mixed Forested Wetlands) would be applicable as mitigation banking habitats. The permitting agency responsible for the development of the bank would assess the quality of these habitats and then distribute credit values among them appropriately.

5.1.7. Hydrological Protection and Restoration

Hydrological processes and functions such as sheet flow and hydroperiod are often altered by anthropogenic means such as development, agriculture and intensive silviculture. This causes ecological alterations and degradation to natural communities, which in turn can alter the production of forest resources and the attainment of other forest landowner objectives. Additionally, impacts from silvicultural operations near aquatic resources can have significant impacts on streams, rivers, and lakes. Erosion from road construction can contribute sedimentation to water bodies affecting flow and quality of the water. Similarly, excessive harvesting near aquatic resources can increase water temperature and sedimentation from erosion which has detrimental impacts on fish and other aquatic life. These impacts can be mitigated and in some cases restored through the Silviculture BMPs which protect and enhance hydrology and soil quality through sustainable silvicultural practices and proper forest operations. Contacting a Florida Forest Service BMP Forester or County Forester before undertaking any management activities in or near the wetlands is advised. It is recommended to get a Notice of Intent (NOI) signed which may protect the landowner if water quality issues arise form a silviculture activity. Hydrological restoration also takes place at the property level through engineered projects like plugging drainage ditches and canals. These more large-scale types of projects may affect adjacent landowners or those miles up or downstream.

Hydrology is an important component of healthy, fully functioning natural communities. Upland and wetland ecosystems are impacted by hydroperiod, sheet flow and water quality. Hydrological impacts can be mitigated and in some cases restored through Silviculture BMPs, which protect and enhance hydrology and soil quality through sustainable silvicultural practices and proper forest operations.

On wetter pine forest types, bedding can be avoided or minimized if hydrological protection and restoration are primary objectives. On all forest types, limit new road construction. Existing forest roads may be properly maintained through grading, pulling ditches, installing culverts, hard surface low water crossings, turnouts and water bars as needed. Old windrows and beds can be leveled to improve hydrology but can be avoided if more overall harm will be done to the ecosystem than good (i.e. groundcover impacts).

5.1.8. Forest Health Management

Maintaining and promoting forest health is a major landowner concern and objective. Many unengaged landowners not actively managing their forests initially contact a forest resource professional regarding forest health issues.

Various cost share programs, grants and services aid Florida landowners in taking preventative measures to avoid devastating outbreaks and infestations. Silvicultural options such as timber harvest, prescribed burning and non-native invasive species treatments are also available to landowners to improve forest health.

Non-native invasive species such as cogon grass and feral hogs can cause major ecological and economic damage to Florida forests. Native forest pests such as southern pine beetle are always a potential threat to our forests. Several native diseases such as fusiform rust and pitch canker among others and non-native diseases such as oak and laurel wilt also cause damage across multiple forest types. These pests and diseases as well as other known to affect species within Florida forests will be addressed below by species type for pines and by hardwood grouping. Additional information concerning the multiple invasive pests affecting Florida forests can be found through the FFWCC Nonnative Fish and Wildlife webpage, while information concerning the various diseases affecting Florida forests can be found through the FDACS Forest and Shade Tree Diseases webpage available from the Florida Department of Agriculture and Consumer Services. While the following sections provide a short background of major issues, the two referenced sources are the best resources for additional information.

5.1.8.1. Pine Forest Health Management

Despite all of the following potential insect and disease issues, with appropriate seedling and site selection and release and thinning regimes, pines generally have minimal issues following successful establishment.

As previously mentioned, slash pine is second to longleaf as the most overall insect and disease resilient of Florida pine species. The most detrimental disease is fusiform rust but resistant seedling stock can be planted and the alternate host – *Quercus* spp. can be reduced where infection is excessive. Fusiform rust can become a major issue following over-fertilization of slash pine, vegetation control and on old field sites that were heavily fertilized or grazed. Pitch canker can cause damage in planted stands and resistant seedlings are available. Annosus root rot can be an issue following thinning, but only on well drained sites. Diplodia tip blight (*Sphaeropsis sapinea*) can affected any species of pine, but has been shown to affect Central and North Florida slash pine, especially on sites where there exists nitrogen enrichment of the soil. Pales weevil, feral hogs and livestock can cause damage to seedlings. Lightning and subsequent southern pine beetle and Ips beetle outbreaks cause severe damage in older, less managed stands.

The most destructive insect pests to loblolly pine are southern pine beetle (SPB), Ips, and black turpentine beetle (BTB). Loblolly is the preferred host for SPB. It is usually not a major issue in younger, well-managed stands. However, damage can be severe in overstocked and senescent stands, especially if offsite or other stressors occur (i.e. drought, lightning strikes, fire stress). Once a severe outbreak occurs, it can spread to adjacent, well-managed, younger stands. Outbreaks are cyclical and range from a few spots across a stand to hundreds of acres. Also, pine sawflies are a major defoliant of loblolly pines, capable of causing the complete loss of foliage on small trees. Ips and BTB are less aggressive and cause damage on an annual basis, usually following summer drought, and their attacks rarely exceed more than 3/10th of an acre. SPB and Ips both contain a lethal blue stain fungus that clogs the tree's water conducting tissue, making most attacks along the trunk lethal. BTB does not have the lethal blue stain fungus and pines can survive after being attacked.

Maintaining health and vigor among your pines is the most economical way of reducing loss from bark beetles. Pines exhibiting these qualities will have plenty room and resources to grow, have 33-40 percent crowns (crown length/total length), and are free of disease along their trunks. Foresters sustain these attributes in pine plantations by removing pines that do not exhibit these qualities while retaining pines that do. Suppressing understory competition can be just as effective at increasing pine health and vigor as thinning. Foresters control this competition in pine plantations through prescribed burns, herbicides, or cutting by machine or hand. All the above ensures most of the resources are available for the pines that can most utilize them, and these same pines will then usually have enough internal water pressure/turgor to drown attacking beetles, even during times of environmental stress.

Pitch canker and fusiform rust are fungal diseases affecting pines and are most problematic when affecting the main trunk, which disrupts the uptake of water and nutrients and causes increased susceptibility to a bark beetle attack. Pitch canker is known for its heavy resin exudation and affects all pine species throughout Florida. Fusiform rust is known for its galls that create a weak spot along the trunk, which continues to grow with the tree over time and produces orange spores every Spring. Resistance to both diseases continues to be developed in planting stock with much success.

The most detrimental disease to shortleaf pine is littleleaf disease. Infection is high on poorly drained sites, on poor soils and following root damage and drought. However, due to severe erosion resulting from past farming practices in Florida's forests, these at-risk soils are now ubiquitous. Littleleaf mostly occurs in 30-50-year-old stands and seldom in stands less than 20 years old. It can result in slow growth and high mortality. Proper shortleaf pine site selection and appropriately timed thinning or clearcutting can reduce chances of infection with littleleaf. Tip moths, pine saw flies, and pales and pitch-eating weevils can be problematic in young stands. Tip moths damage the terminal shoots on young pine seedlings, which can result in loss of growth and deformity of the tree if severe. Pine sawflies are a major defoliant of young pine saplings, capable of causing the complete loss of foliage on small trees. Loblolly pine sawfly also attacks shortleaf pine. Pales and pitch-eating weevils usually cause issues in newly planted stands if planted too soon after harvest. Reforestation of stands harvested after July should not be done the next planting season or, if done, should use seedlings that have been treated with insecticides.

Annosus root rot is a fungal disease associated with all pines growing in sandy soils that prevents the normal uptake of water and nutrients. Its spores will land on freshly, cut stump surfaces, inoculate, and then spread to living pines through existing root grafts, making it an issue with recently thinned pines growing on sandy soils. Infected pines usually die from attacking beetles rather than solely from the disease, which makes Annosus largely overlooked. Peak tree loss seems to occur during 3-6 years post thinning and the disease subsides 8-10 years post thinning. Old agricultural sites with sandy, well-drained soils with a low water table and a hardpan missing, or deeper than 12",

are considered high hazard sites, which placed this disease in the limelight during the early 2000s when CRP stands were being first-thinned. Prevention is the key with annosus root rot. If conducting a first thinning on high hazard sites, consider thinning during the summer months or treating the stumps within 24hrs of felling with a Borax compound. Minimizing stand entries by thinning heavier (60-70 BA) should also be considered. If pine loss occurs on sandy soils and 2-4 years post thinning, suspect annosus root rot. Once confirmed in a stand, it is generally recommended to wait until the disease has become inactive (8-10 years post thinning) before conducting the next thinning.

As previously mentioned, longleaf is the most resilient of Florida pine species, as they are not typically affected as severely by Ips, SPB, or BTB. The most detrimental disease is brown spot needle blight which is only an issue during seedling stage in planted stands. It is not an issue once rapid vertical growth commences and can be mitigated by prescribed burning grass stage seedlings starting around the second year, post-establishment. Pitch canker and fusiform are not a major concern with longleaf and issues are localized, although the latter can cause excessive damage on old field sites.

Pales weevil can also severely impact a forest stand. For pales weevil, the majority of damage inflicted occurs in the Spring (March and April), especially to seedlings following planting, although some damage may also occur in the Fall. These weevils attack any species of pine growing near an area where pines or other conifer species are harvested (NC State Extension, 2019). Adults are attracted to the smell of freshly-cut stumps, scorched pine trees, or dying trees. To combat these weevils, it is recommended to delay planting for approximately 6 to 9 months following harvest (Texas A&M Forest Service).

Lightning and subsequent southern pine beetle and Ips beetles causes severe damage in mature stands, where otherwise these are not a major concern. Southern pine beetle is not a major concern in younger, well managed longleaf stands. It can become a concern in offsite, overstocked and stagnant stands, especially during drought conditions and following fire stress. The first year of establishment is most vulnerable for longleaf, particularly during droughts or the typically dry months of spring. Feral hogs and livestock can also cause damage to seedlings of longleaf pine. Control and exclusion from the area when possible may help mitigate the damage to seedlings from these threats.

Slash, loblolly, and shortleaf pine cannot tolerate prescribed fire until the bark thickens and they reach about 10-15 feet tall (depending on fuel load). Slash pine forests may be prescribed burned every two to four years to maintain and restore the natural communities in which it is dominant and to enhance wildlife habitat, improve aesthetics, reduce vegetative competition, reduce fuel loads and stimulate rare plants.

They are susceptible to crown and inner bark scorch, especially in younger stands. Longleaf is naturally fire-resistant at this early life stage.

If any of the above diseases or pests are suspected, FFS should be contacted for a consultation. See non-native invasive species section.

5.1.8.2. Hardwood Forest Health Management

Upland mixed hardwood-pine, mixed floodplain, tupelo-cypress mixed, mixed forested wetland, and tropical hardwood hammock forests are generally not as intensively managed as pine forests and as such mortality caused by native diseases and insects are typically not a major concern. Common issues with hardwood forest types are insect defoliators, butt rot and heart rot fungi, and oak wilt.

The most common defoliators are canker worms and forest tent caterpillars. Both occur in early spring, just after leaf formation, and generally just cause a loss of growth for that growing season. Mortality sometimes occurs on the weakest trees when defoliations have occurred in consecutive years. Canker worms rarely impact more than a few acres, while forest tent caterpillars are usually found in bottomland hardwood forests and can defoliate thousands of acres.

Butt rot and heart rot fungi enter a hardwood tree from deep basal wounds caused by fire or logging. These diseases grow undetected for many years, eventually degrading the tree's use for lumber. During logging operations, it is imperative to minimize damage to residual hardwood trees, and if conducting a prescribed burn within an upland hardwood stand, understand the risks and try to minimize damage to trunks and root flares by not burning when it is too hot and dry. Prescribed burns are more likely to damage hardwoods when pine litter, which increases fire intensity, is adjacent to them, such as the case with loblolly or shortleaf pine-hardwood mixed stands.

Oak wilt is primarily a fungal disease of red oaks (especially water and willow oaks) growing on sandy soils located in the Southeastern Plains. Infected trees will eventually have their water conducting tissues blocked, causing their leaves to abruptly wilt soon after leaf formation in early spring. The fungal disease may start from a wound caused by an insect or equipment, but once started, it likely transmits from tree to tree via root grafts. Fungal mats located under the bark of infected tree are also inoculum sources used by insects to transmit the disease. Suspect oak wilt if young, healthy red oaks are suddenly dying. Sanitation and severing root grafts with a vibratory plow are two methods used for its control.

Major native insect and disease damage is species and site specific and should evaluated by a forester. For example, the ambrosia beetle-borne laurel wilt disease is decimating red bays in tupelo-cypress mixed forest types. It can only be slowed by actions such as limiting transport of firewood. This disease will likely eventually eliminate most red bay trees. The hemlock woolly adelgid (*Adelges tsugae*) is another pest known to affect hardwoods (hemlocks). Eastern hemlock is the most susceptible to these pests, which feed by sucking sap from these species.

If any of the above diseases or pests are suspected, contact the FFS for a consultation.

5.1.9. Economic Return

Sources of forest-based revenue in Florida are diverse and can be derived from each forest type. Some landowners choose to balance revenue with other objectives while for others it is their primary objective and livelihood.

5.1.9.1. Timber Management

Landowners have strong, diverse timber markets in Florida, allowing them to manage on short or long rotations for pine, hardwood and cypress products. This flexibility and economic potential in timber markets allows for restoration, revenue and investment.

A current timber price report by quarter is available through the Florida Forestry Stewardship (http://sfrc.ufl.edu/extension/florida_forestry_information/events_calendar/files/timber_price_update182.pdf).

Also, it is recommended that landowners utilize FFA-certified master loggers in their timber management. There is a website (http://floridaforest.org/programs/master-logger/master-logger-search-tool/) that provides landowners with loggers certified as "Master Loggers" by the Florida Forestry Association in order to protect landowners from liabilities while also providing a quality service.

Economy of scale plays a large role in timber management, and landowners must always take that into consideration when managing their forest lands. Forest landowners often retain portions of their land in natural ecosystems and habitats, where regulatory considerations, economies of scale, and silvicultural options indicate this is the best management approach. For instance, adherence to BMP standards encourage the retention of mixed forested wetland overstory along existing stream channels. Factors affecting economies of scale are stand acreage; forest product type, size, and quality; and distance from a related forest product mill. Loggers incur costs whenever they move their equipment from one tract to the other, which makes larger tracts/stands with high-value forest products closer to the mill more attractive.

As a result, landowners should consider that the size of their forested area may have an impact on profitability, and landowners with smaller stands may need to do timber management in conjunction with another stand or with an adjacent landowner.

The above scenario becomes apparent in southern and central Florida, where parcel sizes are generally smaller and farther away from most pulpwood mills. Landowners in this region are encouraged to plant above-average, genetically available pines on a farther spacing than conventional and conduct the first-thinning at a later date, which increases the availability of higher value product classes and the likelihood of the stand being thinned.

On the contrary, landowners located in north Florida should consider taking advantage of available pulpwood markets and plant pines on a conventional spacing and thin as soon as they can. This is especially true for pulpwood-sized stands located on well-drained soils in the upper Southeastern Plains. During wet winters, these stands usually demand the highest pulpwood prices and are known as "all-weather-tracts."

Timber sales can either be done as a per unit basis or as a lump sum sale. Most thinnings are sold as a per unit (ton) basis, where the contract states a price per ton for each product removed. Lump sum sales usually involve final harvests or stands where the take trees have been marked.

There are many tools available to help with timber management including thinning, clearcutting and natural and artificial regeneration. Landowners can utilize uneven-aged management with longleaf pine and hardwoods and even-aged management with other pine species and cypress. With its ease of implementation, most forest types are managed as even-aged, with uneven-aged management usually limited to aesthetically sensitive areas or areas facing other constraints such as threatened and endangered species. Also, native species are preferred in the management of wood plantations in Florida due to multiple factors, including: their evolutionary adaptations to endemic soils, climate, and threats, comprising the vast majority of the nursery stock of South Carolina, the requirement of various cost-share programs to utilize only native species, and the preference of local markets and mills to process native species as opposed to exotics.

5.1.9.2. Non-Timber Forest Products

Forestland owners have many revenue sources aside from timber products. Florida's forests provide various non-timber forest products (NTFP). These are wide-ranging and include pine straw, honey, silvopasture, saw palmetto drupes, ginseng, lyonia sticks, wax myrtle, and cypress knee sales. These markets can provide landowners with revenue between timber harvests or may be the main source of revenue generation from their forests (Chamberlain and Predny 2003).

5.1.9.3. Non-Forest Associated Land Uses

Some revenue-generating options should be considered with caution due to disadvantages associated with them. For example, the following land uses may prevent or cause loss of ATFS certification.

- Eco-tourism through opening private land to public access for a fee.
  - Canoe, kayak and boat rentals and tours along the many scenic waterways adjacent to Florida's forests.
  - Hunting leases
- Mining for aggregate materials
  - Sand, clay, stone, and gravel
    - Need local permitting
    - Will alter local hydrology and cause ecological impacts
- Mineral and gas leases
- Oil, gas, and electric Right-of-Way and easement leases
  - Can be positive or negative, depending on how the land is maintained
- Timberland real estate
  - May involve land development or forestry/agriculture
  - Can conflict with ATFS and FSP Standards
- Conversion of forested land from a forested state) natural or plantation-style plantings) to an unnatural tree plantation containing non-native or exotic tree types.

Some instances of forests being converted to non-forested land uses are acceptable under various standards. These circumstances consist of:

1. The area concerned is small (the total area to be converted to a non-forested land use is no more than 5% of the total forest management unit
2. This conversion clearly benefits long-term nature conservation advantages
3. This conversion causes no damage or threat of damage to high conservation-value areas.

5.1.9.4. Timber Tax

No matter the reason for deriving revenue from one's forest, one issue that must be faced by all landowners regarding economic return is timber taxes. The timber tax code is extensive and can be confusing for landowners whose goal is to simply manage property for periodic financial gain. These taxes are dependent on a variety of factors and situations, with some of the more frequently encountered described briefly below (Wang 2018).

5.1.9.4.1. Timber Property Types

In calculating timber taxes, it is first necessary to determine the type of property in question, as this governs how taxes are determined. Properties may be classified as personal-use (lands used for personal enjoyment instead of profit), investment property (lands used mainly for the generation of profit from growing timber or appreciating assets), or business property (lands that experience regular, active, and continuous timber activities to make a profit). These varying property types are impacted differently by taxes; for example, if the land is personal use and not engaged for profit, losses to trees are not tax deductible.

5.1.9.4.2. Deductions of Timber Expenses and Taxes

Timber expense and tax deductions are calculated differently depending on the property type in question. For timber on a business property, if one is materially participating in the business, expenses such as forester/accountant/attorney fees, precommercial thinning, firebreak maintenance, vegetation/competition control, insect/disease/fire control, or depreciation from equipment used are all fully deductible through Form 1040. If the property is an investment, however, starting in the 2018-2025 cycle timber expenses are no longer deductible on an annual basis and can be applied as "Carrying Charges" to the timber basis and deducted upon timber sales. State and local property taxes on these investment properties are still deductible on an annual basis using a Schedule A, or can be applied as carrying charges as well. Also, Florida has an agricultural sales tax exemption for farmers, foresters, or other agricultural land users.

5.1.9.4.3. Timber Basis and Depletion Deduction

Timber basis is the amount one paid for the timber when purchasing the property. If the property was inherited, the timber basis is the timber's fair market value on the previous owner's date of death. This original timber basis from the two above scenarios can change as capital improvements are made to the land or as depletion, amortization, or depreciation are deducted from the timber basis (Megalos et al 2016). Certain timber management and operation expenses may be capitalized as "Carrying Charges" to the timber basis and recovered upon timber sales. Depletion deductions are deductions against the timber basis upon timber sale. These deductions reflect the removal of timber from the property and provide a way to calculate the timber basis that remains on the property. Another type of depletion could be the loss of timber to a casualty event such as hurricane, fire, earthquake, tornado, etc. This type of depletion is also tax deductible, calculated by the difference of the fair market value (FMV) of the timber immediately before and after the casualty.

5.1.9.4.4. Reforestation Costs

Reforestation costs may be tax deductible as well. Landowners can deduct up to $10,000 per year for land designated as qualified timber property (QTP). If it costs more than $10,000 per year for reforestation, the cost may be deducted over the span of 84 months (amortized). Trusts, however, are only eligible to use the amortization method. The amount deducted cannot also be expensed as a timber basis or vice versa.

