AMERICAN FOREST FOUNDATION

Landscape Management Plan

Florida Panhandle Region
Landscape Management Plan Creation

Plan Development and Composition

With the guidance, technical consultation, and support of a wide array of stakeholders, the American Forest Foundation (AFF), in conjunction with Southern Forestry Consultants, Inc. (SFC), 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.

Florida Panhandle LMP Development Support Committee

The Florida Panhandle LMP was developed via the collaboration of the Florida Panhandle LMP Development Support Committee (Support Committee) made up of natural resource professionals, local and national stakeholders, and landowners. The Support Committee provided content and input on various thematic, structural, and scientific components of the plan, including through various drafts. Additionally, Support Committee members facilitated access to and procured data for the development of the geospatial database. We wish to thank and recognize the individual members of the team and partnering organizations. Support Committee members included representatives of:

- Florida Forest Service (FFS)
- Florida Fish and Wildlife Commission (FWC)
- Florida Tree Farm Program
- The Nature Conservancy
- University of Florida Institute of Food and Agricultural Sciences
- University of Florida Cooperative Extension
- University of Georgia Cooperative Extension
- Florida Forestry Association
- U.S. Forest Service
- U.S. Fish & Wildlife Service
- Weyerhaeuser Company
- Georgia-Pacific
- Enviva Biomass
- WestRock

Additional Stakeholders

AFF and SFC also sought input from a variety of additional stakeholders with expertise in the natural resources, species conservation, planning, forest certification and auditing, consulting forestry, landowner engagement, change management, and regulatory disciplines. Support Committee members also solicited feedback and ideas from their own organizations and external stakeholders.
Funding Support

The development of the Florida Panhandle LMP was made possible with financial support from the following partners. We wish to thank and recognize them:

- The Programme for the Endorsement of Forest Certification (PEFC™)
- U.S. Forest Service
- Georgia-Pacific
- Florida Forest Service
- American Forest Foundation

AFF’s Landscape Conservation and Wildlife Goals

The South’s forests rank highly in biodiversity and number of wildlife species. But today wildlife are under pressure from years of conversion of forests to non-forest uses (including development and residential uses), fragmented waterways, natural fire suppression, and an influx of invasive species. In fact, there are more than 500 at-risk wildlife species across the South, including Florida. In addition, the South’s forests are also important from an economic standpoint. More than 50% of the wood harvested that flows into supply chains comes from family-owned forestland in the region. The forestry sector supports more than 1.1 million jobs in the South alone.

AFF’s recent research has found that wildlife habitat and a sustainable wood supply can go hand in hand when family landowners are actively managing. In fact, landowners who are harvesting are also helping wildlife—85% of those who have harvested have also implemented one or more other wildlife-improvement activities. AFF with local, state, and federal partners is working to increase the number of landowners across the South actively and sustainably managing their forests to provide a sustainable wood supply and wildlife habitat for at-risk species.

Measurable Goals For Conservation Impact

Using innovative tools such as this LMP enables partners to set measurable goals for landowner engagement and conservation impact in their region. In the Panhandle region of Florida, this LMP is designed to guide stewardship actions on the ground to achieve the following goals:

1. In the next year, enrollment of 30 previously unengaged landowners in the Forest Stewardship Program (FSP) and the American Tree Farm System® (ATFS) certification program, becoming certified forest stewards through direct marketing and impactful engagement with FFS foresters.

2. Within five years, more than 150 landowners taking specific conservation actions on their land, supported by this LMP, and another 2,000 in the pipeline to take actions.
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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, industry, 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, 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 the Florida Panhandle.
- 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.
- 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 federal, state, or local forestry regulations that may not be addressed directly in this plan.

Why a LMP? Conservation at Scale

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 and time-consuming for both landowners and foresters to develop, they have been identified as the biggest barrier to family landowner engagement.

In addition, recent research conducted by the U.S. Forest Service related to the FSP suggests that the development of individual landowner forest management plans have only moderate to minimal impacts 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. 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 about what will effectively encourage family landowner behavior and support coordinated efforts to address the critical landscape-scale conservation needs and opportunities.
Even more, individual management plans generally do not offer a means for inspiring, understanding, and coordinating important conservation strategies across family ownerships. By setting motivational goals at the landscape level, a new call to action is being created that allows a wider network of landowners to be engaged. Values like wildlife conservation and management are important to landowners. This landscape-scale management plan allows aspirational goals for the landscape that align with that motivation to be set.

Drawing on emerging research from the U.S. Forest Service, the AFF, and others, as well as models used in Scandinavia and techniques used by some American consulting firms, the LMP is designed to reduce the management plan barrier that family landowners face to becoming involved in conservation activities and streamline the 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 offers a mechanism for coordinating landscape-scale priorities across small family forest ownerships.

The AFF, in conjunction with numerous natural resource partners, has therefore developed this LMP to address landowner and landscape-level objectives within the 16-county Florida Panhandle ecoregion (including Jackson, Jefferson, Gadsden, Liberty, Calhoun, Gulf, Franklin, Wakulla, Leon, Bay, Washington, Holmes, Walton, Okaloosa, Santa Rosa, and Escambia counties). 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 (AFF Standards)**
- **Forest Stewardship Program National Standards and Guidelines (FSP 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 and Consumer Services (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 revised and updated periodically to reflect changing dynamics with specific forest resources and on the landscape broadly, as well as updates to the certification standards. Similarly, it is critical to monitor landowners’ management to ensure congruence between the LMP and efforts on the ground. As required under certification, routine monitoring efforts conducted by active ATFS Inspecting Foresters shall take place at the individual landowner level.

### 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.”

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 is commonly provided to landowners 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, 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, and the Association of Consulting Foresters (ACF), provide membership standards and requirements to ensure the 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 compliance policies for all ATFS Inspectors.

The Florida Forest Service Vendor Database is a web-based database 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

This LMP is purposefully designed as an adaptive tool for implementation in a wide array of settings and circumstances, recognizing the range, variability, and fluidity of the landscape and evolving objectives and conditions. It is not designed as a strict blueprint for action but, rather, as a guide and supportive structure, responsive to a number of interacting factors.

All silvicultural options, management activities, and implementation measures provided in this LMP are predicated on an underlying assumption of variation and changing conditions. Changes and variability in conditions (especially objectives, 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.

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 shifting window of conditions to achieve the desired result. For example, prescribed burning within longleaf pine stands can occur anytime and season within the three to five year window to maximize needlecast, time weather conditions, and manage fuel loads. Harvesting operations and regeneration efforts could vary significantly when focused on meeting different landowners’ 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 LMP should not be viewed as an unchangeable text, but rather a living document dependent on ongoing evaluation and adapted implementation required for success.

1.3 2015-2020 AFF Standards of Sustainability within the LMP

The AFF 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 eligibility requirements for participation in the ATFS state program certification are available on the ATFS website.

The AFF 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 AFF Standards 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 AFF 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.

The standards, performance measures, and indicators below include links to examples of where they are addressed within the LMP:

**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 and adaptive, 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 (Plan Creation, Forest Resource Professionals).

**INDICATOR 1.1.2 (A)**

Management plans shall describe current forest conditions, landowner’s objectives, and 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. Under the LMP, relevant mapping is addressed via the geodatabase and related programmatic documentation.

**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 (FORI). 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 (Hydrologic spatial layer, Soil spatial layer, Hydrological Protection and Restoration, Watershed Protection and Restoration), desired species, recreation (Recreation objective, Recreation resource), forest aesthetics (Aesthetics objectives, Aesthetics resources), 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 Addresses This Standard**

This LMP serves as the written management plan for all participating landowners in the designated region of northern 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 region, regardless of the size and scale of their property. As noted in the links included throughout this section, this LMP addresses each of the AFF Standards.

The geodatabase serves as the related mapping element required under the standard. This secure geodatabase reflecting the best available science was developed to include all the necessary spatial information to support sustainable forest management in the area, including the following geodatabase layers: Hydrologic spatial layer, Hydrological Protection and Restoration, Watershed Protection and Restoration, Mills spatial layer, Timber Management, Support Healthy Forest Products Industry, Listed Species spatial layer, Critical Habitat spatial layer, Rare Habitat spatial layer, Rare Plant and Animal
Introduction: Standards

Protection, Historical Structures spatial layer, Cemeteries spatial layer, Historical and Cultural Sites, iMap spatial layer, EDDMaps spatial layer, Non-Native and Invasive Species (NNIS) and Nuisance Species Management.

Additional maps can be generated from this database by a forester or ATFS Inspector upon request by the landowner or a third-party assessor. However, this is not a requirement as the geodatabase mapping suffices. In addition, landowners utilizing the LMP may also have information specific to their tree farm included the ATFS Inspection Form (004 Form) by an ATFS Inspecting Forester as additional documentation and appendage to the LMP.

It is important to note that the strategy for implementing the plan to meet the landowners’ objectives is that: foresters will regularly monitor markets, forest health, etc., to propose treatments; owners will approve implementation of practices and harvests; and foresters and owners will meet at regular intervals, appropriate to management, to discuss progress and changes needed.

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 Addresses This Standard

This LMP makes reference to the application of relevant laws and regulations. All landowners certified to ATFS agree to meet all federal, state, and local regulations.

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 forestland 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 Addresses This Standard

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 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 may also document these efforts within the 004 Form to ensure conformance.

Standard 4

AIR, WATER, AND SOIL PROTECTION

Performance Measure 4.1

Landowner shall meet or exceed practices prescribed by state Silviculture BMPs.

INDICATOR 4.1.1

Landowner shall implement specific state forestry BMPs that are applicable to the property (Hydrological Protection and Restoration, Support Healthy Forest Products Industry, Watershed Protection and Restoration).
INDICATOR 4.1.2
Landowner shall minimize road construction and other disturbances within riparian zones and wetlands (Hydrological Protection, Support Healthy Forest Products Industry, Watershed Protection and Restoration).

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 (NNIP and Nuisance Plant Treatment Methods, NNIA Treatment Methods, Nuisance Animal Treatment Methods, Biological Control).

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 Addresses This Standard
This LMP references applicable Florida BMPs, which accompany the strategies to be implemented on the ground. All landowners certified to ATFS agree to meet or exceed all applicable state forestry BMPs, even those that are voluntary. When management activities that will cause any soil disturbance or require chemical application, the Silviculture BMPs are consulted and applicable BMP methods employed. No field evidence of BMP implementation is expected where no management activity has occurred.

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 (Listed Species spatial layer, Critical Habitat spatial layer, Rare Habitat spatial layer, Wildlife Management and Protection, Rare Plant and Animal Protection Table).

INDICATOR 5.1.1
Landowner shall confer with natural resource agencies, state natural resource heritage programs, or 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 (Listed Species spatial layer, Critical Habitat spatial layer, Rare Habitat spatial layer).

INDICATOR 5.1.2
Forest management activities shall incorporate measures to protect identified threatened or endangered species on the property (Wildlife Management and Protection, Rare Plant and Animal Protection).

Performance Measure 5.2
Landowner should address the desired species 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 or desired 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 preventing, controlling, or responding 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 spatial layer).

**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 Addresses This Standard**
This LMP was developed in direct consultation with appropriate natural resource agencies including the U.S. Fish & Wildlife Service, Florida Fish and Wildlife Commission, U.S. Forest Service, Florida Forest Service, and others. Based on this consultation, considerations for and, where applicable, protections of threatened and endangered species, their habitat requirements, desired species, desired forest communities, forest health and FORI are integrated into the silvicultural strategies included in this LMP, as required by the AFF Standards.

In addition, resources compiled by the relevant authorities are referenced throughout the LMP. The LMP geodatabase provides required information on threatened and endangered species, their habitat requirements, desired species, desired forest communities, forest health and FORI in the LMP’s area. The database includes spatial information about where there are known occurrences of threatened or endangered species, FORI, the regional soil types, and documented areas of invasive species incursion. Foresters and ATFS Inspectors may also use the 004 Form to include information specific to a tree farm regarding forest health, such as additional species composition information or treatment information.

Foresters working with landowners can provide technical support in managing of site-specific resources, as supported by this LMP.

With support of the LMP as guidance, foresters can advise landowners in making practical efforts to promote forest health. Integrated pest management (IPM) is an excellent approach to controlling, suppressing, or preventing pests and can take many forms. Preventative measures to improve forest health or 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 the 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.

**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 (Aesthetics objectives, Silvicultural Options).
Introduction: Standards

How the LMP Addresses This Standard
This LMP addresses aesthetic issues relevant to each of the common forest types in the region in their respective sections. 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.

Standard 7
SPECIAL SITES PROTECTION

Performance Measure 7.1
Forest management activities shall consider and maintain any special sites relevant on the property (Historical Structures spatial layer, Cemeteries spatial layer, Historical and Cultural Sites).

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 (Historical Structures spatial layer, Cemeteries spatial layer).

How the LMP Addresses This Standard
The LMP was developed in direct consultation with relevant authorities on special sites of biological and geological significance. In addition, additional resources were consulted in the development of the LMP, including the section on special sites. This includes direction how to identify special sites and protect them while implementing forest management activities. Publicly designated special sites are included in layers of the geodatabase relative to threatened and endangered species, FORI, and cultural and historical sites.

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 or designated representatives are advised to 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 and approaches to protection with qualified natural resource professionals and qualified contractors assisting in forest management activities.

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 (Forest Resource Professionals).

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 AFF Standards.
Performance Measure 8.2

Landowner shall monitor forest product harvests and other management activities (Forest Resource Professionals, Silvicultural Options) 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 (Common Forest Resources, Forest Resources).

**How the LMP Addresses This Standard**

The LMP encourages landowners to seek qualified natural resource professionals and qualified contractors, who carry appropriate insurance and comply with appropriate federal, state, and local safety and fair labor rules, regulations, and standard practices. The LMP also encourages landowners to retain appropriate contracts for three years, recognizing, in some circumstances, that that may not be appropriate and necessary.

The silvicultural strategies in this LMP are specifically designed with an aim to achieve landowner’s objectives and conservation objectives and to maintain the potential of the property to produce forest products and other benefits sustainably.
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 in more actively managing their forest and related resources. FSP aids owners of forestland 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 Florida’s Forest Action Plan 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 10 years. The FSP is not a cost-share program. Cost-share assistance for plan implementation may be available through other conservation incentive programs.

The FSP Standards were addressed and evaluated during the completion of this LMP. More specifically, in order provide an LMP that is “multi-resource in scope and adequately comprehensive with respect to forest ecosystem management,” the following plan element discussions are linked below:

NOTE: In the event an element is discussed in multiple forest types, only the location in the first forest type is linked below:

- Aesthetic quality (Aesthetics objective, Aesthetics resource) and desired timber species
- Recreation (Recreation objective, Recreation resource)
- Wood and fiber production (Mills spatial layer, Revenue, Support Healthy Forest Products Industry)
- Fish and wildlife (Wildlife Management and Protection, Wildlife Habitat Management and Protection)
- Threatened or endangered species (Listed Species spatial layer, Critical Habitat spatial layer, Rare Habitat spatial layer, Rare Animal Species of Florida’s Panhandle by LMP Forest Type Table)
- Forest health and invasive species (iMap spatial layer, EDDMaps spatial layer, Non-Native and Invasive Species)
- Conservation-based estate planning or legacy planning information (Conservation, Conservation Incentives)
- Archeological, cultural, and historic sites (Historical Structures spatial layer, Cemeteries spatial layer, Historical and Cultural Sites)
- Wetlands (Hydrologic spatial layer, Soil spatial layer, Hydrological Protection and Restoration, Watershed Protection and Restoration)
- Fire
- Carbon sequestration and climate resilience (Sea level spatial layer, Ecosystem Services)
- Forests of recognized importance (FORI spatial layer)

1.5 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. The USDA Natural Resource Conservation Service (NRCS) and Farm Service Agency offer programs such as the Conservation Reserve Program, Emergency Forest Restoration Program, Healthy Forests Reserve Program, Environmental Quality Incentives Program (EQIP), Regional Conservation Partnership Program, and Conservation Stewardship Program that provide matching funds or cost-share reimbursements to private landowners for management activities such
as reforestation, silvopasture, thinning, and prescribed burning. The Florida Forest Service (FFS) administers a number of programs including the southern pine beetle program, cogon grass treatment program, and the longleaf pine private landowner incentive program for the National Fish and Wildlife Foundation (NFWF) and the U.S. Forest Service (USFS). The U.S. Fish & Wildlife Service (USFWS), through the FWC, may provide technical and financial assistance through the Partners for Fish and Wildlife Program. FWC provides technical assistance in concert with these programs. These conservation-minded landowners often choose to maintain their land as legacy forests that can be passed down for future generations to utilize, protect, and enjoy.

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 Northwest Florida Water Management District (NWFWM), Florida Forest Service (FFS), or Florida Department of Environmental Protection (FDEP). Conservation easements vary, but most ensure the land is never developed while allowing the landowner to continue management activities such as timber harvests in return for which 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 or threatened or endangered species habitat.

This LMP is designed to complement, provide continuity with, and help support landowner engagement in these described programs.

1.6 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 no significant markets for these services in the Panhandle, but they may develop in coming years. However, lack of financial incentives does not discount the crucial services ecosystems provide, making ecological maintenance and restoration an important objective for many landowners.

1.7 Engaging the Landowner

The supplemental guide, *Forester’s Guide to Implementing the Florida Landscape Management Plan*, is designed as a resource to help foresters using the LMP to effectively support landowners while streamlining administrative and related elements of landowner engagement. This resource provides a step-by-step approach for foresters to document a participating landowner’s conformance to the AFF Standards utilizing the 004 Form, which also serves as a form of management plan documentation as well.

This LMP and *Forester’s Guide* can also be utilized for landowners with existing or outdated plans. The same process should be followed when replacing the existing or outdated plan. Additionally, the existing plan can be used during a review of the landowner’s objectives, forest types and resources, and implementation activities, but is not required. The additional information found in this LMP and the geodatabase will then be used to supplement and replace the existing plan.
2

Site Specific Characterization Through Geodatabase Tools
To support identification of the existing conditions present on any site for which the LMP may be used, a GIS-based evaluation tool was developed. 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 using the best available science.

Use of the geodatabase is not compulsory for use of the LMP. In addition, site conditions may also be identified through on the ground reconnaissance.

2.1 Instructions for Use

This geodatabase will require a geographic information system (GIS) to view, summarize, and manipulate 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 (Parcels > 10 acres) 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 contiguous tax parcels. After identifying the referenced property, users can toggle and select between individual 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 or endangered species or nearby invasive species could be present on their referenced site.

2.2 Geodatabase Layer Descriptions

The following 16 geospatial layers and aerial imagery layer 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 layer’s name, location, and a brief description of the content found within the layer.

2.2.1 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](http://www.fgdl.org/metadataexplorer/explorer.jsp)

2.2.2 Cemeteries

- **Layer Source Name:** Historic Cemeteries in Florida-July 2016, FGDL
- **Description:** This dataset contains historic cemetery boundaries and basic cemetery attributes as recorded at the Florida Master Site File.
- **Layer Source Location:** [http://www.fgdl.org/metadataexplorer/explorer.jsp](http://www.fgdl.org/metadataexplorer/explorer.jsp)

2.2.3 Hydrologic

- **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

### 2.2.4 Listed Species

- Layer Source Name: U.S. FISH & 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 & Wildlife Service. The Environmental Conservation Online System (ECOS) is a gateway website that provides access to data systems in the U.S. Fish & 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 February 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

### 2.2.5 Conservation Lands

- Layer Source Name: Florida Managed Area – March 2016, FGDL
- Description: FLORIDA CONSERVATION LANDS (layer name FLMA): This is a polygon data layer for public (and some private) lands that the Florida Natural Areas Inventory (FNAI) has identified as having natural resource value and that are being managed at least partially for conservation purposes. The term “Managed Area” refers to a managed conservation land.
- Layer Source Location: http://www.fgdl.org/metadataexplorer/explorer.jsp

### 2.2.6 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.

### 2.2.7 Rare Habitat

- Layer Source Name: Rare Species Habitat Conservation Priorities
- Description: This layer identifies habitat for rare plant and animal species with habitat ranked based on G and S ranks and overlap between species.
- Layer Source Location: http://atoll.floridamarine.org/metadata/custom/fwli/raresp_hab.htm

### 2.2.8 Sea Level

- Layer Source Name: Sea-Level Rise
- Description: These layers show the rise of sea level from zero to six feet.
- Layer Source Location: https://coast.noaa.gov/slrdata/
2.2.9 iMap
- Layer Source Name: Invasive Species, Florida iMapInvasives. 2016.
- Description: Point data of invasive species.

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

2.2.11 Counties
- Layer Source Name: Florida County Boundaries – September 2015, FDGL
- 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

2.2.12 Roads
- Layer Source Name: USGS 1:24,000 Roads
- Description: This coverage contains the digital line graphs (DLG) for the State of Florida as compiled by the Earth Science Information Center of the U.S. Geological Survey. The RDS24 coverage is a subset of all transportation data from the DLG data files derived from the 1:24,000-scale and other large-scale maps. This dataset has been updated from the previous version on Florida Geographic Data Library (FGDL) 3.0.
- Layer Source Location: http://www.fgdl.org/metadataexplorer/explorer.jsp

2.2.13 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

2.2.14 Parcels > 10 acres
- Layer Source Name: Florida Parcel Data by County – 2010, 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

2.2.15 Mills
- Layer Source Name: North Florida Mills, 2015
- Description: Point location data of mills available in the Northwest Florida region.
2.2.16 Imagery: World Imagery

- Layer Source Name: ESRI World Imagery, 2016
- 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

2.2.17 Forest of Recognized Importance

- Layer Source Name: FORI
- Description: Forests of recognized importance identified within the region based on the best available science, regional conservation initiatives and collaborative input from the Support Team.
- Layer Source Location: www.treefarmsystem.org/LMP-northern-florida
3 Objectives
Objectives

Forest management objectives generally fall into two overlapping, mutually supportive categories: landowner and landscape objectives. Landowner objectives are those considerations important to landowner achievement which measure 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). Landowner objectives change over time with changes in personal circumstances, life stages, and other factors. They are subject to change and, as such, management should be adaptable. Landowner objectives may also change or adapt as the landowner becomes aware of landscape objectives or their stewardship practice matures.

Landscape or landscape-level objectives are those objectives identified on a national or ecoregional level that provide the greatest benefit towards forested ecosystem restoration, maintenance, and enhancement. 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 or longleaf pine restoration.

3.1 Landowner Objectives

The following common landowner objectives considered under this LMP were derived from the USDA National Woodland Owner Survey Results and Observations (Butler et al 2016) and the FWC Private Landowner Survey Results (Pienaar and Plate 2015). Research suggests significant general continuity in objectives across the family landowner demographic. Each potential landowner objective is discussed relative to its application towards forest management. Each landowner objective is also discussed relative to its application within each of the common Panhandle forest types.

3.1.1 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 decrease aesthetic value, the consistent application 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, but the resultant functional and aesthetic changes in species composition and midstory or nuisance species control become 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.
3.1.2 Wildlife Management and Protection

The Florida Panhandle is rich with both game and non-game wildlife species. Many landowners are interested in managing, conserving, and protecting these species and their habitat.

The Panhandle has some of the best hunting opportunities in the State of Florida 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 by many family landowners.

Non-native invasive species such as cogon grass and feral hogs cause major ecological and economic damage to Panhandle forests. Native forest pests such as southern pine beetle are always a potential threat to forests. Several native diseases such as fusiform rust and pitch canker and non-native diseases such as laurel wilt also cause damage across multiple forest types.

Various cost-share programs, grants, and services aid Panhandle 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.

3.1.3 Recreation

Many landowners enjoy a variety of forms 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 while others may live across the state or country and only visit during hunting season. Information about trail building is available at the Florida Trail Association website.

3.1.4 Conservation

Many landowners indicate a general interest in conservation of nature. Some landowners have a conservation objective because they would like to see their forest ownership remain intact and capable of being passed down between generations. Others see conservation as protecting the intrinsic values of nature.

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. This LMP integrates this objective into proposed strategies.

3.1.5 Forest Health Management

Maintaining and promoting forest health is a major landowner concern and objective. This objective is also specifically addressed in individual landscape objectives such as invasive species. Many unengaged landowners not actively managing their forests initially contact a forest resource professional regarding forest health issues.

Non-native invasive species such as cogon grass and feral hogs cause major ecological and economic damage to Panhandle forests. Native forest pests such as southern pine beetle are always a potential threat to forests. Several native diseases such as fusiform rust and pitch canker and non-native diseases such as laurel wilt also cause damage across multiple forest types.

Various cost-share programs, grants, and services aid Panhandle 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.

3.1.6 Revenue

Sources of forest-based revenue in the Panhandle 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.

3.1.6.1 Timber Management

Landowners have strong, diverse timber markets in the Panhandle, 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.

There are many tools available to meet these various objectives including thinning, clearcut, and natural and artificial regeneration. They can utilize uneven-aged management with longleaf pine and hardwoods and even-aged management with other pine species and cypress.

3.1.6.2 Non-Timber Forest Products

Forestland owners have many revenue sources aside from timber products. The Panhandle’s forests provide various non-timber forest products (NTFP). These are wide-ranging and include pine straw, honey, silvopasture, and saw palmetto drupe sales. These markets can provide landowners with revenue between timber harvests or serve as their main source of revenue generation from their forests.
### 3.1.6.3 Non-Forest Associated Land Uses

Some private landowners wish to generate revenue through eco-tourism by opening their land to public access for a fee. Good examples include canoe, kayak, and other boat rentals and tours along the many scenic waterways adjacent to the Panhandle's forests. Hunting leases are another example.

Various aggregate material including sand, clay, stone, and gravel can be mined for construction, development, concrete, forest roads, and other uses. This may entail local and state permitting. Additional permitting information is available at the [Department of Environmental Protection – Mining and Mitigation](https://www.dep.state.fl.us/mining/). These activities can be conducted in conjunction with pond construction. Both activities will alter nearby hydrology, which will likely have ecological impacts. Commercial extraction of such materials may prevent or cause the loss of ATFS certification.

Mineral and gas leases can provide yet another alternative form of revenue for landowners. These activities will have ecological and aesthetic impacts.

Oil, gas, and electric easement and right-of-way leases can be profitable, as can tele-communication tower leases. Each will have aesthetic tradeoffs. Ecological impacts can be positive and negative. If native vegetation is maintained without frequent, heavy herbicide use, many rare plants thrive on utility right-of-ways due to full sunlight. Many utilities are cooperative in maintenance methods and timing. The open nature of right-of-ways can also benefit many wildlife species.

Land conversion from forestland may prevent or cause loss of ATFS certification and access to certified fiber for industry.

Timberland real estate can be a lucrative source of revenue for many landowners, but may not be consistent with the requirements of the [AFF Standards](https://www.deq.state.mn.us/) and [FSP Standards](https://www.flaud.gov/), resulting in decertification with transition to another land use. Some properties are passed down through generations while others may change ownership over time as investments. Life and business circumstances can change rapidly and real estate provides flexible options to quickly adapt to potential obstacles. Timberland real estate may involve land development or staying in forestry and agriculture.

### 3.2 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 Action Plan](https://www.dep.state.fl.us/). Forest type-specific landscape objectives are discussed in the [Common Panhandle Forest Types](https://www.dep.state.fl.us/foresttypes/) section.

#### 3.2.1 Support Healthy Forest Products Industry

This LMP promotes maintaining a healthy forest products industry in the Panhandle through sustainable forest management practices. This can be achieved through carefully planned timber harvests and timely site preparation and reforestation. Certification through ATFS also supports sustainable forestry and adds value to timber markets.

Silviculture BMPs also support sustainable silvicultural through practices that protect and enhance water and soil quality. By voluntarily conducting safe, responsible, and sustainable forestry practices, over-regulation is avoided, which keeps timber markets alive and thriving. 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 silviculture activity.

#### 3.2.2 Wildlife Management and Protection

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 Panhandle provide valuable habitat to imperiled species such as eastern indigo snake, gray bat, gopher tortoise, Florida panther, Bachman's sparrow, and Pine Barrens tree frog. These and other species, including at risk, threatened, and endangered species, are considered in the development of silvicultural strategies and reflect the Florida's Forest Action Plan. Many silvicultural tools are available to maintain, enhance, and restore habitat for game and non-game species including prescribed fire, timber harvests, groundcover restoration, invasive species control, food plots, and wildlife openings.
The Wildlife BMPs manual compiles strategies and considerations for managing and protecting these 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 some 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 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

The Panhandle has some of the best hunting opportunities in the State of Florida 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.

### 3.2.3 Watershed Protection and Restoration

Florida’s Panhandle contains several major watersheds including the Apalachicola, Choctawhatchee, Escambia, Perdido, Blackwater, Yellow, Chipola, Ochlocknee, and Aucilla Rivers. Well-managed forests protect these watersheds and ensure clean drinking water, waterways, and healthy aquatic habitats.

Silvicultural and agricultural BMPs are often implemented and promoted to ensure these operations don’t impair water quality in the region. In many cases, Silviculture BMPs like wetland harvest restrictions, road construction guidelines, and streamside management zones (SMZs), 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.

### 3.2.4 Forestland Conservation and Retention

Florida’s forests face many threats, with land-use conversion 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.

### 3.2.5 Non-Native and Invasive Species (NNIS) and Nuisance Species Management

There are many non-native invasive plant (NNIP) and animal (NNIA) species in Florida’s Panhandle. Table 1 provides a list of the most common NNIS and nuisance species that impact forest management. Additionally, there are numerous native species that can function as nuisance species when their abundance and distribution adversely 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 gallberry (Ilex coriacea and Ilex glabra) limit forest regeneration, increase wildfire risk, and reduce biodiversity. Forest resource professionals can accurately assess which native species are serving in a nuisance capacity and inhibiting 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).

### 3.2.5.1 Prevention and Monitoring

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

### 3.2.5.2 Documentation and Planning

Documentation of new and existing infestations with GPS coordinates, GIS mapping, or location notes assists in the treatment and monitoring of infestations. Infestations can be marked with flagging, paint, or other means. Documentation is also beneficial to ensure all pesticides are approved by the 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 (IPM) 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

### 3.2.5.3 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)

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**Table 1. Common Florida Panhandle non-native invasive plant (upland) and animal species list.**

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cogon grass</td>
<td><em>Imperata cylindrica</em></td>
</tr>
<tr>
<td>Japanese climbing fern</td>
<td><em>Lygodium japonicum</em></td>
</tr>
<tr>
<td>Mimosa</td>
<td><em>Albizia julibrissin</em></td>
</tr>
<tr>
<td>Chinese tallow</td>
<td><em>Triadica sebifera</em></td>
</tr>
<tr>
<td>Chinese wisteria</td>
<td><em>Wisteria sinensis</em></td>
</tr>
<tr>
<td>Chinese privet</td>
<td><em>Ligustrum sinense</em></td>
</tr>
<tr>
<td>Japanese honeysuckle</td>
<td><em>Lonicera japonica</em></td>
</tr>
<tr>
<td>Kudzu</td>
<td><em>Pueraria montana var. lobata</em></td>
</tr>
<tr>
<td>Coral ardisia</td>
<td><em>Ardisia crenata</em></td>
</tr>
<tr>
<td>Chinaberry</td>
<td><em>Melia azedarach</em></td>
</tr>
<tr>
<td>Air potato</td>
<td><em>Dioscorea bulbifera</em></td>
</tr>
<tr>
<td>Feral hog</td>
<td><em>Sus scrofa</em></td>
</tr>
<tr>
<td>Feral cat</td>
<td><em>Felis catus</em></td>
</tr>
<tr>
<td>Feral dog</td>
<td><em>Canis lupus familiaris</em></td>
</tr>
</tbody>
</table>
Objectives: Landscape Objectives

- 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.

3.2.5.4 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.

3.2.5.5 Nuisance Animal Treatment Methods

- White-tailed deer
  - Do not transport onto property and prohibit hunting lessees from doing so
  - Modify and increase deer harvest to control population abundance and sex ratios
  - Property boundary fencing
  - Install exclusionary fencing around young plantations or regeneration areas
    » Licensed contract trappers available
  - Time-logging activities and use uneven aged stands to provide continual availability of browse and forage options

- 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.

3.2.5.6 Biological Control

Per the U.S. 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 IPM 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).

3.2.6 Ecological Restoration

Restoration of specific working forest ecosystems is a priority identified in the Florida's Forest Action Plan. This includes forest ecosystems that have been reduced in scale or impacted by disruption of natural management regimes, including fire.
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 Lower Gulf Coastal Plain ecosystems.

Longleaf pine and wiregrass (Aristida stricta) community is a good restoration example. Many landowners in the Florida Panhandle ecoregion 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, preservation, and revenue 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 within all the Common Panhandle Forest Types.

3.2.7 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. Hydrological restoration also takes place at the property level through engineered projects like plugging drainage ditches and canals. These larger-scale projects may affect adjacent landowners or those miles up- or downstream.
4 Common Forest Resources
4 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. These identified resources include elements reflected in the priorities and actions identified in the Florida’s Forest Action Plan and those required for consideration by ATFS, FSP, and other programs. They are summarized below rather than included in the forest types discussion due to their relative uniform applicability across all forest types.

4.1 Historical and Cultural Sites

Many private lands contain various historical and cultural resources, which are noted as “special sites” under the AFF Standards. 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. Some resources may be mapped with federal, state, or local agencies and organizations. Forest resource professionals often 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 or blazed trees, fencing, or signage and communicated to contractors and sub-contractors.

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

- **Significance:**
  - Has made a significant contribution to the broad patterns of history.
  - Is associated with the lives of significant persons of the past.
  - Embodies 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 is likely to yield information important in history or pre-history.

- **Age:** Minimum 50 years old.

- **Integrity:**
  - Retains its historical physical integrity with its character-defining features still present.
  - Building, structure, or landscape feature is relatively unchanged.
Common Forest Resources: Forests of Recognized Importance

- Is relatively undisturbed archeologically, with its patterns and layers of artifacts relatively intact.
- Is a traditional cultural site 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, etc.
- Geological formations, sinkholes, limestone bluffs or outcroppings, caves or entrances, spring heads, springs, etc.
- Rare plant populations, pitcher plant bog, champion trees, bear den, etc.

### 4.2 Forests of Recognized Importance

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 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.

#### 4.2.1 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 at this time 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.

In an effort to support and facilitate identification of these resources within this project, AFF worked with the Support Committee to develop a list of FORIs within the region (Jackson, Jefferson, Gadsden, Liberty, Calhoun, Gulf, Franklin, Wakulla, Leon, Bay, Washington, Holmes, Walton, Okaloosa, Santa Rosa, and Escambia counties) 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.
Common Forest Resources: Forests of Recognized Importance

Longleaf Forests

One of the main priorities within the region is longleaf forest restoration. As Florida’s Forest Action Plan states: “Longleaf pine ecosystems are among the most threatened ecosystems in the United States. Longleaf pine once comprised about 60% of the landscape of the southeastern Coastal Plain and Florida currently has the largest number of existing acres (1,198,248 acres) in longleaf forest types. The enhancement of this important and diverse ecosystem is a priority for both public and private landowners in the state.”

The Longleaf Alliance, an area conservation organization, which was established in 1995 with the express purpose of coordinating a partnership between private landowners, forest industries, state and federal agencies, conservation groups, researchers, and other enthusiasts interested in managing and restoring longleaf pine forests for their ecological and economic benefits, outlines the importance of the longleaf ecosystem based on the following qualities:

- **Wildlife species:** Well-managed longleaf pine forests provide quality habitat for a variety of desirable plant and animal species. For example, bob-white quail populations thrive in frequently burned longleaf pine stands, which typically support high legume populations. Fox squirrels, wild turkeys, whitetail deer, countless varieties of songbirds, and many native butterflies flourish in longleaf pine forests as well. Reptiles and amphibians are frequent inhabitants of these forests, many found nowhere else.

- **Biodiversity:** Though typically thought of as a sandhill species, longleaf pine once covered about two-thirds of the southeast. At a landscape level, longleaf pine forests cover a variety of different habitat types (mountains, rolling hills, sandhills, and flatwoods). A longleaf pine stand maintained by fire is among the most biologically diverse habitats in North America.

- **Aesthetics:** For visual effect, few forests can compare with longleaf pine forests. Mature longleaf forests are frequently referred to as “park-like”. In both the spring and fall, wildflowers bring the forest to life with a myriad of colors.

- **Carbon Sink:** Because longleaf pine is longer lived than other southern pines and has the ability to sustain growth at older ages (150 years or more), it has the ability to tie up stored carbon for long periods of time.

- **Cultural:** Longleaf was literally the tree that built the South. Aside from lumber that was used to build homes, businesses, ships, etc., longleaf pine forests provided fare for the dinner table, medicines, a place to graze cattle, extract resin to refine turpentine, or simply a place to go out and listen to the “whispering of the pines”.

Through America’s Longleaf Restoration Initiative, the Longleaf Alliance identified priority landscapes within the region that qualify as FORIs. These priority longleaf forests (Gulf Coast Plain Ecosystem Partnership Managed Areas) are included in the FORI spatial layer.

Conservation Lands

The Nature Conservancy identified the Apalachicola Bluffs and Ravines Preserve as an area of significant importance due to the “Preserve’s steephead ravines [which] are a very rare geological feature that provide refuge for a number of rare species of plants and animals, some found nowhere else on Earth.” This preserve is located in Bristol, Florida, in northern Liberty County. The Apalachicola Bluffs and Ravines Preserve is included in the FORI spatial layer.

Public Lands

Due to their recognized conservation priorities for protecting habitat, biodiversity, water resources, cultural sites, and unique geologic features, all area federal and state protected public lands 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. The state and federal public lands within the region are included in the FORI spatial layer.

4.2.2 Landowner Actions to Protect FORIs

For family landowners, a likely scenario is that their property is adjacent to a state or federally protected area and 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 confirm the presence or absence of a FORI on 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.

### 4.3 Recreation

Florida Panhandle 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. Potential recreation activities include:

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

### 4.4 Aesthetics

From a towering pine stand with a sea of grasses to a lush, mixed bottomland hardwood draped with Spanish moss, the wide range of forest types, topography, and aquatic features throughout the Florida Panhandle provide unique forest aesthetic values. The forests themselves vary from open, pine-dominated rolling hills to dense cypress ponds. The Panhandle boasts hardwood forests only found in this part of the state. These dense forests are composed of many northern species, providing an Appalachian aesthetic. The cypress-lined rivers and ponds have their own prehistoric beauty.

Florida’s Panhandle is unique to the rest of the state in topography. It has rolling sand and clay hills, steephead 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 Panhandle’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.
5 Common Panhandle Forest Types
This section discusses the common forest types and general stand conditions natural resource professionals may encounter while working with landowners in the Panhandle 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 cypress-gum). 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 Areas Inventory’s (FNAI) Natural Community Guide 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. FNAI natural communities associated with the LMP Common Panhandle Forest Types are discussed within each respective forest type section.

5.1 Slash Pine Dominant

Slash pine is a highly valuable commercial species in Florida’s Panhandle. 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. However, it can be managed on longer rotations for high-value products.

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. Slash pine shares these flatwoods sites in variably mixed stands with longleaf pine, with little to no hardwood in managed stands. Slash pine grows marginally along scrubby flatwoods sites with sand pine, longleaf pine, and mixed scrub oaks. Slash pine is considered offsite on sandhill and clay soils, but can be found marginally on these sites.

5.1.1 Landowner Objectives Summary

5.1.1.1 Aesthetics

Well-managed slash pine forests often meet some landowner’s objective for aesthetics. Mature stands that have been prescribed burned or thinned have an open, park-like structure with large, well-formed slash 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 come fall. 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 slash pine stand, a strip of pines can be left as a buffer against adjacent high-visibility areas such as roadways or neighboring homes. During thinning operations, logging decks can be placed within the interior of the stand, away from roadways.
5.1.1.2 Wildlife Habitat Management and Protection

The slash pine forest type and its associated natural communities provide excellent wildlife habitat management and protection opportunities. Many game and imperiled species can be found within slash pine forests. Active management of game species is more common on private lands while non-game species are managed to a lesser extent.

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

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

5.1.1.3 Recreation

Slash pine forests are popular recreational areas in Florida, especially in the cooler, dryer months. The open, park-like stand structure provides a scenic backdrop for any of the following recreational activities:

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

5.1.1.4 Conservation

The slash pine forest type 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. Slash pine forests are fire dependent and require frequent application of prescribed fire at minimum for ecological maintenance.

5.1.1.5 Ecological Restoration

Slash pine is a dominant overstory component in mesic and wet flatwoods. It can be replanted as a step in restoring these natural communities.

5.1.1.6 Hydrological Protection and Restoration

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 slash pine sites, bedding can be avoided or minimized if hydrological protection and restoration are primary objectives. 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 should be avoided if more overall harm will be done to the ecosystem than good (e.g., groundcover impacts).

5.1.1.7 Forest Health Management

As previously mentioned, slash pine is second to longleaf as the most overall insect and disease resilient of Panhandle pine species. The most detrimental disease is fusiform rust but resistant seedling stock can be planted and the alternate host oak species (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.
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 senescent stands. Southern pine beetle is not a major concern in younger, well-managed stands. It can become a concern in offsite, overstocked, and senescent stands, especially during drought conditions and following fire stress.

Slash pine cannot handle prescribed fire until the bark thickens and it reaches about 10 to 15 feet tall (depending on fuel load). It is susceptible to crown and inner bark scorch, especially in younger stands.

With appropriate seedling and site selection and release and thinning regimes, slash pine generally has minimal issues following successful establishment.

Non-native invasive species should be monitored and treated. See the non-native invasive species section.

5.1.1.8 Revenue
Slash pine provides a wide array of revenue opportunities including timber and NTFP, silvopasture, and eco-tourism.

5.1.2 Landscape Objectives

5.1.2.1 Wildlife Habitat Management
Slash pine forests provide habitat for game and non-game species at the landscape scale.

5.1.2.2 Utilization of Prescribed Fire
The focus of prescribed fire at the landscape scale is fuel management. Slash pine forests can build up very heavy fuel loads and those managed with prescribed fire have substantially lower fuel loads which helps reduce the landscape-level wildfire risk and hazard to the Panhandle community.

Wildlife and aesthetic benefits of fire-maintained forests across the landscape are also important. Migratory wildlife benefit from the widespread, high-quality habitat prescribed fire creates across the region. Tourists and local travelers observe the enhanced aesthetics of slash pine stands that have been prescribed burned. Prescribed burning also provides diverse private and public landowners and fire managers across the region with an incentive to coordinate for a common mission. Many have formed partnerships such as the North Florida Prescribed Fire Council and the Apalachicola Regional Stewardship Alliance to share prescribed fire knowledge, experience, and resources. These organizations support this invaluable land management tool at the regional level and beyond.

5.1.2.3 Rare Plant and Animal Protection
The Florida Panhandle is home to many rare species found only in this region and contains several global populations. Many plant species found in the Panhandle are the only occurrences in Florida, with the next closest occurrence hundreds of miles north in Appalachia. Slash pine forests provide vital habitat to many imperiled plant and animal species. Table 2 shows the imperiled species found in the Panhandle by forest type. This table was created using Florida's imperiled species management plan occurrences within FNAI natural community types. These natural community types found within the FNAI Natural Community Guide were then associated with each forest type. Additional information on current listing status for each species can be found in the geodatabase.
Table 2. Rare animal species of Florida’s Panhandle by LMP forest type.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Longleaf Pine</th>
<th>Slash Pine</th>
<th>Loblolly Pine</th>
<th>Sand Pine</th>
<th>Shortleaf Pine</th>
<th>Upland Mixed Hardwood-Pine</th>
<th>Cypress-Gum Dominant</th>
<th>Mixed Bottomlands</th>
<th>Mixed Forested Wetland</th>
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<tr>
<td>American alligator</td>
<td>Alligator mississippiensis</td>
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<td>X</td>
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<tr>
<td>Barbour's map turtle</td>
<td>Gnaptémys barbouri</td>
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<tr>
<td>Eastern indigo snake</td>
<td>Drymarchon corais cooperi</td>
<td>X</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>Florida pine snake</td>
<td>Pituophis melanoleucus mugitus</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Suwannee cooter</td>
<td>Pseudemys suwanniensis</td>
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</tbody>
</table>
5.1.3 Silvicultural Options

5.1.3.1 Timber Harvest

The following silvicultural and land management tools are available to Florida Panhandle 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.

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 and 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. Historical and cultural resource protection and recreation management are also considered during planning and active silvicultural operations.

Slash pine is a highly productive commercial species. Slash pine is most productive on the spodic soils of mesic and wet flatwoods. It is offsite on deep, sandy soils. It is generally managed on shorter rotations for pulpwood, oriented strand board, and chip-n-saw. Slash pine can be grown on longer rotations for higher valued products such as saw timber, poles, and ply logs.

Slash pine is highly shade intolerant and is best suited for even-aged management, providing landowners the option of managing intensively and maximizing revenue with short rotations. Slash pine also allows the flexibility to grow stands out longer for aesthetics and wildlife.

Thinning

Thinning is a primary land management tool used in the Panhandle 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 release thinning are utilized in pine stands within the Panhandle. Merchantable release thinning includes row thinning in un-thinned planted pine stands. The most common row thinning methods are every third or fifth row thinnings. Every other or fourth row thinnings are also utilized along with every sixth or seventh row.

Single-tree selection via logger-selection or a logger-select thinning (operator select) of the residual rows is common during first thinning. Some first thinnings in planted pine, and most thereafter, are thinned through marked selection or marked-select thinning by a forester. Foresters can also mark demonstration areas of one or more acres 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 thinning 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 may leave 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.

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,
Common Panhandle Forest Types: Slash Pine Dominant

a decision must be made on final harvest or conducting a natural regeneration cut. Natural regeneration and underplanting harvests, including artificial regeneration with select harvests, utilize thinning and will be discussed in Reforestation.

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

First thinnings in planted slash 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 planted slash pine stands more than 20 years old 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 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. Additional information about pine straw raking is available on the FDACS.

Many landowners may choose not to thin mature even-aged and two-aged slash 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 slash pine for revenue, forest health, and maintaining overstory composition. See the forest health section for the risks associated with managing mature slash pine.

Natural regeneration harvests are discussed in the reforestation section.

Clearcut

Clearcutting is a standard silvicultural practice in managing shade intolerant slash pine for timber and other objectives. In most Panhandle 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.

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. The common Panhandle 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.

There are site-specific Silviculture BMPs and Wildlife BMPs when using clearcuts, particularly in wetlands and SMZs. The size and shape of clearcuts should be considered if wildlife and aesthetics are also objectives. 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.

Chipping

Another form of timber harvest in the Panhandle is chipping. Material is felled and skidded conventionally, then run through an industrial chipping machine at the loading deck, with chips being hauled to the mill rather than tree-length. 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.

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 Panhandle 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 landowner 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 debris-free post-harvest site is required. For example, fuelwood chipping can be used as part of site preparation for groundcover restoration projects.

Slash pine stands present opportunities for fuelwood chipping operations such as reducing overstocked natural regeneration in mature, two-aged stands or hardwood reduction.

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. 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 slash pine stands. For example, a hurricane may wind-throw an entire stand that would need to be salvaged.

5.1.3.2 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 is dictated by: landowner objectives, site conditions, current and forecasted timber markets, budget, and other factors.

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 3).

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 plants, 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 slash pine sites and the appropriate site preparation techniques should be selected to adequately control it. Vegetative competition control prior to planting increases the stand establishment success. With adequate site preparation, slash pine will initiate fast, early vertical growth.

Chemical Site Preparation

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
**Table 3.** Comparison summary of artificial and natural regeneration methods of reforestation.

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>More productive timber management</td>
<td>More expensive: seedling and planting costs</td>
</tr>
<tr>
<td>Better stand development: form, growth</td>
<td>Rows may decrease aesthetics during early rotation</td>
</tr>
<tr>
<td>More control over seedling quality through improved genetics: growth rate, disease resistance, form</td>
<td>More heavy equipment entry required (soil compaction, rare plants)</td>
</tr>
<tr>
<td>Control over planting density and spacing</td>
<td></td>
</tr>
<tr>
<td>More conducive to high-production management</td>
<td></td>
</tr>
<tr>
<td>Less likely to require pre-merchantable thinning (cost)</td>
<td></td>
</tr>
<tr>
<td>Can use for species conversion, <em>i.e.</em>, underplant longleaf pine</td>
<td></td>
</tr>
<tr>
<td>Less fire exclusion time due to faster growth</td>
<td></td>
</tr>
<tr>
<td>Less expensive: no seedling and planting costs</td>
<td>Less productive timber management</td>
</tr>
<tr>
<td>More conducive to conservation-oriented management: uneven-aged</td>
<td>Poorer stand development: form, growth</td>
</tr>
<tr>
<td>Less heavy equipment entry (soil compaction, rare plants)</td>
<td>Less control over seedling quality: only single tree selection thinning (seed trees)</td>
</tr>
<tr>
<td>Lack of rows may increase aesthetics</td>
<td>Less control over seedling density and spacing</td>
</tr>
<tr>
<td>Even-aged pine stands can be converted to two-aged, then uneven-aged structures</td>
<td>No control of cone or seed production</td>
</tr>
<tr>
<td>More fire exclusion time due to slower growth (slash, loblolly, shortleaf)</td>
<td>May require single or multiple pre-merchantable release thinnings (cost)</td>
</tr>
</tbody>
</table>
the broadcast or banded techniques. There are site-specific Silviculture BMPs and Wildlife BMPs related to site preparation, particularly in wetlands and SMZs.

**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 slash pine.

**Bedding** is used on flat, wet slash pine 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 how wet the site is. 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, bulldozers, or, more commonly, skidding machines, depending on horsepower requirements and site conditions.

**Roller drum chopping** is used on various slash pine flatwoods sites to reduce woody and herbaceous plant competition. 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 saw-palmetto-gallberry site with a full drum. Choppers are pulled behind farm tractors, bulldozers, or, more commonly, skidding machines, depending on horsepower requirements and site conditions.

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

**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.

**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.

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

**Shearing** involves a heavy bulldozer equipped with an oversized V-blade that shears off stumps and any 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 can also be used during groundcover restoration or converting clearcut timber to pasture or crops.

**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, or prescribed fire site preparation.

**Prescribed Site Preparation Burn**

**Prescribed fire** can be used solely or in combination with other site preparation methods. It is common to prescribe burn following mechanical and chemical site preparation. Site preparation burns typically take place in the late summer or early fall once fuels have cured and prior to winter planting.

**Artificial Regeneration**

Artificial regeneration follows clearcutting. Table 3 provides a comparison summary of the advantages and disadvantages of artificial and natural regeneration. Planting density is an important consideration and dependent on: landowner objectives, budget, site conditions, cost-share requirements, and other factors. The soil productivity, hydrology, and natural community should be evaluated during artificial regeneration planning. A density should be 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 result in a stand of short, shrub-like trees with excessive limbs, which will never develop into tall, straight, well-formed trees. 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. Distance between rows is often determined by equipment sizes needed to maintain the planting. Spacing of trees within each row is based on desired trees per acre.

High survival rates depend on selecting appropriate species for the site, adequate site preparation, suitable planting method, 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 to decide if supplemental planting is required to achieve desired stocking.

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. Although the State of Florida has no regulation regarding survival standards, attaining survival rates of 90 percent or higher with slash pine 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.

Hand Planting vs. Machine Planting

Hand planting entails crews planting seedlings by hand. Refer to Table 4 for more information on this method and a comparison with 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 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, the use of a V-blade can result in planting seedlings in a trench on wetter sites, which can result in high mortality. V-blade planting 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 4 for more information on machine planting. Any of these planting methods can be used to plant slash pine.