5.1.9.4.5. Cost-Share Payments

Cost-share programs are of great value to many landowners, and some applications of cost-share can be excluded from your income. Part or all of a qualified cost-share payment received can be excluded from income if it was used for capital expenditure (purchases of land, timber, or equipment, expenditures for bridge or road construction, or expenses for tree planting or seeding; Jones and Jacobson 2000). Qualified federal programs that accept income inclusion are the Forest Health Protection Program, Conservation Reserve Program, Conservation Security Program, and Environmental Quality Incentives Program. There are also multiple state programs that qualify for exclusion, depending on the state. Florida Forest Service's Longleaf Pine Private Landowner Incentive Program and Southern Pine Beetle Assistance and Prevention Program (SPB) both qualify for this exclusion. The excludable amount is calculated at fixed dollar-per-acre or dollar-per-seedling rates established for each practice offered. The maximum reimbursement offered is $10,000 per year for each FFS program and the plans are available to private non-industrial forest landowners with at least 5 acres but not more than 5,000 acres of forest land in Florida.

5.1.9.4.6. Florida Greenbelt Law

If a landowner plans on using a farm for legitimate agricultural activities (excluding wholesaling, retailing, or processing of farm products), the Florida Greenbelt Law may be applicable and could save the landowner money in taxes. A property appraiser is sent to determine the actual use of the property and whether it may qualify for the Greenbelt Law. This law allows the farm to be taxed based on its current "use" property value instead of its development value, which is usually much higher; this stipulation helps the property owner by allowing them to pay a significantly lower amount of property taxes. More information on this benefit can be found here: http://blogs.ifas.ufl.edu/sfrc/2018/01/25/dont-forget-greenbelt/.

5.1.9.5. Long-Term Investment

Another way to generate economic return from timberland is to use the land as a long-term investment. In the past, the economic return of treating timberland as an investment has compared favorably with stocks while providing more financial stability (King 2019). The U.S. timber investment performance is monitored by the National Council of Real Estate Investment Fiduciaries (NCREIF) Timberland Index. Returns through timber investment as monitored by this index have shown that, over the previous 20 years, timberland-generated profits are nearly equal to those gained by equity investments through the S&P 500 while encountering less than half of the volatility.

There are a few main reasons that a landowner may choose to use their timberland as an investment. First, timberland value tends to rise with inflation, thereby hedging the risk of devaluation by inflation and keeping timber prices stable relative to the index. Secondly, trees continue to grow in volume over time, as well as value, completely independent of the current economic state. Therefore, if the timber market is currently in an unfavorable state, the trees can remain in the ground to retain their value until the prices become more favorable. However, postponing the first thinning of a young pine stand can have negative effects on the stand's long-term growth and IRR. A third more intrinsic value of timberland as an investment is that the land can be enjoyed recreationally while waiting to make a profit. This "bonus" can even be as valuable to landowners as the profit they will eventually make from the timberland investment.

Regardless of the reasons for using timberland as a long-term investment, the property must be managed properly in order to produce the most and best-quality timber possible. A forester can assist in the management of timberland through a multitude of forest and silvicultural management techniques, as discussed in Section 8.

5.2. Common Landscape Objectives

The landscape-level objectives discussed below are important to all forest types and should be considered for each landowner. They are summarized below, rather than included in the forest types discussion due to their uniform applicability across all forest types. Some of the landscape objectives were derived from Florida's Forest Resource Assessment and Strategy. Forest type-specific landscape objectives are discussed below.

5.2.1. Support Healthy Forest Products Industry

This LMP promotes maintaining a healthy forest products industry in Florida through sustainable forest management practices. This can be achieved through carefully planned timber harvests and timely site preparation and reforestation. Certification through the American Tree Farm System also supports sustainable forestry and adds value to timber markets. Many forest products companies need certified wood to be able to compete globally, so third-party certification through ATFS or other certifying bodies helps support these companies.

Silviculture BMPs also support sustainable silviculture through practices that protect and enhance water and soil quality. Healthy and robust timber markets are encouraged by voluntarily conducting safe, responsible, and sustainable forestry practices. Through their implementation, these BMPs can also retain or increase the on-site stocks of carbon present in the forest in the medium to long term. The objectives set forth by FFS, through their retention of forestland, serve as an added benefit also help to retain or increase carbon stocks in the medium to long term. Carbon retention in forestland is directly linked to the forest retention, which is a primary priority in the utilization of BMPs to maintain forested landscapes. Landowners may also submit to FDACS a Notice of Intent to Implement these BMPs. This is a one-time notification per landowner and not required for each silvicultural activity.

Another way to support the forest products industry is through the practice of sustainable forestry. The concept of a "sustainably-managed" or "normal" forest is integral to forest management in Florida. A regulated forest is at its core an ideal forest structure and is represented through a forest with an equal number of acres in each different age class. A regulated forest must have age and size classes represented in such a proportion and be growing consistently at such rates so that annual yields of products representing desired size and quality can be obtained through perpetuity (Davis and Johnson 1997).

A regulated forest will produce the maximum amount of fiber, on average, per year. Consequently, a regulated forest also produces the most money over time from the following: maintaining high average growth rates, diversification of product classes, frequency of payments, and compounding interest. Having a regulated forest also helps satisfy multiple other different landscape or landowner objectives. A regulated forest can provide net habitat for wildlife on an annual basis (Wildlife Management and Protection), always supplies sustainable products for perpetuity (Support Healthy Forest Products Industry), and can create a forest that is visually pleasing (Aesthetics) while providing a steady supply of revenue (Economic Return). Additional information concerning creating a regulated forest can be obtained through a discussion with a forest resource professional.

5.2.2. Watershed Protection and Restoration

Florida contains several major watersheds including the Apalachicola-Chipola, Suwannee, Tampa Bay, Everglades, Upper and Lower St. Johns, and Withlacoochee among many others. Well managed forests protect these watersheds and ensure clean drinking water, waterways and healthy aquatic habitats. Among these watersheds and basins, certain basins contain waters that are impaired due to pollutants. These basins are governed further by Basin

Management Action Plans (BMAPs), which work to restore impaired waters through a reduction of pollutant loads. The goal of each BMAP is that the pollutant loads of the impaired waters meet certain specified levels. Additional information concerning the BMAP procedures and the impaired water bodies of Florida click here: https://floridadep.gov/dear/water-quality-restoration/content/basin-management-action-plans-bmaps.

Silvicultural and Agricultural best management practices are often implemented and promoted to ensure these operations don't impair water quality in the region while also ensuring that the high water quality of these forested lands remains into the future. These objectives developed by FFS serve to retain and/or increase carbon stocks in the medium to long-term by this perpetuation of forest land use. In many cases Silviculture BMPs enhance water quality, helping to restore watersheds. Silviculture BMPs are voluntary yet widely followed, which helps avoid mandatory regulation on these practices while protecting watersheds. Watershed restoration also involves other forest operations such as replacing and improving culverts and installing hard-surface low water crossings.

5.2.3. Wildlife and Habitat Conservation

Florida's forests face many threats, with changes in land use being the leading cause of loss in forest cover. Forests, their ecosystems and natural resources can be conserved through conservation easements, sustainable forest management, and habitat management.

Florida is home to many rare species found only in this region and contains several global populations. Florida forests provide vital habitat to many imperiled plant and animal species.

Table 3 shows United States Fish and Wildlife Service's (USFWS) listed species (threatened, endangered, and at-risk) as well as Florida Fish and Wildlife Conservation Commission (FFWCC) state-listed species found in the forested habitats of Florida by LMP forest type. This table was created using Florida's imperiled species management plan occurrences within FNAI natural community types. FNAI may also be used to locate listed species occurrences by county within the state. Not all listed Florida species are shown, only those with the potential to utilize some portion of forested habitat within their life cycle. These habitats were then associated with each LMP forest type. Additional information on current listing status for each species can be found in the geodatabase.

Table 3 Rare Animal Species of Florida by LMP Forest Type

Common Name	Scientific Name	Longleaf Pine	Slash Pine	Loblolly Pine	Sand Pine	Shortleaf Pine	Upland Mixed Hardwood-Pine	Cypress-Gum Dominant	Bottomland Hardwoods	Mixed Forested Wetland	Tropical Hardwood Hammock
Amphibians											
Florida Bog Frog	*Lithobates okaloosae*							✕	✕	✕	
Frosted Flatwoods Salamander	*Ambystoma cingulatum*	✕	✕	✕				✕			
Reticulated Flatwoods Salamander	*Ambystoma bishopi*	✕	✕	✕				✕			
Georgia Blind Salamander	*Haideotriton wallacei*										
Gopher Frog	*Lithobates capito*	✕	✕	✕	✕	✕	✕				
Striped Newt	*Notophthalmus perstriatus*	✕	✕	✕				✕	✕	✕	
Pine Barrens Treefrog	*Hyla andersonii*								✕	✕	
Birds											
Red-cockaded Woodpecker	*Picoides borealis*	✕	✕	✕		✕	✕				
Southeastern American Kestrel	*Falco sparverius paulus*	✕	✕	✕	✕	✕	✕				
Limpkin	*Aramus guarauna*							✕	✕	✕	
Little Blue Heron	*Egretta caerulea*							✕	✕	✕	
Osprey	*Pandion haliaetus*							✕	✕	✕	
Tricolored Heron	*Egretta tricolor*							✕	✕	✕	
White-crowned Pigeon	*Patagionenas leucocephala*										✕
White Ibis	*Eudocimus albus*							✕	✕	✕	
Wood Stork	*Mycteria americana*							✕	✕	✕	
Ivory-billed Woodpecker	*Campephilus principalis*							✕	✕	✕	

Common Name	Scientific Name	Longleaf Pine	Slash Pine	Loblolly Pine	Sand Pine	Shortleaf Pine	Upland Mixed Hardwood-Pine	Cypress-Gum Dominant	Bottomland Hardwoods	Mixed Forested Wetland	Tropical Hardwood Hammock
Fish											
Blackmouth Shiner	*Notropis melanostomus*								✕	✕	
Bluenose Shiner	*Pteronotropis welaka*								✕	✕	
Crystal Darter	*Crystallaria asprella*								✕		
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*								✕		
Okaloosa Darter	*Etheostoma okaloosae*								✕		
Southern Tessellated Darter	*Etheostoma olmstedi maculaticeps*								✕		
Invertebrates											
Chipola Slabshell	*Elliptio chiplolaensis*								✕		
Black Creek Crayfish	*Procambarus pictus*								✕		
Fat Threeridge	*Amblema neislerii*								✕		
Gulf Moccasinshell	*Medionidus penicillatus*								✕		
Ochlockonee Moccasinshell	*Medionidus simpsonianus*								✕		
Oval Pigtoe	*Pleurobema pyriforme*								✕		
Panama City Crayfish	*Procambarus econfinae*	✕	✕	✕				✕	✕	✕	
Purple Bankclimber	*Elliptoideus sloatianus*								✕		
Shinyrayed Pocketbook	*Lampsilis subangulata*								✕		
Mammals											
Big Cypress Fox Squirrel	*Sciurus niger avicennia*	✕	✕	✕	✕	✕	✕	✕			
Everglades Mink	*Neovision vison evergladensis*							✕	✕	✕	✕

Common Name	Scientific Name	Longleaf Pine	Slash Pine	Loblolly Pine	Sand Pine	Shortleaf Pine	Upland Mixed Hardwood-Pine	Cypress-Gum Dominant	Bottomland Hardwoods	Mixed Forested Wetland	Tropical Hardwood Hammock
Florida Mouse	*Podomys floridanus*	✕	✕	✕	✕	✕	✕				
Gray Bat	*Myotis grisescens*	✕	✕	✕	✕	✕	✕	✕	✕	✕	
Indiana Bat	*Myotis sodalis*	✕	✕	✕	✕	✕	✕	✕	✕	✕	
Sanibel Island Rice Rat	*Oryzomys palustris sanibeli*							✕	✕	✕	
Sherman's Fox Squirrel	*Sciurus niger shermani*	✕	✕	✕		✕	✕	✕			
Sherman's Short-Tailed Shrew	*Blarina shermani*						✕	✕	✕	✕	
West Indian Manatee	*Trichechus manatus*								✕		
Reptiles											
Gopher Tortoise	*Gopherus polyphemus*	✕	✕	✕	✕	✕	✕				
Suwannee Alligator Snapping Turtle	*Macrochelys suwanniensis*								✕	✕	
American Alligator	*Alligator mississippiensis*							✕	✕	✕	
Barbours Map Turtle	*Graptemys barbouri*								✕		
Eastern Indigo Snake	*Drymarchon corais couperi*	✕	✕	✕	✕	✕	✕	✕			
Florida Brown Snake of the Lower Keys	*Storeria victa*										✕
Florida Keys Mole Skink	*Plestiodon egregious egregius*										✕
Florida Pine Snake	*Pituophis melanoleucus mugitus*	✕	✕	✕	✕	✕	✕				
Key Ringneck Snake	*Diadophis punctatus acricus*										✕
Rim Rock Crowned Snake	*Tantilla oolitica*										✕
Short-Tailed Snake	*Lampropeltis extenuata*	✕	✕	✕	✕	✕	✕				
Suwannee Cooter	*Pseudemys suwanniensis*								✕		

The Wildlife BMPs manual compiles strategies and considerations for managing and protecting certain state-listed species and their habitat during silvicultural operations. The natural resource professional and landowner can try in the field to locate and protect any imperiled species and their habitat prior to silvicultural activities. The LMP geodatabase and associated resources can be used to locate any known imperiled species occurrences on a property. Although not an exhaustive list, if imperiled species or their habitats are located, the following protection measures can be used. However, adaptation, as needed for specific conditions, is appropriate:

- Limited or seasonal mechanical entry
- Increased management activity (prescribed fire, thinning, etc.)
- Restricted pesticide use
- Residual tree maintenance
- Buffer zone establishment and maintenance
- Hunting or fishing limitations
- Signage or marking of the habitat area
- Communication of sensitive habitat or species locations in contracts; discussion with contractors

In addition to the above-mentioned protection measures, the landowner may also choose to enhance habitat where the species is found. If choosing to participate in ecological restoration or protection, sites that demonstrate a high conservation value, as well as representative areas of the forest types that are found in the forest management unit, should be identified, protected, and, where possible, enhanced. The sites may contain one or more of the following values: diversity of species, ecosystems and habitats, ecosystem services, ecosystems at landscape level, and cultural values. Conservation of the particular type(s) of forest areas found within the forest management unit is essential in protecting the forest's natural resources for this and future generations. Locating these high conservation value sites is aided through utilization of NatureServe Explorer, a GIS-based tool that provides locations of rare and protected plants, animals, and ecosystems of the United States.

Efforts to attempt enhancement of habitat species may include removing nuisance and invasive species or, depending on the species preferred habitat, participating in ecological restoration efforts. State and federally-listed plant species are not legally required for protection unless there is a federal funding nexus on the site or additional landowner objectives require. While it is recognized that protection of endangered or threatened plants may not be legally required, many landowners actively choose to do so as a part of their land management. Also, foresters that assist the landowners make note of these T & E species as a standard practice.

Once a high conservation value or representative forest area are determined to occur within a landowner's property, strategies and actions to maintain these areas using the existing local and national laws and legislations are essential to the protection of these assets. A facet of utilizing these strategies should be the periodic monitoring/evaluation of their effectiveness. Although landowners are encouraged to conduct their own periodic monitoring of the high conservation areas on their property, their assessments as a whole are not entirely valid or effective in determining the efficacy of such measures. As the scale of monitoring high value conservation areas is quite large, the applicable local, regional, or federal entities hold responsibility for this task.

The natural resource professional and landowner should plan and implement silvicultural activities with regard to known and visibly apparent species and their habitats. Additionally, guidelines for the protection of certain USFWS Threatened and Endangered (T&E) species can be found through the Environmental Protection Agency's (EPA)

threatened and endangered pesticide use guidelines, as well as the USFWS's Landowner Tools site. The LMP Geodatabase and associated resources can be used to locate any known imperiled species occurrences on a property. Although not an exhaustive list, if imperiled species and/or their habitats are located, the following protection measures can be used:

• Conservation zones (or protected areas). Size and location of the conservation zones should conform to national and local legislation and be sufficient to guarantee the continuing presence of the identified species. Conservation zones should be identified and marked on maps and, where necessary, on the ground in a way that is visible when entering the zone; and

• Reduced harvesting methods to protect nesting and breeding sites.

5.2.3.1. Working Lands for Wildlife

One major initiative throughout the state of Florida is the program of Working Lands for Wildlife (WLFW). Established through the NRCS Florida group, this program's focus is to assist landowners in voluntary conservation efforts toward threatened species. NRCS provides financial and technical support to participants who voluntarily make certain improvements to their working lands in order to facilitate improvement of these species' habitat. This initiative has proven successful in helping conserve more than 7.1 million acres of wildlife habitat nationwide, and has benefitted species such as the greater sage-grouse and New England cottontail.

In Florida, a main target species of the WLFW program is the gopher tortoise. WLFW will assist landowners in the state to voluntarily create, restore, or enhance gopher tortoise habitat, and also to improve habitat connectivity to allow the tortoise a greater range of habitat availability. NRCS funds will share the cost of conservation practices with landowners, as more than 80% of gopher tortoise habitat in the state is within private or corporate ownership.

Gopher tortoise habitat conservation falls within some of the core practices of WLFW, such as Restoration and Management of Rare and Declining Habitats and Upland Wildlife Habitat Management, as well as some of the supporting practices (Prescribed Burning, Forest Stand Improvement, Tree Shrub Site Preparation). Conservation of gopher tortoise habitat also falls within the scope of the Longleaf Pine Initiative (LLPI), which aims to focus resources on increasing the amount of longleaf pine habitat, as healthy longleaf pine habitat provides some of the best gopher tortoise habitat.

Another species of WLFW focus within Florida is the northern bobwhite (*Colinus virginianus*) through the Northern Bobwhite in Pine Savannas initiative. The northern bobwhite is typically an "edge" dweller, living where woodlands and crop fields intersect and taking cover under brush. While historic land use supported this species, modern land use changes have decreased the bobwhite's population by more than 80% in the past 60 years. Now, bobwhite depend on early successional grassland, shrubby areas, and pine or oak savannas through the eastern Unites States. Through this WLFW program, NRCS is providing technical and financial assistance for landowners to make improvements to their land to attempt to create this necessary habitat, such as establishing field borders and buffer strips, thinning mature forests to create diverse, shrubby understory, and integrating native plants into pasture plantings. The habitat created for the northern bobwhite is also beneficial for other woodland species, including turkeys, white-tailed deer, rabbits, gopher tortoises, bog turtles, and various types of songbirds.

5.2.4. Non-Native and Invasive Species (NNIS) and Nuisance Species Management

There are many non-native invasive plant (NNIP) and animal (NNIA) species in the state of Florida. Table 4 provides a list of the most common Category 1 NNIS and nuisance species that impact forest management, as gathered from the Florida Exotic Pest Plant Council (FLEPPC 2019). Additionally, there are numerous native species which can function as nuisance species when their abundance and distribution impact historic and healthy forest conditions. For example, the absence of historic wildfires and the lack of prescribed burning in some areas develops conditions where titi (*Cyrilla racemiflora*), fetterbush (*Lyonia lucida*), and Chinese tallow tree (*Triadica sebifera*) limit forest regeneration, increase wildfire risk, and reduce biodiversity. Forest resource professionals can accurately assess which native species are serving in a nuisance capacity to inhibit the achievement of landscape objectives. Management and control of both NNIS and nuisance species is often most successful when it is integrative and adaptive (Miller et al 2015).

In the Forest Resource Assessment and Strategy Plan, Florida has identified cogongrass (*Imperata cylindrica*) as a major invasive threat to natural Florida communities. Cogongrass is a federally-listed noxious weed and widely regarded as the worst invasive present in the southern United States. It is an invader of both natural and disturbed habitat, where its presence disrupts natural ecosystem functions, crowds out endemic shrub and grass species, and alters fire regimes and intensity (Bryson and Carter 1993).

Florida is at the forefront of the advancing front of cogongrass infestation across the Southeast. As of 2010, multiple counties across the entire state of Florida had infestations in the hundreds or thousands (EDDMapS 2019). The FDACS has been geolocating cogongrass infestations for annual monitoring and assessments. Landowners in the vicinity of these cogongrass infestations are being made aware of the issues with cogongrass and the importance of its control.

5.2.4.1. Prevention and Monitoring

Prevention is the key first step. Landowners and managers can limit the spread of NNIP's by minimizing ground disturbance activities and inspecting silvicultural and agricultural equipment for cleanliness prior to entering and departing the property. Spread of NNIA's can be minimized by avoiding the transport of these species from one property to another and fencing. Even through strong prevention measures, birds, weather and other modes of spread will occur.

Monitoring can take place during routine work or recreational activities on the property. It is important to have species identification skills and resources to aid in monitoring. Early detection through monitoring allows for rapid, aggressive treatment before infestations become established and spread throughout the property.

5.2.4.2. Documentation and Planning

Documentation of new and existing infestations with GPS coordinates, GIS mapping, or location notes assist in the treatment and monitoring of infestations. Infestations can be marked with flagging, paint or other means. Documentation is also beneficial to insure all pesticides are approved by the Environmental Protection Agency (EPA) and applied, stored and disposed of in accordance with EPA-approved labels and by persons appropriately trained, licensed, and supervised.