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 the Panhandle and is costly, especially hardwoods. Pond and bald cypress are available in traditional, “cell” containerized form, while hardwood seedlings generally start in larger, one to three 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.

Containerized vs. Bare Root

Containerized seedlings are considered higher quality, 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 (or “reefer”). Slash 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 in early summer to ensure needs are met and to avoid delays in planting.
Common Panhandle Forest Types: Slash Pine Dominant

Table 4. Comparison summary of hand and machine planting methods of artificial regeneration.

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

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

The survivability of both types of seedlings increases exponentially if the seedlings are planted as soon as possible after lifting, stored in a reefer, 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 Panhandle pine species, as bare root or containerized seedlings.

**Afforestation**

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

Many of these sites were heavily fertilized or grazed and still contain high nutrient loads, especially those with heavy clay soils. This causes many slash pine stands to develop poor form, with excessive limbs and forks, and
have a high occurrence of fusiform rust. This effect tends to be localized and more severe on heavy soils and where cattle were fed. 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 or ripping (subsoiling) as discussed in the site preparation section.

**Natural Regeneration**

Pine, hardwood, and cypress stands can be naturally regenerated to meet various objectives, including uneven-aged management. This section will focus on pine, as cypress and hardwood management are less common in 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 3 for general information on pine natural regeneration and a comparison between this method and artificial regeneration.

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

Existing slash pine stands can be naturally regenerated to meet various objectives, including two-aged management and aesthetics. Due to the growth characteristics and product markets, slash pine is not managed uneven-aged. Some natural slash 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.

Slash pine produces seed annually, which usually peaks in October. Planning for natural regeneration of slash pine entails evaluating the cone crop the prior spring and carefully timed site preparation prior to fall seed catch. Natural regeneration of slash requires careful planning and coordination.

**Site Preparation**

Site preparation options are the same between natural pine regeneration methods and are similar to site preparation for artificial regeneration. 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 to promote seed catch. Conducting prescribed burns near seed dispersal should be avoided as seed predation will be greater due to less groundcover. Some understory regrowth is desirable to prevent the seeds from being 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. 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.

**Shelterwood**

Shelterwood is generally the most effective method of natural regeneration across Panhandle pine species. This entails thinning a stand to approximately 30 to 40 square feet per acre of basal area or about 20 to 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. Seed trees should be the highest quality in terms of crown size, form, and health or vigor. Seedling growth may be slightly lower compared to seed tree method if seed trees are retained, which is optional, following successful stand establishment.

**Seed Tree**

The seed tree method is the most commonly used to naturally regenerate slash pine. The seed tree method is similar to the shelterwood method, except stands are thinned to a slightly lower basal area of approximately 10 to 30 square feet per acre or about 10 to 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 of the highest quality in terms of crown size, form, and health or vigor. Seedling growth may be slightly higher compared to seed tree method if seed trees are retained, which is optional following successful stand establishment.

**Group Selection**

The final method of natural regeneration is group selection, which is less commonly used to naturally regenerate slash pine. These are small, quarter-acre to one-acre clearcuts.
interspersed throughout a stand. The size and shape of the clearcuts are 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, which leads 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.

5.1.3.3 Release

Early and mid-rotation release treatments are common in slash pine management within the Panhandle. Chemical, mechanical, and prescribed fire are the three primary types of treatments used to release pines from competitive and promote timber production through increased vertical and diameter growth and good form. Targeted vegetation includes herbaceous plants, grasses, non-crop pines, woody shrubs, and hardwood species. These treatments may take place in planted or natural pine stands. A merchantable thinning harvest is another form of release and is discussed in the timber harvest section.

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 method is selected to effectively target the primary woody and herbaceous 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

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 methods and include: mowing, chopping, and mulching. All three treatments 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 near mid-rotation.

Prescribed Fire

Prescribed fire can be used as an early-rotation release in slash pine stands once the trees can handle fire, typically between heights of 10 to 15 feet. Broadcast prescribed burning serves as a mid-rotation release in slash stands.

Pre-merchantable 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 financially.

Merchantable thinning is a release treatment in older stands and is discussed in the timber harvest section.

5.1.3.4 Prescribed Fire

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 slash pine forests, mimicking historic natural fires. Without fire, slash pine forests would gradually transition to hardwood forests in most cases.
Slash pine is fire tolerant once the bark thickens and it reaches about 10 to 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 they are dominant and to enhance wildlife habitat, improve aesthetics, reduce vegetative competition, reduce fuel loads, and stimulate rare plants.

**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 than 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 species, including several rare species such as the red-cockaded woodpecker, which requires 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, which enhance recreational activities such as hunting, wildlife viewing, and hiking. Prescribed fire also reduces many forest pest species such as ticks and chiggers, improving outdoor recreational experiences and helping reduce the spread of tick-borne illnesses such as Lyme disease and Rocky Mountain spotted fever.

**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 when adequate soil moisture is present to avoid damaging feeder roots. Appropriate firing techniques should be selected with consideration for 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 for a burn that does not go as planned, which causes many landowners to avoid prescribed burning. Landowners have the option to transfer that liability by hiring a state or private contractor to conduct their burning. Florida has strong prescribed fire statutes that protect safe, responsible prescribed burn managers (Wade and Lunsford 1989).

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.
Methods of Prescribed Fire

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.

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.

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.

Fire Return Intervals
Fire return interval is the frequency at which a burn 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. This can be adjusted based on the factors listed in the previous paragraph.

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 a 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 through June is Florida's primary wildfire season and conditions can be hot and dry, narrowing 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 with 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.

Slash pine can be prescribed burned year-round.

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 U.S. Forest Service’s “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, and 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 affect 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.

5.1.3.5 Fertilization

Fertilization can be utilized on Florida’s nutrient poor soils. Slash pine on flatwoods sites responds to fertilization. Fertilization uptake is dependent on soil composition (e.g., 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.

5.1.4 Forest Resources

5.1.4.1 Fish and Wildlife

The forests and associated aquatic ecosystems of Florida’s Panhandle provide habitat for a wide array of game and non-game fish and wildlife, including several imperiled species (Table 2). 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 or recreation. Present listed species should be documented, mapped, and monitored.

The Wildlife BMPs compile strategies and considerations for managing and protecting these species and their habitat during silvicultural operations such as marking a rare plant or animal area with flagging, paint, or signage to protect during harvest operations, regular
active monitoring, and following up with post-harvest inspections. Silviculture BMPs also consider fish and wildlife conservation in relation to silvicultural activities.

Slash pine forests provide habitat to hundreds of game and non-game species including bob-white quail, wild turkey, and deer. Slash pine forests are home to several rare species including: gopher tortoise, eastern indigo snake, Bachman’s sparrow, and red-cockaded woodpecker (Table 2).

5.1.4.2 Timber Products

Timber merchantability, whether planted or natural, pine or hardwood, depends 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
- Chip-n-saw: pine
- Saw timber: pine and hardwood
- Poles and pilings: pine
- Mulch: hardwood
- Fuelwood:
  - Pine, hardwood, and large woody shrub species
    - Chips for energy production
  - Hardwood
    - Firewood
- Other hardwood products: pallets, mats, small-diameter saw timber for furniture

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 slash pine forests including pulpwood, chip-n-saw, saw timber, and poles. Slash pine forests also allow for fuelwood harvests, especially utilizing natural regeneration and hardwood reduction treatments. Slash pine is commonly managed for lower-value, short-rotation products such as pulpwood. It is also managed for all the other pine products.

5.1.4.3 Non-Timber Forest Products

Many NTFP opportunities exist within slash pine forests, including pine straw, silvopasture, beekeeping, and saw palmetto drupe harvests.

Pine Straw

Slash pine produces desirable pine straw. Pine straw raking for landscaping material is the most common market in the region. It often generates $100 to $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 the first thinning, which is around age eight or nine for slash pine. If landowner objectives are focused on maximizing revenue, they may wish to forego thinning and rake straw beyond the economic or biological thinning age. Clearcutting for pulpwood at age 18 to 20 and starting over. If landowner objectives are varied and involve thinning, the stand can be thinned at the economic or biological thinning age to promote proper stand development.

Traditional pine straw raking reduces or eliminates the native groundcover with annual herbicide, 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.

Honey
Beekeeping and honey production are common within slash 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, lease their lands to honey producers, or it may be a hobby 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 is considered a valuable industry by the FDACS. In order to protect this industry from pests and unwanted species of honey bees, they require beekeepers to register honey bee colonies through their website.

Silvopasture
Slash pine 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 saw timber) 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 and enhance 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 consider silvopasture cost-sharable through 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).

Fruits
Saw palmetto drupes are harvested from slash pine forests to produce medicines used to treat symptoms of enlarged prostate and in 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 should 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 (Ursus americanus) (Dobey et al 2005) and provide valuable nutrition to raccoon (Procyon lotor), gray fox (Urocyon cinereoargenteus), gopher tortoise (Gopherus polyphemus), opossums (Didelphis marsupialis), white-tailed deer (Odocoileus virginianus), wild turkey (Meleagris gallopavo), bob-white quail (Colinus virginianus), feral hog (Sus scrofa), 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.

Blueberry, blackberry, and other native fruits grow in slash pine forests but are not commercially harvested from forest settings. However, landowners may consume for personal use.
5.2 Loblolly Pine Dominant

Loblolly pine is a highly valuable commercial species in Florida’s Panhandle. 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. However, it can be managed on longer rotations for high-value products.

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 (Table 5, Table 6, and Table 7). 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, scruffy flatwoods, and well-drained sandy soils, but can be found marginally on these sites.

5.2.1 Landowner Objectives Summary

5.2.1.1 Aesthetics

Well-managed loblolly forests have high-quality aesthetics. Mature stands that have been prescribed burned or thinned have an open, park-like structure with large, well-formed loblolly pines and little to no midstory. Stands with native groundcover typically have lush green herbs and hardwoods in the spring following prescribed fire and various wildflowers and mixed grasses come fall. Some 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 loblolly stands, a strip of pines can be left as a buffer against adjacent high-visibility areas such as roadways or neighboring homes. During thinning operations, place logging decks within the interior of the stand, away from roadways.

5.2.1.2 Wildlife Habitat Management and Protection

The loblolly forest type and its associated natural communities provide excellent wildlife habitat management and protection opportunities. Many game and imperiled species can be found within loblolly pine forests. Active management of game species is more common on private lands while non-game species are managed to a lesser extent.

Hunting is a common wildlife management objective in the loblolly pine forest type, particularly for wild turkey and bob-white quail. Both species prefer the frequently fire-maintained open, grassy groundcover and lack of midstory. They also prefer a relatively low overstory density. Hunting leases are used to manage healthy game populations while also generating revenue to help pay for loblolly pine management activities such as prescribed fire.

Loblolly habitat objectives can be met with various silvicultural tools, such as thinning planted loblolly stands to a lower overstory density more favorable to wildlife or creating small clearcuts for wildlife openings to diversify habitat and create beneficial edge effects. Many game
and non-game species of loblolly forests will benefit from these activities including white-tailed deer, wild turkey, bob-white quail, gopher tortoise, fox squirrel, and red-cockaded woodpecker.

5.2.1.3 Recreation
Loblolly forests are popular recreational areas in Florida, especially in the cooler months. The open, park-like stand structure, often with rolling hills, provides a scenic backdrop for any of the following recreational activities:

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

5.2.1.4 Conservation
The loblolly pine forest type 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. Loblolly pine forests are fire dependent and require frequent application of prescribed fire at minimum for ecological maintenance.

5.2.1.5 Ecological Restoration
Loblolly pine is an overstory component in the upland pine natural community. It can be replanted as a step in restoring this natural community.

5.2.1.6 Hydrological Protection and Restoration
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 loblolly sites, bedding can be avoided or minimized if hydrological protection and restoration are primary objectives. Limit new road construction. Existing forest roads can 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 should be avoided if more overall harm will be done to the ecosystem than good (e.g., groundcover impacts).

5.2.1.7 Forest Health Management
The most destructive insect pests to loblolly pine are southern pine beetle and Ips beetle. Loblolly is the preferred host for southern pine beetle. 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 (e.g., drought, lightning strikes, or fire stress). Once a severe outbreak occurs, it can spread to adjacent, well-managed, younger stands. Outbreaks range from a few spots across a stand to hundreds of acres. Tip moths and seedling debarking beetles can be problematic in young stands.

The most detrimental diseases are fusiform rust and black root rot. Fusiform rust-resistant seedling stock can be planted and the alternate host – oak (Quercus spp.) – can be reduced where infection is excessive. Fusiform rust can become a major issue following over-fertilization of loblolly pine, vegetation control, and on old field sites that were heavily fertilized or grazed. Root rot can be an issue in thinned stands. The fungus (Phaeolus schweinitzii) is more destructive than root rot. This fungus causes stem and root rot, often following logging damage to residual loblolly trees.

Loblolly pine cannot handle prescribed fire until the bark thickens and it reaches about 10 to 15 feet tall (depending on fuel load). It is very susceptible to crown and inner bark scorch, especially in younger stands.

With appropriate seedling and site selection and release and thinning regimes, loblolly pine generally has minimal issues following successful establishment.

Non-native invasive species should be monitored and treated. See the non-native invasive species section.

5.2.1.8 Revenue
Loblolly pine provides a wide array of revenue opportunities including timber and NTFP, silvopasture, eco-tourism and many others.
5.2.2 Landscape Objectives

5.2.2.1 Wildlife Habitat Management

Loblolly pine forests provide habitat for game and non-game species at the landscape scale.

5.2.2.2 Utilization of Prescribed Fire

The focus of prescribed fire at the landscape scale is fuel management. Loblolly pine forests managed with prescribed fire have low fuel loads, which helps reduce landscape-level wildfire risk and hazard to the Panhandle community. Wildlife and aesthetic benefits of fire-maintained forests across the landscape are also important. Wildlife that migrates throughout the region benefit from the widespread, high-quality habitat prescribed fire creates across the region. Tourists and local travelers observe the enhanced aesthetics of loblolly stands that have been prescribed burned. Prescribed burning also provides private and public landowners and fire managers across the region with an incentive to coordinate for a common mission. Many have formed organizations such as the North Florida Prescribed Fire Council and the Apalachicola Regional Stewardship Alliance to share prescribed fire knowledge, experience, and resources.

5.2.2.3 Rare Plant and Animal Protection

The Florida Panhandle is home to many rare species found only in this region and contains several global populations. Many plant species found in the Panhandle are the only occurrences in Florida, with the next closest occurrence hundreds of miles north in Appalachia. Loblolly pine forests provide vital habitat to many imperiled plant and animal species. Table 2 shows the imperiled species found in the Panhandle by forest type. This table was created using Florida’s imperiled species management plan occurrences within FNAI natural community types. These natural community types found within the FNAI Natural Community Guide were then associated with each forest type. Additional information on current listing status for each species can be found in the geodatabase.

5.2.3 Silvicultural Options

5.2.3.1 Timber Harvest

The following silvicultural and land management tools are available to Florida Panhandle 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.

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 or habitat, aquatic ecosystems, and air and water quality. Silviculture BMPs apply to: timber harvest, site preparation, reforestation, and forest operations (roads, water control structures, etc.) activities. Historical and cultural resource protection and recreation management are also considered during planning and active silvicultural operations.

Loblolly pine is a highly productive commercial species. Loblolly pine is most productive on the clay soils of upland pine sites. It is offsite on deep, sandy soils. It is generally managed on shorter rotations for pulpwood, oriented strand board, and chip-n-saw. Loblolly pine can be grown on longer rotations for higher valued products such as saw timber, poles, and ply logs.

Loblolly 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. Loblolly also allows the flexibility to grow stands out longer for aesthetics and wildlife.

Thinning

Thinning is a primary land management tool used in the Panhandle 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 SMZs.

Several types of merchantable release thinning are utilized in pine stands within the Panhandle. Merchantable release thinning includes row thinning in un-thinned planted pine stands. The most common row thinning methods are every third or fifth row thinnings. Every other or fourth row thinnings are also utilized along with every sixth or seventh row.

Single-tree selection via logger-selection or a logger-select thinning (operator select) of the residual rows is common during first thinning. Some first thinnings in planted pine and most thereafter are thinned through marked selection or marked-select thinning by a forester. Foresters can also mark demonstration areas of one acre or more 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 and 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 stand.

If wildlife, aesthetics, or biodiversity are primary objectives, stands are typically 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.

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 a 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 can be 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 loblolly pine generally requires a first thinning around age 15 to 20. On less productive sites, it may be pre-merchantable or not have enough volume per acre for market access until around age 20, in which case stand replacement may be strongly considered.

First thinnings in planted loblolly 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 planted loblolly pine stands 20 years old or more or those overstocked with natural regeneration may require a pre-merchantable thinning or fuelwood chipping harvest.

Many landowners may choose not to thin mature even-aged and two-aged loblolly 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 loblolly pine for revenue, forest health, and maintaining overstory composition. See the forest health section for the risks associated with managing mature loblolly pine.

Natural regeneration harvests are discussed in the reforestation section.

Clearcut

Clearcutting is a standard silvicultural practice in managing shade intolerant loblolly pine for timber and other objectives. In most Panhandle 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.

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. The common Panhandle example is converting off-site pine and hardwood species
Common Panhandle Forest Types: Loblolly Pine Dominant

back to longleaf pine. Another may be clearcutting longleaf and reforesting with a more productive species like loblolly on certain clay soils.

There are site-specific Silviculture BMPs and Wildlife BMPs when using clearcuts, particularly in wetlands and SMZs. The size and shape of clearcuts should be considered if wildlife and aesthetics are also objectives. 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.

Chipping

Another form of timber harvest in the Panhandle is chipping. Material is felled and skidded conventionally, then run through an industrial chipping machine at the loading deck, with chips being hauled to the mill rather than tree-length. 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.

Hardwood and pine, tree-length pulpwood can be hauled as clean chips, which 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 Panhandle 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 landowner 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 financially break-even. Fuelwood or clean-chipping can be used where a debris-free post-harvest site is required. For example, fuelwood chipping can be used as part of site preparation for groundcover restoration projects.

Loblolly pine stands present opportunities for fuelwood chipping operations such as reducing overstocked natural regeneration in mature, two-aged stands or hardwood reduction.

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. 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 should be made following careful evaluation.

Salvage harvest operations can be used in loblolly pine stands. For example, a southern pine beetle outbreak may require a salvage clearcut.

5.2.3.2 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 is dictated by: landowner objectives, site conditions, current and forecasted timber markets, budget, and other factors.

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 3).

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 plants, 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 loblolly pine sites and the appropriate site preparation techniques can be selected to adequately control it. Vegetative competition will need to be controlled prior to planting to achieve successful establishment. With adequate site preparation, loblolly pine will survive and quickly initiate fast, early vertical growth.

Chemical Site Preparation

Herbicide should be 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 should be 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. There are site-specific Silviculture BMPs and Wildlife BMPs related to site preparation, particularly in wetlands and SMZs.

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 loblolly pine.

Bedding is used on flat, wet loblolly pine 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 how wet the site is. 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, bulldozers, or, more commonly, skidding machines, depending on horsepower requirements and site conditions.

Roller drum chopping is used on various loblolly pine flatwoods sites to reduce woody and herbaceous plant competition. There are various sizes of roller drum choppers with various lengths of blades. The appropriate equipment should be 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 saw-palmetto-gallberry site with a full drum. Choppers are pulled behind farm tractors, bulldozers, or, more commonly, skidding machines, depending on horsepower requirements and site conditions.

Scalping and ripping or 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 and reducing root damage from insects and other root pathogens. Ripping or subsoiling is used in compacted soils like those found in pastures and old field sites, particularly those on clay soils.

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.
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.

Harrowing or 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.

Shearing involves a heavy bulldozer equipped with an oversized V-blade that shears off stumps and any 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 can also be used during groundcover restoration or converting clearcut timber to pasture or crops.

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, or prescribed fire site preparation.

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.

Artificial Regeneration

Artificial regeneration follows clearcutting. Reference Table 3 for a comparison summary of the advantages and disadvantages of artificial and natural regeneration. Planting density is an important consideration and dependent on: landowner objectives, budget, site conditions, cost-share requirements, and other factors. The soil productivity, hydrology, and natural community should be evaluated during artificial regeneration planning. A density should be 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, which will never develop into tall, straight, well-formed trees. 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. Distance between rows is often determined by equipment sizes needed to maintain the planting. Spacing of trees within each row is based on desired trees per acre. However, a random or natural pattern can be established using hand planting. High survival rates depend on selecting appropriate species for the site, adequate site preparation, suitable planting method, proper care of quality seedlings, and natural factors such as climate and pests. A seedling survival check should be conducted following the first growing season to determine if the stand was successfully established, to document initial stocking, and to decide if supplemental planting is required to achieve desired stocking.

Although the State of Florida has no regulation regarding survival standards, attaining survival rates of 90 percent or higher with loblolly pine 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.

Hand Planting vs. Machine Planting

Hand planting entails crews planting seedlings by hand. Refer to Table 4 for more information on this method and a comparison with 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 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, the use of a V-blade can result in
planting seedlings in a trench on wetter sites. This can result in high mortality.

V-blade planting 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 4 for more information on machine planting.

Any of the planting methods can be used to plant loblolly pine.

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 the Panhandle and is costly, especially hardwoods. Pond and bald cypress are available in traditional, “cell” containerized form, while hardwood seedlings generally start in larger, one to three gallon containers for landscaping markets. Hardwoods are more commonly planted on a smaller scale, focusing on wildlife management, such as 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.

Containerized vs. Bare Root

Containerized seedlings are considered higher quality and have 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 (or “reefer”). Loblolly seedlings are available with various genetic improvements such as growth rate, form, and disease resistance. Improved, containerized loblolly pine seedlings are more expensive than bare root and are preferred if planting budget allows. Orders can be placed in early summer to ensure needs are met and to avoid delays in planting.

By comparison, bare root seedlings generally average lower survival rates, require immediate planting once lifted, and are very vulnerable during transport and storage, but they are less expensive. Bare root seedlings are very sensitive to warmer temperatures, dry air, and direct sunlight. Bare root seedlings can have comparable survival to containerized seedlings with proper planting technique (depth, angle, and packing), adequate site preparation, storage, and handling. Both should be planted as soon as possible after lifting, stored in a reefer, and kept under seedling tarps in the shade prior to planting. Hand, flatwoods, and V-blade planting methods can be used to plant all the Panhandle pine species, as bare root or containerized seedlings.

Afforestation
The Panhandle region of Florida has a long history of agricultural production such as tobacco and cotton. Both industries have faded in recent decades, causing land-use conversions to timber and cattle production. Many landowners plant loblolly pine on old field and pasture sites within the Panhandle.

Many of these sites were heavily fertilized or grazed and still contain high nutrient loads, especially those with heavy clay soils. This causes many loblolly pine stands to develop poor form, with excessive limbs and forks, and have a high occurrence of fusiform rust. This effect tends to be localized and more severe on heavy soils and where cattle were fed. 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 or ripping (subsoiling) as discussed in the site preparation section.

Natural Regeneration
Pine, hardwood, and cypress stands can be naturally regenerated to meet various objectives, including uneven-aged management. This section will focus on pine, as cypress and hardwood management are less common in 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 3 for general information on pine natural regeneration and a comparison between this method and artificial regeneration.

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

Existing 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, loblolly pine is not
managed uneven-aged. Some natural loblolly 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.

Loblolly pine generally produces abundant seed annually, peaking in October. Planning for natural regeneration of loblolly pine should entail evaluating the cone crop the prior spring and carefully timed site preparation prior to fall seed catch. Natural regeneration of loblolly requires careful planning and coordination.

Site preparation
Site preparation options are the same between natural pine regeneration methods and are similar to site preparation for artificial regeneration. 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 late summer, early fall will prepare the seed bed by scarifying the soil, promoting seed catch. Conducting prescribed burns near seed dispersal should be avoided, as seed predation will be greater due to less groundcover. Some understory regrowth is desirable to prevent the seeds from being 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. A combination of site preparation methods can be combined with prescribed fire to achieve natural regeneration sooner.

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

Shelterwood
Shelterwood entails thinning a stand to approximately 30 to 40 square feet per acre of basal area or about 20 to 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. Seed trees should be the highest quality in terms of crown size, form, and health or vigor. Seedling growth may be slightly lower compared to seed tree method if seed trees are retained, which is optional, following successful stand establishment.

Seed Tree
The seed tree method is most commonly used to naturally regenerate loblolly pine. The seed tree method is similar to the shelterwood method, except stands are thinned to a slightly lower basal area of approximately 10 to 30 square feet per acre or about 10 to 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 or vigor. Seedling growth may be slightly higher compared to shelterwood if seed trees are retained, which is optional following successful stand establishment.

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

5.2.3.3 Release
Early and mid-rotation release treatments are common in loblolly pine management within the Panhandle. 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 height and diameter growth and good form. Target vegetation includes herbaceous plants, grasses, non-crop pines, woody shrubs, and hardwood species. These treatments may take place in planted or natural pine stands. A merchantable thinning harvest is another form of release and is discussed in the timber harvest section.

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 should be applied based on the recommended release label rate for the target and crop species and site conditions. The appropriate herbicide and chemical release method should be selected to effectively target the primary woody and herbaceous 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

**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 methods and include: mowing, chopping, and mulching. All three treatments 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 not be used near mid-rotation.

**Prescribed Fire**

Prescribed fire can be used as an early rotation release in loblolly pine stands once they can handle fire. Broadcast prescribed burning serves as a mid-rotation release in loblolly stands.

**Pre-merchantable 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 financially.

Merchantable thinning is a release treatment in older stands and is discussed in the timber harvest section.

### 5.2.3.4 Prescribed Fire

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 loblolly pine forests, mimicking historic natural fires. Without fire, loblolly pine forests would gradually transition to hardwood forests in most cases.

Loblolly pine is fire tolerant once the bark thickens and it reaches about 10 to 15 feet tall (depending on fuel load). Loblolly pine forests should be prescribed burned every one to three years to maintain and restore the upland pine natural community in which they are dominant and to enhance wildlife habitat, improve aesthetics, reduce vegetative competition, reduce fuel loads, and stimulate rare plants.

**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 than 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 species, including several rare species such as the red-cockaded woodpecker, which requires 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, which enhance recreational activities such as hunting, wildlife viewing, and hiking. Prescribed fire also reduces many forest pest species such as ticks and chiggers, improving outdoor recreational experiences and helping reduce the spread of tick-borne illnesses such as Lyme disease and Rocky Mountain spotted fever.

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 should be utilized initially until fuel loads are reduced, especially in long-unburned stands. Thick duff layers should be reduced slowly over time by only burning following precipitation when adequate soil moisture is present to avoid damaging feeder roots. Appropriate firing techniques should be selected with consideration for 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 for a burn that does not go as planned which causes many landowners to avoid prescribed burning. Landowners have the option to transfer that liability by hiring a state or private contractor to conduct their burning. Florida has strong prescribed fire statutes that protect safe, responsible prescribed burn managers (Wade and Lunsford 1989).

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 should at minimum 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.

Methods of Prescribed Fire

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.

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.

Pile Burns

Pile burning is a form of site preparation burning. Large post-harvest debris within clearcuts is 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.
**Fire Return Intervals**

Fire return interval is the frequency at which a burn 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.

Loblolly pine stands should be prescribed burned every one to three years. This can be adjusted based on the factors listed in the previous paragraph.

**Seasonality**

Seasonality plays an important role in a prescribed fire program and should be carefully considered to help meet specific objectives. Seasonality should 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 a 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 through 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 with 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 should be 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.

Loblolly pine can be prescribed burned year-round.

**Fire Weather**

One of the most important considerations in planning and conducting a prescribed burn is fire weather. Burn prescriptions should contain a section with desired,
forecasted, and actual fire weather for a burn unit. The U.S. Forest Service’s “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, and 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** affect 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.

### 5.2.3.5 Fertilization

Fertilization can be utilized on Florida’s nutrient poor soils. Loblolly pine does not respond to fertilization on clay upland pine sites, but does respond on more nutrient poor flatwoods sites. Fertilization uptake is dependent on soil composition (e.g., sand versus clay drainage) among other factors. Excessive fertilization may cause fusiform rust issues. Fertilizer label rates, material safety data sheets, and Florida’s Silviculture BMPs provide additional guidance on application procedures and rates.

### 5.2.4 Forest Resources

#### 5.2.4.1 Fish and Wildlife

The forests and associated aquatic ecosystems of Florida’s Panhandle provide habitat for a wide array of game and non-game fish and wildlife, including several imperiled species (Table 2). These forests can be managed to enhance, restore, and protect the valuable habitats these species call home. These species may be managed for various objectives such as conservation or recreation. Present listed species should be documented, mapped, and monitored.

The **Wildlife BMPs** compile strategies and considerations for managing and protecting these species and their habitat during silvicultural operations, such as, marking a rare plant or animal area with flagging, paint, or signage to protect during harvest operations, regular active monitoring, and following up with post-harvest inspections. The **Silviculture BMPs** also consider fish and wildlife conservation in relation to silvicultural activities. Loblolly pine forests provide habitat to hundreds of game and non-game species including bob-white quail, wild turkey, and deer. Loblolly pine forests are home to several rare species including: gopher tortoise, eastern indigo snake, Bachman’s sparrow, and red-cockaded woodpecker (Table 2).

#### 5.2.4.2 Timber Products

**Timber merchantability**, whether planted or natural, pine or hardwood, depends 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
- Saw timber: pine
- Poles and pilings: pine
Common Panhandle Forest Types: Loblolly Pine Dominant

- Mulch: hardwood
- Fuelwood:
  - Pine, hardwood, and large woody shrub species
    - Chips for energy production
  - Hardwood
    - Firewood
- Other hardwood products: pallets, mats, small-diameter saw timber for furniture

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 loblolly pine forests including pulpwood, chip-n-saw, saw timber and poles. Loblolly forests also allow for fuelwood harvests, especially utilizing natural regeneration and hardwood reduction treatments. Loblolly pine is commonly managed for lower-value, short-rotation products such as pulpwood. It is also managed for all the other pine products.

### 5.2.4.3 Non-Timber Forest Products

Many NTFP opportunities exist within loblolly pine forests, including silvopasture, beekeeping, and saw palmetto drupes harvests.

**Silvopasture**

Loblolly pine 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 saw timber) 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 and enhance 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 consider silvopasture cost-sharable through 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).

**Honey**

Beekeeping and honey production are common within loblolly 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, lease their lands to honey producers, or it may be a hobby 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 is considered a valuable industry by the FDACS. In order to protect this industry from pests and unwanted species of honey bees, they require beekeepers to register honey bee colonies through their website.

**Fruits**

**Saw palmetto drupes** are harvested from loblolly pine forests to a lesser degree than slash, longleaf pine, and sand pine forests. 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 should 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 (*Ursus americanus*) (Dobey et al. 2005) and provide valuable nutrition to raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), gopher tortoise (*Gopherus polyphemus*), opossums (*Didelphis marsupialis*), white-tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallopavo*), bob-white quail (*Colinus virginianus*), feral hog (*Sus scrofa*), 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.

Blueberry, blackberry, and other native fruits grow in loblolly pine forests but are not commercially harvested from forest settings. However, landowners may consume for personal use.

**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

### 5.3 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, insect, and fire resistant of all the southern pine species and very drought tolerant (Burns and Honkala 1990). Panhandle longleaf pine historically grew in sandhills, mesic, wet, scrubby flatwoods, upland pine, and upland mixed woodland natural communities (FNAI 2010).

Longleaf favors moderately to well-drained, deep, sandy, acidic, nutrient poor soils but also thrives on rich, moderately well-drained clay hills (FNAI 2010 and 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.

There are many economic and ecological incentives for landowners to manage for longleaf pine. Private landowners are 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.

For more information on the history and restoration efforts of longleaf pine forests, refer to the Longleaf Pine Restoration section.
5.3.1 Landowner Objectives Summary

5.3.1.1 Aesthetics

Well-managed longleaf forests are known for their aesthetics. Mature stands that have been prescribed burned or thinned have an open, park-like structure with large, well-formed longleaf pines and little to no midstory. Stands with native groundcover typically have lush green wiregrass in the spring following prescribed fire and a golden sea of wheat-like wiregrass come fall. Some 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 should be planned with aesthetics in mind to ensure these objectives are met. For example, when converting a slash pine plantation to longleaf through clearcutting, a strip of slash pines can be left as a buffer against adjacent high-visibility areas such as roadways or neighboring homes. During thinning operations, place logging decks within the interior of the stand, away from roadways.

5.3.1.2 Wildlife Habitat Management and Protection

The longleaf forest type and its associated natural communities provide excellent wildlife habitat management and protection opportunities. Many game and imperiled species can be found within longleaf pine forests.

Active management of game species is more common on private lands while non-game species are managed to a lesser extent.

Hunting is a common wildlife management objective in the longleaf pine forest type, particularly for wild turkey and bob-white quail. Both species prefer the frequently fire-maintained open, grassy groundcover and lack of 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 longleaf pine management activities such as prescribed fire.

Longleaf habitat objectives can be met with various silvicultural tools, such as thinning planted longleaf stands to a lower overstory density more favorable to wildlife or creating small clearcuts for wildlife openings to diversify habitat and create beneficial edge effects. Many game and non-game species of longleaf 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 conservation practices. However, active management with prescribed fire at minimum is required to maintain this forest type and its habitat components.

5.3.1.3 Recreation

Longleaf forests are popular recreational areas in Florida, especially in the cooler months. The open, park-like stand structure, often with rolling hills, provides a scenic backdrop for any of the following recreational activities:

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

5.3.1.4 Conservation

The longleaf pine forest type 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. Longleaf pine forests are fire dependent and require frequent application of prescribed fire at minimum for ecological maintenance.

5.3.1.5 Hydrological Protection and Restoration

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 longleaf pine sites, bedding should be avoided or minimized if hydrological protection and restoration are primary objectives. Limit new road construction. Existing forest roads should 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 should be avoided if more overall harm will be done to the ecosystem than good (e.g., groundcover impacts).

### 5.3.1.6 Forest Health Management

As previously mentioned, longleaf is the most resilient of all Panhandle pine species. 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 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. Annosus root rot can be an issue following thinning.

Pales weevil, feral hogs, and livestock can cause damage to seedlings. Lightning and subsequent southern pine beetle and Ips beetles cause severe damage in mature stands, where otherwise these are not a major concern. The first year of establishment is most vulnerable for longleaf, particularly during droughts or the typically dry months of spring.

With appropriate seedlings, site selection, and release and thinning regimes, longleaf pine generally has minimal issues following successful establishment.

Non-native invasive species should be monitored and treated. See the non-native invasive species section.

### 5.3.1.7 Revenue

Longleaf pine provides a wide array of revenue opportunities including timber and NTFP, silvopasture, and eco-tourism.

### 5.3.2 Landscape Objectives

#### 5.3.2.1 Longleaf Pine Restoration

The longleaf pine (*Pinus palustris*) was once king of the southern pines in terms of historic range and value. Prior to European settlement, the longleaf pine forest once covered 91 million acres from Virginia to Florida, and west to Texas (Jose et al 2006). Today, as little as two percent of this native range may remain (Jose et al 2006). Lack of sustainable forestry practices in the late nineteenth and early twentieth centuries, the high demand for quality lumber by a growing nation, and tree species and land-use conversions fueled the drastic reduction of this iconic species of the southeastern United States.

There has been growing interest in longleaf pine restoration throughout its range for the past 15 to 20 years. 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. The formation of various longleaf-focused conservation and research organizations and increased reforestation funding through cost-share programs, along with state and local conservation efforts, have also aided longleaf restoration. Forest industry and forestry consultants have also recognized the versatility of this species and begun planting more longleaf.

Longleaf pine restoration not only involves reforestation efforts, but also application of prescribed fire. The ecosystems in which longleaf thrives depend on frequent, low intensity prescribed fire. Longleaf restoration with fire involves prescribed burning newly planted stands and the reintroduction of fire to fire-suppressed stands.

Wiregrass is an important pyrogenic groundcover species found within longleaf forests and can be restored.

#### 5.3.2.2 Wildlife Habitat Management

Longleaf pine forests provide habitat for game and non-game species at the landscape scale.

#### 5.3.2.3 Utilization of Prescribed Fire

The focus of prescribed fire at the landscape scale is fuel management. Longleaf pine forests managed with prescribed fire have low fuel loads, which helps reduce landscape-level wildfire risk and hazard to the Panhandle community. Wildlife and aesthetic benefits of fire-maintained forests across the landscape are also important. Wildlife that migrate throughout the region benefit from the widespread, high-quality habitat prescribed fire creates across the region. Tourists and local travelers observe the enhanced aesthetics of longleaf stands that have been prescribed burned. Prescribed burning also provides private and public landowners and fire managers across the region with an incentive to coordinate for a common mission. Many have formed organizations such as the North Florida Prescribed Fire Council and
the Apalachicola Regional Stewardship Alliance to share prescribed fire knowledge, experience, and resources.

5.3.2.4 Rare Plant and Animal Protection
This forest type provides vital habitat to many imperiled species. The Panhandle is home to many species only found in this region and contains several global populations. Many plant species found in the Panhandle are the only occurrences in Florida, with the next closest occurrence 400 miles north in Appalachia. Table 2 shows the imperiled species found in the region by forest type. This table was created using Florida’s imperiled species management plan occurrences within FNAI natural community types. These natural community types found within the FNAI Natural Community Guide were then associated with each forest type. Additional information on current listing status for each species can be found in the geodatabase.

5.3.3 Silvicultural Options

5.3.3.1 Timber Harvest
The following silvicultural and land management tools are available to Florida Panhandle natural 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 should 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.

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 or 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. Historical and cultural resource protection and recreation management are also considered during planning and active silvicultural operations.

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 can have comparable growth rates to slash or loblolly pine on its more productive, upland pine clay soils. It tends to be less productive on deep, sandy soils compared to slash and loblolly on their best sites. However, longleaf is more productive than slash and loblolly on these poor sandy sites.

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.

**Thinning**

Thinning is a primary land management tool used in the Panhandle 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 SMZs.

Several types of merchantable release thinning are utilized in pine stands within the Panhandle. Merchantable release thinning includes row thinning in un-thinned planted pine stands. The most common row thinning methods are third row thinnings or fifth row thinnings. Every other or fourth row thinnings are also utilized along with every sixth or seventh row.

Single-tree selection via logger-selection or a logger-select thinning (operator select) of the residual rows is common during first thinning. Some first thinnings in planted pine and most thereafter are thinned through marked selection or marked-select thinning by a forester. Foresters can also mark demonstration areas of one acre or more on logger-selection first thinnings to walk through and discuss with logging crews how the stand should 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 and 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 stand.

If wildlife, aesthetics, or biodiversity are primary objectives, stands are typically 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.

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 should be revisited. Eventually, a decision must be made on final harvest or conducting a natural regeneration harvest.

Natural regeneration and under-planting harvests utilize thinning and will be discussed in Reforestation.

On productive sites, planted longleaf generally requires first thinning around age 15 to 20. On less productive sites, planted longleaf may be pre-merchantable or not have enough volume per acre to market until age 20 to 30.

First thinnings in planted longleaf 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 planted longleaf stands of 20 to 25 years old 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 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. Additional information about pine straw raking is available on the FDACS.

Many landowners may choose not to thin uneven-aged longleaf stands as their desired future condition has been met. They enjoy benefits of uneven-aged management such as high-quality wildlife habitat, aesthetics, and recreational opportunities. Other landowners may choose to occasionally lightly thin their uneven-aged longleaf for revenue, forest health, and maintaining stand structure and overstory composition.

Natural regeneration harvests are discussed in the Reforestation section.

Clearcut

Clearcutting longleaf pine is uncommon but is a sound silvicultural practice in managing this shade intolerant species for timber, pine straw, and other objectives. In most Panhandle timber markets, on most soils, timber revenue is maximized through short-rotation, even-aged management for pulpwood production. Clearcuts are utilized in planted or natural stands. However, the diversity of forest products and the longer rotation age for longleaf pine reduces the amount of clearcutting that occurs under longleaf pine management.

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. The common Panhandle 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 loblolly on certain clay soils.

There are site-specific Silviculture BMPs and Wildlife BMPs when using clearcuts, particularly in wetlands and SMZs. The size and shape of clearcuts should be considered if wildlife and aesthetics are also objectives. Non-clearcut buffers or “beauty strips” can be used along roads and highways to reduce negative aesthetics associated with clearcuts. Timing and seasonality is crucial when clearcutting wetlands and wet upland sites.

Chipping

Another form of timber harvest in the Panhandle 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. 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.

Hardwood and pine tree-length pulpwood can be hauled as clean chips, which 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.

**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 Panhandle markets.

Chipping is commonly used in low-value, hardwood, fuelwood 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 landowner objectives, such as hardwood reduction and removal or site clearing. Merchantable sand pine clearcuts can be clean-chipped. 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 financially break-even. Fuelwood or clean-chipping can be used where a debris-free post-harvest site is required.

Longleaf pine stands present opportunities for fuelwood chipping operations such as reducing overstocked natural longleaf regeneration in uneven-aged stands or hardwood reduction.

**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 goal of a salvage harvest is to utilize as much of the damaged timber resource prior to mortality and complete loss of merchantability. Secondary goals are to maintain or enhance forest health and aesthetics. Sometimes unrelated objectives that become attainable or a higher priority following one of these events can be accomplished. For example, restoration or recreation goal prioritization 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 should be made following careful evaluation.

Salvage harvest operations can be used in longleaf stands. For example, an improperly conducted prescribed burn or wildfire may cause mortality.

### 5.3.3.2 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 is dictated by: landowner objectives, site conditions, current and forecasted timber markets, budget, and other factors.

#### 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 3).

#### 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 plants, grasses, non-crop pines, woody shrubs, and hardwood.
Common Panhandle Forest Types: Longleaf Pine Dominant

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.

Adequate site preparation is critical in successfully establishing longleaf pine. Vegetative competition varies across longleaf pine sites and the appropriate site preparation techniques should be selected to adequately control it. Vegetative competition will need to be controlled prior to planting to achieve successful establishment. With adequate site preparation, longleaf pine will survive and quickly initiate vertical growth.

Chemical Site Preparation

Herbicide should be 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 should be selected to effectively target the primary woody and herbaceous vegetative competition. Site preparation herbicide can be applied aerially by helicopter or through ground application using the broadcast or banded techniques. There are site-specific Silviculture BMPs and Wildlife BMPs related to site preparation, particularly in wetlands and SMZs.

Mechanical Site Preparation

There are many mechanical site preparation methods to choose from. Some can be used on varying sites while others have very site-specific applications.

Bedding is used on flat, wet sites to elevate the roots of pine seedlings and promote respiration and growth. There are various bedding machines that create beds of different heights, depending on how wet the site is. Some wet sites are difficult or impossible to successfully, artificially regenerate without beds.

This method is appropriate for timber management objectives and less so for aesthetics, rare plants, native groundcover, and wildlife.

Bedding machines are pulled behind farm tractors, bulldozers, or, more commonly, skidding machines, depending on horsepower requirements and site conditions.

Longleaf is generally established on higher, drier sites so bedding is not typically necessary. However, it may be used on wetter longleaf sites. Bedding can have long-term negative impacts on desirable longleaf-associated groundcover and aesthetics, which conflicts with common longleaf management objectives.

Roller drum chopping is used on various sites to reduce woody and herbaceous plant competition, although more common on flatter sites due to risk of erosion on hills. There are various sizes of roller drum choppers with various lengths of blades. The appropriate equipment should be 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 saw-palmetto site with a full drum.

Choppers are pulled behind farm tractors, bulldozers, or, more commonly, skidding machines, depending on horsepower requirements and site conditions.

Scalping and ripping or 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 and reducing root damage from insects and other root pathogens. Ripping or subsoiling is used in compacted soils like those found in pastures and old field sites, particularly those on clay soils.

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.

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.

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

Shearing involves a heavy bulldozer equipped with an oversized V-blade that shears off stumps and any 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 can also be used during groundcover restoration or converting clearcut timber to pasture or crops.

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 and prescribed fire site preparation.

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.

Longleaf stands are successfully established using one or more of the following site preparation methods: chemical, mechanical, and prescribed fire.

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.

Artificial Regeneration
Artificial regeneration follows clearcutting, but is also used for under-planting longleaf pine. Reference Table 3 for a comparison summary of the advantages and disadvantages of artificial and natural regeneration.

Planting density is an important consideration and dependent on: landowner objectives, budget, site conditions, cost-share requirements, and other factors. The soil productivity, hydrology and natural community should be evaluated during artificial regeneration planning. A density should be selected that meets primary objectives such as timber, wildlife, aesthetics, and recreation. If timber management is an objective, a relatively higher density should be selected.

If timber management is not an objective, lower planting densities may 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, which will never develop into tall, straight, well-formed trees. A medium, balanced density that meets multiple objectives can also be considered. Qualified natural resource professionals may consider a range of density options, based on objectives and site conditions.

Artificial regeneration generally involves planting seedlings in rows that are spaced at a desired density. Distance between rows is often determined by equipment sizes needed to maintain the planting. Spacing of trees within each row is based on desired trees per acre. 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, proper care of quality seedlings, and natural factors such as climate and pests. A seedling survival check should be conducted following the first growing season to determine if the stand was successfully established, to document initial stocking, and to 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 more 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 should be reviewed with the landowner prior to species selection. This decision should be driven by the typical species selection considerations but landowner objectives will ultimately determine the appropriate species to plant.

Although the State of Florida has no regulation regarding survival standards, attaining survival rates of 90 percent or higher with longleaf pine 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.
There are three general methods of planting longleaf pine in the Panhandle: hand planting, machine, and V-Blade.

Hand Planting vs. Machine Planting

**Hand planting** entails crews planting seedlings by hand. Refer to Table 4 for more information on this method and a comparison with 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, hence 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 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 4 for more information on machine planting.

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.

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 the Panhandle and is costly, especially hardwoods. Pond and bald cypress are available in traditional, “cell” containerized form, while hardwood seedlings generally start in larger, one to three gallon containers for landscaping markets. Hardwoods are more commonly planted on a smaller scale, focusing on wildlife management, such as 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.

**Containerized vs. Bare Root**

**Containerized seedlings** are considered higher quality and have 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 (or “reefer”). Longleaf seedlings are available with various genetic improvements, such as growth rate, form, and disease resistance. Improved, containerized longleaf 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.

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

Both should be planted as soon as possible after lifting, stored in a reefer, and kept under seedling tarps in the shade prior to planting.

Hand, flatwoods, and V-blade planting methods can be used to plant all the Panhandle pine species, as bare root or containerized seedlings.

**Planting depth** is critical for longleaf seedling survival. Regardless of planting method, seedlings should be planted in the following manner. Containerized seedlings should be planted with the top of the plug level with the soil surface. Planting shallow with a half-inch of the plug exposed is tolerable but planting deep with the terminal bud buried will result in mortality. Bare root seedlings
should be planted so the soil surface is level with the root collar. The root collar may be up to one inch below the surface, but no more than a half-inch above.

**Afforestation**

The Panhandle region of Florida has a long history of agricultural production such as tobacco and cotton. Both industries have faded in recent decades, causing land-use conversions to timber and cattle production. Many landowners plant longleaf, loblolly, slash, and shortleaf pines on old field and pasture sites within the Panhandle.

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 have a high occurrence of fusiform rust, particularly in longleaf. This effect tends to be localized and more severe on heavy soils and where cattle were fed. 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 or ripping (subsoiling) as discussed in the site preparation section.

**Natural Regeneration**

Pine, hardwood, and cypress stands can be naturally regenerated to meet various objectives, including uneven-aged management. This section will focus on pine, as cypress and hardwood management are less common in 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 3 for general information on pine natural regeneration and a comparison between this method and artificial regeneration.

**Pre-merchantable thinning** is often required in natural regeneration management regimes and is discussed in the release treatment section.

Existing longleaf pine stands can be naturally regenerated to meet various objectives, including uneven-aged management. Even-aged stands can be moved towards two-aged, then uneven-aged stand structures through natural regeneration. Some natural longleaf stands encountered may have been historically high-graded and a decision must be made on whether to clearcut and start over with higher quality genetics or naturally regenerate and hope for the best.

Longleaf pine produces seed annually, usually peaking in October, but has bumper crops every 7 to 10 years. Planning for natural regeneration of longleaf should entail evaluating the cone crop the spring prior and researching the previous bumper crop year.

Natural regeneration of longleaf requires careful planning and coordination such as evaluating cone crops during spring, potential timber harvest, and carefully timed site preparation prior to fall seed catch.

**Site Preparation**

Site preparation options are the same between natural pine regeneration methods and are similar to site preparation for artificial regeneration. 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 late summer, early fall will prepare the seed bed by scarifying the soil, promoting seed catch. Conducting prescribed burns near seed dispersal should be avoided, as seed predation will be greater due to less groundcover. Some understory regrowth is desirable to prevent the seeds from being 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. A combination of site preparation methods can be combined with prescribed fire to achieve natural regeneration sooner.

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

**Shelterwood**

Shelterwood is generally the most effective method of natural regeneration longleaf pine. This entails thinning a stand to approximately 30 to 40 square feet per acre of basal area or about 20 to 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.
Common Panhandle Forest Types: Longleaf Pine Dominant

Seed trees should be the highest quality in terms of crown size, form, and health or vigor. Seedling growth may be slightly lower compared to seed tree method if seed trees are retained, which is optional, following successful stand establishment.

Seed Tree

The seed tree cut method is similar to the shelterwood method, except stands are thinned to a slightly lower basal area of approximately 10 to 30 square feet per acre or about 10 to 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 or vigor. Seedling growth may be slightly higher compared to shelterwood if seed trees are retained, which is optional following successful stand establishment.

Group Selection

The final method of natural regeneration is group selection, or small, quarter-acre to one-acre clearcuts interspersed throughout a stand. The size and shape of the clearcuts are 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, which leads 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.

5.3.3.3 Release

Early and mid-rotation release treatments are common in pine timber management within the Panhandle. 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 height and diameter growth and good form. Target vegetation includes herbaceous plants, grasses, non-crop pines, woody shrubs, and hardwood species. These treatments may take place in planted or natural pine stands. A merchantable thinning harvest is another form of release and is discussed in the timber harvest section.

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 should be applied based on the recommended release label rate for the target and crop species and site conditions. The appropriate herbicide and chemical release method should be selected to effectively target the primary woody and herbaceous 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

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 include: mowing, chopping and mulching. All three can be used for early-rotation release; however, caution should be used to avoid damaging young pines. Mowing and mulching only should be used near mid-rotation as chopping may damage feeder roots in mature pines.

Prescribed Fire

Prescribed fire can be used as an early rotation release in longleaf stands once they can handle fire. A grass stage burn will promote earlier, more uniform vertical growth in longleaf. Broadcast prescribed burning serves as a mid-rotation release in longleaf stands.

Pre-merchantable 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 financially.

Merchantable thinning is a release treatment in older stands and is discussed in the timber harvest section.

5.3.3.4 Prescribed Fire

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.

Longleaf is the most fire-tolerant species of all the southern pines. Prescribed fire plays a critical ecological maintenance and restoration role in longleaf pine forests, mimicking historic natural fires. Without fire, longleaf forests would gradually transition to hardwood forests in most cases.

Prescribed fire enhances wildlife habitat, improves aesthetics, reduces vegetative competition and fuel loads, and stimulates rare plants within the longleaf pine ecosystem. Longleaf pine forests should be prescribed burned every one to three years to support these objectives and maintain the natural communities in which longleaf pine can be found.