NNIS and nuisance species management plans can be developed to treat minor and major infestations. Integrated pest management is adaptive, aggressive and may include the following:

- Infestation occurrence and treatment documentation
  - Good record keeping
  - GIS mapping of new and existing
- Treatment plan and schedule
  - Frequency, seasonality and methods
  - Combination of treatment methods typically most effective
- Monitoring plan and schedule
  - Frequency and locations
- Adjust retreatment methods and monitoring as needed
- Repeat this cycle until control is achieved

5.2.4.3. NNIP and nuisance plant treatment methods:

Chemical

- Ground: broadcast or isolated treatment
  - Foliar, cut stump, hack-n-squirt, injection, basal bark, soil spot (grid)
  - Backpack and hand sprayers; ATV, farm tractor, skidder-mounted sprayers
- Aerial: broadcast by helicopter (broadcast)

Mechanical: broadcast or isolated

- Hand-pull, chop, mow, mulch

Prescribed fire (broadcast)

- Dormant or growing season

Additional information can be found through Miller et al 2015 and online at https://www.srs.fs.fed.us/pubs/gtr/gtr_srs131.pdf

5.2.4.4. NNIA treatment methods:

Feral hogs

- Do not transport onto property and prohibit hunting lessees from doing so
- Property boundary fencing
- Promote year-round aggressive hunting and trapping
  - Licensed contract trappers available
- Careful game species food plot crop selection
- Consultation and additional information through USDA Wildlife Services

5.2.4.5. Nuisance animal treatment methods:

White-tailed deer

- Do not transport onto property and prohibit hunting lessees from doing so
- Ensure the specimens encountered are not infected with chronic wasting disease

- Modify and increase deer harvest to control population abundance and sex ratios
- Maintain property boundary fencing
- Install exclusionary fencing around young plantations and/or regeneration areas
    - Licensed contract trappers available
- Practice time logging activities and use uneven aged stands to provide continual availability of browse and forage options.
- For further deer treatment methods: https://www.qdma.com/manage/quality-deer-management/

Beaver

- Do not transport onto property and prohibit hunting lessees from doing so
- Monitor all water sources and potential impoundment locations frequently for activity
- Promote year-round aggressive hunting and trapping
    - Licensed contract trappers available
- Destroy any dams or impoundments in conjunction with trapping and harvesting efforts
- Consultation and additional information through USDA Wildlife Services

Table 4 Common Florida Non-Native Invasive, Plant (Upland) and Animal Species

Common Name	Scientific Name
Rosary pea	*Abrus precatorius*
Earleaf acacia	*Acacia auriculiformis*
Mimosa, silk tree	*Albizia julibrissin*
Woman's tongue	*Albizia lebbeck*
Coral ardisia	*Ardisia crenata*
Shoebutton ardisia	*Ardisia elliptica*
Asparagus fern	*Asparagus aethiopicus*
Orchid tree	*Bauhinia variegata*
Bishopwood	*Bischofia javanica*
Santa Maria	*Calophyllum antillanum*
Australian-pine	*Casuarina equisetifolia*
Suckering Australian-pine	*Casuarina glauca*
Elephantgrass, Napier grass	*Cenchrus purpureus*
Camphor-tree	*Cinnamomum camphora*
Wild taro	*Colocasia esculenta*
Latherleaf	*Colubrina asiatica*
Carrotwood	*Cupaniopsis anacardioides*
Japanese false spleenwort	*Deparia petersenii*
Winged yam	*Dioscorea alata*
Air potato	*Dioscorea bulbifera*
Cat's-claw vine	*Dolichandra unguis-cati*
Water-hyacinth	*Eichhornia crassipes*
Surinam cherry	*Eugenia uniflora*
Laurel fig	*Ficus microcarpa1*
Hydrilla	*Hydrilla verticillata*
Green hygro	*Hygrophila polysperma*
West Indian marsh grass	*Hymenachne amplexicaulis*
Cogongrass	*Imperata cylindrica*
Water-spinach	*Ipomoea aquatica*
Gold Coast jasmine	*Jasminum dichotomum*
Brazilian Jasmine	*Jasminum fluminense*
Lantana, shrub verbena	*Lantana strigocamara2*

Common Name	Scientific Name
Glossy privet	*Ligustrum lucidum*
Chinese privet	*Ligustrum sinense*
Japanese honeysuckle	*Lonicera japonica*
Peruvian primrose willow	*Ludwigia peruviana*
Black mangrove	*Lumnitzera racemosa*
Tropical American watergrass	*Luziola subintegra*
Japanese climbing fern	*Lygodium japonicum*
Old World climbing fern	*Lygodium microphyllum*
Sapodilla	*Manilkara zapota*
Melaleuca, paper bark	*Melaleuca quinquenervia*
Natalgrass	*Melinis repens*
Serpent fern, wart fern	*Microsorum grossum*
Japanese stiltgrass	*Microstegium vimineum*
Catclaw mimosa	*Mimosa pigra*
Heavenly bamboo, nandina	*Nandina domestica*
Asian sword fern	*Nephrolepis brownii*
Sword fern	*Nephrolepis cordifolia*
Burma reed	*Neyraudia reynaudiana*
Crested floatingheart	*Nymphoides cristata*
Sewer vine	*Paederia cruddasiana*
Skunk vine	*Paederia foetida*
Torpedograss	*Panicum repens*
Water-lettuce	*Pistia stratiotes*
Stawberry guava	*Psidium cattleianum*
Guava	*Psidium guajava*
Kudzu	*Pueraria montana var. lobata*
Downy rose-myrtle	*Rhodomyrtus tomentosa*
Mexican petunia	*Ruellia simplex*
Water spangles	*Salvinia minima*
Beach naupaka, half-flower	*Scaevola taccada*
Schefflera, umbrella tree	*Schefflera actinophylla*
Brazilian pepper	*Schinus terebinthifolia*
Wright's nutrush	*Scleria lacustris*

Common Name	Scientific Name
Tropical nutrush	*Scleria microcarpa*
Christmas senna, climbing cassia	*Senna pendula var. glabrata*
Wetland night shade	*Solanum tampicense*
Tropical soda apple	*Solanum viarum*
West Indian dropseed	*Sporobolus jacquemontii*
Feral hog	*Sus scrofa*
Arrowhead vine	*Syngonium podophyllum*
Java plum	*Syzygium cumini*
Incised halberd fern	*Tectaria incisa*
Jeweled maidenhair fern	*Thelypteris opulenta*
Seaside mahoe	*Thespesia populnea*
Small-leaf spiderwort	*Tradescantia fluminensis*
Oyster plant	*Tradescantia spathacea*
Chinese tallow-tree	*Triadica sebifera*
Caesar's weed	*Urena lobata*
Paragrass	*Urochloa mutica*
Beach vitex	*Vitex rotundifolia*

5.2.4.6. Biological Control

Per the USDA Forest Service's Forest Health Technology and Enterprise Team (FHTET), a biological control is "the reduction of an organism's population density through use of its natural enemies". The FHTET recognizes biological control as being one of the most effective and cost-efficient long-term approaches for managing widespread non-native invasive species infestations. This involves utilizing natural enemies (parasites, predators, herbivores, and pathogens) to reduce the population of hosts, whose abundance influences the population levels of natural enemies (USDA-FS 2016). Biological control can be used as a component within a comprehensive Integrated Pest Management program (van Lenteren 2012). For example, some areas under this LMP have utilized rotational grazing of goats to control kudzu infestations.

In some scenarios, biological control may also be used for native vegetation management such as utilizing fenced goats as an alternative to herbicide, mechanical or prescribed fire treatments (USDA-NRCS 2015). However, the use of "prescribed grazing" in these scenarios can be less selective from a species standpoint, impacting both desirable and undesirable species (USDA-NRCS 2015). Despite good intentions and rigorous governmental regulatory environmental risk assessments along with standards and guidelines for the import, export, shipment, evaluation and release of biological controls, it is still possible for these species themselves to become ecologically problematic in forest settings (van Lenteren 2012).

6 Common Florida Forest Types

6. COMMON FLORIDA FOREST TYPES

This section will discuss the common forest types and general stand conditions natural resource professionals may encounter while working with landowners in the state of Florida. Since this LMP is forestry specific, forest type is defined here as a classification of forests by dominant overstory species or group of species (e.g. slash pine or mixed hardwoods). Forest type is not to be confused with the term natural community because each forest type may contain multiple natural communities. Likewise, a given natural community may be dominated by a variety of forest type species.

An example would be the mesic pine flatwoods natural community which could be dominated by longleaf pine or slash pine. Therefore, the mesic pine flatwoods natural community could occur in both the longleaf pine and slash pine forest types. Therefore, referring to Florida Natural Area Inventory's (FNAI) Natural Community Guide as well as the may be useful in meeting landowner objectives. Detailed natural community descriptions, photos, species lists and other information on all the natural communities of Florida can be found in the FNAI Natural Community Guide. Florida natural communities associated with the LMP Common Florida Forest Types are discussed within each respective forest type section. Refer to Table 5 for a listing of the common, dominant overstory species by associated LMP forest type. For this table, the respective species composition for the different forest types was found within the Florida Natural Area Inventory's (FNAI) Natural Community Guide. Multiple Communities of Florida comprise each LMP Forest Type (i.e. Bottomland Hardwoods Forest Type contains wet hardwood flatwood, tupelo-blackgum swamp, and bottomland hardwood forest Communities of Florida).

In this section, the landscape objectives for each forest type will be discussed as well. While some objectives are not applicable across all forest types within Florida, they will be further discussed below the forest type they involve.

Table 5 Common, Dominant Overstory Tree Species by LMP Forest Type

Common Name	Scientific Name	Slash dominated (N FL)	Slash dominated (S FL)	Loblolly dominated	Longleaf dominated	Shortleaf dominated	Upland mixed hardwood-pine	Bottomland hardwoods	Tropical hardwoods
Florida maple	*Acer barbatum*						✕		
Red maple	*Acer rubrum*	✕	✕	✕	✕			✕	
River birch	*Betula nigra*							✕	
Gumbo limbo	*Bursera simaruba*								✕
American hornbeam	*Carpinus caroliniana*							✕	
Water hickory	*Carya aquatica*						✕	✕	
Pignut hickory	*Carya glabra*						✕		
Mockernut hickory	*Carya tomentosa*	✕	✕	✕	✕	✕	✕		
Sugarberry	*Celtis laevigata*						✕	✕	
Atlantic white cedar	*Chamaecyparis thyoides*							✕	
Black titi	*Cliftonia monophylla*							✕	
Pigeon-plum	*Coccoloba diversifolia*								✕
Flowering dogwood	*Cornus florida*						✕		
Swamp dogwood	*Cornus foemina*							✕	
Swamp titi	*Cyrilla racemiflora*	✕	✕	✕	✕				
American beech	*Fagus grandifolia*						✕		
Strangler fig	*Ficus aurea*								✕
Green ash	*Fraxinus pennsykvan*							✕	

Common Name	Scientific Name	Slash dominated (N FL)	Slash dominated (S FL)	Loblolly dominated	Longleaf dominated	Shortleaf dominated	Upland mixed hardwood-pine	Bottomland hardwoods	Tropical hardwoods
Water locust	*Gleditsia aquatica*							✕	
Loblolly bay	*Gordonia lasianthus*							✕	
Holly	*Ilex spp.*	✕	✕	✕	✕	✕		✕	
Red cedar	*Juniperus virginiana*							✕	
Sweetgum	*Liquidambar styraciflua*	✕	✕	✕	✕	✕	✕	✕	
Tulip tree	*Liriodendron tulipifera*						✕	✕	
Wild tamarind	*Lysiloma latisiliqua*								✕
Magnolia	*Magnolia sp*	✕	✕	✕	✕	✕	✕		
Sweetbay	*Magnolia virginiana*							✕	
Swamp tupelo	*Nyssa biflora*							✕	
Tupelo	*Nyssa sylvatica*							✕	
Swamp bay	*Persea palustris*							✕	
Shortleaf pine	*Pinus echinata*					✕	✕		
Slash pine	*Pinus elliotti*	✕						✕	
Spruce pine	*Pinus glabra*						✕	✕	
Longleaf pine	*Pinus palustris*				✕		✕		
Loblolly pine	*Pinus taeda*			✕			✕	✕	
White oak	*Quercus alba*						✕		
Chapman's oak	*Quercus chapmanii*						✕		

Common Name	Scientific Name	Slash dominated (N FL)	Slash dominated (S FL)	Loblolly dominated	Longleaf dominated	Shortleaf dominated	Upland mixed hardwood-pine	Bottomland hardwoods	Tropical hardwoods
Southern red oak	*Quercus falcata*	✕		✕	✕	✕	✕		
Turkey oak	*Quercus laevis*	✕	✕	✕	✕	✕	✕		
Laurel oak	*Quercus laurifolia*	✕	✕	✕	✕		✕	✕	
Overcup oak	*Quercus lyrata*							✕	
Blackjack oak	*Quercus marilandica*						✕		
Swamp chestnut oak	*Quercus michauxii*						✕	✕	
Water oak	*Quercus nigra*	✕	✕					✕	
Shumard oak	*Quercus shumardii*						✕		
Post oak	*Quercus stellata*						✕		
Live oak	*Quercus virginiana*						✕	✕	
Sand live oak	*Quercus virginiana var. geminata*						✕		
Cabbage palm	*Sabal palmetto*							✕	
Wild mastic	*Sideroxylon foetidissimum*								✕
Willow-bustic	*Sideroxylon salicifolium*								✕
Paradise tree	*Simarouba glauca*								✕
Horse sugar	*Symplocos tinctoria*						✕		
Cypress	*Taxodium sp.*							✕	
American elm	*Ulmus americana*						✕	✕	

6.1. Slash Pine Dominant

Slash pine is a highly valuable commercial species in Florida. It is often planted in dense, productive plantations with genetically improved seedling stock. It is often managed even-aged on revenue-maximizing short rotations. Slash is not as long-lived as longleaf pine and is unsuitable for uneven-aged management. It is generally managed on shorter rotations for pulpwood, oriented strand board and chip-n-saw. However, it can be managed on longer rotations for high-value products such as saw timber, poles and ply logs.

Slash pine is second only to longleaf pine in terms of disease, insect and fire resistance, but only moderately drought tolerant. Slash pine is not only economically valuable but is a key ecological component in pine flatwoods natural communities. Revenue and conservation objectives can be balanced or achieved individually through slash pine management.

Slash pine can be found scattered throughout various wetlands and their ecotones, but thrives in the sandy, acidic spodic soils of mesic and wet flatwoods. It shares these flatwoods sites in variably mixed stands with longleaf pine, with little to no hardwood in managed stands. Slash grows marginally along scrubby flatwoods sites with sand pine, longleaf pine and mixed scrub oaks. It is considered offsite on sandhills and clay soils, but can be found marginally on these sites.

6.1.1. North Florida/South Florida Slash Pine

There is enough difference present in the north (*Pinus elliottii*) and south (*Pinus elliottii* var. *densa*) Florida varieties of slash pine to warrant discussion. The north Florida slash is a large pine tree, approximately 50-100 ft tall, with leaves in fascicles of 2 and 3. The seedling is normal size with a slender stem, and the wood from north Florida slash has normal proportions of springwood and summerwood. As mentioned above, north Florida slash is a highly-valuable commercial species and grows well on a variety of soils and conditions (UF IFAS Extension Slash Pine Fact Sheet).

South Florida slash pine, also known as “Dade County Pine”, is found from the lower Florida Keys into central Florida. This version of slash grows more slowly than the north Florida variety and reaches a lesser overall height, reaching about 40 ft tall in approximately 30 years. This stunted growth is likely due to the habitats they occupy: narrow soil layers present above limestone rock and other sand layers. The seedling stages of south Florida pine differ from that of north Florida varieties, appearing more grasslike with crowded needles and a very short stem. These south Florida slash are more resistant to fire in their early growth stages, potentially allowing uneven-aged management through the early use of fire. The wood of south Florida slash is also much denser due to the slower growth stage, as the wood is comparatively harder and contains a thicker summerwood (Little and Dorman 1964).

6.2. Loblolly Pine Dominant

Loblolly pine is a highly valuable commercial species in Florida. It is often planted in dense, productive plantations with genetically improved seedling stock. It is often even-aged-managed on revenue-maximizing short rotations. Loblolly is not as long-lived as longleaf or slash pine and unsuitable for uneven-aged management. It is generally managed on shorter rotations for pulpwood, oriented strand board and chip-n-saw. However, it can be managed on longer rotations for high-value products such as saw timber, poles and ply logs.

Loblolly pine is third behind longleaf and slash pine in terms of disease, insect, and fire resistance, and is not very drought tolerant. Loblolly pine is not only economically valuable but is a key ecological component in upland pine and

several wetland natural communities. Revenue and conservation objectives can be balanced or achieved individually through loblolly pine management.

Loblolly pine grows in several types of wetlands and their ecotones, but thrives in productive clay uplands. It shares upland pine sites in variably mixed stands with longleaf and shortleaf pines, southern red oak (*Quercus falcata*) and hickory (*Carya* spp.) among other hardwoods. Loblolly is occasionally found sparsely on mesic and wet flatwoods sites, particularly adjacent to wetlands. It is considered offsite on sandhills, scrubby flatwoods and well drained sandy soils, but can be found marginally on these sites.

6.3. **Longleaf Pine Dominant**

Longleaf pine is a popular forest type due to its high regional ecological, social, cultural and biological values. Longleaf pine is the most disease, wind, insect and fire resistant of all the southern pine species and very drought tolerant (Burns and Honkala 1990). Longleaf pine historically grew in mesic savannahs, mesic/wet/scrubby flatwoods, upland pine, and upland mixed natural communities (LSU AgCenter 2006). Longleaf pine is a long-lived species with relatively slower growth characteristics compared to slash and loblolly pines, particularly for the first one to five years. Once it reaches the "rocket stage" (rapid vertical growth), growth rates are comparable among these species. This relatively slower growth habit and other physiological characteristics produce high quality saw timber and pole products. It is often managed on longer rotations for these high-value products compared to slash and loblolly pines.

Longleaf favors moderately to well-drained, deep, sandy, acidic, nutrient poor soils but also thrives on rich, moderately well drained clay hills (Burns and Honkala 1990). It grows in nearly pure stands on sandhills aside for scattered mixed scrub oak species and some marginal slash or loblolly pine. In mesic and wet flatwoods, it can be found in variably mixed stands with slash pine, with little to no hardwood midstory in managed stands. In scrubby flatwoods, it can be found alongside marginal sand and slash pines with mixed scrub oaks. On upland pine and upland mixed woodland sites longleaf grows alongside short leaf pine, loblolly pine, southern red oak (*Quercus falcata*) and hickory (*Carya* spp.), among other hardwoods. Scattered natural longleaf can be found growing within wetlands and more so in their ecotones. However, longleaf is difficult to artificially establish on wetter sites, especially if regular fire disturbances have been absent for twenty years or more.

There are many economic and ecological incentives for landowners to manage for longleaf pine. Landowners become a valuable part of the landscape-level restoration of longleaf pine. Longleaf is an ecologically and commercially valuable species that allows for single-use or multiple-use management.

The longleaf pine ecosystem has one of the richest species diversities of any ecosystem in the world outside of tropical rainforests (Noss 1989; Peet and Allard 1993; Jose et al 1990). Wiregrass (*Aristida stricta*) commonly dominates the diverse, pyrogenic understory of longleaf forests. Many endemic wildlife species of longleaf pine forests prefer its open stand structure, including gopher tortoise, fox squirrel, and wild turkey. Frequent, low-intensity prescribed fire is essential for maintaining and restoring this ecosystem and its diversity.

Longleaf is well suited for uneven-aged management, providing landowners the option of managing for a steady, long-term income stream through single-tree selection or group selection harvests. This allows for a mix of products per harvest and meeting a mix of objectives, such as aesthetics.

6.4. Shortleaf Pine Dominant

Shortleaf pine is not a highly productive commercial species in Florida. Shortleaf pine is most productive on the dry hills of central and northern Florida (FNAI Natural Communities of Florida 2010). It is offsite on deep, sandy soils.

Shortleaf mostly occurs scattered in natural, uneven-aged, mixed hardwood-pine stands. Planted stands are uncommon and it is not generally managed in Florida. However, on appropriate soils it can be planted and managed, but loblolly is generally more productive on these sites. It is generally found growing in natural stands that produce pulpwood and oriented strand board products. On the limited, better Florida shortleaf sites, it can produce chip-n-saw, sawtimber and ply logs.