Prescribed fire should be applied in the grass stage as soon as fuels allow and longleaf can handle fire, which is generally one full year following planting. Once longleaf reaches three to five feet in height, fire-caused mortality increases. Above six feet, longleaf is more tolerant of fire.

Fire applied during the grass stage helps reduce the likelihood of brown spot needle blight which can become an issue with lack of fire. This disease is not an issue beyond the grass stage.

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 than 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 species, including several rare species such as the red-cockaded woodpecker, which requires 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, which enhances recreational activities such as hunting, wildlife viewing, and hiking. Prescribed fire also reduces many forest pest species such as ticks and chiggers, improving outdoor recreational experiences and helping reduce the spread of tick-borne illnesses such as Lyme disease and Rocky Mountain spotted fever.

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 should be utilized initially until fuel loads are reduced, especially in long-unburned stands. Thick duff layers should be reduced slowly over time by only burning following precipitation when adequate soil moisture is present to avoid damaging feeder roots. Appropriate firing techniques should be selected with consideration for 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 for a burn that does not go as planned which causes many landowners to avoid prescribed burning. Landowners have the option to transfer that liability by hiring a state or private contractor to conduct their burning. Florida has strong prescribed fire statutes which protect safe, responsible prescribed burn managers (*Wade and Lunsford 1989*).

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 should at minimum include:

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

**Methods of Prescribed Fire**

**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.

**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.

**Pile Burns**

Pile burning is a form of site preparation burning. Large post-harvest debris within clearcuts is 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.

**Fire Return Intervals**

Fire return interval is the frequency at which a burn 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.

Longleaf pine stands should be prescribed burned every one to three years. This can be adjusted based on the factors listed in the previous paragraph.

**Seasonality**

Seasonality plays an important role in a prescribed fire program and should be carefully considered to help meet specific objectives. Seasonality should 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 a 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 through 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 with 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 should be 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. It may also be beneficial to burn in late summer or early fall to catch heavy seed crops when managing for uneven-aged longleaf pine.

Longleaf pine can be prescribed burned year-round.

**Fire Weather**

One of the most important considerations in planning and conducting a prescribed burn is fire weather. Burn prescriptions should contain a section with desired, forecasted and actual fire weather for a burn unit. The U.S. Forest Service’s “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, and 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** affect 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.

### 5.3.3.5 Fertilization

Fertilization can be utilized on Florida’s nutrient poor soils. Longleaf pine on moderately to well-drained sandy soils are not conducive to fertilization. Longleaf pine responds to fertilization on clay soils. Fertilization uptake is dependent on soil composition (e.g., 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.

### 5.3.4 Forest Resources

#### 5.3.4.1 Fish and Wildlife

The forests and associated aquatic ecosystems of Florida’s Panhandle provide habitat for a wide array of game and non-game fish and wildlife, including several imperiled species (Table 2). These forests can be managed to enhance, restore, and protect the valuable habitats these species call home. These species may be managed for various objectives such as conservation or recreation. Present listed species should be documented, mapped, and monitored.

The Wildlife BMPs compile strategies and considerations for managing and protecting these species and their habitat during silvicultural operations, such as marking a rare plant or animal area with flagging, paint, or signage to protect during harvest operations, regular active monitoring, and following up with post-harvest inspections. The Silviculture BMPs also consider fish and wildlife conservation in relation to silvicultural activities.

Longleaf forests are among the most diverse ecosystems in the world and provide habitat to hundreds of game and non-game species including bob-white quail, wild turkey, and deer. Longleaf forests are home to several rare species including: gopher tortoise, eastern indigo snake, Bachman’s sparrow, and red-cockaded woodpecker (Table 2).

#### 5.3.4.2 Timber Products

Timber **merchantability**, whether planted or natural, pine or hardwood, depends 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**
- **Saw timber: pine**
- **Poles and pilings: pine**
- **Mulch: hardwood**
- **Fuelwood**:
  - Pine, hardwood, and large woody shrub species
    - Chips for energy production
  - Hardwood
    - Firewood
- **Other hardwood products: pallets, mats, small diameter saw timber for furniture**
- **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 longleaf pine forests including pulpwood, chip-n-saw, saw timber, and poles. Longleaf forests also allow for fuelwood harvests, especially utilizing natural regeneration and hardwood reduction treatments.

Longleaf pine is commonly managed on longer rotations for quality, high value saw timber and pole products. It is also managed for all the other pine products. Many hardwood products can also be harvested within longleaf forests.

#### 5.3.4.3 Non-Timber Forest Products

Many NTFP opportunities exist within longleaf pine forests, including **pine straw**, **silvopasture**, **honey**, and **saw palmetto** drupe harvests.
**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 to $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. For slash pine this is around age eight or nine, for longleaf around age ten. If landowner objectives are focused on maximizing revenue, they may wish to forgo thinning and rake straw beyond economic or biological thinning age, clearcutting for pulpwood at age 18 to 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.


**Silvopasture**

Longleaf pine 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 saw timber) 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 and enhance 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 consider silvopasture cost-sharable through 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).

**Honey**

Beekeeping and honey production are common within longleaf 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, or it may be a hobby 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 is considered a valuable industry by the FDACS. In order to protect this industry from pests and unwanted species of honey bees, they require beekeepers to register honey bee colonies through their website.

Fruits

Saw palmetto drupes are harvested from longleaf pine forests 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 should 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 (*Ursus americanus*) (Dobey et al 2005) and provide valuable nutrition to raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), gopher tortoise (*Gopherus polyphagus*), opossums (*Didelphis marsupialis*), white-tailed deer (*Odocoileus virginianus*), bob-white quail (*Colinus virginianus*), feral hog (*Sus scrofa*), 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.

Blueberry, blackberry, and other native fruits grow in longleaf pine forests but are not commercially harvested from forest settings. However, landowners may consume for personal use.

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

5.4 Sand Pine Dominant

There are two varieties of sand pine, Choctawhatchee (var. *immuginata*) and Ocala (var. *clusa*). This section will focus on the Choctawhatchee variety native to the western areas of the Panhandle. Choctawhatchee sand pine has non-serotinous cones while Ocala bears serotinous cones. Both are prolific seeders and will aggressively encroach offsite to other natural communities and forest types.

Natural stands generally have a more open and uneven-aged structure. In the Panhandle, planted stands are typically Choctawhatchee but could potentially be the Ocala variety. Sand pine is planted densely and managed on short, even-aged rotations for pulpwood, oriented strand board, and fuelwood. The only exception is large sand pine with good form can potentially be marketed as ply logs.

Sand pine is last among the other Panhandle pine species in terms of disease, insect, and fire resistance, but is the most drought tolerant. Sand pine is low in economic value, but is a key ecological component in scrub natural communities. Revenue and conservation objectives can be balanced or achieved individually through sand pine management.
Sand pine is dominant and grows best on the deep, low-nutrient, unproductive, sandy soils of the scrub natural community. It can be found scattered marginally on scrubby flatwoods and sandhills sites dominated by longleaf pine. It is often planted on sandhills and scrubby flatwoods sites where it grows well, is cheaper to establish, and is a short rotation alternative to longleaf pine. Sand pine is considered ecologically offsite in scrubby, mesic, wet flatwoods, sandhills, and poorly drained soils.

Sand pine does not develop a well-formed tap root. This growth characteristic combined with the deep, sandy soils it grows on make it very susceptible to wind throw.

5.4.1 Landowner Objectives Summary

5.4.1.1 Aesthetics
Sand pine forests are not known for high-quality aesthetics. However, they can be managed at high densities to provide privacy to landowners.

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 sand pine stands, a strip of pines can be left as a buffer against adjacent high-visibility areas such as roadways or neighboring homes.

5.4.1.2 Wildlife Habitat Management and Protection
The sand pine forest type and its associated natural communities provide wildlife habitat management and protection opportunities. Many game and imperiled species can be found within sand pine forests.

Active management of game species is more common on private lands while non-game species are managed to a lesser extent.

Hunting is a common wildlife management objective in the sand pine forest type, particularly for white-tailed deer that use these dense stands as cover. Hunting leases are used to manage healthy game populations while also generating revenue.

Sand pine habitat objectives can be met with various silvicultural tools, such as clearcutting planted sand pine stands to diversify habitat and create beneficial edge effects. Many game and non-game species of sand pine forests will benefit from these activities including white-tailed deer and gopher tortoise.

5.4.1.3 Recreation
Sand pine forests are not relatively popular recreational areas in Florida due to lower aesthetic values. However, these high and dry forests allow for any of the following recreational activities year-round:

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

5.4.1.4 Conservation
The sand pine forest type 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. Sand pine forests are fire dependent and require application of prescribed fire at minimum for ecological maintenance.

5.4.1.5 Ecological Restoration
Sand pine is an overstory component in the scrub natural community. It can be replanted as a step in restoring this natural community.

5.4.1.6 Hydrological Protection and Restoration
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.

Sand pine typically grows on erodible sandy hills. Existing forest roads should be properly maintained through grading, pulling ditches, installing culverts, hard surface low water crossings, turnouts, and water bars as needed. Limit new road construction. Old windrows and beds can be leveled to improve hydrology but should be avoided if more overall harm will be done to the ecosystem than good (e.g., groundcover impacts).
5.4.1.7 Forest Health Management

The most destructive insect pests to sand pine are Ips beetles, especially Choctawhatchee sand pine. Damage can be severe in overstocked and senescent stands, especially if offsite or other stressors occur (e.g., extreme drought, lightning strikes, fire stress). Sand pine sawfly, blackheaded pine sawfly, pitch-eating weevil, and pales weevil can also cause significant damage in sand pine stands.

Sand pine’s most detrimental disease is mushroom root rot, especially when the Ocala variety is planted in the Panhandle region. This disease often prevents sand pine from becoming merchantable in size. The Choctawhatchee variety is resistant to this disease.

Sand pine is less fire resistant than longleaf, slash, loblolly, and shortleaf pines. However, it should be prescribed burned with caution as its natural communities are fire dependent. It is susceptible to crown and inner bark scorch and crown fires, especially in younger stands and dense stands of any age.

Sand pine is also very susceptible to wind throw damage.

With appropriate seedlings, site selection, and clearcutting regimes, sand pine generally has minimal issues following successful establishment.

Non-native invasive species should be monitored and treated. See the non-native invasive species section.

5.4.1.8 Revenue

Sand pine provides revenue opportunities including timber, NTFP, and eco-tourism (mainly hunting leases).

5.4.2 Landscape Objectives

5.4.2.1 Wildlife Habitat Management

Sand pine forests provide habitat for game and non-game species at the landscape scale.

5.4.2.2 Utilization of Prescribed Fire

The focus of prescribed fire at the landscape scale is fuel management. Sand pine forests managed with prescribed fire have low fuel loads which help reduce landscape-level wildfire risk and hazard to the Panhandle community. Wildlife and aesthetic benefits of fire-maintained forests across the landscape are also important. Wildlife that migrate throughout the region benefit from the widespread, high-quality habitat prescribed fire creates across the region. Prescribed burning also provides private and public landowners and fire managers across the region with an incentive to coordinate for a common mission. Many have formed organizations such as the North Florida Prescribed Fire Council and the Apalachicola Regional Stewardship Alliance to share prescribed fire knowledge, experience, and resources.

5.4.2.3 Rare Plant and Animal Protection

The Florida Panhandle is home to many rare species found only in this region and contains several global populations. Many plant species found in the Panhandle are the only occurrences in Florida, with the next closest occurrence hundreds of miles north in Appalachia. Sand pine forests provide vital habitat to many imperiled plant and animal species. Table 2 shows the imperiled species found in the Panhandle by forest type. This table was created using Florida’s imperiled species management plan occurrences within FNAI natural community types. These natural community types found within the FNAI Natural Community Guide were then associated with each forest type. Additional information on current listing status for each species can be found in the geodatabase.

5.4.3 Silvicultural Options

5.4.3.1 Timber Harvest

The following silvicultural and land management tools are available to Florida Panhandle natural 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 should 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.

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 or habitat.
Common Panhandle Forest Types: Sand Pine Dominant

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. Historical and cultural resource protection and recreation management are also considered during planning and active silvicultural operations.

Sand pine is most productive on deep, well-drained sandy soils of scrub, sandhills, and scrubby flatwoods sites. It is ecologically offsite when planted on sand hill sites. Silviculturally, sand pine is productive on sand hill. Sand pine timber management involves short rotations for pulpwood and oriented strand board products. Managed sand pine is not grown on longer rotations. Large diameter sand pine can be harvested for ply logs in some markets.

Sand 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. Sand pine does not allow the flexibility to grow stands out longer for higher-valued timber products.

Thinning

Thinning is a primary land management tool used in the Panhandle 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 SMZs.

Several types of merchantable release thinning are utilized in pine stands within the Panhandle. Merchantable release thinning includes row thinning in un-thinned planted pine stands. The most common row thinning methods are every third or fifth row thinnings. Every other or fourth row thinnings are also utilized along with every sixth and seventh row.

Single-tree selection via logger-selection or a logger-select thinning (operator select) of the residual rows is common during first thinning. Some first thinnings in planted pine, and most thereafter, are thinned through marked selection or marked-select thinning by a forester. Foresters can also mark demonstration areas of one acre or more on logger-selection first thinnings to walk through and discuss with logging crews how the stand should 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 stand.

If wildlife, aesthetics, or biodiversity are primary objectives, stands are typically 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.

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 should be revisited. Eventually, a decision must be made on final harvest or conducting a natural regeneration harvest.

Natural regeneration and under-planting harvests utilize thinning and will be discussed in Reforestation.

Sand pine management does not involve thinning. Due to a shallow tap root and the deep sandy soils it grows on, it is highly susceptible to wind throw, particularly post thinning. Sand pine also retains branches longer, making it extremely knotty and preventing its development into high-value timber products.

Clearcut

Clearcutting is the standard silvicultural practice in managing shade intolerant sand pine for timber and other objectives. In most Panhandle 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.

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. The common Panhandle example is converting off-site slash pine and hardwood species back to longleaf pine. Another may be clearcutting longleaf and reforesting with sand pine to meet short-rotation timber management objectives.

There are site-specific Silviculture BMPs and Wildlife BMPs when using clearcuts, particularly in wetlands and SMZs. The size and shape of clearcuts should be considered if wildlife and aesthetics are also objectives. 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.

Chipping

Another form of timber harvest in the Panhandle 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. 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.

Hardwood and pine tree-length pulpwood can be hauled as clean chips, which 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 which is common in sand pine stands.

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 Panhandle 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 landowner objectives, such as hardwood reduction and removal or site clearing. Chipping can also be utilized 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 financially break-even. Fuelwood or clean-chipping can be used where a debris-free post-harvest site is required. For example, fuelwood chipping can be used as part of site preparation for groundcover restoration projects.

Sand pine stands are commonly harvested using fuelwood chipping operations. Hardwoods in sand pine stands can also be chipped.

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. 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 should be made following careful evaluation.

Salvage harvest operations can be used in sand pine stands. Sand pine is often salvage harvested following a major wind event due to widespread wind throw.
5.4.3.2 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 is dictated by: landowner objectives, site conditions, current and forecasted timber markets, budget, and other factors.

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 3).

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 plants, 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 sand pine sites and the appropriate site preparation techniques should be selected to adequately control it. Vegetative competition will need to be controlled prior to planting to achieve successful establishment. With adequate site preparation, sand pine will survive and quickly initiate vertical growth.

Chemical Site Preparation

Herbicide should be 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 should be 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.

There are site-specific Silviculture BMPs and Wildlife BMPs related to site preparation, particularly in wetlands and SMZs.

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 sand pine.

Bedding is used on wet sites to elevate the roots of seedlings and promote respiration and growth. There are various types of bedding machines that create beds of different heights, depending on how wet the site is. 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, bulldozers, or, more commonly, skidding machines, depending on horsepower requirements and site conditions.

Bedding is not necessary on sand pine sites.

Roller drum chopping is used on various sand pine flatwoods sites to reduce woody and herbaceous plant competition. There are various sizes of roller drum choppers with various lengths of blades. The appropriate equipment should be 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 saw-palmetto-gallberry site with a full drum.

Choppers are pulled behind farm tractors, bulldozers, or, more commonly, skidding machines, depending on horsepower requirements and site conditions.

Scalping and ripping or 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 and reducing root damage from insects and other root pathogens.

Ripping or subsoiling is used in compacted soils like those found in pastures and old field sites, particularly those on clay soils.

**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.

**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.

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

**Shearing** involves a heavy bulldozer equipped with an oversized V-blade that shears off stumps and any 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 can also be used during groundcover restoration or converting clearcut timber to pasture or crops.

**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, or prescribed fire site preparation.

**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.

**Artificial Regeneration**

Artificial regeneration follows clearcutting. Reference Table 3 for a comparison summary of the advantages and disadvantages of artificial and natural regeneration.

Planting density is an important consideration and dependent on: landowner objectives, budget, site conditions, cost-share requirements, and other factors. The soil productivity, hydrology, and natural community should be evaluated during artificial regeneration planning. A density should be selected that meets primary objectives such as timber, wildlife, aesthetics, and recreation. If timber management is an objective, a relatively higher density should be selected.

If timber management is not an objective, lower planting densities may 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, which will never develop into tall, straight, well-formed trees. 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. Distance between rows is often determined by equipment sizes needed to maintain the planting. Spacing of trees within each row is based on desired trees per acre. However, a random or natural pattern can be established using hand planting.

High survival rates depend on selecting appropriate species for the site, adequate site preparation, suitable planting method, proper care of quality seedlings, and natural factors such as climate and pests. A seedling survival check should be conducted following the first growing season to determine if the stand was successfully established, to document initial stocking, and to decide if supplemental planting is required to achieve desired stocking.

Although the State of Florida has no regulation regarding survival standards, attaining survival rates of 90 percent or higher with sand pine 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.

**Hand Planting vs. Machine Planting**

Hand planting entails crews planting seedlings by hand. Refer to Table 4 for more information on this method and a comparison with 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 hence 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 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 4 for more information on machine planting.

Any of the planting methods can be used to plant sand pine.

**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 the Panhandle and is costly, especially hardwoods. Pond and bald cypress are available in traditional, “cell” containerized form, while hardwood seedlings generally start in larger, one to three gallon containers for landscaping markets. hardwoods are more commonly planted on a smaller scale, focusing on wildlife management, such as 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.

**Containerized vs. Bare Root**

**Containerized seedlings** are considered higher quality and have 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 (or “reefer”).

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

Both should be planted as soon as possible after lifting, stored in a reefer, and kept under seedling tarps in the shade prior to planting.

Hand, flatwoods, and V-blade planting methods can be used to plant all the Panhandle pine species, as bare root or containerized seedlings.

Unlike longleaf, slash, and loblolly, sand pine seedlings are not available with genetic improvements, such as growth, disease resistance, and form. Sand pine seedlings are only available bare root. Orders can be placed early summer to ensure needs are met and avoid delays in planting.

**Afforestation**

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

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. This effect tends to be localized and more severe on heavy soils and where cattle were fed. 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 or ripping (subsoiling) as discussed in the site preparation section.

Afforestation with sand pine is not as common as with longleaf, slash, and loblolly.


**Natural Regeneration**

Existing sand pine stands can be naturally regenerated, but this method is uncommon due to its density and not recommended if timber management is an objective.

### 5.4.3.3 Release

Early and mid-rotation release treatments are not common in sand pine management within the Panhandle. 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 height and diameter growth and good form. Target vegetation includes herbaceous plants, grasses, non-crop pines, woody shrubs, and hardwood species. These treatments may take place in planted or natural pine stands. A merchantable thinning harvest is another form of release and is discussed in the timber harvest section.

**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 should be applied based on the recommended release label rate for the target and crop species and site conditions. The appropriate herbicide and chemical release method should be selected to effectively target the primary woody and herbaceous 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

**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 methods 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 not be used mid-rotation.

**Prescribed Fire**

Prescribed fire can be used carefully as an early rotation release in sand pine stands once they can handle fire. Broadcast prescribed burning serves as a mid-rotation release in sand pine stands.

**Pre-merchantable 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 financially.

Merchantable thinning is a release treatment in older stands and discussed in the timber harvest section.

### 5.4.3.4 Prescribed Fire

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 sand pine forests, mimicking historic natural fires. Without fire, sand pine forests would gradually transition to hardwood forests in most cases.

Sand pine is less fire tolerant than longleaf, slash, and loblolly pines, but sand pine can handle carefully applied prescribed fire. Sand pine forests can be prescribed
burned every 20 to 80 years to maintain and restore the scrub natural community in which they are dominant and naturally regenerate a new sand pine stand. They can be burned more frequently to enhance wildlife habitat, improve aesthetics and access, reduce vegetative competition, reduce fuel loads, and stimulate rare plants. However, sand pine has very thin bark and can be killed back by fire. Sand pine also retains its dead branches, and its needles are highly flammable, making prescribed burns challenging.

If timber management is the sole landowner objective, fire can be completely excluded. Fire exclusion comes along with an increased risk of complete stand loss due to catastrophic wildfire.

**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 than compared to areas without.

Prescribed fire opens up 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 species, including several rare species such as the red-cockaded woodpecker, which requires 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, which enhance recreational activities such as hunting, wildlife viewing, and hiking. Prescribed fire also reduces many forest pest species such as ticks and chiggers, improving outdoor recreational experiences and helping reduce the spread of tick-borne illnesses such as Lyme disease and Rocky Mountain spotted fever.

**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 should be utilized initially until fuel loads are reduced, especially in long-unburned stands. Thick duff layers should be reduced slowly over time by only burning following precipitation when adequate soil moisture is present to avoid damaging feeder roots. Appropriate firing techniques should be selected with consideration for 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 for a burn that does not go as planned, which causes many landowners to avoid prescribed burning. Landowners have the option to transfer that liability by hiring a state or private contractor to conduct their burning. Florida has strong prescribed fire statutes that protect safe, responsible prescribed burn managers (Wade and Lunsford 1989).

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 should at minimum include:

- Thorough burn prescription development
- Weather forecasting and observations
Common Panhandle Forest Types: Sand Pine Dominant

- 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.

Methods of Prescribed Fire

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.

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.

Pile Burns
Pile burning is a form of site preparation burning. Large post-harvest debris within clearcuts is 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.

Fire Return Intervals
Fire return interval is the frequency at which a burn 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.

Sand pine stands should be prescribed burned every 20 to 80 years. This can be adjusted based on the factors listed in the previous paragraph.

Seasonality
Seasonality plays an important role in a prescribed fire program and should be carefully considered to help meet specific objectives. Seasonality should 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 a 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 through 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 with 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 should be 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.

Sand pine can be prescribed burned year-round. However, extreme caution should be used when prescribed burning sand pine in the spring and fall, and a cold day in the dormant season would be the most reasonable time to burn sand pine for fuels reduction or aesthetic maintenance.

**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.

**Temperature** is a major factor in RH, fire intensity, scorch potential, and 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** affect 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.

**5.4.4 Forest Resources**

**5.4.4.1 Fish and Wildlife**

The forests and associated aquatic ecosystems of Florida’s Panhandle provide habitat for a wide array of game and non-game fish and wildlife, including several imperiled species (Table 2). These forests can be managed to enhance, restore, and protect the valuable habitats these species call home. These species may be managed for various objectives such as conservation or recreation. Present listed species should be documented, mapped, and monitored.
The Wildlife BMPs compile strategies and considerations for managing and protecting these species and their habitat during silvicultural operations such as marking a rare plant or animal area with flagging, paint, or signage to protect during harvest operations, regular active monitoring, and following up with post-harvest inspections. The Silviculture BMPs also consider fish and wildlife conservation in relation to silvicultural activities.

Sand pine forests provide habitat to many of game and non-game species including white-tailed deer and gopher tortoise. Sand pine forests may be home to several rare species including the eastern indigo snake (Table 2). However, canopy closure resulting from dense, older sand pine stands limits understory vegetation and wildlife utilization.

5.4.4.2 Timber Products

Timber merchantability, whether planted or natural, pine, or hardwood, depends 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
- Saw timber: pine and hardwood
- Poles and pilings: pine
- Mulch: cypress, hardwood
- Fuelwood:
  - Pine, hardwood, and large woody shrub species
    - Chips for energy production
  - Hardwood
    - Firewood
- Other hardwood products: pallets, mats, small-diameter saw timber for furniture

Timber is considered pre-merchantable if it is not marketable as one of the products above.

Sand pine is commonly managed for lower-value, short-rotation products such as pulpwood. Sand pine forests also allow for fuelwood harvests, especially utilizing natural regeneration and hardwood reduction treatments. Some ply wood mills will accept large sand pine logs with good form.

5.4.4.3 Non-Timber Forest Products

NTFP opportunities exist within sand pine forests, including Christmas tree, beekeeping, and saw palmetto drupe harvests.

Christmas Trees

Sand pine can be grown horticulturally for Christmas trees. This can be done in a forest setting, but sand pine Christmas tree farms are typically established for commercial production.

Honey

Beekeeping and honey production can be done in sand pine forests. However, other forest types are typically more desirable due to sand pine's sparse flowering understory. 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. Or it may be a hobby 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 is considered a valuable industry by the FDACS. In order to protect this industry from pests and unwanted species of honey bees, they require beekeepers to register honey bee colonies through their website.

Fruits

Saw palmetto drupes are harvested from sand pine forests to a lesser degree than slash and longleaf pine forests. 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
5.5 Shortleaf Pine Dominant

Shortleaf pine (*Pinus echinata*) is a less common species in the Panhandle of Florida, which is the southernmost extent of its native range. Large, monotypic, planted, or natural tracts of this species are rare in Florida. It does not exhibit good growth or form characteristics in Florida and per the Shortleaf Pine Initiative, shortleaf seedlings are not available in Florida. However, seedlings can be purchased in Georgia and Alabama. For these reasons, shortleaf pine is not a widely commercial species in Florida’s Panhandle.