Other than littleleaf disease, shortleaf pine exhibits relatively good disease and insect resistance. Shortleaf seedlings and saplings readily sprout from the base following excessive fire damage, making its fire resistance more in line with longleaf than loblolly. It is also similar to slash and loblolly in fire resistance and sprouts from the base following excessive fire damage. Shortleaf is not highly valuable economically in Florida, but is a minor ecological component in upland pine, upland mixed woodland and dry upland hardwood forest natural communities. Revenue and conservation objectives can be balanced or achieved individually through shortleaf management.

Shortleaf pine is shade intolerant and is best suited for even-aged management, providing landowners the option of managing intensively and maximizing revenue with short rotations. Shortleaf also allows the flexibility to grow stands out longer mainly for aesthetic and wildlife objectives as it generally does not produce quality, high-valued timber products in Florida. It has been successfully uneven-aged-managed, which can be a good fit for natural stands of shortleaf on private lands.

6.5. Upland Mixed Hardwood-Pine

Upland Mixed Hardwood-Pine (UMHP) is a combination of uneven-aged, natural forest types which includes multiple upland natural communities. Refer to Table 2 for a listing of the common, dominant overstory species by associated forest type comprising UMHP.

The natural communities within UMHP are each similar in silvicultural operability to other xeric sites in Florida. This community type is found in the uplands of the Panhandle and upper peninsular portion of Florida and varies based on hydrology and elevation from site to site. This section will focus on the hardwood component of the hardwood-dominated natural communities that compose UMHP. Upland pine has been represented and covered within the loblolly pine and shortleaf pine forest type sections.

In comparison to the pine-dominated upland forest types, these UMHP forests have relatively low timber productivity and generally are not actively managed, aside from upland pine. They are not fire tolerant/dependent, aside from upland pine and upland mixed woodland. Each has a closed canopy except upland pine and some upland mixed woodlands. Soils, productivity, and timber quality vary greatly across these hardwood sites. UMHP forests produce mostly low value products such as hardwood pulpwood and fuelwood. These forests are dominated by shade tolerant hardwoods which are best suited for uneven-aged management. UMHP allows the flexibility to manage for timber while also meeting aesthetic and wildlife objectives.

6.6. Upland Hardwoods

Upland hardwood (UH) communities represent a mixture of hardwood tree species with little to no presence of pine species. The associated natural communities according to The Natural Communities of Florida (Nelson 1986) include: basic forest, beech-magnolia hammock, chestnut oak forest, hemlock forest, maritime forest, oak-hickory forest, mixed mesic hardwood forest, and Southern mixed hardwood forest. This forest type is variable depending on location and found throughout the. This forest type is similar in composition to other mesophytic and riparian forests found throughout the state. Soils within upland hardwoods are typically sub-xeric and acidic, varying from quite sandy to clayey depending on where they are found in Florida and the surrounding habitat. See Table 5 for a listing of the common tree species for the upland hardwoods forest type.

In comparison to the pine-dominated upland forest types, UH forests usually have longer timber rotations requiring little management. Soils, productivity, and timber quality vary greatly across these hardwood sites. UH forests dominated by shade intolerant species, such as oaks, growing on productive soils are capable of producing quality sawtimber. UH forests dominated by shade tolerant species, such as red maple, growing on sub-xeric soils produce mostly low value products such as hardwood pulpwood and fuelwood. Although not usually regarded as fire tolerant/dependent, research has shown that fire applied at the beginning of an UH rotation has increased more valuable shade-intolerant species such as oaks. UH forests are important for wildlife because of the annual mast production they provide. These forests also allow the flexibility to manage for timber while also meeting aesthetic and wildlife objectives.

6.7. Bottomland Hardwoods

Bottomland hardwood (BH) communities are typically river swamps found along larger streams and rivers throughout the southeast and south-central United States. These habitats are generally lacking in slope due to their presence within the broad, flat floodplains of their associated hydrologic feature. Due to their presence in floodplains, BH soils typically consist of alluvial sediment ranging from clay to sand depending on the features (size, water velocity, etc.) of the nearby stream or river. All species within BH communities are dependent on occasional flooding, with the flooding regime determining which species are best adapted for each particular habitat.

In comparison to the pine-dominated upland forest types, these BH forests have relatively low timber productivity and generally are not actively managed. They are not fire tolerant/dependent. BH forests produce mostly low value products such as hardwood pulpwood and fuelwood. These forests are dominated by shade tolerant hardwoods which are best suited for uneven-aged management. UMHP allows the flexibility to manage for timber while also meeting aesthetic and wildlife objectives.

The varied associated natural communities within the BH designation according to The Natural Communities of Florida (2009) include: dome swamp, basin swamp, strand swamp, floodplain swamp, baygall, hydric hammock, bottomland forest, and alluvial forest. After conferring with a group of natural resource professionals and stakeholders from Florida, however, it was determined that for the purpose of landscape management within this plan, the BH designation should apply to 3 distinct forest types: mixed floodplain, tupelo-cypress mixed, and mixed forested wetland.

6.7.1. Mixed Floodplain

Mixed floodplains are a combination of forest types which includes multiple wetland natural communities that are associated with riverine or creek systems. They are each similar in silvicultural operability and hydrology. These are uneven-aged, natural forested wetlands with long hydroperiods. They are not fire tolerant/dependent and each has a closed canopy. The associated natural communities include: hardwood flats and flatwoods. See Table 5 for a listing of the common, dominant overstory tree species for the mixed floodplain forest type.

In comparison to the pine-dominated upland forest types, these wetlands have relatively low timber productivity. This is due to slower growth rates and their harvest windows being limited by longer hydroperiods. However, they can be sustainably managed by using Florida's Silviculture BMPs and Wildlife BMPs.

6.7.2. Tupelo-Cypress Mixed

Tupelo-cypress mixed communities are relatively small, isolated, non-fire dependent wetlands embedded within various upland, pyrogenic natural communities. Pond cypress (*Taxodium distichum* var. *nutans*) and swamp tupelo (*Nyssa sylvatica* var. *biflora*) are relatively slow-growing and dominate this forest type together or in pure stands. These wetland ponds have a hydroperiod that lasts most of the year, with gum-dominated ponds having a longer hydroperiod than cypress. Cypress-dominated stringer swamps occur along intermittent streams that only flow following heavy rainfall. They occur on relatively unproductive organic muck, heavy clay, wet sand and peat soils. However, these typically even-aged forest types can be managed sustainably by using the Florida Silviculture BMPs.

Both cypress and gum have low fire tolerance, as do their associated species. Cypress/gum ponds can contain various mixed hardwoods including bays (*Persea* spp.*, Gordonia lasianthus*, *and Magnolia virginiana*), red maple (*Acer rubrum*), holly (*Ilex* spp.) and swamp titi (*Cyrilla racemiflora*). Cypress-dominated ponds and stringer swamps generally occur within pine flatwoods and sandhills, while gum-dominated ponds generally occur within upland pine natural communities.

In comparison to the pine-dominated upland forest types, these tupelo-cypress mixed forests have relatively low timber productivity and value and generally are not actively managed silviculturally on most private lands. However, silvicultural opportunities exist within these communities. Cypress-dominated ponds and stringers are shade intolerant and best suited for even-aged management. Gum ponds are shade tolerant but typically managed even-aged as well. Tupelo-cypress mixed forest type allows the flexibility to manage for timber while also meeting aesthetic and wildlife objectives. These forests produce mostly low value products such as hardwood pulpwood and fuelwood and cypress mulch. Mature cypress stands can produce saw logs used for various ornamental products such as tables, trim and furniture.

6.7.3. Mixed Forested Wetland

Mixed Forested Wetland (MFW) is a community located in still water depressions or lowlands and not associated with rivers or creeks. This is an uneven-aged, natural forested wetland with a varying hydroperiod. MFW communities are not fire tolerant/dependent and they have a closed canopy. MFW's typically have dense over/mid/understories and are sometimes impenetrable. See Table 5 for a listing of the common, dominant overstory tree species for the Mixed Forested Wetland forest type.

In comparison to the pine-dominated upland forest types, these wetlands have relatively low timber productivity. This is due to slower growth rates and their harvest windows being limited by longer hydroperiods. However, they can be sustainably managed by using Florida's Silviculture BMPs and Wildlife BMPs.

6.8. Tropical Hardwood Hammock

Tropical hardwood hammock (THH) is a forest type that is unique to Florida within the United States, found entirely in the southern portion of continental Florida as well as throughout portions of the Florida Keys. This forest type is a raised area of land comparable to its surroundings that is composed of evergreen and occasionally semi-deciduous hardwood trees having their origin in the West Indies and various islands surrounding the continental United States (a listing of tropical hardwood hammock species can be found in Table 5). Although a majority of THH habitat on the mainland of Florida has been acquired and properly managed, THH habitat through the Florida Keys is still threatened by further development (USFWS 2019). THH can serve as essential habitat for a variety of flora and fauna that use them as a source of upland shelter within frequently wet surrounding environments; in fact, THH have been shown to harbor up to 36 different threatened or endangered plant species and multiple different animal species, including the Eastern indigo snake and Key Largo woodrat.

In comparison to the pine-dominated upland forest types, these tropical hardwood hammocks have relatively low timber productivity and value and generally are not actively managed silviculturally on most private lands. THHs were logged within the last century for valuable lumber trees such as mahogany; however, instead of active management for timber yields, these communities are generally managed for restoration following previous development impacts to these communities (Karim and Main 2013).

7

Forest Resources

7. FOREST RESOURCES

7.1. Common Forest Resources

The forest resources discussed below are applicable resources from all forest types in the LMP and may be considered for each landowner. They are summarized below, rather than included in the forest types discussion due to their relative uniform applicability across all forest types.

7.1.1. Conservation Incentives

There are several programs and markets available to landowners that can reward them and provide incentives for their conservation efforts. The most widely used programs are cost-shares. A list of some of the major incentives available within Florida by providing agency is given below. The state conservation initiatives are not discussed in depth within this LMP due to their abundance and specificity, but additional information concerning each can be obtained through clicking on their links in Table 6 below.

Table 6 Conservation Incentives within Florida, by Providing Agency

Providing Agency	Program Title
USDA Natural Resources Conservation Service (NRCS)/Farm Service Agency/National Initiatives	America's Longleaf Restoration Initiative
	Biomass Crop Assistance Program
	Conservation Reserve Program
	Emergency Watershed Protection Program
	Environmental Quality Incentives Program
	Conservation Stewardship Program
	National Water Quality Initiative
	Longleaf Pine Initiative
	Shortleaf Pine Initiative
	Regional Conservation Partnership Program
	Red-Cockaded Woodpecker Recovery Program
	Wetlands Reserve Program
	Partners for Fish and Wildlife Program
	Florida Rural Development Program
	Agricultural Conservation Easement Programs

Providing Agency	Program Title
Florida Forest Service/Florida Fish and Wildlife Conservation Commission	Southern Pine Beetle Prevention Program
	Florida's Wildlife Legacy Initiative
	Forest Legacy Program
	Forest Stewardship Program
	Landowner Incentive Program
	Longleaf Pine Private Landowner Incentive Program
	Wildlands Conservation
	Red-Cockaded Woodpecker Safe Harbor Program
	Farm Bill Technical Support Program
	Rural and Family Lands Protection Program
	Landowner Assistance Program
Private Organizations	Longleaf Restoration Program (Longleaf Alliance)
	Pine Rockland Initiative

Some landowners sign conservation easements ensuring this long-term protection. Landowners can enter their property into a conservation easement agreement through various entities such as The Nature Conservancy, Florida Department of Environmental Protection (FDEP), or Florida Forest Service (FFS). Conservation easements vary, but most ensure the land is never developed, while allowing the landowner to continue management activities such as timber harvests, and in return they receive a property tax break. This option also allows many landowners a strategy during the estate planning process. Some landowners may also be available to earn credits on private mitigation banking markets through the enhancement or restoration of wetlands and/or threatened and endangered species habitat.

7.1.1.1. Conservation Initiatives Within Ecoregions

Conservation is essential to maintain the abundant natural resources found in Florida. There are multiple Conservation Initiatives (CI) at work in the state that are working to protect these resources. This report will focus on those with components that involve or affect forested habitat or species located within these habitats. It should be noted, though, that this section may not be an entirely comprehensive list of all conservation incentives available to landowners within Florida. Research should be personally conducted in conjunction with a forester or biologist consultation in order to discern whether other CIs may be available to landowners, as others may be available depending on the time or location.

7.1.1.1.1. National Conservation Initiatives and Programs

The United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) administers the Environmental Quality Incentives Program (EQIP) to "provide financial and technical assistance to forestry and agricultural producers to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, reduced soil erosion and sedimentation, and improved or created wildlife habitat." Through this program, NRCS provides guidance and financial resources to implement environmental improvements. EQIP is available throughout all ecoregions in Florida; depending on where your land is located, any number of 200 different forest and farm-focused land improvement practices may be available. Some of these various EQIP practices can be found in subsequent sections of the LMP.

The USDA Farm Service Agency (FSA) administers the Conservation Reserve Program (CRP). Since its inception in 1985, CRP is the largest private-lands conservation program in the United States. Through this program, farmers agree to accept a yearly rental payment and participate in cost-share of up to 50% and in return remove lands deemed environmentally sensitive from their normal production and instead plant species to improve environmental quality and health. The contract length for lands enrolled in CRP vary from 10 to 15 years, with the long-term goal of re-establishing valuable land cover to improve water quality, prevent soil erosion, and reduce wildlife habitat loss. The CRP has multiple initiatives that landowners can choose to participate in, ranging from the Longleaf Pine Initiative to the Bottomland Hardwoods Initiative, which is applicable in the Florida wetland forested habitats.

An aquatic initiative active within Florida is the National Water Quality Initiative (NWQI). Through this program, the NRCS provides both financial and technical assistance to landowners interested in improving the quality and habitat structure of impaired streams. In Florida, the watersheds meeting the criteria to be classified as "priority watershed" are the Deep Creek Watershed, the Clarks Creek Watershed, and the Little Scurlock Creek Watershed. These watersheds contain the Lower St. Johns River within portions of Putnam and St. Johns counties as well as the Lower Choctawhatchee River within portions of Jackson and Washington counties. Possible sources of contamination within these watersheds are failing septic systems, cattle watering in creeks, birds, and wildlife. A main method of improving these watersheds is the control of nutrient and manure runoff into the water bodies. This control may be accomplished through assistance installing cover crops, filter strips, and tailwater recovery systems, which will aid landowners in protecting natural resources voluntarily while also receiving a profit. In Florida, the above-mentioned priority watersheds are found only in the Southeastern Plains and Southern Coastal Plain ecoregions.

A forest-based restoration initiative that is present throughout multiple southeastern states is the EQIP Longleaf Pine Initiative (LPI) through the NRCS. This initiative seeks to improve the sustainability and profitability of Longleaf ecosystems and forests. Through the NRCS Farm Bill, landowners within Florida receive technical and financial assistance in propagating the spread and protection of these longleaf pine habitats. Under the LLPI, landowners participate in a variety of forestry practices, such as site preparation, forest stand improvement, and prescribed burning to create an optimal habitat for longleaf pine. The priority area boundaries of the LLPI in Florida cover portions of the Southeastern Plains and Southern Coastal Plains, areas that are historic longleaf habitat.

Within the America's Longleaf Restoration Initiative, four different Implementation teams exist across the state of Florida: the Gulf Coastal Plain Ecosystem Partnership, the Apalachicola Regional Stewardship Alliance, the Ocala Local Implementation Team, and the Okefenokee-Osceola Partnership. Each of these partnerships has the goal of reestablishing, maintaining, and enhancing the longleaf pine ecosystem using a variety of management practices and collaboration within stakeholders. Each of these local partnerships are composed of a mix of state, federal, and

private organizations as well as private landowners within the respective regions. Participating in the various land management activities promoted by these individual partnerships may qualify the landowner for cost-share benefits. The Shortleaf Pine Initiative (SPI) is a program designed to address the multiple threats facing the increasingly imperiled shortleaf pine forest (Shortleaf Pine Restoration Plan, 2016). Recently, factors such as pine beetle outbreaks, changes in timber management practices, altered fire regimes, and land use changes have contributed to the decline of this specific ecosystem. In 2013, the SPI was formed to address these issues through policy formed by key federal and state agencies from the 22 states affected by the shortleaf pine decline. Shortleaf pine restoration depends on site-specific efforts by regional practitioners and partners to educate landowners interested in restoration on their lands. These efforts include the demonstration of shortleaf pine restoration practices, the sharing of technical information, and the promotion of site-based conservation. This initiative is available throughout mainly the Southeastern Plains but also the Southern Coastal Plains ecoregions within Florida.

A wildlife-focused conservation initiative within Florida is the National Bobwhite Conservation Initiative (NBCI 2015). The NBCI is a 25-state effort to restore bobwhite to the whole of America's landscape. The NBCI is focused on developing an ever-evolving strategy to approach bobwhite revival on a landscape scale as opposed to a small-scale, individual farm-based approach as previously utilized. Through the NBCI Technical Committee, representatives from the 25 states can lend their biological, scientific research, and private conservation expertise to the protection and restoration of bobwhite. Methods for promoting the reestablishment of bobwhite quail include advancing the establishment of native grasses and flowers along cropland and rural land edges to promote habitat connectivity, converting up to one-third of existing pasture to native grasses beneficial to both cattle and bobwhite, and managing pine and other forests to promote forest habitat connectivity. The NBCI is available to landowners with appropriate acreage and suitable habitat that are deemed to qualify for a NBCI Focal Area, and area where quail populations can be studied more in depth. NBCI provides coordination, design, training, data management, reporting tools, and nationwide outreach. All ecoregions within Florida can qualify under the NBCI. For information about the Florida Bobwhite Initiative, go to: https://myfwc.com/hunting/quail/.

Another wildlife-focused conservation initiative throughout the state of Florida is the program of Working Lands for Wildlife (WLFW). Established through the NRCS Florida group, this program's focus is to assist landowners in voluntary conservation efforts toward threatened species. NRCS provides financial and technical support to participants who voluntarily make certain improvements to their working lands in order to facilitate improvement of these species' habitat. This initiative has proven successful in helping conserve more than 7.1 million acres of wildlife habitat nationwide, and has benefitted species such as the greater sage-grouse and New England cottontail. In Florida, a main target species of the WLFW program is the gopher tortoise. Additional information concerning the WLFW initiative can be found in Section 5.2.3.1 Working Lands for Wildlife.

7.1.2. Ecosystem Services

Forests provide ecosystem services to society that are wide ranging and difficult to value. These ecosystem services include clean air and water, carbon sequestration, aquifer recharge, climate resilience, and biodiversity. There are currently few significant markets for these services in Florida, but they may develop in coming years. However, lack of financial incentives does not discount the crucial services ecosystems provide us, making ecological maintenance and restoration an important objective for many landowners.

7.1.3. Historical and Cultural Sites

Many private lands contain various historical and cultural resources, also known through ATFS as "special sites." Therefore, forest management activities are often developed to consider and maintain any special sites relevant on the property. Landowners may be aware of these sites or their locations may be documented and mapped with federal, state or local agencies and organizations. Forest resource professionals could discuss known sites with landowners. If the landowner is unaware of any sites or the land is newly acquired, there are many resources available to review potential recorded sites such as the National Register of Historic Places (NRHP) or the Florida Division of Historical Resources (FDHR) and local historical societies and museums. The Historical Structures and Cemeteries layers within the geodatabase can also be used to provide information on site-specific historic and cultural resources.

The property can also be reviewed on the ground through visual reconnaissance by the landowner or forest resource professional, within a reasonable scale relative to property acreage and accessibility. The FDHR and local historical organizations have limited resources but may be able to assist with locating or interpreting potential significant sites and local preservation laws. Sites listed by these organizations reflect a determination of a site's significance to the history of a community, state or nation and should be protected as required by federal, state or local laws. Non-listed sites of personal significance to the landowner may also be protected.

Special sites may be identified in a property's 004 Form or other programmatic documentation, which serves as a supporting component of this plan. Where appropriate, special sites may also be identified on the ground. However, some landowners may choose not to identify some special sites on a map, a 004 Form, or other documentation, or on the ground to protect these sites from vandalism or overuse. Many landowners may simply verbally describe the special site and its location, as a complement to this plan.

Landowners and their forest resource professionals are encouraged to make reasonable efforts to locate and protect special sites appropriate for the size of the forest and the scale and intensity of forest management activities. Protection of historical and cultural sites during land management activities can be considered during planning, contract development, monitoring, and follow-up inspections. These sites can be designated on the ground with vegetative buffers, flagged/blazed trees or fencing, signage and communication with contractors and sub-contractors.

Landowner considerations for determining whether to designate an unlisted site may include:

- **Significance**:
  - Site has made a significant contribution to the broad patterns of our history;
  - Associated with the lives of significant persons of the past;
  - Embody distinctive characteristics of a type, period or method of construction, or represent the work of a master, or possess high artistic values, or represent a distinguishable entity whose components may lack individual distinction;
  - Yielded or likely to yield information important in history or pre-history
- **Age**: Minimum 50 years-old
- **Integrity**:
  - Site must retain its historical physical integrity with its character-defining features still present.
  - Building, structure or landscape feature must be relatively unchanged.