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.

Shortleaf pine exhibits relatively good disease and insect resistance. It is also similar to slash and loblolly in fire resistance and sprouts from the base following excessive fire damage. Florida shortleaf is not highly valuable economically, but is a minor ecological component in upland pine, upland mixed woodland, and dry upland hardwood forest natural communities (*FNAI* 2010). Revenue and conservation objectives can be balanced or achieved individually through shortleaf management.

Shortleaf pine commonly grows on moderately to well-drained clay soils similar to loblolly pine. It shares upland pine sites with longleaf and loblolly pines and mixed hardwoods such as southern red oak (*Table 6*). This section will focus on shortleaf pine on upland pine sites. It grows alongside longleaf, oaks, and hickories on upland mixed woodland sites (*Table 6*). Within dry upland hardwood forest, shortleaf can be found scattered with loblolly pine and dominant mixed hardwoods (*Table 6*).

5.5.1 Landowner Objectives Summary

5.5.1.1 Aesthetics

Well-managed shortleaf pine forests have high-quality aesthetics. Mature stands that have been prescribed burned or thinned have an open, park-like structure with large, well-formed shortleaf pines and little to no midstory. Stands with native groundcover typically have lush green herbs and hardwoods in the spring following prescribed fire and various wildflowers and mixed grasses
come fall. Some 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 should be planned with aesthetics in mind to ensure these objectives are met. For example, when clearcutting shortleaf stands, 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, place logging decks within the interior of the stand, away from roadways.

5.5.1.2 Wildlife Habitat Management and Protection

The shortleaf forest type and its associated natural communities provide excellent wildlife habitat management and protection opportunities. Many game and imperiled species can be found within shortleaf pine forests.

Active management of game species is more common on private lands while non-game species are managed to a lesser extent.

Hunting is a common wildlife management objective in the shortleaf pine forest type, particularly for wild turkey and bob-white quail. Both species prefer the frequently fire-maintained open, grassy groundcover and lack of 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 shortleaf pine management activities such as prescribed fire.

Shortleaf habitat objectives can be met with various silvicultural tools, such as thinning planted shortleaf stands to a lower overstory density more favorable to wildlife or creating small clearcuts for wildlife openings to diversify habitat and create beneficial edge effects. Many game and non-game species of shortleaf forests will benefit from these activities including white-tailed deer, wild turkey, bob-white quail, gopher tortoise, fox squirrel, and red-cockaded woodpecker.

5.5.1.3 Recreation

Shortleaf forests are popular recreational areas in Florida, especially in the cooler months. The open, park-like stand structure, often with rolling hills, provides a scenic backdrop for any of the following recreational activities:

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

5.5.1.4 Conservation

The shortleaf pine forest type 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. Shortleaf pine forests are fire dependent and require frequent application of prescribed fire at minimum for ecological maintenance.

5.5.1.5 Ecological Restoration

Shortleaf pine is an overstory component in the upland pine natural community. It can be replanted as a step in restoring this natural community.

5.5.1.6 Hydrological Protection and Restoration

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 shortleaf sites, bedding should be avoided or minimized if hydrological protection and restoration are primary objectives. Limit new road construction. Existing forest roads should 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 should be avoided if more overall harm will be done to the ecosystem than good (e.g., groundcover impacts).
5.5.1.7 Forest Health Management
The most detrimental disease to shortleaf pine is littleleaf disease. Infection is high on poorly drained sites and poor soils and following root damage and drought. Littleleaf mostly occurs in 30 to 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.

Root rot can be an issue in thinned stands. Red heart impacts stands over 80 years old. Shortleaf-loblolly and shortleaf-slash hybrids have shown resistance to fusiform rust.

Young shortleaf stands are impacted by Nantucket tip moth. Shortleaf is the preferred species of the redheaded pine sawfly. Loblolly pine sawfly also attacks shortleaf pine. Pales and pitch-eating weevils can cause issues in newly planted stands. Southern pine beetle and Ips attacks occur in overstocked and senescent stands, especially if offsite or other stressors occur (e.g., drought, lightning strikes, fire).

Shortleaf pine cannot handle prescribed fire until the bark thickens and it reaches about 10 to 15 feet tall (depending on fuel load). It is susceptible to crown and inner bark scorch, especially in younger stands. Shortleaf up to 30 years old are able to resprout from the stump after top-killed by fire.

With appropriate seedling and site selection and release and thinning regimes, shortleaf pine generally has minimal issues following successful establishment.

Non-native invasive species should be monitored and treated. See the non-native invasive species section.

5.5.1.8 Revenue
Shortleaf pine provides a wide array of revenue opportunities including timber and NTFP, silvopasture, eco-tourism, and many others.

5.5.2 Landscape Objectives

5.5.2.1 Wildlife Habitat Management
Shortleaf pine forests provide habitat for game and non-game species at the landscape scale.

5.5.2.2 Utilization of Prescribed Fire
The focus of prescribed fire at the landscape scale is fuel management. Shortleaf pine forests managed with prescribed fire have low fuel loads which helps reduce landscape-level wildfire risk and hazard to the Panhandle community. Wildlife and aesthetic benefits of fire-maintained forests across the landscape are also important. Wildlife that migrate throughout the region benefit from the widespread, high-quality habitat prescribed fire creates across the region. Tourists and local travelers observe the enhanced aesthetics of shortleaf stands that have been prescribed burned. Prescribed burning also provides private and public landowners and fire managers across the region with an incentive to coordinate for a common mission. Many have formed organizations such as the North Florida Prescribed Fire Council and the Apalachicola Regional Stewardship Alliance to share prescribed fire knowledge, experience, and resources.

5.5.2.3 Rare Plant and Animal Protection
The Florida Panhandle is home to many rare species found only in this region and contains several global populations. Many plant species found in the Panhandle are the only occurrences in Florida, with the next closest occurrence hundreds of miles north in Appalachia. Shortleaf pine forests provide vital habitat to many imperiled plant and animal species. Table 2 shows the imperiled species found in the Panhandle by forest type. This table was created using Florida’s imperiled species management plan occurrences within FNAI natural community types. These natural community types found within the FNAI Natural Community Guide were then associated with each forest type. Additional information on current listing status for each species can be found in the geodatabase.

5.5.3 Silvicultural Options

5.5.3.1 Timber Harvest
The following silvicultural and land management tools are available to Florida Panhandle 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 should 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 in order to efficiently and effectively meet landowner objectives.

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 or 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. Historical and cultural resource protection and recreation management are also considered during planning and active silvicultural operations.

Shortleaf pine is not a highly productive commercial species in Florida. Shortleaf pine is most productive on the clay soils of upland pine sites. It is offsite on deep, sandy soils. 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, saw timber, and ply logs. It can be planted and managed in the Panhandle, but loblolly is generally more productive on these sites so this is rare.

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.

**Thinning**

Thinning is a primary land management tool used in the Panhandle 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 SMZs.

Several types of merchantable release thinning are utilized in pine stands within the Panhandle. Merchantable release thinning includes row thinning in un-thinned planted pine stands. The most common row thinning methods are every third or fifth row thinnings. Every other or fourth row thinnings are also utilized along with every sixth and seventh row.

Single-tree selection via logger-selection or a logger-select thinning (operator select) of the residual rows is common during first thinning. Some first thinnings in planted pine, and most thereafter, are thinned through marked selection or marked-select thinning by a forester. Foresters can also mark demonstration areas of one acre or more on logger-selection first thinnings to walk through and discuss with logging crews how the stand should 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 typically 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.

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 should be 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 shortleaf pine generally requires first thinning around age 15 to 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.
First thinnings in planted shortleaf 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 planted shortleaf pine stands 20 years old or more or those overstocked with natural regeneration, may require a pre-merchantable thinning or fuelwood chipping harvest.

Many landowners may choose not to thin mature even-aged, two-aged, or uneven-aged shortleaf 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 shortleaf pine for revenue, forest health, and maintaining overstory composition. See the forest health section for the risks associated with managing mature shortleaf pine.

Natural regeneration harvests are discussed in the reforestation section.

Clearcut

Clearcutting is a standard silvicultural practice in managing shade intolerant shortleaf pine for timber and other objectives. In most Panhandle 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.

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. Offsite species can be clearcut and replanted with shortleaf pine.

There are site-specific Silviculture BMPs and Wildlife BMPs when using clearcuts, particularly in wetlands and SMZs. The size and shape of clearcuts should be considered if wildlife and aesthetics are also objectives. 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.

**Chipping**

Another form of timber harvest in the Panhandle is chipping. Material is felled and skidded conventionally, then run through an industrial chipping machine at the loading deck, with chips being hauled to the mill rather than tree-length. 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.

Hardwood and pine tree-length pulpwood can be hauled as clean chips, which 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 Panhandle 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 landowner 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 financially break-even. Fuelwood or clean-chipping can be used where a debris-free post-harvest site is required. For example, fuelwood chipping can be used as part of site preparation for groundcover restoration projects.

Shortleaf pine stands present opportunities for fuelwood chipping operations such as reducing overstocked natural regeneration in two-aged and uneven-aged stands or hardwood reduction.
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. 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 should be made following careful evaluation.

Salvage harvest operations can be used in shortleaf pine stands. For example, a widespread littleleaf disease infection may require a salvage clearcut.

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 plants, 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 shortleaf pine sites and the appropriate site preparation techniques should be selected to adequately control it. Vegetative competition will need to be controlled prior to planting to achieve successful establishment. With adequate site preparation, shortleaf pine will survive and quickly initiate vertical growth.

Chemical Site Preparation

Herbicide should be 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 should be 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.

There are site-specific Silviculture BMPs and Wildlife BMPs related to site preparation, particularly in wetlands and SMZs.

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 shortleaf pine.

Bedding is used on flat, wet shortleaf pine 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 how wet the site is. 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, bulldozers, or, more commonly, skidding machines, depending on horsepower requirements and site conditions.

**Roller drum chopping** is used on various shortleaf pine flatwoods sites to reduce woody and herbaceous plant competition. There are various sizes of roller drum choppers with various lengths of blades. The appropriate equipment should be 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 saw-palmetto-gallberry site with a full drum.

Choppers are pulled behind farm tractors, bulldozers, or, more commonly, skidding machines, depending on horsepower requirements and site conditions.

**Scalping** and **ripping or 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 and reducing root damage from insects and other root pathogens.

Ripping or subsoiling is used in compacted soils like those found in pastures and old field sites, particularly those on clay soils.

**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.

**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.

**Harrowing or 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.

**Shearing** involves a heavy bulldozer equipped with an oversized V-blade that shears off stumps and any 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. This can also be used during groundcover restoration or converting clearcut timber to pasture or crops.

**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, or prescribed fire site preparation.

**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 or early fall once fuels have cured and prior to winter planting.

**Artificial Regeneration**

Artificial regeneration follows clearcutting. Reference Table 3 for a comparison summary of the advantages and disadvantages of artificial and natural regeneration.

Planting density is an important consideration and dependent on: landowner objectives, budget, site conditions, cost-share requirements, and other factors. The soil productivity, hydrology, and natural community should be evaluated during artificial regeneration planning. A density should be selected that meets primary objectives such as timber, wildlife, aesthetics, and recreation. If timber management is an objective, a relatively higher density should be selected.

If timber management is not an objective, lower planting densities may 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, which will never develop into tall, straight, well-formed trees. 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. Distance between rows is often determined by equipment sizes needed to maintain the planting. Spacing of trees
within each row is based on desired trees per acre. However, a random or natural pattern can be established using hand planting.

High survival rates depend on selecting appropriate species for the site, adequate site preparation, suitable planting method, proper care of quality seedlings, and natural factors such as climate and pests. A seedling survival check should be conducted following the first growing season to determine if the stand was successfully established, to document initial stocking, and to decide if supplemental planting is required to achieve desired stocking.

Although the State of Florida has no regulation regarding survival standards, attaining survival rates of 90 percent or higher with shortleaf pine 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.

Hand Planting vs. Machine Planting

Any of the planting methods can be used to plant shortleaf pine.

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 the Panhandle and is costly, especially hardwoods. Pond and bald cypress are available in traditional, "cell" containerized form, while hardwood seedlings generally start in larger, one to three gallon containers for landscaping markets. Hardwoods are more commonly planted on a smaller scale, focusing on wildlife management, such as 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.

Containerized vs. Bare Root

Per the Shortleaf Pine Initiative, there are no Florida nurseries that sell shortleaf pine seedlings. However, they are available in Georgia and Alabama.

Containerized seedlings are considered higher quality and have average higher survival rates, but they 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 (or "reefer"). Shortleaf seedlings are available with various genetic improvements, such as growth rate, form, and disease resistance. Improved, containerized shortleaf pine seedlings are more expensive than bare root seedlings and are preferred if planting budget allows. Orders can be placed early summer to ensure needs are met and avoid delays in planting.

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

Both should be planted as soon as possible after lifting, stored in a reefer, and kept under seedling tarps in the shade prior to planting.
Hand, flatwoods, and V-blade planting methods can be used to plant all the Panhandle pine species, bare root, or containerized.

Afforestation

The Panhandle region of Florida has a long history of agricultural production such as tobacco and cotton. Both industries have faded in recent decades, causing land-use conversions to timber and cattle production. Although not common practice, shortleaf pine can be planted on old field and pasture sites within the Panhandle.

Many of these sites were heavily fertilized or grazed and still contain high nutrient loads, especially those with heavy clay soils. This causes many longleaf, slash, and loblolly stands to develop poor form, excessive limbs and forks, and a high occurrence of fusiform rust. This effect tends to be localized and more severe on heavy soils and where cattle were fed. However, shortleaf is not as vulnerable to fusiform rust so this effect may be less severe in shortleaf planted on these sites. 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 or ripping (subsoiling) as discussed in the site preparation section.

Natural Regeneration

Pine, hardwood, and cypress stands can be naturally regenerated to meet various objectives, including uneven-aged management. This section will focus on pine, as cypress and hardwood management are less common in 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 3 for general information on pine natural regeneration and a comparison between this method and artificial regeneration.

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

Existing shortleaf pine stands can be naturally regenerated to meet various objectives, including two-aged and uneven-aged management and aesthetics. Some natural shortleaf 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.

Shortleaf pine produces seed annually which usually peaks in October. Bumper cone crops occur every three to six years. Planning for natural regeneration of shortleaf pine should entail evaluating the cone crop the prior spring and carefully timed site preparation prior to fall seed catch. Natural regeneration of shortleaf requires careful planning and coordination.

Site Preparation

Site preparation options are the same between pine natural regeneration methods and are similar to site preparation for artificial regeneration. 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. A combination of site preparation methods can be combined with prescribed fire to achieve natural regeneration sooner.

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

Shelterwood

Shelterwood entails thinning a stand to approximately 30 to 40 square feet per acre of basal area or about 20 to 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. Seed trees should be the highest quality in terms of crown size, form, and health or vigor. Seedling growth may be slightly lower compared to seed tree method if seed trees are retained, which is optional, following successful stand establishment.
Seed Tree

The seed tree method is most commonly used to naturally regenerate shortleaf pine. The seed tree method is similar to shelterwood except stands are thinned to a slightly lower basal area of approximately 10 to 30 square feet per acre or about 10 to 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 or vigor. Seedling growth may be slightly higher compared to shelterwood if seed trees are retained, which is optional following successful stand establishment.

Group Selection

The final method of natural regeneration is group selection, which is less commonly used to naturally regenerate shortleaf pine. These are small, quarter-acre to one-acre clearcuts interspersed throughout a stand. The size and shape of the clearcut 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.

5.5.3.3 Release

Early and mid-rotation release treatments can be used in shortleaf pine management within the Panhandle. 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 height and diameter growth and good form. Target vegetation includes herbaceous plants, grasses, non-crop pines, woody shrubs, and hardwood species. These treatments may take place in planted or natural pine stands. A merchantable thinning harvest is another form of release and is discussed in the timber harvest section.

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 should be applied based on the recommended release label rate for the target and crop species and site conditions. The appropriate herbicide and chemical release method should be selected to effectively target the primary woody and herbaceous 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

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 like 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 not be used mid-rotation.

Prescribed Fire

Prescribed fire can be used as an early rotation release in shortleaf pine stands once they can handle fire. Broadcast prescribed burning serves as a mid-rotation release in shortleaf stands.

Pre-merchantable 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 financially.
Merchantable thinning is a release treatment in older stands and discussed in the timber harvest section.

5.5.3.4 Prescribed Fire

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 shortleaf pine forests, mimicking historic natural fires. Without fire, shortleaf pine forests would gradually transition to hardwood forests in most cases.

Shortleaf pine is fire tolerant once the bark thickens and it reaches about 10 to 15 feet tall (depending on fuel load). Shortleaf pine forests should be prescribed burned every one to three years to maintain and restore the upland pine natural community in which it is dominant and to enhance wildlife habitat, improve aesthetics, reduce vegetative competition, reduce fuel loads, and stimulate rare plants.

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 than 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 species, including several rare species such as the red-cockaded woodpecker, which requires 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, improving outdoor recreational experiences and helping reduce the spread of tick-borne illnesses such as Lyme disease and Rocky Mountain spotted fever.

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 should be utilized initially until fuel loads are reduced, especially in long-unburned stands. Thick duff layers should be reduced slowly over time by only burning following precipitation when adequate soil moisture is present to avoid damaging feeder roots. Appropriate firing techniques should be selected with consideration for 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 for a burn that does not go as planned, which causes many landowners to avoid
prescribed burning. Landowners have the option to transfer that liability by hiring a state or private contractor to conduct their burning. Florida has strong prescribed fire statutes that protect safe, responsible prescribed burn managers (Wade and Lunsford 1989).

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 should at minimum 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.

Methods of Prescribed Fire

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.

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.

Pile Burns

Pile burning is a form of site preparation burning. Large post-harvest debris within clearcuts is 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.

Fire Return Intervals

Fire return interval is the frequency at which a burn 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.

Shortleaf pine stands should be prescribed burned every one to three years. This can be adjusted based on the factors listed in the previous paragraph.

Seasonality

Seasonality plays an important role in a prescribed fire program and should be carefully considered to help meet specific objectives. Seasonality should 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 a 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 through 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 should be 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.

Shortleaf pine can be prescribed burned year-round.

**Fire Weather**

One of the most important considerations in planning and conducting a prescribed burn is fire weather. Burn prescriptions should contain a section with desired, forecasted and actual fire weather for a burn unit. The U.S. Forest Service’s “*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.

**Temperature** is a major factor in RH, fire intensity, scorch potential, and 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** affect 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.
Common Panhandle Forest Types: Shortleaf Pine Dominant

5.5.4 Forest Resources

5.5.4.1 Fish and Wildlife

The forests and associated aquatic ecosystems of Florida’s Panhandle provide habitat for a wide array of game and non-game fish and wildlife, including several imperiled species (Table 2). These forests can be managed to enhance, restore, and protect the valuable habitats these species call home. These species may be managed for various objectives such as conservation or recreation. Present listed species should be documented, mapped, and monitored.

The Wildlife BMPs compile strategies and considerations for managing and protecting these species and their habitat during silvicultural operations, such as marking a rare plant or animal area with flagging, paint, or signage to protect during harvest operations, regular active monitoring, and following up with post-harvest inspections. The Silviculture BMPs also consider fish and wildlife conservation in relation to silvicultural activities.

Shortleaf pine forests provide habitat to hundreds of game and non-game species including bob-white quail, wild turkey, and deer. Shortleaf pine forests are home to several rare species including: gopher tortoise, eastern indigo snake, Bachman’s sparrow, and red-cockaded woodpecker (Table 2).

5.5.4.2 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
- **Chip-n-saw:** pine
- **Saw timber:** pine
- **Poles and pilings:** pine
- **Mulch:** hardwood
- **Fuelwood:**
  - Pine, hardwood, and large woody shrub species
  - Chips for energy production
- **Hardwood**
  - Firewood
- **Other hardwood products:** pallets, mats, small-diameter saw timber for furniture

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 shortleaf pine forests including pulpwood, chip-n-saw, saw timber, and poles. Longleaf forests also allow for fuelwood harvests, especially utilizing natural regeneration and hardwood reduction treatments.

Shortleaf pine is commonly managed for lower-value, short-rotation products such as pulpwood. It is also managed for all the other pine products.

5.5.4.3 Non-Timber Forest Products

Many NTFP opportunities exist within shortleaf pine forests, including silvopasture, beekeeping, and saw palmetto drupe harvests.

**Silvopasture**

Shortleaf pine 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 saw timber) 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 consider silvopasture cost-sharable through 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).

Honey

Beekeeping and honey production are common within shortleaf 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. Or it may be a hobby 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 is considered a valuable industry by the FDACS. In order to protect this industry from pests and unwanted species of honey bees, they require beekeepers to register honey bee colonies through their website.

Fruits

Saw palmetto drupes are harvested from shortleaf pine forests to a lesser degree than slash, longleaf pine, and sand pine forests. 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 should 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.

Palmetto drupes are a primary dietary staple of Florida black bear (Ursus americanus) (Dobey et al 2005) and provide valuable nutrition to raccoon (Procyon lotor), gray fox (Urocyon cinereoargenteus), gopher tortoise (Gopherus polyphemus), opossums (Didelphis marsupialis), white-tailed deer (Odocoileus virginianus), wild turkey (Meleagris gallopavo), bob-white quail (Colinus virginianus), feral hog (Sus scrofa), 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.

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.

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
5.6 Upland Mixed Hardwood-Pine

Upland Mixed Hardwood-Pine (UMHP) is a combination of uneven-aged, natural forest types which include multiple upland natural communities. Refer to Table 5 for a listing of the common dominant overstory species by associated FNAI natural community comprising UMHP. For this table, the natural community types and their respective species composition were found within the FNAI Natural Community Guide, which was then associated with the UMHP forest type.

The natural communities within UMHP are each similar in silvicultural operability to other xeric sites in Florida. The associated natural communities include: slope forest, upland hardwood forest, dry upland hardwood forest, xeric hammock, upland mixed woodland, and upland pine. Two of these natural communities are typically pure hardwood (upland hardwood forest and xeric hammock) while the remaining four are variably mixed with pine (Table 5). Only the upland pine natural community is dominated by pine. This section will focus on the hardwood component of the five 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 or dependent, aside from upland pine and upland mixed woodland. Each has a closed canopy except upland pine and some upland mixed woodlands.

5.6.1 Landowner Objectives Summary

5.6.1.1 Aesthetics

Upland mixed hardwood-pine forests have high-quality, varying aesthetics across the natural communities that compose this forest type. The overstory diversity provides character and variety compared to the pine-dominated forests. Most UMHP forests provide rare opportunities in Florida for fall foliage colors. Slope forests provide relatively steep topography and vegetation that are indicative of the Piedmont or Appalachian regions of the United States. Most uplands in Florida are pine dominated and even-aged, and provide their own type of beauty, but these UMHP forests are less common, natural, uneven-aged, and possess a lot of character. These aesthetic characteristics often provide Panhandle landowners incentives to exclude silvicultural management in these forests, especially those presently in desired future condition. Thus, UMHP forests are often solely preserved for their regionally 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 UMHP stands, a strip of hardwoods can be left as a buffer against adjacent high-visibility areas such as roadways or neighboring homes.

5.6.1.2 Wildlife Habitat Management and Protection

The UMHP forest type and its associated natural communities provide excellent wildlife habitat management and protection opportunities. Many game and imperiled species can be found within UMHP forests.

Active management of game species is more common on private lands while non-game species are managed to a lesser extent.

Hunting is a common wildlife management objective in the UMHP forest type, particularly for white-tailed deer, wild turkey, and gray squirrel. Hunting leases are used to manage healthy game populations while also generating revenue to help pay for management activities such as NNIS.

UMHP habitat objectives can be met with various silvicultural tools, such as creating small group selection clearcuts for wildlife openings to diversify habitat and creating beneficial edge effects. Many game and non-game species of UMHP forests will benefit from these activities, including white-tailed deer and wild turkey.

5.6.1.3 Recreation

UMHP forests are popular recreational areas in Florida, especially in the cooler months. The open, park-like stand structure, often with rolling hills, provides a scenic backdrop for any of the following recreational activities:

- Hunting and leases
- Bicycling
- Equestrian
- Camping
- Environmental education
- Geocaching
- Off-highway vehicles (OHV) and leases
- Wildlife viewing and birding
- Hiking
### Table 5. Common dominant overstory tree species for Upland Mixed Hardwood-Pine forest type by associated FNAI natural community.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Slope Forest</th>
<th>Upland Hardwood Forest</th>
<th>Dry Upland Hardwood Forest</th>
<th>Xeric Hammock</th>
<th>Upland Mixed Woodland</th>
<th>Upland Pine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loblolly pine</td>
<td>Pinus taeda</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Spruce pine</td>
<td>Pinus glabra</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shortleaf pine</td>
<td>Pinus echinata</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Longleaf pine</td>
<td>Pinus palustris</td>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>Laurel oak</td>
<td>Quercus laurifolia</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Live oak</td>
<td>Quercus virginiana</td>
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<td></td>
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<td>X</td>
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<tr>
<td>Sand live oak</td>
<td>Quercus virginiana var. geminata</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Chapman's oak</td>
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<td></td>
<td></td>
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<td>Turkey oak</td>
<td>Quercus laevis</td>
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<td>Bluejack oak</td>
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<td>Southern red oak</td>
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<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>Pignut hickory</td>
<td>Carya glabra</td>
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<td>Water hickory</td>
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<td>Mockernut hickory</td>
<td>Carya tomentosa</td>
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<td>American beech</td>
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<td>Florida maple</td>
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<td>Magnolia</td>
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<td>Quercus shumardii</td>
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</tr>
<tr>
<td>Sugarberry</td>
<td>Celtis laevigata</td>
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<td></td>
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<td>X</td>
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<tr>
<td>Swamp chestnut oak</td>
<td>Quercus michauxii</td>
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<td></td>
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<td>X</td>
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<tr>
<td>Horse sugar</td>
<td>Symlocos tingctoria</td>
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<td></td>
<td></td>
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<td>X</td>
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<tr>
<td>Flowering dogwood</td>
<td>Cornus florida</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Dependent (Fire Return Interval)</td>
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<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes (2-20)</td>
<td>Yes (1-3)</td>
<td></td>
</tr>
</tbody>
</table>
5.6.1.4 Conservation

The UMHP forest type 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.

5.6.1.5 Ecological Restoration

Natural regeneration can be conducted to restore these UMHP forests. Hydrological restoration can also assist in ecological restoration of these forests.

5.6.1.6 Hydrological Protection and Restoration

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.

Existing forest roads should be properly maintained through grading, pulling ditches, installing culverts, hard surface low water crossings, turnouts, and water bars as needed. Limit new road construction. Old windrows and beds can be leveled to improve hydrology but should be avoided if more overall harm will be done to the ecosystem than good (e.g., groundcover impacts).

5.6.1.7 Forest Health Management

UMHP forests are generally not intensively managed and, as such, minor mortality caused by native diseases and insects are typically not a major concern. If a major mortality incident occurs, it should be evaluated and addressed. Major native insect and disease damage is species and site specific and should evaluated by a forester.

Non-native invasive species should be monitored and treated. See the Non-native invasive species section.

5.6.1.8 Revenue

UMHP provides a wide array of revenue opportunities including timber, NTFP, non-forest associated land uses, and many others.

5.6.2 Landscape Objectives

5.6.2.1 Wildlife Habitat Management

UMHP forests provide habitat for game and non-game species at the landscape scale.

5.6.2.2 Utilization of Prescribed Fire

Most UMHP forests are not fire dependent (aside from upland mixed woodland and previously discussed upland pine) or managed with prescribed fire.

5.6.2.3 Rare Plant and Animal Protection

The Florida Panhandle is home to many rare species found only in this region and contains several global populations. Many plant species found in the Panhandle are the only occurrences in Florida, with the next closest occurrence hundreds of miles north in Appalachia. UMHP forests provide vital habitat to many imperiled plant and animal species. Table 2 shows the imperiled species found in the Panhandle by forest type. This table was created using Florida’s imperiled species management plan occurrences within FNAI natural community types. These natural community types found within the FNAI Natural Community Guide were then associated with each forest type. Additional information on current listing status for each species can be found in the geodatabase.

5.6.3 Silvicultural Options

5.6.3.1 Timber Harvest

The following silvicultural and land management tools are available to Florida Panhandle 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 should 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 in order to efficiently and effectively meet landowner objectives.
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 or 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. Historical and cultural resource protection and recreation management are also considered during planning and active silvicultural operations.

In comparison to the pine-dominated upland forest types, these upland mixed pine-hardwood forests have relatively low timber productivity and value and generally are not actively managed silviculturally. However, silvicultural opportunities exist within UMHP.

Soils, productivity, and timber quality vary greatly across these hardwood sites. UMHP forests produce mostly low-value products such as hardwood pulpwood and fuelwood.

UMHP 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.

Thinning
Thinning UMHP forests is not commonly practiced in the Panhandle. 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 natural regeneration method.

Thinning is a primary land management tool used in the Panhandle 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 SMZs.

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 the 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, and maintaining overstory composition.

Natural regeneration harvests are discussed in the reforestation section.

Clearcut
Clearcutting is the standard silvicultural practice in managing UMHP for timber and other objectives. This is primarily driven by timber markets and economics, not silviculture and tree biology.

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 to be replanted with the appropriate pine species.

There are site-specific Silviculture BMPs and Wildlife BMPs when using clearcuts, particularly in wetlands and SMZs. The size and shape of clearcuts should be considered if wildlife and aesthetics are also objectives. 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.

Chipping
Another form of timber harvest in the Panhandle 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. 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.
Common Panhandle Forest Types: Upland Mixed Hardwood-Pine

Hardwood and pine tree-length pulpwood can be hauled as **clean chips**, which 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 Panhandle 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 landowner 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 regeneration or tree density in overly stocked stands. This avoids pre-merchantable thinning costs and will generate revenue or financially break-even. Fuelwood or clean-chipping can be used where a debris-free post-harvest site is required.

**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. 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 should be made following careful evaluation.

Salvage harvest operations can be used in UMHP stands. For example, widespread wind throw may require a salvage clearcut. Or various native and non-native **forest health** issues may call for a salvage harvest in UMHP.

5.6.3.2 **Reforestation**

**Natural Regeneration**

UMHP stands can be naturally regenerated to meet various objectives, including uneven-aged timber management, timber stand improvement, wildlife, and aesthetics. UMHP species can coppice and are generally clearcut and regenerated in this manner. High-graded hardwood stands can be clearcut and naturally regenerated to essentially start over by improving timber quality and aesthetics. **Pre-merchantable thinning** is often required in natural regeneration management regimes and is discussed in the **release** treatment section.

**Site Preparation**

A carefully timed natural regeneration harvest typically serves as site preparation when naturally regenerating UMHP stands. For example, a clearcut can be regenerated through coppice. Other forms of **site preparation** previously discussed may also be utilized.

**Thinning from Above**

Thinning from above can be used to release existing natural regeneration in UMHP. This method entails removing all or part of the dominant overstory trees, releasing the suppressed natural regeneration already in place within the midstory. This method requires carefully planned logging operations as to not destroy the desired trees being released during overstory harvest.
Shelterwood

Shelterwood entails thinning a UMHP stand to a lower density, allowing seed trees to naturally regenerate the site. Shelterwood allows for a more uniform coverage of natural regeneration across a stand. Natural regeneration is sheltered by a higher density of seed trees. Seed trees should be the highest quality in terms of crown size, form, and health or vigor. Seedling growth may be slightly lower compared to seed tree method if seed trees are retained, which is optional, following successful stand establishment.

Seed Tree

The seed tree method is similar to shelterwood except stands are thinned to a slightly lower density. Seed trees should be the highest quality in terms of crown size, form, and health or vigor. Seedling growth may be slightly higher compared to shelterwood if seed trees are retained, which is optional following successful stand establishment.

Group Selection

The final method of natural regeneration is group selection. These are small, quarter-acre to one-acre clearcuts interspersed throughout a stand. The size and shape of the clearcut is critical to ensure adequate seed coverage. If they are too large, the interior portions may not regenerate adequately. Group selections can be conducted independently or made in combination with a stand-wide thinning. Group selections can be beneficial to wildlife since they create edge and a juxtaposition of habitat.

Aside from the upland pine natural community, which has been discussed in the longleaf, loblolly, and shortleaf pine sections, UMHP forests are not artificially regenerated in Florida’s Panhandle at a significant scale warranting discussion.

5.6.3.3 Release

Early and mid-rotation release treatments are uncommon but can be used in UMHP management within the Panhandle. Chemical and mechanical are the two primary types of treatments used to release hardwoods from vegetative competition and promote timber production through increased height and diameter growth and good form. Target vegetation includes herbaceous plants, grasses, non-crop tree species, and woody shrubs. A merchantable thinning harvest is another form of release and is discussed in the timber harvest section.

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 should be applied based on the recommended release label rate for the target and crop species and site conditions. The appropriate herbicide and chemical release method should be selected to effectively target the primary woody and herbaceous vegetative competition.

These early and mid-rotation methods include:

- Ground
  - Broadcast or banded
    - Skidder, farm tractor, or ATV-mounted sprayers
  - Spot: hack and squirt or individual tree injections
    - ATV or backpack sprayers
- Aerial
  - Broadcast
  - Helicopter

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 not be used mid-rotation.

Pre-merchantable Thinning

Pre-merchantable thinnings are common in overstocked, naturally regenerated UMHP 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 financially.
5.6.3.4 Prescribed Fire

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. UMHP forests with an adequate pine component will carry fire. Pure hardwood stands only entirely burn within narrow fire weather conditions.

5.6.4 Forest Resources

5.6.4.1 Fish and Wildlife

The forests and associated aquatic ecosystems of Florida's Panhandle provide habitat for a wide array of game and non-game fish and wildlife, including several imperiled species (Table 2). These forests can be managed to enhance, restore, and protect the valuable habitats these species call home. These species may be managed for various objectives such as conservation or recreation. Present listed species should be documented, mapped, and monitored.

The Wildlife BMPs compile strategies and considerations for managing and protecting these species and their habitat during silvicultural operations, such as marking a rare plant or animal area with flagging, paint, or signage to protect during harvest operations, regular active monitoring, and following up with post-harvest inspections. The Silviculture BMPs also consider fish and wildlife conservation in relation to silvicultural activities.

UMHP forests provide habitat to hundreds of game and non-game species including wild turkey, white-tailed deer, and gopher tortoise. UMHP forests are home to several rare species including: gopher frog, eastern indigo snake, and Southeastern American kestrel (Table 2).

5.6.4.2 Timber Products

Timber merchantability, whether planted or natural, pine, or hardwood, depends 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
- Saw timber: pine and hardwood
- Poles and pilings: pine
- Mulch: hardwood and cypress
- Fuelwood:
  - Pine, hardwood, and large woody shrub species
    » Chips for energy production
  - Hardwood
    » Firewood
- Other hardwood products: pallets, mats, small-diameter saw timber for furniture

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 UMHP forests including pulpwood, chip-n-saw, saw timber, and fuelwood. UMHP forests are commonly managed for hardwood pulpwood, various pine products, and fuelwood.

5.6.4.3 Non-Timber Forest Products

NTFP opportunities exist within UMHP forests, including beekeeping and saw palmetto drupe harvests.

Honey

Beekeeping and honey production can be practiced in UMHP forests. However, other forest types are typically more desirable due to sparse flowering in UMHP. 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. Or it may be a hobby 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 is considered a valuable industry by the FDACS. In order to protect this industry from pests and unwanted species of honey bees, they require beekeepers to register honey bee colonies through their website.

**Fruits**

**Saw palmetto drupes** are harvested from some UMHP forests, but to a much lesser extent than any of the pine forests. 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 should 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.

Palmetto drupes are a primary dietary staple of Florida black bear (*Ursus americanus*) (Dobey et al 2005) and provide valuable nutrition to raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), gopher tortoise (*Gopherus polyphemus*), opossums (*Didelphis marsupialis*), white-tailed deer (*Odocoileus virginianus*), feral hog (*Sus scrofa*), 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.

Blueberry, blackberry, and other native fruits grow in UMHP forests but are not commercially harvested from forest settings. However, landowners may consume for personal use.

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**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

**5.7 Cypress-Gum Dominant: Ponds and Stringers**

Cypress-gum ponds and stringers (CGPS) 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 and Wildlife 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.
5.7.1 Landowner Objectives Summary

5.7.1.1 Aesthetics

CGPS have high-quality aesthetics. Cypress and gums both have 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. These aesthetic reasons often provide Panhandle landowners incentives to not silviculturally manage these forests.

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 CGPS stands, a strip of trees can be left as a buffer against adjacent high-visibility areas such as roadways or neighboring homes.

5.7.1.2 Wildlife Habitat Management and Protection

The CGPS forest type and its associated natural communities provide wildlife habitat management and protection opportunities. Many game and imperiled species can be found within CGPS forests.

Active management of game species is more common on private lands while non-game species are managed to a lesser extent.

Hunting is a common wildlife management objective in the CGPS forest type, particularly for wood ducks and gray squirrel. Hunting leases are used to manage healthy game populations while also generating revenue to help pay for management activities such as NNIS management.

CGPS habitat objectives can be met with various silvicultural tools. For example, clearcuts can be used to create beneficial edge effects and diversify habitat. Many game and non-game species of CGPS forests will benefit from these activities, including white-tailed deer and wild turkey.

5.7.1.3 Recreation

CGPS forests can be popular recreational areas in Florida, especially in the cooler months when biting insects subside. The cypress and gum trees provide a unique backdrop for the following recreational activities:

- Hunting and leases
- Environmental education
- Wildlife viewing and birding
- Hiking (boardwalks)
- Geocaching

5.7.1.4 Conservation

The CGPS forest type 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.

5.7.1.5 Ecological Restoration

Natural regeneration and small-scale artificial regeneration can be conducted to restore these CGPS forests. Large-scale artificial regeneration of cypress or gums is economically unviable and undesirable for most landowners. Hydrological restoration can also assist in ecological restoration of these forests.

5.7.1.6 Hydrological Protection and Restoration

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.

Existing forest roads should be properly maintained through grading, pulling ditches, installing culverts, hard surface low water crossings, turnouts, and water bars as needed. Limit new road construction. Old windrows and beds can be leveled to improve hydrology but should be avoided if more overall harm will be done to the ecosystem than good (e.g., groundcover impacts).
5.7.1.7 Forest Health Management

CGPS forests are generally not intensively managed and, as such, minor mortality caused by native diseases and insects are typically not a major concern. If a major mortality incident occurs, it should be evaluated and addressed. Major native insect and disease damage is species and site specific and should be evaluated by a forester.

The ambrosia beetle-borne laurel wilt disease is decimating red bay in this and other wetland forests. It can only be slowed by actions such as limiting transport of firewood. This disease will likely eventually eliminate most red bay trees.

Non-native invasive species should be monitored and treated. See the NNIS section.

5.7.1.8 Revenue

CGPS pine provides revenue opportunities including timber, NTFP, and non-forest associated land uses.

5.7.2 Landscape Objectives

5.7.2.1 Wildlife Habitat Management

CGPS forests provide habitat for game and non-game species at the landscape scale.

5.7.2.2 Utilization of Prescribed Fire

CGPS are not fire dependent. See prescribed fire section for more information.

5.7.2.3 Rare Plant and Animal Protection

The Florida Panhandle is home to many rare species found only in this region and contains several global populations. Many plant species found in the Panhandle are the only occurrences in Florida, with the next closest occurrence hundreds of miles north in Appalachia. CGPS forests provide vital habitat to many imperiled plant and animal species. Table 2 shows the imperiled species found in the Panhandle by forest type. This table was created using Florida’s imperiled species management plan occurrences within FNAI natural community types. These natural community types found within the FNAI Natural Community Guide were then associated with each forest type. Additional information on current listing status for each species can be found in the geodatabase.

5.7.3 Silvicultural Options

5.7.3.1 Timber Harvest

The following silvicultural and land management tools are available to Florida Panhandle 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 should 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 in order to efficiently and effectively meet landowner objectives.

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 or habitat, aquatic ecosystems, and air and water quality, during silvicultural operations. Silvicultural BMPs apply to: timber harvest, site preparation, reforestation, and forest operations (roads, water control structures, etc.) activities. Historical and cultural resource protection and recreation management are also considered during planning and active silvicultural operations.

In comparison to the pine-dominated upland forest types, these CGPS forests have relatively low timber productivity and value and generally are not actively managed for silviculture on most private lands. However, silvicultural opportunities exist within CGPS.

CGPS occur on relatively unproductive organic muck, heavy clay, wet sand, and peat soils. They are inundated most of the year and harvest windows are narrowed to dryer months (generally April through June and September through October) and droughts. UMHP 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.

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. CGPS allows the flexibility to manage
for timber while also meeting aesthetic and wildlife objectives.

**Thinning**

Thinning CGPS forests is not commonly practiced in the Panhandle. Cypress and gums produce low-value products and it is not economically viable to manage these forests through thinning. Though uncommon, silviculturally CGPS forests may be thinned to favor quality cypress.

**Clearcut**

Clearcutting is the standard silvicultural practice in managing CGPS for timber and other objectives. This is primarily driven by timber markets and economics, as well as silviculture and tree biology. Cypress and gums both coppice and should be cut above the stem mean water mark to allow for successful regeneration.

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

Timing and seasonality are crucial in wetlands and wet upland sites. There are site-specific Silviculture BMPs and Wildlife BMPs when using clearcuts, particularly in wetlands and SMZs. The size and shape of clearcuts should be considered if wildlife and aesthetics are also objectives. Non-clearcut buffers or “beauty strips” can be used along roads and highways to reduce negative aesthetics associated with clearcuts.

**Chipping**

Another form of timber harvest in the Panhandle 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. 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.

Hardwood and pine tree-length pulpwood can be hauled as clean chips, which 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 Panhandle 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 landowner 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 regeneration or tree density in overly stocked stands. This avoids pre-merchantable thinning costs and will generate revenue or financially break-even. Fuelwood or clean-chipping can be used where a debris-free post-harvest site is required.

CGPS stands present opportunities for fuelwood chipping operations as an alternative to hauling tree-length.

**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, which 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. 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 should be made following careful evaluation.
Salvage harvest operations can be used in CGPS pine stands. For example, a stand replacing wildfire may occur in a CGPS stand during drought and the impacted timber can be salvaged.

5.7.3.2 Reforestation

Natural Regeneration

Site Preparation

A carefully timed natural regeneration harvest typically serves as site preparation when naturally regenerating CGPS stands. For example, a clearcut can be regenerated through coppice. Other forms of site preparation previously discussed may also be utilized.

CGPS stands can be naturally regenerated to meet various objectives, including timber management, timber stand improvement, wildlife, and aesthetics. CGPS species can coppice and are generally clearcut and regenerated in this manner. High-graded CGPS stands can be clearcut and naturally regenerated to essentially start over by improving timber quality and aesthetics. *CGPS forests are not artificially regenerated in Florida’s Panhandle at a significant scale worth discussion.*

5.7.3.3 Prescribed Fire

CGPS 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.

5.7.4 Forest Resources

5.7.4.1 Fish and Wildlife

The forests and associated aquatic ecosystems of Florida's Panhandle provide habitat for a wide array of game and non-game fish and wildlife, including several imperiled species (*Table 2*). 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* or *recreation*. Present listed species should be documented, mapped, and monitored.

The *Wildlife BMPs* compile strategies and considerations for managing and protecting these species and their habitat during silvicultural operations, such as marking a rare plant or animal area with flagging, paint, or signage to protect during harvest operations, regular active monitoring, and following up with post-harvest inspections. The *Silviculture BMPs* also consider fish and wildlife conservation in relation to silvicultural activities.

CGPS forests provide habitat to hundreds of game and non-game species including wood ducks, white-tailed deer, and Sherman’s fox squirrel. CGPS forests are home to several rare species including: gray bat, American alligator, and Panama City crayfish (*Table 2*).

5.7.4.2 Timber Products

Timber *merchantability*, whether planted or natural, pine or hardwood, depends 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
- Saw timber: pine and cypress
- Poles and pilings: pine
- Mulch: cypress, hardwood
- Fuelwood:
  - Pine, hardwood, and large woody shrub species
    - Chips for energy production
  - Hardwood
    - Firewood
- Other hardwood products: pallets, mats, small-diameter saw timber for furniture
Timber is considered **pre-merchantable** if it is not marketable as one of the products above. The following timber product groups can be harvested from CGPS forests: hardwood pulpwood, cypress mulch, saw timber, and fuelwood. CGPS forests are commonly managed for lower-value products such as hardwood, pulpwood, and cypress mulch.

### 5.7.4.3 Non-Timber Forest Products

NTFP opportunities exist within CGPS forests, including beekeeping and cypress knees.

**Cypress Knees**

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

**Honey**

Beekeeping and honey production can be done CGPS forests. However, other forest types are typically more desirable due to sparse flowering in CGPS and longer hydroperiod. 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. Or it may be a hobby 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 is considered a valuable industry by the FDACS. In order to protect this industry from pests and unwanted species of honey bees, they require beekeepers to register honey bee colonies through their website.

**Fruits**

Blueberry, blackberry, and other native fruits grow in CGPS forests but are not commercially harvested from forest settings. However, landowners may consume for personal use.

### 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

### 5.8 Mixed Bottomlands: Hardwood-Pine-Cypress

Mixed bottomlands are a combination of forest types, which include 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 or dependent and each has a closed canopy.

The associated natural communities include: floodplain swamp, bottomland forest, and alluvial forest. Refer to Table 6 for a listing of the common dominant overstory species by associated FNAI natural community. For this table, the natural community types and their respective species composition were found within the [FNAI Natural Community Guide](#), which was then associated with the mixed bottomlands 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](#).
Common Panhandle Forest Types: Mixed Bottomlands

Table 6. Common dominant overstory tree species for Mixed Bottomlands forest type by associated FNAI natural communities.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Floodplain Swamp Usually Inundated</th>
<th>Bottomland Forest Occasionally Inundated</th>
<th>Alluvial Forest Inundated Growing Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cypress</td>
<td><em>Taxodium distichum</em></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loblolly pine</td>
<td><em>Pinus taeda</em></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Spruce pine</td>
<td><em>Pinus glabra</em></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Atlantic white cedar</td>
<td><em>Chamaecyparis thyoides</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tupelo</td>
<td><em>Nyssa spp.</em></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Yellow poplar</td>
<td><em>Liriodendron tulipifera</em></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Sweetbay magnolia</td>
<td><em>Magnolia virginiana</em></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Sweetgum</td>
<td><em>Liquidambar styraciflua</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red maple</td>
<td><em>Acer rubrum</em></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Water oak</td>
<td><em>Quercus nigra</em></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Laurel oak</td>
<td><em>Quercus laurifolia</em></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Overcup oak</td>
<td><em>Quercus lyrata</em></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Water hickory</td>
<td><em>Carya aquatica</em></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Green ash</td>
<td><em>Fraxinus pennsylvanica</em></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>American elm</td>
<td><em>Ulmus americana</em></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Water locust</td>
<td><em>Gleditsia aquatica</em></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>River birch</td>
<td><em>Betula nigra</em></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Source: FNAI Natural Community Guide

5.8.1 Landowner Objectives Summary

5.8.1.1 Aesthetics

Mixed bottomlands have high-quality aesthetics across the natural communities that compose this riverine-associated forest type. The highlight for most landowners are the rivers, creeks, and streams that punctuate mixed bottomlands’ overstory diversity and uneven-aged structure. Most mixed bottomlands provide rare opportunities in Florida for viewing fall foliage. These aesthetic reasons alone often provide Panhandle landowners incentives to not silviculturally manage these forests. They are often solely preserved for their regional uniqueness, 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 mixed bottomlands stands, a strip of trees can be left as a buffer against adjacent high-visibility areas, such as roadways or neighboring homes.

5.8.1.2 Wildlife Habitat Management and Protection

The mixed bottomlands forest type and its associated natural communities provide wildlife habitat management and protection opportunities. Many game and imperiled species can be found within these forests.

Active management of game species is more common on private lands while non-game species are managed to a lesser extent.
Hunting is a popular wildlife management objective in the mixed bottomlands forest type, particularly for wood ducks, gray squirrel, and white-tailed deer. Hunting leases are used to manage healthy game populations while also generating revenue to help pay for management activities such as NNIS management.

Mixed bottomland habitat objectives can be met with various silvicultural tools. For example, clearcuts can be used to create beneficial edge effects and diversify habitat. Many game and non-game species of mixed bottomlands will benefit from these activities including white-tailed deer, wild turkey, and wood stork.

5.8.1.3 Recreation

Mixed bottomland forests can be popular recreational areas in Florida, especially in the cooler months when biting insects subside. Their overstory diversity and water features provide a unique backdrop for the following recreational activities:

- Hunting and leases
- Environmental education
- Wildlife viewing and birding
- Hiking (boardwalks)
- Geocaching

5.8.1.4 Conservation

The mixed bottomlands forest type 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.

5.8.1.5 Ecological Restoration

Natural regeneration and small-scale artificial regeneration can be conducted to restore these mixed bottomland forests. Large-scale artificial regeneration of hardwoods is economically unviable for most Panhandle landowners. Hydrological restoration can also assist in ecological restoration of these forests.

5.8.1.6 Hydrological Protection and Restoration

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.

Existing forest roads should be properly maintained through grading, pulling ditches, installing culverts, hard surface low water crossings, turnouts, and water bars as needed. Limit new road construction. Old windrows and beds can be leveled to improve hydrology but should be avoided if more overall harm will be done to the ecosystem than good (e.g., groundcover impacts).

5.8.1.7 Forest Health Management

Mixed bottomlands are generally not intensively managed and, as such, minor mortality caused by native diseases and insects are typically not a major concern. If a major mortality incident occurs, it should be evaluated and addressed. Major native insect and disease damage is species and site specific and should evaluated by a forester.

The ambrosia beetle-borne laurel wilt disease is decimating red bays in this and other wetland forests. It can only be slowed by such actions as limiting transport of firewood. This disease will likely eventually eliminate most red bay trees.

Non-native invasive species should be monitored and treated. See the NNIS section.

5.8.1.8 Revenue

Mixed bottomlands provide revenue opportunities including timber and NTFP and eco-tourism.

5.8.2 Landscape Objectives

5.8.2.1 Wildlife Habitat Management

Mixed bottomlands provide habitat for game and non-game species at the landscape scale.

5.8.2.2 Utilization of Prescribed Fire

Mixed bottomlands are not fire dependent. See prescribed fire section for more information.

5.8.2.3 Rare Plant and Animal Protection

Mixed bottomlands provide vital habitat to many imperiled plant and animal species. Table 2 shows the
imperiled species found in the region by forest type. The Panhandle is home to many species only found in this region and contains several global populations. Many plant species found in the Panhandle are the only occurrences in Florida, with the next closest occurrence hundreds of miles north in Appalachia. Additional information on current listing status for each species can be found in the geodatabase.

5.8.3 Silvicultural Options

5.8.3.1 Timber Harvest

The following silvicultural and land management tools are available to Florida Panhandle 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 should 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 in order to efficiently and effectively meet landowner objectives.

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 or habitat, aquatic ecosystems, and air and water quality, during silvicultural operations. Silvicultural BMPs apply to: timber harvest, site preparation, reforestation, and forest operations (roads, water control structures, etc.) activities. Historical and cultural resource protection and recreation management are also considered during planning and active silvicultural operations.

In comparison to the pine-dominated upland forest types, mixed bottomlands have relatively low timber productivity and value and generally are not actively managed for silviculture on most private lands. However, silvicultural opportunities exist within mixed bottomlands.