- Archeological site must be relatively undisturbed, with its patterns and layers of artifacts relatively intact.
- Traditional cultural site must be recognizable to today's affiliated cultural group, evidenced through tradition and still used or revered today.

- **Personal Significance**: such as a location, structure or artifact with a family importance or meaning.

Special sites of biological and geological significance and sensitivity may be identified through consultation undertaken related to the identification of threatened or endangered species and natural communities. Cultural and historical resources can be mapped and marked on the ground to aid general protection, documentation and monitoring efforts. However, some landowners may wish to keep these sites unmarked and unmapped to avoid attracting attention that could lead to vandalism, theft or degradation.

Historic, cultural, and special sites may include:

- Native American burial grounds, camps, middens, mounds etc.
- Historic dwellings, structures, foundations, barns, wells, cattle dipping vats, ruins, cemeteries, bridges
- Geological formations, sinkholes, limestone bluffs or outcroppings, caves/entrances, spring heads, springs, etc.
- Rare plant populations, pitcher plant bog, champion trees, bear den, etc.

7.1.4. Recreation

Florida forests are popular places to recreate for their unique topography, biological diversity, and the wide range of potential activities. Landowners can enjoy personal and family recreational use or lease their land as a means of revenue generation. Table 7 provides examples of potential recreation activities that can occur within forested Florida landscapes.

Table 7 Potential Recreation Activities

Bicycling	Equestrian	Hunting and leases
Camping	Fishing and leases	Off-highway vehicles (OHV) and leases
Eco-tourism and leases	Geocaching	Paddling
Environmental education	Hiking	Wildlife viewing and birding

7.1.5. Aesthetics

From a towering pine stand with a sea of grasses to a lush, bottomland hardwood forest draped with Spanish moss to a bright, exotic tropical hardwood hammock in the Florida Keys, the wide range of forest types, topography, and aquatic features throughout Florida provide unique forest aesthetic values. The forests themselves vary from open, pine-dominated rolling hills to dense cypress ponds. The panhandle of Florida boasts hardwood forests only found in the northern part of the state. These dense forests are composed of many northern species, providing a more Appalachianesque aesthetic than the southern Florida lowlands, where the cypress lined rivers and ponds have their own prehistoric beauty.

Northern Florida is quite diverse in its topography due to its stretching from coastal lowlands to rolling hills. It has rolling sand and clay hills, steep-head spring ravines, slope forests and high river bluffs. These features allow for exceptional forest views in a relatively flat state. Various aquatic features such as forested wetlands, lakes, ponds,

rivers, streams, springs, and sink holes are major visual highlights of the state's forests. These are present naturally throughout the region and add character to a property; so much so that many landowners choose to enhance their property's aesthetics by creating man made ponds and waterbodies. These forest aesthetic considerations not only provide beautiful views but also a sense of privacy, adventure, and landowner pride.

7.1.6. Forests of Recognized Importance (FORI)

Forests of Recognized Importance (FORI) represent globally, regionally, and nationally significant large landscape areas of exceptional ecological, social, cultural, or biological values. These forests are evaluated at the landscape level, rather than at the stand level, and are recognized for a combination of unique values, rather than a single attribute. FORIs may include landscapes with exceptionally high concentrations of one or more of the following:

- Protected, rare, sensitive, or representative forest ecosystems such as riparian areas and wetland biotopes.
- Areas containing endemic species and critical habitats of multiple threatened or endangered plant and animal species, as identified under the Endangered Species Act (ESA) or other recognized listings.
- Recognized large-scale cultural or archeological sites including sites of human habitation, cities, burial grounds, and *in situ* artifacts.
- Areas containing identified and protected water resources upon which large metropolitan populations are dependent.
- Areas containing identified unique or geologic features including geysers, waterfalls, lava beds, caves, or craters.

While landowners are encouraged to contribute to or support the values that led to the FORI designation of the area, the FORI designation does not compel the landowner to take any actions.

7.1.6.1. FORI Designation within Region

In the United States, because of their significance, FORIs have generally been identified and protected by federal or state governments or are under conservation easement by an environmental nonprofit organization. There is currently no state or federal agency that regulates FORIs on private forestlands in the United States. Several conservation organizations have identified areas that they believe are of exceptional status, yet there remains no single central clearinghouse of information regarding such forested landscapes.

To support and facilitate identification of these resources within this project, the Florida Tree Farm Program (FTFP) coordinated with AFF to develop a list of FORIs within the state while consulting the Florida's Forest Action Plan and area conservation priorities. The following forest landscapes were identified for the LMP, by these stakeholders, based on the combination of their unique attributes, consistent with the definition of FORI under ATFS.

7.1.6.1.1. Public Lands and Conservation Easements

Due to their recognized conservation priorities for protecting habitat, biodiversity, water resources, cultural sites, and unique geologic features, all area federal and state, as well as county and municipally-protected public lands and private conservation easements are considered FORIs within this LMP. This designation includes state forests, state parks, national forests, national parks, water management areas, wildlife management areas, and wildlife refuges. Some instances of federal or state lands not included under this designation include historical sites, museums, botanical gardens, etc. The state and federal public lands within the region are included in the FORI spatial layer.

Appropriate actions to protect and enhance this type of FORI would be adherence to applicable Silvicultural and Wildlife Best Management Practices.

7.1.6.1.2. Forest Lands Bordering Special Waterbodies

As defined by FDEP, an Outstanding Florida Water (OFW) is "a water designated worthy of special protection because of its natural attributes." This special designation is applied to certain waters within the state with the goal of protecting existing good water quality. The majority of OFWs are already managed by Florida or Federal governments as parks, wildlife refuges, preserves, scenic and wild rivers, or aquatic preserves. These waterbodies are also now identified as "Special Waterbodies" as identified in the Florida BMP Manual, Appendix 4. Other types of waterbodies identified through this Appendix are Class I Waters in Florida, which receive the same level of FORI protection. As protection of the quality of these OFWs is essential to water quality within the state, all forests that border or surround them also should receive the special designation of FORI. Appropriate actions to protect and enhance this type of FORI would be adherence to applicable Best Management Practices.

7.1.6.1.3. Forests Surrounding Sinkholes with Connection to the Floridian Aquifer

The main source of water for the majority of northern and central Florida comes directly from underground aquifers, most notably the Floridan aquifer. These aquifers can be made from different types of earthen and natural materials, although the majority form in hollow spaces within limestone (SJRWMD 2019). While saltwater generally composes the deeper portions of aquifers, freshwater from the surface is present in the upper portion of these aquifers. This freshwater is replenished by rainfall from the surface seeping down to the subterranean caverns of the aquifer. Sinkholes with a connection to the aquifer can be found throughout all different habitat types within Florida, notably within forests. Therefore, forests that contain sinkholes with potential aquifer connections are deemed to be FORI due to their potential impact on the quality of aquifer water, a major source of drinking water for the state of Florida. Appropriate actions to protect and enhance this type of FORI would be adherence to applicable Best Management Practices.

Landowner Actions to Protect FORIs

For family landowners, a likely scenario is that their property is adjacent to a state or federally protected area that has been identified as a FORI at a landscape scale. Landowners should consider the impact to a neighboring FORI and opportunities to support consideration of specific values or attributes when planning and implementing activities on their forest property. Given the size and scale of family ownerships eligible for ATFS certification, landowners may be limited in their abilities to significantly impact FORI presence and quality through management at the small scale.

Management activities on or adjacent to an identified FORI should seek to contribute to or support the values that led to the designation of the area. While landowners are encouraged to contribute to or support the values that led to the FORI designation of the area, the FORI designation does not compel the landowner to take any actions.

During the ATFS inspection process, an ATFS Inspecting Forester shall whether FORI are relevant to the property. The ATFS Inspecting Forester should also identify any efforts the landowner is making to support the values of the identified FORI within the 004 Form.

7.2. Forest Type-Specific Forest Resources

7.2.1. Fish & Wildlife

The forests and associated aquatic ecosystems of Florida provide habitat for a wide array of game and non-game fish and wildlife, including several imperiled species. These forests can be managed in a way that enhance, restore, and protect the valuable habitats these species call home. These species may be managed for various objectives such as conservation, legacy planning or recreation. Present listed species can be documented, mapped and monitored.

The Wildlife BMPs compile strategies and considerations for managing and protecting these state-listed species and their habitat during silvicultural operations. For example, marking a rare plant or animal area with flagging, paint or signage to protect during harvest operations, active monitoring before or during silvicultural operations and following up with post-harvest inspection(s). Silviculture BMPs manual also considers fish and wildlife conservation in relation to silvicultural activities. The Wildlife BMPs offer guidance for these silvicultural activities, while more importantly providing the landowner with protection in the case that listed species are harmed while implementing silvicultural operations. The Wildlife BMPs are voluntary practices that are applied at the discretion of the landowner or other person or entity responsible for conducting activities on the property. Landowners and others are not specifically required to enroll in the FDACS Water Quality BMP programs to participate in the Wildlife BMP program; however, water quality BMPs applicable to specified State Imperiled Species must be implemented as indicated on the Wildlife BMP Notice of Intent (NOI). In addition, applicants who enroll by completing a Wildlife BMP NOI and implement the applicable practices are not required to obtain a permit to authorize the incidental take of the 16 State Imperiled Species associated with their operations.

Pine forests provide habitat to hundreds of game and non-game species including bob white quail, wild turkey and deer. They are also home to several rare species including: gopher tortoise, eastern indigo snake, Bachman's sparrow and red cockaded woodpecker. Hardwood forests also provide habitat for their own collection of game and non-game species.

7.2.2. Timber Products

Timber merchantability, whether planted or natural, pine or hardwood, will depend on local timber markets and mill product specifications. The geodatabase can be utilized to locate and contact local mills and calculate haul distance. Panhandle timber markets are in Florida, Georgia and Alabama and currently include these products:

- Pulpwood:
  - Pine and Hardwood
    - Tree-length and clean chips
- Oriented strand board (OSB): pine
  - Similar price as pulpwood
- Chip-n-saw: pine
- Sawtimber: pine and hardwood
- Poles and pilings: pine
- Mulch: hardwood and cypress
- Fuelwood:

- Pine, hardwood and large woody shrub species
  - Chips/Pellets for energy production
- Hardwood
  - Firewood
- Other hardwood products: Pallets, mats, small diameter saw timber for furniture, horse bedding (pine shavings or hardwood pellets), veneer

Timber, like any other commodity, experiences price fluctuation according to the laws of supply and demand; prices may vary significantly from one part of the state to another. The price paid for any product class also varies according to quality.

7.2.2.1. Pine forest products

Timber is considered pre-merchantable if it is not marketable as one of the products above. All the major timber product groups can be harvested from all of the different pine forest types including pulpwood, chip-n-saw, saw timber and poles. These pine forests also allow for fuelwood harvests, especially utilizing natural regeneration and hardwood reduction treatments. Slash, loblolly, and shortleaf pine are commonly managed for lower value, short rotation products such as pulpwood, while longleaf is commonly managed on longer rotations for quality, high-value saw timber and pole products. Each pine species is also managed for all the other pine products. All of the major timber product groups can be harvested from pine-hardwood mixed forests.

7.2.2.2. Hardwood forest products

All the major timber product groups can be harvested from Upland Mixed Hardwood-Pine, Upland Hardwood, and Bottomland Hardwood forest types including pulpwood, veneer, saw timber and fuelwood. Pine-Hardwood Mixed and Bottomland Hardwood forests are commonly managed for hardwood pulpwood, various pine products and fuelwood. Bottomland Hardwoods also allow for fuelwood harvests, especially utilizing natural regeneration and hardwood reduction treatments.

The following timber product groups can be harvested from Tupelo-Cypress Mixed forests: hardwood pulpwood, cypress mulch and sawtimber and fuelwood. This forest type is commonly managed for lower value products such as hardwood pulpwood and cypress mulch.

7.2.3. Non-Timber Forest Products

Many non-timber forest products (NTFP) opportunities exist within pine forests, including pine straw (slash and longleaf pine) silvopasture (all pine forests), bee-keeping (all pine forests), firewood, and saw palmetto drupe harvests (all pine forests). NTFPs exist to a certain scale within hardwood forests as well. Upland Mixed Hardwood-Pine, Upland Hardwood, Mixed Floodplain, Tupelo-Cypress Mixed, and Mixed Forested Wetland all provide opportunities for bee-keeping and fruit harvests, while tupelo-cypress mixed forest types provide opportunities for the collection of cypress knees as well.

7.2.3.1. Pine-specific forest types

7.2.3.1.1. Pine straw

Longleaf pine straw is the most valuable and desirable as it produces long, resilient, attractive needles ideal for landscaping. Pine straw raking for landscaping material is the most common NTFP market in the region. It often generates $100-$150 per acre, per year or more and can be conducted while the timber is still pre-merchantable, providing landowners with early returns on their stand establishment investment (i.e. site preparation and reforestation costs). Raking is generally initiated at crown closure and ceases following first thinning (year 20). For slash pine crown closure is around age eight or nine and longleaf around age ten. If landowner objectives are focused on maximizing revenue, they may wish to forego thinning and rake straw beyond economic or biological thinning age, clearcutting for pulpwood at age 18-20 and starting over. If landowner objectives are varied and involve thinning, the stand should be thinned at economic or biological thinning age to promote proper stand development.

Traditional pine straw raking reduces or eliminates the native groundcover with annual herbicide and mowing and removal of coarse woody debris. This eliminates impurities being mixed in with the pine straw and allows for efficient raking. The result is a monoculture of the pine species, drastically reducing, and in some cases, eliminating wildlife habitat. However, a more conservation-oriented form of pine straw management has been developed which entails raking the pine straw from the top of native groundcover and avoids frequent herbicide and mechanical treatments (NWF 2015). This approach may generate less revenue but may be a better fit for landowners balancing revenue with wildlife and aesthetic objectives. Pine straw stands are often fertilized to produce more pine straw, promote tree growth and avoid depleting soils. Pine straw raking can be rewarding yet requires a lot of work to be successful. Planning and site selection begins prior to stand establishment.

Visit "Straw Raking in Southern Pine Stands and Fertilization Recommendations" and "Lifting Longleaf Pine Straw: An Option to Balance Income and Wildlife" for more information.

7.2.3.1.2. Silvopasture

All pine habitat is conducive to silvopasture. Silvopasture is an agroforestry practice combining livestock, forage and timber management within the same land management unit (Hamilton 2008). This system provides landowners various combinations of options to manage forage (hay, etc.), livestock (cattle, etc.) and pine straw for short-term revenues while managing their timber for high-value products (poles and sawtimber) on longer rotations. Properly managed silvopasture systems also allow farms to be more profitable by diversifying revenue sources and cutting feed costs. However, landowners should be willing and able to actively manage the forage, livestock and timber components.

The open forage areas within the management unit allow for biodiversity, enhancing cool season grasses, while also allowing for warm season grass production. The areas with timber provide shade to livestock. This open, relatively low density stand structure enhances aesthetics, property values and recreational opportunities. This system also promotes wildlife populations and provides habitat for wild turkey and quail. The combination of timber and quality forage also prevents erosion and improves water quality and hydroperiod.

Silvopasture provides economic security by reducing risk through diversification of products. However, prior to establishing a new silvopasture system, local land-use, cost share and tax regulations should be reviewed. Forestry and agriculture may have different land use and zoning regulations which may be tied to separate tax structures.

Some states, including Florida, consider silvopasture cost-sharable through Environmental Quality Incentive Program (EQIP).

Silvopasture is generally established in pastures. Existing timber stands can be thinned or clearcut corridors of adequate width that support forage production. Converting existing stands can be costly due to extensive site preparation needs. Large acreage is required to simultaneously support viable timber and livestock production.

Visit Silvopasture: Establishment & management principles for pine forests in the Southeastern United States for more information (Hamilton 2008).

7.2.3.2. Hardwood-specific forest types

7.2.3.2.1. Cypress knees

Tupelo-cypress mixed forests produce knees that can be cut and used for art and craft purposes. This is non-commercial and on a small-scale

7.2.3.3. Pine and hardwood forest types

7.2.3.3.1. Honey

Beekeeping and honey production are common within pine forests. Honey production can provide annual short-term revenues. Landowners can produce and sell honey themselves, sell their honey to larger producers and distributors, or lease their lands to honey producers. Beekeeping may also just be a hobby designed strictly for personal consumption. Properties with a diverse stand composition, in terms of overstory and understory species and uplands and wetlands, can potentially generate honey revenue nearly year-round. Upland and wetland forests are marketable for apiary leases; however, this is not particularly lucrative and often done by bartering honey for leased land.

Beekeeping and honey production are considered a valuable industry in Florida. The Florida Department of Agriculture and Consumer Services Division of Plant Industry (FDACS-DPI) is the governing body that oversees the rules and regulations of keeping honey bees in Florida. Florida has a mandatory registration law, thus each beekeeper having honey bee colonies within the state must register with the Department.

7.2.3.3.2. Fruits

Saw palmetto drupes are harvested from all pine forest types, but shortleaf pine forests to a lesser degree than slash, longleaf pine and sand pine forests. They can also be harvested from Mixed Floodplain, Upland Mixed Hardwood-Pine, and Upland Hardwood forest types within Florida. Saw palmetto drupes are harvested to produce medicines used to treat symptoms of enlarged prostate and prostate cancer prevention (Anderson and Oakes 2012). Palmetto drupes can be sold to producers through contract, permit or by leasing land for harvests, providing landowners short-term revenue. However, pickers can be troublesome and need to be monitored. Trespassing, cutting fence and other issues have arisen without adequate permitting and monitoring of crews. Prescribed fire stimulates palmetto drupe production and they ripen August through October (Anderson and Oakes 2012).

Palmetto drupes are a primary dietary staple of Florida black bear (US Fish and Wildlife Service 2019) and provide valuable nutrition to raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), gopher tortoise (*Gopherus poloyphemus*), opossums (*Didelphis marsupialis*), white-tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris*

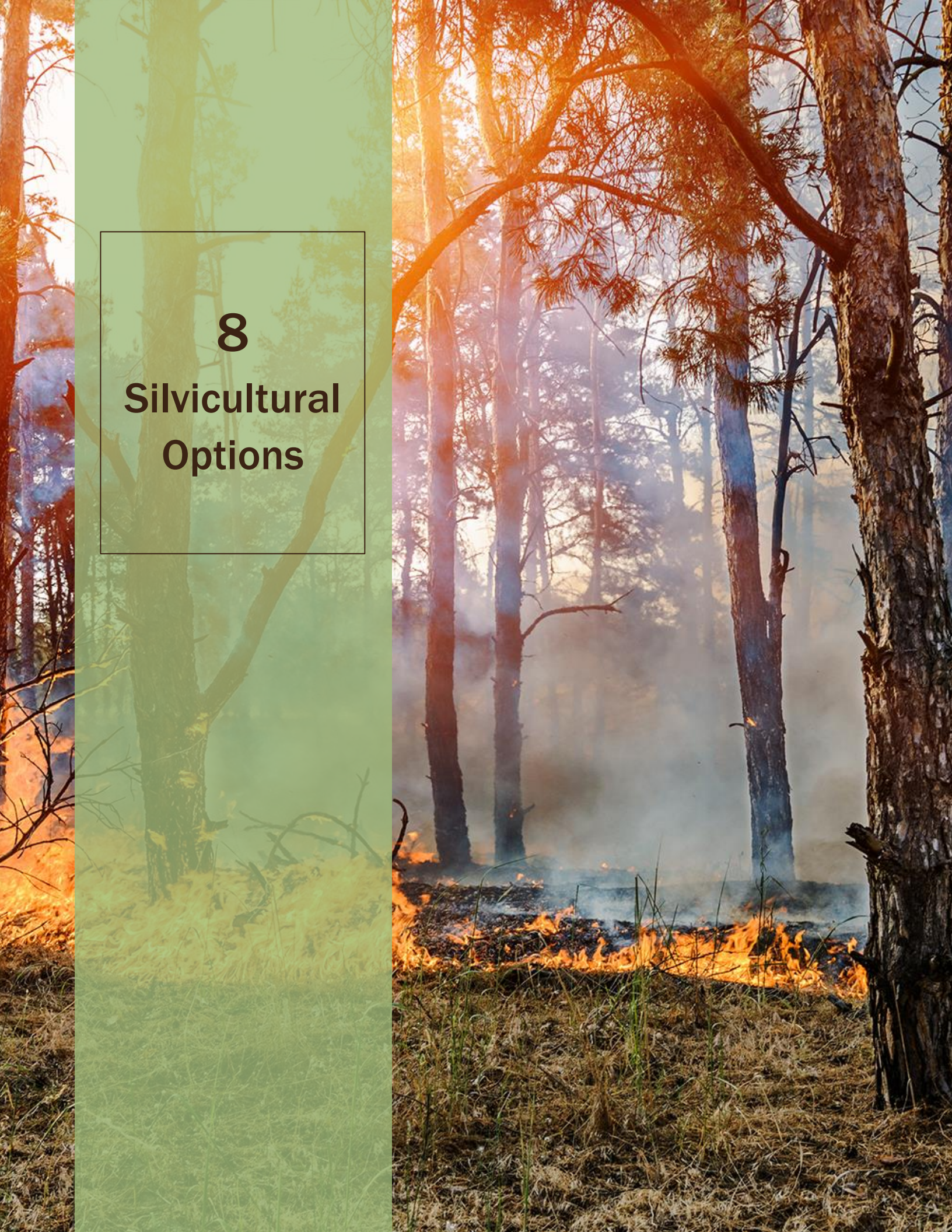
gallopavo), bobwhite (*Colinus virginianus*), black bear (*Ursus americanus*), feral hog, and various birds such as American robin (*Turdus migratorius*), northern mockingbird (*Mimus polyglottos*), yellow-rumped warbler (*Dendroica coronata*) and pileated woodpecker (*Dryocopus pileatus*) (Anderson and Oakes 2012). If wildlife management is an objective, landowners may wish to avoid or limit palmetto drupe harvests.

Mayhaw (*Crataegus* spp.) can be collected from Bottomland Hardwood forests as a group and is often made into a jelly and sold commercially. Blueberry, blackberry and other native fruits grow in shortleaf pine forests but are not commercially harvested from forest settings. However, landowners may consume for personal use.

7.2.3.4. Other Current and Potential NTFP Markets

- **Medicinal Native Plants**
  - St. John's Wort
- **Other Edible Products**
  - Nuts
  - Mushrooms
- **Ornamental Products**
  - Spanish Moss
  - Pine Tips for Garlands
  - Pine Cones
  - Grapevines
  - Burl and Crooked Wood
- **Landscape Products**
  - Pine Bark Mulches
  - Palm Trees

8
Silvicultural Options



8. SILVICULTURAL OPTIONS

8.1. Timber Harvest

The following silvicultural and land management tools are available to Florida forest resource professionals to meet various landowner objectives and utilize forest resources. These are the common methods used in this region but there may be others available. One or a combination of these tools may be used to meet single or multiple objectives. Landowner objectives and budget ultimately determine which tools may be utilized. Local contractor availability, timber and NTFP markets, project scale, local regulations, site conditions, local climate, the degree of planning and scheduling, and other factors also influence the forester and landowner decision making process when determining which tools to utilize to efficiently and effectively meet landowner objectives. Annual harvest levels (which may be referred to as annual allowable cut or annual yield) should be determined based on the silvicultural options described in this LMP and should be informed by current stand conditions and other factors (such as those described above). Harvest rates and volumes should support forest productivity that can be sustained in the medium and long-term.

The Silviculture BMPs and Wildlife BMPs compile voluntary guidelines, strategies and considerations for managing, enhancing, and protecting timber and NTFP resources, rare plant and animal species/habitat, aquatic ecosystems, and air and water quality during silvicultural operations. Silviculture BMPs apply to: timber harvest, site preparation, reforestation and forest operations (roads, water control structures, etc.) activities. These BMPs are critical to the protection of timber lands and the communities they support; another potential consideration of timber harvesting is the original purpose or hydrologic designation of the harvest site. Conversion of forestland from peatland, wetlands, and other hydric systems after 2007 should be evaluated judiciously. If sites were previously peatland, wetlands, or other hydric systems, special consideration should be taken to ensure that harvesting timber does not result in water depletion of a previously undrained soil. Forest management typically occurs outside of wetland areas; in cases where wetland harvesting may occur, or there may be significant justification to convert an existing wetland into timberland, state BMPs will provide guidance on the conversion of these areas.

Historical and cultural resource protection and recreation management are also considered during planning and active silvicultural operations. The Wildlife BMPs are voluntary practices that are applied at the discretion of the landowner or other person or entity responsible for conducting activities on the property. Landowners and others are not specifically required to enroll in the FDACS Water Quality BMP programs to participate in the Wildlife BMP program; however, water quality BMPs applicable to specified State Imperiled Species must be implemented as indicated on the Wildlife BMP Notice of Intent (NOI). In addition, applicants who enroll by completing a Wildlife BMP NOI and implement the applicable practices are not required to obtain a permit to authorize the incidental take of the 16 State Imperiled Species associated with their operations.

The general descriptions of each specific Florida forest type provide information related to their specific harvest and profitability information. Each forest type is examined for its preferred management method (i.e. even-aged), length of growth rotation, site suitability for commercial species, and further options beyond commercial harvesting (i.e. aesthetics, wildlife). Below are descriptions of each type of silvicultural activity and how each activity is applicable to the different forest types within Florida. In instances where there is no difference between multiple different forest types in respect to the silvicultural practice, only the forest types that differ will be further explained.

8.1.1. Thinning

8.1.1.1. Pine Forest Types

Thinning is a primary land management tool used in Florida to meet various objectives such as revenue, aesthetics, wildlife, and restoration. The type and timing of thinning are dependent on several factors including landowner objectives, market conditions and stand and site conditions. This is a stand-specific determination that can be made by a forester. There are also site-specific Silviculture BMPs and Wildlife BMPs related to thinning harvests, particularly in wetlands and streamside management zones.

Several types of merchantable thinnings are utilized in pine stands in Florida. These partial harvests may involve row thinning, single tree selection, or a combination of both. Due to a lack of equipment mobility, individual rows must be removed during first thinnings to allow equipment access. The most common row thinning method for first thinnings is a third-row thinning. Single-tree selection via logger-selection or a logger-select thinning, also known as "operator select," of the residual rows is also common during first thinnings. Another commonly-used method for first thinnings is a combination of both the "fifth row and select" method, in which the fifth row is removed to provide access to logging equipment, and then the lower quality trees in the leave rows are removed in order to reach the target stand density.

Some first thinnings in planted pine, and most thereafter, are thinned through marked selection or marked-select thinning by a forester. Foresters also mark 1+ acre demonstration areas on logger-selection first thinnings to walk through and discuss with logging crews how the stand will be thinned.

Single-tree selection in combination with row thinning is preferred over straight row thinnings without selection. Whether marked or logger-selection, single-tree selection improves forest health, aesthetics and promotes higher net growth. A straight row thinning reduces competition for the trees adjacent to take row but leaves inferior cull trees throughout the stand.

If wildlife, aesthetics, or biodiversity are primary objectives, stands are thinned to a lower density. If timber and revenue are primary objectives, a higher density is maintained. If managing for multiple-uses, a moderate density can be used. The crown density of remaining trees should be considered when evaluating the effectiveness of a thinning procedure.

Natural pine stands are typically thinned using marked selection by a forester. Marking natural stands allows for more control over thinning density and quality due to their variable nature. If a natural stand is relatively uniform, with mostly lower value pulpwood or has a dense understory, it may be more efficient to use logger-selection and close supervision. Due to lack of row access, first thinnings in natural stands may call for a slightly lower density to improve logger operability.

Following two to three thinnings, planted stands appear more natural and have improved aesthetics. Prior to each thinning, landowner objectives are revisited. Eventually, a decision must be made on final harvest or conducting a natural regeneration cut. Natural regeneration and under-planting harvests utilize thinning and will be discussed in Reforestation.

On productive sites, planted pine generally requires first thinning around age 15-20. On less productive sites, it may be pre-merchantable or not have enough volume per acre to market until around age 20 in which case stand

replacement should be strongly considered. This stipulation applies mainly to slash or loblolly pine stands, as poor growth in these species usually indicates a poor match of the species to the soil type present.

First thinnings in planted pine stands involve row-thinning, preferably with marked-selection or operator-selection thinning. Natural stands are thinned using marked-selection. Subsequent thinnings will generally take place every five to ten years in planted and natural stands.

Pre-merchantable 20+ year-old planted slash pine stands or those overstocked with natural regeneration may require a pre-merchantable thinning or fuelwood chipping harvest.

Many landowners tend to continue pine straw raking in planted longleaf and slash pine stands beyond the biological and economic thinning ages. This decision can have negative impacts on stand development in terms of forest health and timber quality and value.

Many landowners may choose not to thin mature even-aged and two-aged pine stands as their desired future condition has been met. They enjoy the benefits of this mature stand structure such as high-quality wildlife habitat, aesthetics and recreational opportunities. Other landowners may choose to occasionally lightly thin their mature pine for revenue, forest health and maintaining overstory composition. See the forest health section for the risks associated with managing mature pine.

8.1.1.1.1. Upland Mixed Hardwood-Pine Forest Type

Thinning UMHP forests is not commonly practiced in Florida. Hardwoods produce low value products and it is not economically viable to manage these forests through thinning. However, thinning can be conducted in UMHP.

Thinning from above can be used as a natural regeneration method.

Thinning is a primary land management tool used to meet various objectives such as revenue, aesthetics, wildlife and restoration. The type and timing of thinning are dependent on several factors including landowner objectives, market conditions and stand and site conditions. This is a stand-specific determination that should be made by a forester. There are also site-specific Silviculture BMPs and Wildlife BMPs related to thinning harvests, particularly in wetlands and streamside management zones.

UMHP stands can be thinned using marked selection by a forester. Marking UMHP stands allows for more control over thinning density and quality due to their variable nature. Desired residual species ratio should be considered during planning. Logger operability should be considered during marking.

Pre-merchantable thinning or fuelwood chipping harvests can be used in UMHP stands.

Many landowners may choose not to thin UMHP as their stands are already in desired future condition. They enjoy the benefits of this forest type's structure such as high-quality wildlife habitat, aesthetics and recreational opportunities. Other landowners may choose to occasionally lightly thin their UMHP for revenue, forest health, wildlife habitat improvement, and maintaining overstory composition.

8.1.1.1.2. Upland Hardwoods Forest Type

Thinning UMHP forests is not commonly practiced in Florida. Hardwoods produce low value products and it is not economically viable to manage these forests through thinning.

8.1.1.1.3. Bottomland Hardwoods Forest Types (Mixed Floodplain, Tupelo-Cypress Mixed, Mixed Forested Wetland)

Thinning Bottomland Hardwoods is not commonly practiced in Florida. They produce low value products and it is not economically viable to manage these forests through thinning.

8.1.2. Clearcut

Clearcutting is a standard silvicultural practice in managing shade intolerant pine as well as hardwoods for timber and other objectives. In most Florida timber markets, on most soils, timber revenue is maximized through short-rotation, even-aged management for pulpwood production. Uneven-aged management is used only in longleaf pine stands and hardwood. Clearcuts are utilized in planted or natural stands of pine, hardwood and cypress. When clearcutting, hardwoods coppice and should be cut above the stem mean water mark to allow for successful regeneration.

In Florida, multiple techniques are used to clearcut timber depending on the circumstances. If the timber to be harvested is located on upland, high ground, the normal methods being discussed can be implemented. If, however, timber is located in bottomlands or swamps, the use of "shovel logging" or "mat logging" may be needed. This method of logging minimizes the impacts created by logging equipment in these low-lying environments.

Additional information concerning this logging method can be found here:
https://www.ncforestservice.gov/publications/Forestry%20Leaflets/BF4.pdf.

Another primary use of clearcutting is for salvage harvests which are discussed in that section.

A clearcut can also be utilized for species conversion within a timber stand to meet various objectives or may reflect a change in objectives. Many UMHP forests were historically dominated by longleaf, shortleaf, loblolly or slash pine. Clearcutting can be used to remove offsite UMHP stands and replanted with the appropriate pine species. The common Florida example is converting off-site pine and hardwood species back to longleaf pine. Another may be clearcutting longleaf and reforesting with a more productive species like slash pine on certain spodic soils or loblolly on certain clay soils.

There are site-specific Silviculture BMPs and Wildlife BMPs when using clearcuts, particularly in wetlands and streamside management zones (SMZs). The size and shape of clearcuts may be considered if wildlife and aesthetics are also objectives. Also, timing and seasonality are crucial when considering clearcutting in wetlands or wet upland sites. Mat logging is a technique utilized to minimize soil and hydrological impacts in these hydric forest types (Bottomland Hardwoods). Non-clearcut buffers or "beauty strips" can be used along roads and highways to reduce negative aesthetics associated with clearcuts. Timing and seasonality are crucial in wetlands and wet upland sites.

8.1.2.1. Patch Cuts

Patch cuts are a form of clearcutting that cuts groups (patches) of trees in an individual stand (USDA Reforestation Glossary 2019). This method can help to create varying habitat within a forest stand while promoting natural

regeneration within the small openings in canopy cover (Zielke and Bancroft 1999). All these small patch cuts will then be managed as individual stand units.

8.1.3. Chipping

Another form of timber harvest in Florida is chipping. Material is felled and skidded conventionally, then ran through an industrial chipping machine at the loading deck, with chips being hauled to the mill rather than tree-length logs. Both pre-merchantable and merchantable pine, hardwood, and shrub materials can be chipped. The maximum diameter of the material to be chipped varies by chipping machine and species.

Both hardwood and pine tree-length pulpwood can be hauled as clean chips, which often have a similar stumpage price as pulpwood. Clean chips are derived from nearly pure, living wood with very little vegetation and debris mixed in. Hardwood and pine clean chip loads must be sorted. Young merchantable pine clearcuts can be clean-chipped.

Fuelwood chips can be derived from the same size and species of material as clean chips but include dead and living vegetation such as needles, leaves and limbs. A load of fuelwood chips can contain a mix of hardwood, pine and shrub materials. Fuelwood chips are burned at mills and biomass energy plants to generate electricity and are the lowest value timber product in Florida markets. They are also processed into pellets and shipped to European markets and burned for energy production.

Fuelwood chipping is commonly used in low-value, hardwood, clearcuts, land clearing operations, or other situations where it is not feasible to conduct a traditional timber harvest. These operations may break-even or generate a small amount of revenue from fuelwood, but more importantly, they can meet other objectives, such as hardwood reduction and removal or site clearing. Chipping can also be used in place of a pre-merchantable thinning to reduce natural pine regeneration or tree density in overly stocked planted pine stands. This avoids pre-merchantable thinning costs and will generate revenue or break-even. Fuelwood or clean-chipping can be used where a very debris-free post-harvest site is required. For example, fuelwood chipping can be used as part of site preparation for groundcover restoration projects.

Pine and hardwood stands present opportunities for fuelwood chipping operations such as reducing overstocked natural regeneration in mature, two-aged stands or hardwood reduction/adjusting hardwood ratios. Within the hydric Bottomland Hardwoods forest type, fuelwood chipping operations may serve an alternative to hauling tree-length.

8.1.4. Salvage

Salvage harvests are valuable tools that help make the most of difficult circumstances. They are commonly utilized to harvest timber following varying degrees of catastrophic natural disasters. These include wildfires, climatic events such as hurricanes, and forest health issues such as southern pine beetle outbreaks.

The primary purpose of a salvage harvest is to utilize as much of the damaged timber resource prior to mortality and a complete loss of merchantability. Salvage is also used to maintain or enhance forest health and aesthetics, as well as reducing hazardous fuel buildups and reducing site preparation costs for future reforestation efforts. Sometimes secondary objectives become primary or attainable following a catastrophic event. For example, restoration and recreation goals may get realigned, allowing for good management accomplishments to arise out of what appears to be a completely bad situation at the time.

Salvage operations typically involve clearcuts but that is not always the case. A salvage operation can entail evaluating an impacted stand and thinning the damaged timber using marked-selection, while maintaining the relatively healthy trees. There is always a forest health risk involved in the determination to clearcut or thin damaged timber. This determination is situation and site-specific and made following careful evaluation.

Salvage harvest operations can be used in pine stands as well as hardwoods. A variety of natural and anthropogenic factors could cause the need for a salvage harvest. For example, a hurricane may wind-throw an entire stand that would need to be salvaged, southern pine beetle outbreaks may require a clearcut for salvage, or an improper prescribed burn may decimate the landscape.

8.2. Reforestation

Reforestation is a core tool of sustainable forestry. The goal is to successfully establish a species appropriate for the site, while meeting landowner objectives. This process involves careful planning and selection of: artificial or natural regeneration, species, seedlings, density, site preparation, planting method and release. Each of these elements of reforestation are dictated by: landowner objectives, site conditions, current and forecasted timber markets, budget and other factors.

The Upland Hardwoods and Bottomland Hardwoods forest types are not artificially regenerated in Florida at a significant scale worth discussion.

8.2.1. Artificial Vs. Natural Regeneration

A selection between artificial and natural regeneration must be made during the stand and property-level silvicultural planning process. This selection is driven by landowner objectives and site-specific circumstances. However, there are pros and cons to each reforestation strategy (Table 8).

Table 8 Comparison Summary of Artificial and Natural Regeneration Methods of Reforestation

	Pros	Cons
Artificial	More productive timber management	More expensive: seedling and planting costs
	Better stand development: form, growth	Rows may decrease aesthetics during early rotation
	More control over seedling quality through improved genetics: growth rate, disease resistance, form	More heavy equipment entry required (soil compaction, rare plants)
	Control over planting density and spacing	
	More conducive to high production management	
	Less likely to require pre-merchantable thinning (cost)	
	Can use for species conversion i.e. underplant longleaf pine	
	Less fire exclusion time due to faster growth	
Natural	Less expensive: no seedling and planting costs	Less productive timber management

	More conducive to conservation-oriented management: uneven-aged	Poorer stand development: form, growth
	Less heavy equipment entry (soil compaction, rare plants)	Less control over seedling quality: only single tree selection thinning (seed trees)
	Lack of rows may increase aesthetics	Less control over seedling density and spacing
	Even-aged pine stands can be converted to two-aged, then uneven-aged structures	No control of cone/seed production
	More fire exclusion time due to slower growth (slash, loblolly, shortleaf)	May require single or multiple premerchantable release thinnings (cost)

8.2.2. Site Preparation

Adequate site preparation is required to achieve high survival rates and successfully establish a new stand of timber. The following methods can be used in various forest types for natural or artificial regeneration. Site conditions, landowner objectives, and budget drive this selection. Target vegetation includes herbaceous, grasses, non-crop pines, woody shrubs and hardwood species. Site preparation is broken into three categories: chemical, mechanical and prescribed fire. These methods can be used individually or in combination. Site preparation treatments generally take place in the Spring and Summer months prior to Winter planting.

Vegetative competition varies across sites and the appropriate site preparation technique(s) should be selected to adequately control it. Vegetative competition control *prior* to planting increases the stand establishment success. With adequate site preparation, slash, loblolly, and shortleaf pine will initiate fast, early vertical growth, while longleaf will initiate slower rates of vertical growth during its grass stage, although it adds early root growth. There are site-specific FL BMPs for Forestry related to site preparation, particularly in wetlands and streamside management zones.

8.2.2.1. Chemical Site preparation

The use of herbicides over mechanical treatments in site preparation has increased in the last couple decades for a variety of reasons, including increased machinery and fuel costs, increased chemical specificity, the ability of herbicides to kill the entire root of unwanted hardwoods, and the minimal impact of herbicides on soils (UF IFAS Extension 2009). Herbicide is applied based on the recommended site preparation label rate for the target and crop species and site conditions. The appropriate herbicide and chemical site preparation technique is selected to effectively target the primary woody and herbaceous vegetative competition. Site preparation herbicide is typically applied aerially by helicopter or through ground application using the broadcast or banded techniques. If herbicides are to be used in forestry practices on the landowner's property, all state and national pesticide requirements and regulations must receive strict adherence. For Florida, the Department of Agriculture and Consumer Services (FDACS) is the state authority, while the EPA maintains its national authority on pesticide use. There are also site-specific FL BMPs for Forestry related to site preparation, particularly in wetlands and streamside management zones.

The use of herbicides in chemical site preparation offers some noticeable benefits, but also has noticeable shortcomings. Herbicides can effectively provide longer-lived control of competing vegetation, which leads to an increased economic return for the landowner. Their application does not affect the soil of a site, meaning that soil compaction does not occur and the soil is protected. They can also control exotic or invasive species relatively effectively. However, there are disadvantages as well to choosing chemical site preparation, with chief among them being the cost depending on the brand used. Herbicides may also prevent a problem if used without caution, as surface runoff or spills can have potentially unintended effects on surrounding vegetation.

Each herbicide used has different characteristics that allow it to be used in specific situations and to target specific forms of vegetation. The active ingredient present within the herbicide has the greatest influence on the effectiveness of the herbicide, as it is the portion of the herbicide that negatively affects the desired vegetation (Osiecka et al. 2005). A listing of common active ingredients, along with the species targeted by the herbicide, the species resistant to the herbicide, and the proper application period can be found through the NC State 2017 Quick Guide to Forestry Herbicides Used for Softwood and Hardwood Site Preparation and Release. When selecting an herbicide for chemical site preparation, protection of sensitive and difficult to restore native understory species, such as wiregrass, must be considered. The herbicide being utilized must be researched to determine any primary and potentially unwanted secondary effects that it may have on vegetation present in the treatment area. It is important to consult a professional forester prior to herbicide use in order to ensure correct application and usage.

Chemical site preparation techniques and application methods are varied, depending on the species present and the desired outcome of the chemical application. Herbicide labels give the types of application methods registered for each herbicide. Factors such as tract size, stand density and structure, the needed application rate, and the proper application timing are also essential to determine before selecting the proper herbicide (Osiecka et al. 2005). Below are common techniques for the application of herbicides.

8.2.2.1.1. All Herbicide Types

Broadcast

Broadcast applications involve herbicide being spread out over an entire area. This method of treatment is accomplished either through the air (usually by helicopter or more rarely aircraft) or on the ground through the use of machine-mounted or hand-held equipment. This is the general method utilized for site preparation, but it may also be utilized for conifer release or weed control.

Band

Band applications are similar to broadcast treatments in their general application method but are applied in strips or along rows of planted trees with ground-based equipment. This method is as effective as using broadcast for herbaceous weed control in young pine plantations and may also provide a significant cost decrease if used properly. Applications can also be sprayed over the top of planted pine. Annual weeds are usually more effectively controlled by this method compared to perennial weeds.

Spot

Spot applications are applied as needed to smaller areas or even individual stems, typically with hand-held spraying devices to ensure greater accuracy. If the proper species are targeted with this method, the reduction of unwanted species can be obtained at a far cheaper cost. However, these types of treatments are typically very labor intensive and can only be justified as a treatment method within areas containing a small number of problem spots needing treatment.

Directed Spray

Directed spray is a form of spot treatment used primarily for conifer release and occasionally weed control. The spray from hand-held spray units can be effectively directed only to the foliage being targeted while avoiding crop/plantation trees. In addition to spraying, herbicide can be applied through this method by wiping directly onto the target species with a wick applicator.

Basal Bark Spray

The basal bark application method involves spraying intact bark with a particular herbicide. This application type is best utilized with ester formulations with an oil carrier. With basal bark spraying, small stems can be treated by thinline spraying (herbicide applied in a narrow band 6-24 inches above stem base) or full basal (spray-to-wet) spraying (spraying the entire lower 12-20 inches of the plant to the point of runoff). Basal bark spraying can be done throughout the year as long as the bark is dry.

Hack and Squirt

The hack and squirt application method involves cutting or drilling into the sapwood of the tree and immediately applying herbicide to the interior of this cut. This application method is most effectively for treating large-diameter trees and requires the herbicide to be water soluble and not in an ester formulation. Hack and squirt can be done most of the year, but it is less effective before and during the Spring flush.

Injection

The injection method is similar to hack and squirt, except it does not involve cutting into the tree prior to application. Herbicide in this method is injected directly into the tree's interior through use of a special device. The application timing for this method is similar to hack and squirt.

Cut Stump

The cut stump application method involves application of an herbicide to the outer edge of a freshly-cut stump. This method is most effective on woody species that are known to resprout following being cut down.

Grid Application

The grid application method involves using a grid pattern when applying soil-active herbicide to an entire area. The grid pattern selected as well as the rate of herbicide application is dependent on the soils texture and woody species composition of the site. This method can be used for conifer release as well as site preparation, particularly on sites with a high density of unwanted woody vegetation.

Spot-Around

The spot-around application method involves the application of granular soil-active herbicide to an area around the trunks of the trees wanted to be kept. Herbicide application within this method can be in the form of small spots or a small area. This method prevents woody and herbaceous vegetation from overcrowding the target tree species.

Individual Stem

The individual stem (basal soil) application method involves the application of specific herbicides to the soil directly adjacent to the stems of targeted woody species.

8.2.2.2. Mechanical Site preparation

There are many mechanical site preparation methods to choose from. Some can be used on various sites, while others have very site-specific applications. All the following methods can be used with establishing all of the pine forest types.

8.2.2.2.1. Bedding

Bedding is used on flat, wet sites to elevate the roots of seedlings and promote respiration and growth. There are various bedding machines that create beds of different heights, depending on is the moisture level of the site. Some wet sites are difficult or impossible to successfully, artificially regenerate without beds. Bedding is appropriate for timber management objectives but can have long-term negative impacts on desirable groundcover, aesthetics and hydrology. Bedding machines are pulled behind farm tractors, bull dozers, or more commonly, skidding machines, depending on horsepower requirements and site conditions.

8.2.2.2.2. Roller drum chopping

Roller drum chopping is used on various pine flatwoods sites to reduce woody and herbaceous competition, but it is mostly used to help facilitate planting access on sites with thick competing cover resulting from 3-5 growing seasons. Chemical site preparation in conjunction with roller drum chopping will deliver the best results when compared to roller drum chopping alone. There are various sizes of roller drum choppers with various lengths of blades. The appropriate equipment is selected based on site conditions (i.e. soil moisture, topography, etc.) and vegetation size and density. Many chopping machines can be filled with varying levels of water to achieve different degrees of vegetative impacts. For example, a site with light, herbaceous vegetation may not require the chopper to be filled, while it may be appropriate to chop a heavy gallberry site with a full drum. Choppers are pulled behind farm tractors, bull dozers, or more commonly, skidding machines, depending on horsepower requirements and site conditions. Multiple passes or heavy chopping can have an adverse effect on the survival of native understory plants.

8.2.2.2.3. Scalping and ripping/subsoiling

Scalping and ripping/subsoiling usually only take place on old field and pasture sites during afforestation. Scalping peels back thick, matted turf grass, creating a vegetation-free strip to plant seedlings in. Ripping or subsoiling is used in compacted soils like those found in pastures and old field sites, particularly those on clay soils.

8.2.2.2.4. Root raking and piling

Root raking and piling, with an optional pile burn is a common site preparation method to reduce debris for mechanical planting. Usually only large surface material is raked for silvicultural use, not stumps and roots which is the case during land clearing operations. The piles may be left or burned, depending on objectives and budget.

8.2.2.2.5. Mowing and mulching

Mowing and mulching can be effective mechanical site preparation in stands to be naturally regenerated, especially those with heavy fuel loads and lack of prescribed fire history. Mowing can reduce the fuel load and allow for safer, more effective site preparation burns.

8.2.2.2.6. Harrowing/disking

Harrowing/disking can be used on relatively clean sites or those that have been raked or burned, to create vegetation-free strips to plant seedlings in.

8.2.2.2.7. Shearing

Shearing involves a heavy bulldozer equipped with an oversized V-blade that shears off stumps and other vegetation and debris. This material is then piled with root rakes and typically burned. This creates a very clean planting site, ideal for establishing a pine straw stand. Shearing is most often used with bedding. If the tractor is large enough, it

can shear and bed at the same time, but most often it takes two tractors, one shearing in the front and one bedding in the rear. Shearing can also be used during groundcover restoration; converting clearcut timber to pasture or crops; or shearing strips within thick competing cover to allow planting access.

8.2.2.2.8. Logging

Logging impacts to understory vegetation can be utilized as part of a broader site preparation plan, especially when carefully timed. In heavy fuels and understory, logging acts as an initial fuel reduction treatment that can be followed up by chemical, mechanical and/or prescribed fire site preparation.

8.2.2.2.9. Anchor chain/dragging

Anchor chain/dragging is an efficient way to remove dense stands of trees and shrubs (Boerr et al 1986). This method involves pulling a heavy anchor chain (~7000 lbs) 100-500 feet between 2 bulldozers in a V-or-J-shaped loop. Steel bars may be welded to individual chain links in order to increase scarification within the soil. Dragging requires high-power machinery, and is not as effective on young, supple plants.

8.2.2.3. Prescribed Site Preparation Burn

Prescribed fire can be used solely or in combination with other site preparation methods. It is common to prescribed burn following mechanical and chemical site preparation. Site preparation burns typically take place in the late Summer, early Fall once fuels have cured and prior to Winter planting.

If timber management is not an objective, a hot, Spring site preparation burn alone may be adequate to establish a longleaf stand. Survival rates will likely be lower compared to more intensively prepped sites. Follow-up burns will need to be applied to control regrowth until longleaf are well established. This involves burning longleaf in the vulnerable three to five-foot-tall “kill stage”, causing further reduction in stocking.

8.2.3. Artificial Regeneration

Artificial regeneration follows clearcutting. Table 8 provides comparison summary of the advantages and disadvantages of artificial and natural regeneration. Planting density and depth are important considerations and dependent on: landowner objectives, budget, site conditions, cost share requirements and other factors. The soil productivity, hydrology and natural community is most accurately evaluated during artificial regeneration planning. A density is selected that meets primary objectives such as timber, wildlife, aesthetics and recreation. If timber management is an objective, a relatively higher density may be selected.

If timber management is not an objective, lower planting densities will meet wildlife, rare plant, and aesthetic objectives. However, due to tree biology and physiology, planting at too low of a density will result in aesthetic tradeoffs and a stand of short, shrub-like trees with excessive limbs. They will never develop into tall, straight, well-formed trees that most landowners aesthetically desire and envision in their forest. A medium, balanced density that meets multiple objectives can also be considered.

Artificial regeneration generally involves planting seedlings in rows that are spaced at a desired density. However, a random or natural pattern can be established as well using hand planting. High survival rates depend on selecting appropriate species for the site, adequate site preparation, suitable planting method, suitable planting depth, proper care of quality seedlings and natural factors such as climate and pests. A seedling survival check can be conducted

following the first growing season to determine if the stand was successfully established, to document initial stocking and decide if supplemental planting is required to achieve desired stocking.

Successful artificial regeneration with longleaf pine has been historically challenging, especially on wetter sites. However, in recent decades, an increase in research has led to higher quality seedling stock and more effective site preparation and reforestation techniques. This progress has resulted in higher survival rates, increasing seedling demand and the number of nurseries growing quality longleaf seedlings.

Longleaf is a good alternative to sand pine on less productive, sandy soils for landowners interested in managing for multiple uses. The dichotomy between managing slash and longleaf on flatwoods sites can be reviewed with the landowner prior to species selection. This decision is driven by the typical species selection considerations but landowner objectives will ultimately determine the appropriate species to plant. When planting longleaf, the Longleaf Alliance (https://longleafalliance.org/) is a good resource concerning the spacing and depth of seedlings.

Although the state of Florida has no regulation regarding survival standards, attaining 90+% survival rates with pine species can be achieved with careful reforestation planning and execution. Landowners should establish their own standard for survival prior to planting, given the site conditions. Planting a few extra seedlings for "insurance" towards a desired stocking density may also be worthwhile.

8.2.3.1. Hand Planting Vs. Machine Planting

8.2.3.1.1. Hand planting

Hand planting entails crews planting seedlings by hand. Refer to Table 9 for more information on this method and a comparison with machine planting.

8.2.3.1.2. Machine planting

Machine planting involves two main methods (flatwoods planting (rubber-tired tractor) or V-blade planting). Flatwoods planting requires a cleaner site, hence more mechanical site preparation. This is due to limitations of the planting machine itself and the rubber-tired farm tractor commonly used to pull it. V-blade machine planting generally uses the same planting machine, but is pulled behind a bulldozer with a large heavy duty "V"-shaped blade that clears large debris and creates a vegetation-free strip that seedlings are planted in. V-blade planting can handle rougher sites, and therefore does not require as much mechanical site preparation. V-blade is essentially planting and site preparation in-one, but costs more than flatwoods planting. If contract specifications allow it, V-blade planting can result in planting seedlings in a trench on wetter sites. This can result in high mortality. V-blade is particularly useful if mechanical or chemical site preparation plans are not completed prior to scheduled planting, or where chemical site preparation methods conflict with landowner objectives. Refer to Table 9 or more information on machine planting. Any of these planting methods can be used to plant pine species.

Table 9 Comparison Summary of Hand and Machine Planting Methods of Artificial Regeneration

	Pros	Cons
Hand Planting	Less expensive than machine planting	More potential for human-caused error i.e. J or L rooting, seedling depth and packing issues, etc.

	Pros	Cons
	Can plant rough sites without raking	Inexperienced crews require more supervision
	Experienced, supervised crews have similar quality and consistency to machine planting	
	Less groundcover impact and soil compaction	
	Easier to plant any pattern for natural look (no rows)	
	Can use for under-planting thinned stands	
	Can plant any pine or cypress species; bare root or containerized seedlings	
	Can be used on hills and steep topography	
Machine Planting (Flatwoods & V-Blade)	Less human-caused error i.e. J or L rooting, seedling depth and packing issues	More expensive than hand planting
	Generally, more consistent than hand planting	Flatwoods requires cleaner site/more mechanical site preparation
	Requires less supervision	More groundcover and soil impacts, especially V-blade
	Can plant any pine species, bare root or containerized seedlings	Harder to plant natural pattern
	V-blade requires less site preparation	Cannot under-plant thinned stands
		Harder to plant hills and steep topography

8.2.3.2. Under-Planting

Under-planting longleaf pine in heavily thinned slash or loblolly stands can be used as an alternative to clearcutting for species conversion. This method fits landowners interested in aesthetics, wildlife, and rare plants, with less interest in timber management. The advantages to this method are better quality post-planting prescribed burns due to retained needlecast and better aesthetics by avoiding clearcuts. Trees with large crowns should be retained for optimal needle-cast. These overstory trees can be removed during the first longleaf thinning or retained for a multi-aged look. The disadvantage is slowed timber growth due to shading.

8.2.3.3. Seedlings

This section will focus on pine seedlings. Hardwood and cypress seedlings are available in local nursery markets, mainly in containerized form. Reforestation with these species is not large-scale in Florida and is costly, especially hardwoods. Pond and bald cypress are available in traditional, “cell” containerized form, while hardwood seedlings generally start in larger 1-3 gallon containers for landscaping markets. Hardwoods are more commonly planted on a

smaller-scale, focusing on wildlife management. For example, planting white oaks adjacent to food plots for enhancing hunting programs. Cypress is planted near pond edges for wildlife or aesthetics and small-scale wetland restoration.

8.2.3.3.1. Containerized Vs. Bare Root

Containerized seedlings

Containerized seedlings are considered higher quality and average higher survival rates but are more expensive. Containerized seedlings are more resilient during transport and storage and can be kept longer once lifted if properly stored in a refrigerated trailer (i.e., refer). Slash, longleaf, and loblolly pine seedlings are available with various genetic *improvements*, such as growth rate, form and disease resistance. Improved, containerized slash pine seedlings are more expensive than bare root and are preferred if planting budget allows. Orders can be placed early summer to ensure needs are met and avoid delays in planting.

Bare root seedlings

Bare root seedlings, in comparison, generally average lower survival rates, require immediate planting once lifted, and are very vulnerable during transport and storage, yet are less expensive. Bare root seedlings are very sensitive to warmer temperatures, dry air, and direct sunlight. Bare root can have comparable survival to containerized with proper planting technique (depth, angle and packing), adequate site preparation, storage and handling.

Both seedling types' survivability increases exponentially if planted as soon as possible after lifting, stored in a refrigerated cooler (i.e., "reefer"), and/or kept under seedling tarps in the shade prior to planting. Hand, flatwoods and V-blade planting methods can be used to plant all the Florida pine species, bare root or containerized.

8.2.3.4. Afforestation

Florida has a long history of agricultural production such as tobacco, sugarcane, and cotton. These industries have faded in recent decades, causing land-use conversions to timber and cattle production. Many landowners plant various pine species on old field and pasture sites within the state.

Many of these sites were heavily fertilized or grazed and still contain high nutrient loads, especially those with heavy clay soils. This causes many pine stands to develop poor form, excessive limbs and forks and a high occurrence of fusiform rust, as well as potentially pitch canker on higher ground and Diplodia tip blight in Central and North Florida. This effect tends to be localized and more severe on heavy soils and where cattle were fed. Landowners managing their pine for timber products generally are not concerned with these issues. If nutrient loads are not excessive, this can have a positive fertilization-like effect on growth rates and timber production.

Old field and pasture sites will require scalping and/or ripping (subsoiling) prior to beginning the afforestation process as discussed in the site preparation section.

8.2.4. Natural Regeneration

Pine, hardwood and cypress stands can be naturally regenerated to meet various objectives, including uneven-aged management. This section will examine both hardwood and pine natural regeneration site preparation processes, although hardwood management activities are far less common within Florida. Large-scale artificial regeneration of cypress and hardwood is generally not economically feasible for most private landowners. These species can coppice

and are generally clearcut and regenerated in this manner. High-graded hardwood and cypress stands can be clearcut and naturally regenerated to improve timber quality and aesthetics. Reference Table 8 for general information on pine natural regeneration and a comparison between this method and artificial regeneration.

Premerchantable thinning is often required in natural regeneration management regimes and is discussed in the release treatment section.

Existing slash and loblolly pine stands can be naturally regenerated to meet various objectives, including two-aged management and aesthetics. Due to the growth characteristics and product markets, these pine species are not managed uneven-aged, although shortleaf and longleaf stands may be. Some natural pine stands encountered may have been historically high-graded and a decision must be made on whether to clearcut and start over by planting higher quality genetics or naturally regenerate and hope for the best.

The different pine species have different annual windows of seed production. Slash and loblolly pine produces seed annually which usually peaks in October. Longleaf seed production usually peaks in October, but produces bumper crops every 7-10 years, while shortleaf peaks in October as well but produces bumper crops every 3-6 years Planning for natural regeneration of pine entails evaluating the cone crop the prior Spring and carefully timed site preparation prior to Fall seed catch. Natural regeneration of pine species requires careful planning and coordination.

8.2.4.1. Site preparation

8.2.4.1.1. Pine forest types

Site preparation options are the same between pine natural regeneration methods and are similar to artificial regeneration site preparation. A natural regeneration harvest itself can serve as a form of site preparation. On sites with a history of prescribed fire or light fuel loads, site preparation may simply entail a carefully timed prescribed burn. Prescribed burning in late-Summer to early-Fall will prepare the seed bed by scarifying the soil, promoting seed catch. Conducting prescribed burns near seed dispersal could be avoided, as seed predation will be greater due to less groundcover. Some understory regrowth is desirable so the seeds are not completely exposed to predators. In stands with heavy fuel loads, a single site preparation burn will likely not be adequate. Establishing a fire regime and reducing fuel loads over time can allow for a successful site preparation burn in the future. Or a combination of site preparation methods can be used with prescribed fire to achieve natural regeneration sooner.

Seed trees should be considered and protected as needed when conducting any site preparation activities for natural regeneration.

8.2.4.1.2. Hardwood forest types

For Mixed Hardwood-Pine and Upland Hardwood forest types, timing of site preparation activities such as a prescribed burn does not matter to the overall survival of natural recruitment. Different forms of site preparation are recommended for hardwood forests, such as a natural regeneration harvest or clearcut. A carefully timed natural regeneration harvest typically serves as site preparation when attempting to naturally regenerate hardwood stands, while coppice can also be utilized to reforest a clearcut. Other forms of site preparation previously discussed may also be utilized.

The Bottomlands Hardwoods forest type group can be naturally regenerated to meet various objectives, including uneven-aged timber management, timber stand improvement, wildlife and aesthetics. Bottomland Hardwood

hardwood species can coppice and are generally clearcut and regenerated in this manner. High-graded Bottomland Hardwoods can be clearcut and naturally regenerated to essentially start over by improving timber quality and aesthetics.

Thinning from above, shelterwood, seed tree and group selection natural regeneration harvests may also be utilized in Bottomland Hardwoods but this is less common in Florida.

8.2.4.2. Shelterwood

Shelterwood is generally the most effective method of natural regeneration across Florida pine species. This entails thinning a stand to approximately 30-40 square feet per acre of basal area or about 20-50 trees per acre. Shelterwood allows for a more uniform coverage of natural regeneration across a stand. It also allows for a uniform application of prescribed fire across the site by maintaining adequate needlecast. Younger age classes are sheltered by a higher density of seed trees. Seed trees should be the highest quality in terms of crown size, form and health/vigor. Seedling growth may be slightly lower compared to seed tree method if seed trees are retained, which is optional, following successful stand establishment.

8.2.4.3. Seed Tree

The seed tree method is the most commonly used to naturally regenerate slash pine, and is used throughout the varied pine and hardwood forest types. The seed tree method is like shelterwood except stands are thinned to a slightly lower basal area of approximately 10-30 square feet per acre or about 10-20 trees per acre. A good cone crop is important using this method to ensure adequate seed catch at this lower density. Seed trees should be the highest quality in terms of crown size, form and health/vigor. Seedling growth may be slightly higher compared to shelterwood if seed trees are retained, which is optional following successful stand establishment.

8.2.4.4. Group Selection

The final method of natural regeneration is group selection, which is less commonly used to naturally regenerate pine and upland hardwood forest types. These are small 0.25 - 0.5-acre clearcuts interspersed throughout a stand. The size is critical to ensure adequate seed coverage. If they are too large, the interior portions may not regenerate adequately. Consequently, these understocked areas tend not to burn consistently due to lack of needlecast, leading to thickets of woody vegetation. Group selections can be conducted independently, but more commonly made in combination with a stand-wide thinning. Group selections can be beneficial to wildlife since they create edge and a juxtaposition of habitat.

8.2.4.5. Thinning from Above

This method of thinning can be used to release existing natural regeneration in Upland Mixed Hardwood-Pine and Upland Hardwood forest types. This entails removing all or part of the dominant overstory trees, releasing the suppressed natural regeneration already in place within the midstory. This requires carefully planned logging operations as to not destroy the desired trees being released during overstory harvest.

8.3. **Release**

Early and mid-rotation release treatments are common in pine management and less common in Upland Mixed Hardwood-Pine forest types within Florida. Chemical, mechanical and prescribed fire are the three primary types of

treatments used to release pines from vegetative competition and promote timber production through increased vertical and diameter growth and good form. For pine-hardwood mixed, only chemical and mechanical treatment types are utilized, as prescribed fire is not a viable tool within these forests. Target vegetation includes herbaceous, grasses, non-crop pines, woody shrubs and hardwood species. These treatments may take place in planted or natural pine stands. Merchantable thinning harvest is another form of release and discussed in the timber harvest section.

8.3.1. Chemical

Early and mid-rotation herbicide release treatments targeting vegetative competition are utilized where additional competition control is required. This is sometimes due to insufficient site preparation. Herbicide is applied based on the recommended release label rate for the target and crop species and site conditions. The appropriate herbicide and chemical release methods are selected to effectively target the primary herbaceous and woody vegetative competition.

These early and mid-rotation methods include:

- Ground
  - Broadcast or banded
    - Skidder, farm tractor or ATV-mounted sprayers
  - Spot (grid)
    - ATV or backpack sprayers
- Aerial
  - Broadcast
    - Helicopter

8.3.1.1. Herbaceous Weed Treatment

Herbaceous weed control can be utilized in both hardwood and pine forests, and combined with woody stems/understory control comprise the two components of chemical treatment. Certain chemical agents can be sprayed over pine in the Spring, after planting, to control herbaceous weed growth. Herbaceous weed control can help create plant communities that are desirable for the site while removing invasive species, reducing fuel loads in the understory, and improving the overall health of the forest (NRCS Conservation Practice Standard 2018). Herbicides such as Stinger® or Arsenal® can be used to control these herbaceous weeds to reach a desired condition (Hamilton 2008).

8.3.1.2. Woody Stems/Understory

Woody brush may also be suppressed through the use of chemical herbicide application and treatment. This treatment type is used similarly in both hardwood and pine forests and in concert with herbaceous weed control. Velpar® is a common herbicide used to control woody plant species within these forests.

8.3.2. Mechanical

Early and mid-rotation mechanical release treatments targeting vegetative competition are utilized where additional competition control is required. This is sometimes due to insufficient site preparation. These treatments are similar to site preparation and include: mowing, chopping and mulching. All three can be used for early-rotation release but

caution should be used to avoid damaging young pines. Chopping may damage feeder roots in mature pines and should be avoided mid-rotation.

8.3.3. Prescribed Fire

Prescribed fire can be used as an early rotation release in slash pine stands once they can handle fire and in shortleaf pine stands after year two, since they readily resprout after fire. Prescribed fire is an effective competitive management tool in longleaf stands beginning at year two. Broadcast prescribed burning serves as a mid-rotation release in slash or loblolly stands.

8.3.4. Premerchantable Thinning

Pre-merchantable thinnings are common in overstocked, naturally regenerated stands and slow-growing planted and natural stands. These treatments reduce competition and promote proper stand development. They can also be used to improve aesthetics and wildlife habitat. Pre-merchantable thinning is a cost. However, if there is enough material per acre, a fuelwood chipping operation can substitute and generate revenue or break-even. Merchantable thinning is a release treatment in older stands and discussed in the timber harvest section.

8.4. **Prescribed Fire**

8.4.1. Pine forest types

Florida's natural communities were shaped for centuries through fires started by lightning, Native Americans and settlers. Early European settlers documented vast, open, park-like longleaf pine forests maintained with fire. Prescribed fire is a key land management tool used to maintain and restore the fire dependent natural communities of Florida by mimicking historical, natural fire regimes and resetting succession. Prescribed fire is safely and responsibly applied to ecosystems to achieve various land management objectives such as aesthetics, wildlife habitat and biodiversity.

Prescribed fire plays a critical ecological maintenance and restoration role in pine forests, mimicking historic natural fires. Without fire, pine forests would succeed to hardwood forests in most cases.

Slash, shortleaf, and loblolly pine are fire tolerant once the bark thickens and they reach about 10-15 feet tall (depending on fuel load). Longleaf is the most fire tolerant species of all the southern pines; it is able to withstand fire once it is approximately one full year-old following planting. Once longleaf reaches three to five feet in height, fire-caused mortality increases. Above six feet, longleaf is more tolerant of fire. Longleaf, loblolly, and shortleaf pine should all be burned every one to three years, while slash pine forests may be prescribed burned every two to four years to maintain and restore the natural communities in which it is dominant and to enhance wildlife habitat, improve aesthetics, reduce vegetative competition, reduce fuel loads and stimulate rare plants.

8.4.2. Hardwood forest types

Aside from the previously discussed upland pine natural community (longleaf, loblolly and shortleaf pines), UMHP forests are not fire dependent and rarely burn. However, their ecotones generally burn along with their adjacent fire dependent uplands. Burning these ecotones is crucial for the many rare species found there. Mixed forests with an adequate pine component will carry fire. Pure hardwood stands only entirely burn within narrow fire weather conditions.

Certain factors must be considered when burning in oak-dominated Upland Hardwood forests. Oaks can tolerate high-intensity burns better than shade-tolerant species due to their sprouts originating deeper in the soil and greater energy for sprouting stored in their roots (Brose and Van Lear 1998); therefore, a high-intensity burn at the beginning of a stand's origination will help to favor oak regeneration. Oaks have the greatest amount of energy storage in the roots during the dormant season, making this a favorable time to conduct burns to promote oaks.

Similarly, Bottomland Hardwoods forest types are not fire dependent and burn infrequently, with cypress dominated ponds slightly more frequent than gum-dominated. However, their ecotones generally burn along with the fire dependent uplands they are embedded within. Burning these ecotones is crucial for the many rare species found there.

The interior portions generally contain thick duff and muck layers, which rarely burn. If it is an objective to reduce the understory or midstory of one of these ponds with fire, the soil needs to be moist as to avoid a muck fire. Muck fires can burn for months during droughts and cause serious smoke management and safety issues.

Tropical hardwood hammocks are also intolerant of fire. Their sparse understory, dense canopy shade, and moisture-trapping ability help to prevent fire from reaching the interior of a THH. Exceedingly dry periods, however, can cause THHs to become vulnerable to a wildfire, which could completely destroy the species composition of this unique community. Fire should never be prescribed for these communities, and care should be taken if burning in the surrounding environment to avoid fire reaching these THHs (Miami-Dade County 2013).

8.4.3. Advantages of Prescribed Fire

There are many benefits to using prescribed fire to meet land management objectives. This practice reduces fuel loads, which directly lowers the risks and hazards associated with catastrophic wildfires. If a wildfire occurs in an area with a history of prescribed fire, the intensity and severity of that wildfire will be substantially less compared to areas without.

Prescribed fire opens the mid and understories by consuming overgrown vegetation and dead fuels. This stimulates many species of grasses, forbs and herbs. The result is an open, lush, scenic understory that is aesthetically pleasing. Stands maintained with prescribed fire have more plant and wildlife biodiversity compared to fire suppressed stands. Even old field sites planted with pines develop a more diverse understory compared to those without fire. This diverse, open understory is also beneficial to many wildlife, including several rare species such as the red-cockaded woodpecker and gopher tortoise, which require this fire-maintained structure. Likewise, allowing fire to burn through isolated and ephemeral wetlands within forest stands is beneficial for diversity in those natural communities.

Prescribed fire increases the nutrient content of forage species and the mast productivity of species such as blueberry (*Vaccinium* spp.). Wildlife prefer this nutrient and mast-rich understory. Pines and other plant species receive a post-burn flush of nutrients through increased nutrient cycling.

Landowners also enjoy this fire-maintained understory for the improved access and beautiful, open views it provides. This enhances recreational activities such as hunting, wildlife viewing and hiking. Prescribed fire also reduces many forest pest species such as ticks and chiggers. This also improves outdoor recreational experiences and helps reduce the spread of tick-borne illnesses such as Lyme disease and rocky mountain spotted fever.

8.4.4. Disadvantages of Prescribed Fire and Ways to Mitigate

Inappropriately applied prescribed fire can reduce growth rates and lead to mortality in pine stands. Excessive heat can scorch crowns and cause damage to feeder roots and inner bark. Excessive scorch alone may just slow growth and cause isolated mortality. When excessive scorch is combined with other stress factors such as poor soil quality, offsite species, overstocking and drought, widespread mortality may occur. Southern pine beetle *(Dendroctonus frontalis*) or ips beetle (*Ips* spp.) outbreaks are more likely to occur following excessive scorch.

There are ways to mitigate these negative impacts. Cool, dormant season burns can be utilized initially until fuel loads are reduced, especially in long-unburned stands. Thick duff layers can be reduced slowly over time by only burning following precipitation to avoid damaging feeder roots. Appropriate firing techniques should be selected considering overstory species, stand structure, burn objectives, desired fire intensity and severity, fuels (type, loading, structure) and weather conditions.

Fire is inherently dangerous so a certain level of risk comes along with conducting prescribed burns. Tied to that risk is the liability if a burn does not go as planned which causes many landowners to avoid prescribed burning. Landowners have the option to hire a state or private contractor to conduct their burning; the preference would be an individual that is a Certified Prescribed Burn Manager (https://www.fdacs.gov/Divisions-Offices/Florida-Forest-Service/Wildland-Fire/Prescribed-Fire/Certified-Prescribed-Fire-Acreage) . Florida has strong prescribed fire statutes which protect safe, responsible prescribed burn managers (Wade and Lunsford 1989). The standard for landowner liability in the state of Florida is gross negligence. Much of prescribed burning revolves around the weather and even with careful planning and forecasting, the weather can change. Most other preparation and implementation factors can be controlled. Burn planning is crucial and may include:

- Thorough burn prescription development
- Weather forecasting and observations
- Smoke management and screening
- Gathering resources
- Notification of neighbors, the public and local emergency responders
- Having a contingency plan in place

Documentation and record keeping of prescribed fire planning and activities is encouraged. Hiring or becoming a Certified Prescribed Burn Manager provides significant legal protections when conducting prescribed burns.

8.4.5. Methods of Prescribed Fire

8.4.5.1. Broadcast Burning

The act of burning acreage to meet various objectives is referred to as broadcast burning. Broadcast burning includes burning uplands or wetlands. It is the most common type of prescribed fire. Broadcast burning is used to meet various objectives including: fuel reduction, ecological maintenance and restoration, wildlife habitat management, aesthetics and imperiled species management.

8.4.5.2. Site Preparation Burns

Site preparation burning is a form of broadcast burning that prepares sites for artificial or natural regeneration. Site preparation burns reduce vegetative competition, improve access and operability for planting and scarify the soil for seed catch. They also meet some of the same objectives as broadcast burning.

8.4.5.3. Pile Burns

Pile burning is a form of site preparation burning. Large post-harvest debris within clearcuts are raked into scattered piles and burned. The objective is reducing logging slash to improve access and operability for machine planting. Pile burning is not used to reduce vegetative competition. A site preparation burn may incorporate pile burning. When pile burning it is essential to manage the smoke production adequately in order to prevent adverse smoke effects.

8.4.6. Fire Return Intervals

Fire return interval is the frequency at which a forest unit will be burned. This is site-specific and primarily dependent on landowner objectives, budget, forest type, fuel conditions and fire history. Determining the appropriate fire return interval at the burn unit level is vital to a successful burn program.

Slash pine stands may be prescribed burned a minimum of every two to four years, while the other 3 pine species should have prescribed fire every one-to-three years. This can be adjusted based on the factors listed in the previous paragraph.

8.4.7. Seasonality

Seasonality plays an important role in a prescribed fire program and should be carefully considered to help meet specific objectives. Seasonality can be varied over time, avoiding burning the same stands, during the same season. Not *all* natural fires occurred in the growing season.

Historically, most natural fires burned during the growing season in Florida. Many plant species adapted to this seasonality and require fire in the spring or summer months to reproduce. For example, wiregrass produces optimal seed when burned in the Spring. Growing season prescribed fire promotes a higher density of grasses, forbs and herbs and lower density of woody species such as saw palmetto (*Serenoa repens*), gallberry (*Ilex glabra*) and hardwoods. Growing season burns also reduce fuel loads quicker and result in delayed woody regrowth. If wildlife management is the focus, growing season burns result in excellent habitat. If isolated wetlands such as cypress ponds or depression marshes need woody species reduction, a Spring burn would be ideal.

However, growing season burns are challenging due to increased potential for scorch caused by higher ambient temperatures. Growing season prescribed burns are ideal for sites with lighter fuel loads or those with a history of prescribed fire. April-June is Florida's primary wildfire season and conditions can be hot and dry which narrows the total number of available burn days, especially during droughty years. The southern pine beetle's main dispersal is in the Spring when trees are already drought stressed. Adding additional stress caused by a hot prescribed burn may lead to an outbreak. Pines are susceptible to mortality caused by crown scorch during Spring due to bud elongation.

Dormant season burns promote more woody species stems per acre and less grass, forb and herbaceous ground cover. Dormant season burns safely and slowly lighten fuel loads, but post-burn woody regrowth occurs faster. Dormant season burns are generally easier to conduct due to cooler temperatures, less intense fire behavior,

consistent winds and higher fuel and soil moisture. Pine trees are in dormancy during the winter months so impacts from scorch are not as dramatic, but should still be kept to a minimum. There are generally more available burn days in dormant season. There is less potential for dormant season burns to stress pines or lead to mortality issues.

Dormant season burns are ideal for sites with heavier fuel loads or those little to no burn history. For example, reintroducing fire to a dense pine plantation with a thirty-year rough (i.e. time since the last burn) would be most successful using a dormant season burn. If desired, burning can be transitioned to the growing season after one to two initial dormant burns. If wildlife management, groundcover and biodiversity are not objectives, but timber management is, dormant season prescribed fire is a better fit. A dormant season burn can substitute for a scheduled growing season burn if Winter conditions are more favorable, avoiding missing an entire year.

Fall burns are typically not conducted under pines since they are transitioning into dormancy and very susceptible to mortality during this time. If excessive scorch occurs, pines may not have adequate needles to survive until Spring. Fall tends to be the second driest time of year in Florida (Spring being driest) and there is a Fall southern pine beetle dispersal, so adding another stressor is risky. If maintaining quality groundcover is an objective, fall burns are generally avoided since many grasses and herbaceous species flower and seed in the Fall. However, if pine dormancy has begun early, the fuel load is light and appropriate lighting techniques are used, it is possible to successfully conduct a Fall burn. This may be beneficial where hardwood reduction is an objective as they are also vulnerable in the Fall. Burning in the Fall also allows an early start to long burn seasons with ambitious acreage goals.

Using the considerations given above, the pine species can be prescribed burned year-round.

8.4.8. Fire Weather

One of the most important considerations in planning and conducting a prescribed burn is fire weather. Burn prescriptions contain a section with desired, forecasted and actual fire weather for a burn unit. The United States Forest Service's (USFS) "A Guide for Prescribed Fire in Southern Forests" is an excellent resource for burn managers in the region and contains recommendations and detailed descriptions of the following fire weather factors (Wade and Lunsford 1989).

Relative humidity (RH) is the amount of moisture in the air in relation to the air temperature. RH is the main factor for spotting potential and affects fire intensity and fuel availability. Various fuel sizes are affected differently by RH. Fine fuels like grasses and leaves are more responsive to RH. They absorb and release moisture much faster compared to the slower responses of heavier fuels like branches and logs. RH is a factor in whether a fuel will burn and how well it will burn. This is important within the burn unit but also when using natural firebreaks such as hardwoods. The temperature is a major factor in RH, fire intensity, scorch potential, live fuel moisture. Wind speed and direction affects fire intensity, rate of spread, smoke management and spotting potential. Dispersion index is essentially a measure of atmospheric stability which is directly related to smoke and heat lift. It also affects scorch potential. Live fuel moisture is a measure of the amount of moisture in live vegetation. This affects fuel volatility, availability and fire intensity. Days since last rain affects live fuel moisture, fire intensity, drought indices, and the ability of natural firebreaks such as hardwood stands or wetlands to hold fire. The Keech-Byram Drought Index (KBDI) is an indicator of drought severity and may help determine if a prescribed burn can take place. It measures soil and duff layer moisture assuming there are eight inches of moisture available to vegetation in a saturated soil. During burn planning, KBDI can help indicate how wet duff layers and wetlands might be.

8.5. **Fertilization**

Fertilization can be utilized on nutrient poor soils within Florida. Slash pine on flatwoods sites responds to fertilization. Fertilization uptake is dependent on soil composition (i.e. sand versus clay, drainage) among other factors. Excessive fertilization may cause fusiform rust issues. Fertilizer label rates, material safety data sheets and Silviculture BMPs provide additional guidance on application procedures and rates.

9
Acronymic Key

9. ACRONYMIC KEY

Abbreviation	Name
004 Form	ATFS Inspection Form
ACF	Association of Consulting Foresters
AFF Standards	AFF Standards of Sustainability
ALRI	America's Longleaf Restoration Initiative
ATFS	American Tree Farm System
ATV	All-Terrain Vehicle
BMAP	Basin Management Action Plan
BH	Bottomland Hardwoods
BMP	Best Management Practice
BTB	Black Turpentine Beetle
CI	Conservation Initiative
CRP	Conservation Reserve Program
EAB	Emerald Ash Borer
ECOS	Environmental Conservation Online System
EFRP	Emergency Forest Restoration Program
EIN	Employee Identification Number
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESA	Endangered Species Act
FFA	Florida Forestry Association
FFS	Florida Forest Service
FFWCC	Florida Fish and Wildlife Conservation Commission
FGDL	Florida Geographic Data Library
FHTET	Forest Health Technology and Enterprise Team
FMV	Fair Market Value
FORI	Forests of Recognized Importance
FRP	Forest Renewal Program
FSA	Farm Service Agency
FSP	Forest Stewardship Program
FSP Standards	FSP National Guidelines and Standards
FTFP	Florida Tree Farm Program
GIS	Geographic Information System
GoMI	Gulf of Mexico Initiative
GPS	Global Positioning System
HUC	Hydrologic Unit Code
IOBC	International Organization for Biological Control
IPM	Integrated Pest Management
KBDI	Keech-Byram Drought Index
LLC	Limited Liability Company
LLPI	Longleaf Pine Initiative
LMP	Landscape Management Plan
MACP	Middle Atlantic Coastal Plain ecoregion
MBF	Thousand Board Feet of Timber

Abbreviation	Name
MFW	Mixed Forested Wetland
NBCI	National Bobwhite Conservation Initiative
NCREIF	National Council of Real Estate Investment Fiduciaries
NIPF	Non-Industrial Private Forest
NNIA	Non-Native Invasive Animal
NNIP	Non-Native Invasive Plant
NNIS	Non-Native Invasive Species
NOI	Notice of Intent
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NTFP	Non-Timber Forest Product
NWF	National Wildlife Federation
NWOS	National Woodland Owner Survey
NWQI	National Water Quality Initiative
OHV	Off-Highway Vehicles
OSB	Oriented Strand Board
PEFC	Programme for the Endorsement of Forest Certification
QTP	Qualified Timber Property
RCW	Red-cockaded Woodpecker
REPI	Readiness and Environmental Protection Integration
RH	Relative Humidity
SAF	Society of American Foresters
SER	Society of Ecological Restoration
SFC	Southern Forestry Consultants
SFWMD	South Florida Water Management District
Silviculture BMPs	Florida Forest Service Best Management Practices for Silviculture
SMZ	Streamside Management Zone
SP	Southeastern Plains ecoregion
SPB	Southern Pine Beetle
SPI	Shortleaf Pine Initiative
Support Committee	Landscape Management Plan Development Support Committee
SWFWMD	Southwest Florida Water Management District
T&E	Threatened and Endangered Species
THH	Tropical Hardwood Hammock
UH	Upland Hardwoods
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WBD	Water Boundary Dataset
WBMP	Wildlife Best Management Practices
WLFW	Working Lands for Wildlife
WRWI	Withlacoochee River Watershed Initiative

10
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