Mixed bottomlands occur on relatively unproductive organic muck, heavy clay, wet sand, and peat soils. They are saturated or inundated much of the year and harvest windows are narrowed to dryer months (April through June and September through October) and droughts. Mixed bottomlands produce mostly low-value products such as hardwood pulpwood and fuelwood.

Mixed bottomlands are typically managed even-aged. Mixed bottomlands allow the flexibility to manage for timber while also meeting aesthetic and wildlife objectives.

Thinning

Thinning mixed bottomlands is not commonly practiced in the Panhandle. They produce low-value products and it is not economically viable to manage these forests through thinning.

Clearcut

Clearcutting is the standard silvicultural practice in managing mixed bottomlands for timber and other objectives. This is primarily driven by timber markets, economics, and hydrology. Mixed bottomland hardwood species coppice and should be cut above the stem mean water mark to allow for successful regeneration.

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

Timing and seasonality are crucial in wetlands and wet upland sites. Mat logging is generally required to minimize soil and hydrological impacts to mixed bottomlands. There are site-specific Silviculture BMPs and Wildlife BMPs when using clearcuts, particularly in wetlands and SMZs. The size and shape of clearcuts should be considered if wildlife and aesthetics are also objectives. Non-clearcut buffers or “beauty strips” can be used along roads and highways to reduce negative aesthetics associated with clearcuts.

Chipping

Another form of timber harvest in the Panhandle 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. 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.

Hardwood and pine tree-length pulpwood can be hauled as clean chips, which have a similar stumpage price as pulpwood. Clean chips are derived from nearly pure, living wood with very little vegetation and debris.
Mixed bottomlands present opportunities for fuelwood chipping operations as an alternative to hauling tree-length.

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, which 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. 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 should be made following careful evaluation.

Salvage harvest operations can be used in mixed bottomlands. For example, a tornado may occur in a mixed bottomland stand and the impacted timber can be salvaged.

5.8.3.2 Reforestation

Natural Regeneration

Site Preparation

A carefully timed natural regeneration harvest typically serves as site preparation when naturally regenerating mixed bottomland stands. For example, a clearcut can be regenerated through coppice. Other forms of site preparation previously discussed may also be utilized.

Mixed bottomland stands can be naturally regenerated to meet various objectives, including uneven-aged timber management, timber stand improvement, wildlife, and aesthetics. Mixed bottomland hardwood species can coppice and are generally clearcut and regenerated in this manner. High-graded mixed bottomlands 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 mixed bottomlands, but this is less common in Florida.

Mixed bottomland forests are not artificially regenerated in Florida’s Panhandle at a significant scale worth discussion.

5.8.3.3 Prescribed Fire

Mixed bottomlands 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.
5.8.4 Forest Resources

5.8.4.1 Fish and Wildlife

The forests and associated aquatic ecosystems of Florida’s Panhandle provide habitat for a wide array of game and non-game fish and wildlife, including several imperiled species (Table 2). 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 or recreation. Present listed species should be documented, mapped, and monitored.

The Wildlife BMPs compile strategies and considerations for managing and protecting these species and their habitat during silvicultural operations, such as marking a rare plant or animal area with flagging, paint, or signage to protect during harvest operations, regular active monitoring, and following up with post-harvest inspections. The Silviculture BMPs also consider fish and wildlife conservation in relation to silvicultural activities.

Mixed bottomlands provide habitat to hundreds of game and non-game species including wood ducks, whitetailed deer, and Barbour’s map turtle. Mixed bottomland forests are home to several rare species including: limpkin, bog frog, blackmouth shiner, and Chipola slabshell (Table 2).

5.8.4.2 Timber Products

Timber merchantability, whether planted or natural, pine or hardwood, depends 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
- Chip-n-saw: pine
- Saw timber: pine and hardwood
- Poles and pilings: pine
- Mulch: cypress, hardwood

- Fuelwood:
  - Pine, hardwood, and large woody shrub species
    - Chips for energy production
  - Hardwood
    - Firewood
- Other hardwood products: pallets, mats, small-diameter saw timber for furniture

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 mixed bottomland forests including pine and hardwood pulpwood, chip-n-saw, saw timber, and poles. Mixed bottomlands also allow for fuelwood harvests, especially utilizing natural regeneration and hardwood reduction treatments.

Mixed bottomland forests are commonly managed for hardwood pulpwood, various pine products, and fuelwood.

5.8.4.3 Non-Timber Forest Products

NTFP opportunities exist within mixed bottomlands, including beekeeping and fruits.

Honey

Beekeeping and honey production are practiced in mixed bottomland 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. Or it may be a hobby 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 in Florida’s Panhandle. Upland and wetland forests are marketable for apiary leases; however, this is not particularly lucrative and often done by bartering honey for leased land.

Tupelo honey is one of the highest quality, most desirable, and unique honeys in the world. Florida’s Apalachicola River basin and adjacent mixed bottomland forests are the world’s production capital of this highly-prized honey. This is due to the area’s high concentration of the scarce Ogeechee tupelo (Nyssa ogeche) (Burns and Honkala 1990). Uplands with pine and hardwood forests also produce quality saw palmetto, gallberry, and wildflower honeys.
Beekeeping and honey production is considered a valuable industry by the FDACS. In order to protect this industry from pests and unwanted species of honey bees, they require beekeepers to register honey bee colonies through their website.

Fruits

Saw palmetto drupes are harvested from some mixed bottomland forests, but to a much lesser extent than any of the pine forests. 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 should 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.

Palmetto drupes are a primary dietary staple of Florida black bear (Ursus americanus) (Dobey et al 2005) and provide valuable nutrition to raccoon (Procyon lotor), gray fox (Urocyon cinereoargenteus), gopher tortoise (Gopherus polyphemus), opossums (Didelphis marsupialis), white-tailed deer (Odocoileus virginianus), wild turkey (Meleagris gallopavo), bob-white quail (Colinus virginianus), feral hog (Sus scrofa), 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 mixed bottomland forests and is often made into a jelly and sold commercially. Blueberry, blackberry, and other native fruits grow in this forest type but are not commercially harvested from forest settings. However, landowners may consume for personal use.

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

5.9 Mixed Forested Wetland

Mixed forested wetland (MFW) is a combination of forest types, which include multiple wetland natural communities that are primarily still water depressions or lowlands and not associated with rivers or creeks. Each is relatively similar in silvicultural operability and hydrology. These are uneven-aged, natural forested wetlands with varying hydroperiods. They are not fire tolerant or dependent and each has a closed canopy. MFWs typically have dense over-, mid-, and understories and are sometimes impenetrable.

The associated FNAI natural communities include: basin swamp, baygall, and hydric hammock. Refer to Table 7 for a listing of the common dominant overstory species by associated FNAI natural community. For this table, the natural community types and their respective species composition were found within the FNAI Natural Community Guide, which was then associated with the MFW 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.
Table 7. Common dominant overstory species for Mixed Forested Wetland forest type by associated FNAI natural communities.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Basin Swamp</th>
<th>Baygall</th>
<th>Hydric Hammock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pond cypress</td>
<td>Taxodium ascendens</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Slash pine</td>
<td>Pinus elliottii</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Swamp tupelo</td>
<td>Nyssa sylvatica var. biflora</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Swamp bay</td>
<td>Persea palustris</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lobolly bay</td>
<td>Gordonia lasianthus</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Sweetbay</td>
<td>Magnolia virginiana</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Black titi</td>
<td>Cliftonia monophylla</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holly</td>
<td>Ilex spp.</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Sweetgum</td>
<td>Liquidambar styraciflua</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>American elm</td>
<td>Ulmus americana</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Water oak</td>
<td>Quercus nigra</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Live oak</td>
<td>Quercus virginiana</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Laurel oak</td>
<td>Quercus laurifolia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugarberry</td>
<td>Celtis laevigata</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Red maple</td>
<td>Acer rubrum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabbage palm</td>
<td>Sabal palmetto</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Redcedar</td>
<td>Juniperus virginiana</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green ash</td>
<td>Fraxinus pennsylvanica</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>American hornbeam</td>
<td>Carpinus caroliniana</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

5.9.1 Landowner Objectives Summary

5.9.1.1 Aesthetics

MFW are not known for their aesthetics. Silvicultural tools can be used to maintain and enhance aesthetics. Forest operations may be planned with aesthetics in mind to ensure these objectives are met. For example, when clearcutting MFW, a strip of trees can be left as a buffer against adjacent high-visibility areas, such as roadways or neighboring homes.

5.9.1.2 Wildlife Habitat Management and Protection

The MFW and its associated natural communities provide wildlife habitat management and protection opportunities. Many game and imperiled species can be found within MFW forests.

Active management of game species is more common on private lands while non-game species are managed to a lesser extent.

Many wildlife use these dense, often impenetrable wetlands for cover.

Hunting is a popular wildlife management objective in the MFW forest type, particularly for feral hogs, gray squirrel, and white-tailed deer. Hunting leases are used to manage healthy game populations while also generating
Common Panhandle Forest Types: *Mixed Forested Wetland*

**5.9.1.3 Recreation**

MFW forests are not popular recreational areas due to difficult access, poor aesthetics, and high occurrence of biting insects. However, the following recreational opportunities exist:

- Hunting and leases
- Environmental education
- Wildlife viewing and birding
- Hiking (boardwalks)
- Geocaching

**5.9.1.4 Conservation**

The MFW forest type 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.

**5.9.1.5 Ecological Restoration**

Natural regeneration and small-scale artificial regeneration can be conducted to restore these MFW forests. Large-scale artificial regeneration of hardwoods is economically unviable for most Panhandle landowners. Hydrological restoration can also assist in ecological restoration of these forests.

**5.9.1.6 Hydrological Protection and Restoration**

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.

Existing forest roads should be properly maintained through grading, pulling ditches, installing culverts, hard surface low water crossings, turnouts, and water bars as needed. Limit new road construction. Old windrows and beds can be leveled to improve hydrology but should be avoided if more overall harm will be done to the ecosystem than good (e.g., groundcover impacts).

**5.9.1.7 Forest Health Management**

MFW are generally not intensively managed and, as such, minor mortality caused by native diseases and insects are typically not a major concern. If a major mortality incident occurs, it may be evaluated and addressed. Major native insect and disease damage is species and site specific and should be evaluated by a forester.

The ambrosia beetle-borne laurel wilt disease is decimating red bays in this and other wetland forests. It can only be slowed by such actions as limiting transport of firewood. This disease will likely eventually eliminate most red bay trees.

Non-native invasive species should be monitored and treated. See the NNIS section.

**5.9.1.8 Revenue**

MFW provide revenue opportunities including timber and NTFP.

**5.9.2 Landscape Objectives**

**5.9.2.1 Wildlife Habitat Management**

MFW provide habitat for game and non-game species at the landscape scale.

**5.9.2.2 Utilization of Prescribed Fire**

MFW are not fire dependent. See prescribed fire section for more information.

**5.9.2.3 Rare Plant and Animal Protection**

MFW provide vital habitat to many imperiled plant and animal species. Table 2 shows the imperiled species found in the region by forest type. The Panhandle is home to many species only found in this region and contains several global populations. Many plant species found in the Panhandle are the only occurrences in Florida, with the next closest occurrence hundreds of miles north in...
Appalachia. Additional information on current listing status for each species can be found in the geodatabase.

5.9.3 Silvicultural Options

5.9.3.1 Timber Harvest

The following silvicultural and land management tools are available to Florida Panhandle natural 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 should 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 in order to efficiently and effectively meet landowner objectives.

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 or habitat, aquatic ecosystems, and air and water quality, during silvicultural operations. Silvicultural BMPs apply to: timber harvest, site preparation, reforestation, and forest operations (roads, water control structures, etc.) activities. Historical and cultural resource protection and recreation management are also considered during planning and active silvicultural operations.

In comparison to the pine-dominated upland forest types, these MFW have relatively low timber productivity and value and generally are not actively managed for silviculture on most private lands. However, silvicultural opportunities exist within MFW.

MFW occur on relatively unproductive organic muck, heavy clay, wet sand, and peat soils. They are saturated or inundated much of the year and harvest windows are narrowed to dryer months (April through June and September through October) and droughts. MFW produce mostly low-value products such as hardwood pulpwood and fuelwood.

MFW are typically managed even-aged. MFW allow the flexibility to manage for timber while also meeting aesthetic and wildlife objectives.

**Thinning**

Thinning MFW is not commonly practiced in the Panhandle. They produce low-value products and it is not economically viable to manage these forests through thinning.

**Clearcut**

Clearcutting is the standard silvicultural practice in managing MFW for timber and other objectives. This is primarily driven by timber markets, economics, and hydrology. MFW hardwood species coppice and should be cut above the stem mean water mark to allow for successful regeneration.

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

Timing and seasonality are crucial in wetlands and wet upland sites. Mat logging is generally required to minimize soil and hydrological impacts. There are site-specific Silviculture BMPs and Wildlife BMPs when using clearcuts, particularly in wetlands and SMZs. The size and shape of clearcuts should be considered if wildlife and aesthetics are also objectives. Non-clearcut buffers or “beauty strips” can be used along roads and highways to reduce negative aesthetics associated with clearcuts.

**Chipping**

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

Hardwood and pine tree-length pulpwod can be hauled as clean chips, which have a similar stumpage price as pulpwod. 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 Panhandle 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 landowner 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.

MFW present opportunities for fuelwood chipping operations as an alternative to hauling tree-length.

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 including 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. 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 should be made following careful evaluation.

Salvage harvest operations can be used in MFW. For example, a stand replacing wildfire may occur in a MFW stand and the impacted timber can be salvaged.

5.9.3.2 Reforestation

Natural Regeneration

Site Preparation

A carefully timed natural regeneration harvest typically serves as site preparation when naturally regenerating MFW stands. For example, a clearcut can be regenerated through coppice. Other forms of site preparation previously discussed may also be utilized.

Coppice

MFW stands can be naturally regenerated to meet various objectives, including uneven-aged timber management, timber stand improvement, wildlife, and aesthetics. MFW hardwood species can coppice and are generally clearcut and regenerated in this manner. High-graded MFW 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 mixed forested wetlands, but this is less common in Florida.

MFW forests are not artificially regenerated in Florida's Panhandle at a significant scale worth discussion.

5.9.3.3 Prescribed Fire

MFW 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.

5.9.4 Forest Resources

5.9.4.1 Fish and Wildlife

The forests and associated aquatic ecosystems of Florida's Panhandle provide habitat for a wide array of game and non-game fish and wildlife, including several imperiled species (Table 2). 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 or recreation.
Present listed species should be documented, mapped, and monitored.

The Wildlife BMPs compile strategies and considerations for managing and protecting these species and their habitat during silvicultural operations, such as marking a rare plant or animal area with flagging, paint, or signage to protect during harvest operations, regular active monitoring, and following up with post-harvest inspections. The Silviculture BMPs also consider fish and wildlife conservation in relation to silvicultural activities.

MFW provide habitat to hundreds of game and non-game species including feral hogs, white-tailed deer, and alligator snapping turtle. MFW forests are home to several rare species including wood stork, bluenose shiner, Panama City crayfish, and alligator snapping turtle.

5.9.4.2 Timber Products

Timber merchantability, whether planted or natural, pine or hardwood, depends 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
- Saw timber: pine, cypress, and hardwood
- Poles and pilings: pine
- Mulch: cypress, hardwood
- Fuelwood:
  - Pine, hardwood, and large woody shrub species
    - Chips for energy production
  - Hardwood
    - Firewood
- Other hardwood products: pallets, mats, small-diameter saw timber for furniture

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 MFW including hardwood and pine pulpwood, chip-n-saw, saw timber, and poles. MFW also allow for fuelwood harvests, especially utilizing natural regeneration and hardwood reduction treatments.

MFW are commonly managed for lower-value products such as hardwood pulpwood and fuelwood.

5.9.4.3 Non-Timber Forest Products

NTFP opportunities exist within MFW, including beekeeping and fruits.

Honey

Beekeeping and honey production are practiced in MFW. However, other forest types are typically more desirable due to difficult access, sparse flowering, and longer hydroperiod in MFW. 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. Or it may be a hobby 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 is considered a valuable industry by the FDACS. In order to protect this industry from pests and unwanted species of honey bees, they require beekeepers to register honey bee colonies through website.

Fruits

Blueberry, blackberry, and other native fruits grow in MFW but are not commercially harvested from forest settings. However, landowners may consume for personal use.

Other Current and Potential NTFP Markets

- Medicinal Native Plants
  - St. John's Wort
- Other Edible Products
  - Nuts
  - Mushrooms
- Ornamental Products
Common Panhandle Forest Types: *Mixed Forested Wetland*

- Spanish Moss
- Pine Tips for Garlands
- Pine Cones
- Grapevines
- Burl and Crooked Wood

- Landscape Products
  - Pine Bark Mulches
  - Palm Trees
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Resources


References


The following terms are used in this LMP. Definitions are drawn from the glossaries and programming associated with the AFF Standards of Sustainability, the FSP, and other sources, as identified by the Support Committee.

**Acre**
An area of land measuring 43,560 square feet. A square 1-acre plot measures 208.7 feet by 208.7 feet; a circular acre has a radius of 117.75 feet.

**Adaptive Management**
A dynamic approach to forest management in which the effects of treatments and decisions are monitored and used to modify management on a continuing basis to ensure that objectives are being met (Helms, et al., *The Dictionary of Forestry*, Society of American Foresters, 1998).

**Adverse Regulatory Actions**
Written warnings, citations or fines issued by law enforcement or regulatory bodies.

**Amphibian**
Any of a class of vertebrates that regulate their body temperature externally; lay shell-less eggs in wet areas; live in water during early development and live both in water and on land as adults; and use lungs, gills, and their skin for breathing. Most have four legs and smooth, moist skin without scales.

**Angiosperm**
A plant that has true flowers and bears its seeds in fruits. In temperate zones, many angiosperms are deciduous trees while in tropical zones, many are evergreen trees. Examples include oaks, willows, maples, and birches.

**Annual Ring**
The combination of one earlywood layer (light colored) and one latewood layer (dark colored) seen in a cross-section of a tree. One annual ring usually represents one year of growth.

**Artificial Regeneration**
The growth of new trees through seeding and planting.

**Bark**
The tough exterior covering of a woody root or stem that protects the tree from injury caused by insects and other animals, by other plants, by disease and by fire.

**Best Management Practices**
Procedures employed during harvesting or timber stand improvement activities that reduce erosion and prevent or control water pollution.

**Biltmore Stick**
A stick similar to a yardstick in appearance, but usually about 25 inches long. One side is scaled to read a tree’s diameter by holding the stick horizontally at arm’s length and against the tree at breast height. A Merritt hypsometer runs along one edge of the stick and is scaled to read a tree’s height from 66 feet away from the tree’s base. These two measurements are then used to find the tree’s volume according to the volume table printed on one face of the stick.

**Biodiversity**
The variety and abundance of life forms, processes, functions and structures of plants, animals, and other living organisms, including the relative complexity of species, communities, gene pools, and ecosystems at spatial scales that range from local through regional to global (Helms, et al., *The Dictionary of Forestry*, Society of American Foresters, 1998).

**Bird**
Any of a class of vertebrates that regulate their body temperature internally, have bodies that are covered almost entirely with feathers, and have forelimbs modified as wings that enable most to fly.

**Board Foot**
A unit of measure equal to a board that is 1-inch thick, 12-inches long, and 12-inches wide, or 144 cubic inches.

**Bole**
The main trunk of a tree.

**Broadleaf**
A class of trees that have broad, flat leaves of many different shapes; most are deciduous; also called hardwood because most broad-leaved trees have harder wood than do conifers. Examples include oak, hickory, maple, and ash.
Glossary of Forestry Terms

**Buffer Strip**
A narrow zone or strip of land, trees, or vegetation bordering an area. Common examples include visual buffers, which screen the view along roads, and streamside buffers, which are used to protect water quality. Buffers may also be used to prevent the spread of forest pests.

**Cambium**
A thin layer of specialized cells within a tree’s trunk that divide to produce new inner bark cells to the outside and new sapwood cells to the inside. The narrow band of cells that is responsible for the tree’s growth in circumference.

**Canopy**
The “roof” of the forest formed by the crowns of the tallest trees.

**Carrying Capacity**
The maximum number of healthy wildlife that a given habitat or area can support without degradation of the habitat.

**Cellulose**
The scientific name for wood fiber.

**Chain**
A distance of 66 feet.

**Clearcut**
A harvesting and regeneration method that removes all trees within a given area. Most commonly used in pine and hardwood forests that require full sunlight to regenerate and grow efficiently.

**Clinometer**
An instrument that is held at eye level to read stump height and merchantable or total height when standing 50 and 66 feet from the base of the tree. The difference between the two readings yields the height.

**Competition**
The struggle between trees to obtain sunlight, nutrients, water, and growing space. Every part of the tree, from the roots to the crown, competes for space and food.

**Complaint**
Labor complaints are those with formal documentation filed through a state’s fair labor practices board or similar body.

**Conifer**
A class of trees that are evergreen, have needle or scale-like foliage and cone-like fruit; often called softwood. Examples include pine, hemlock, cedar, and cypress.

**Conservation**
Planned management and wise use of natural resources for present and future generations.

**Cord**
A standard unit of measure equivalent to 128 cubic feet of round or split wood. A standard cord measures 4 feet by 4 feet by 8 feet. A face cord or short cord is 4 feet by 8 feet by any length of wood under 4 feet.

**Cover**
(a) Any plant that intercepts rain drops before they reach the soil or that holds soil in place; (b) a hiding place or vegetative shelter for wildlife from predators or inclement weather.

**Crown**
The branches and foliage at the top of a tree.

**Cruise**
A survey or inventory of forestland to locate timber and estimate its quantity by species, products, size, quality, or other characteristics.

**Deciduous**
A group of trees that lose all of their leaves every year.

**Decomposition**
The process by which organic material such as leaves and branches are broken down by bacteria, fungi, protozoans, and the many different kinds of animals that live in the soil.

**Dendrology**
The study of trees; tree identification.

**Desired Species**
Those species of flora and fauna designated in the landowner’s management plan and not known to cause negative impacts on the local environment.

**Designated Representative**
A person designated by a landowner to represent him or her. Designated representatives may include, but are not limited to, family members, trustees, property managers, qualified natural resource professionals, and lawyers.
**Diameter at Breast Height (DBH)**
Tree diameter measured at 4.5 feet above ground level.

**Diameter Tape**
A steel measuring tape that has a scale calibrated to read a tree's diameter when wrapped around the tree's circumference.

**Earlywood**
Wood cells produced at the beginning of a tree's growing season that are generally light in color. Also called springwood.

**Ecology**
The science or study of the relationships between organisms and their environment.

**Ecological Succession**
The gradual change of plant and animal communities over time.

**Ecosystem**
A loosely defined area consisting of numerous habitats.

**Edge**
The transition between two different types or ages of vegetation.

**Environment**
The sum of all external living and non-living conditions and influences that affect the development and survival of an organism.

**Erosion**
The wearing away or removal of land or soil by the action of wind, water, ice, or gravity.

**Even-Aged Management**
A forest management method used to produce stands that are all the same age or nearly the same age by harvesting all trees in an area at one time or in several cuttings over a short time. This management method is commonly applied to shade-intolerant conifers and hardwoods.

**Evergreen**
A group of trees that do not lose all of their leaves every year but go through a gradual replacement by dropping only their oldest leaves each year. Instead of being bare in winter, these trees have leaves all year.

**Foliage**
The leaves of a tree or other plant.

**Forage**
Vegetation such as leaves, stems, buds, and some types of bark that can be eaten for food and energy.

**Forb**
Any herb other than grass.

**Forest Floor**
The lowest level of the forest that is made up of tree seedlings, dead leaves and needles, grasses, ferns, flowers, fungi, and decaying plants and logs.

**Forest Health**
The perceived condition of a forest derived from consideration of such factors as its age, structure, composition, function, vigor, vitality, presence of unusual levels of insects or disease, and resilience to disturbance and a range of stressors.

**Forest Management**
Caring for a forest so that it stays healthy and vigorous and provides the products and values the landowner desires.

**Forest Products**
Goods and materials derived from the forest that are tangible and physical objects of biological origin. Such materials may include, but are not limited to, timber, fuelwood, fibers, biomass, leaves, fruit, grass, fungi, berries, resins, gums, animal parts, water, soil, gravel, stone, and other minerals on forestland. In addition, products may also include other quantifiable goods or services including carbon storage or water protection.

**Forests of Recognized Importance (FORI)**
Globally, regionally, and nationally significant large forest landscape areas of exceptional ecological, social, cultural or biological values. These forests are evaluated at the landscape level, rather than the stand level, and are recognized for a combination of unique values, rather than a single attribute.

**Forest Stewardship Plan (FSP)**
A written document listing activities that enhance or improve forest resources (wildlife, timber, soil, water, recreation, and aesthetics) on private land over a five-year period.
Glossary of Forestry Terms

**Forest Type**
A designation or name given to a forest based on the most abundant tree type or types in the stand; groups of tree species commonly growing in the same stand because their environmental requirements are similar.

**Forestry**
The art and science of managing forests to produce various products and benefits including timber, wildlife habitat, clean water, biodiversity, and recreation.

**Fuel Loading**
A buildup of easily ignited leaves, pine straw, branches, and trees on the forest floor.

**Group Selection**
(a) The removal of small groups of trees to regenerate shade-intolerant trees in the opening (usually at least a quarter acre); (b) a specific type of selective cutting.

**Gymnosperm**
A plant whose seeds are not enclosed in flowers. Most gymnosperms produce their seeds on the surface of the scales of female cones and are pollinated by wind. Conifers are the most common type of gymnosperm.

**Habitat**
An area in which a specific plant or animal naturally lives, grows, and reproduces; the area that provides a plant or animal with adequate food, water, shelter, and living space.

**Hardwoods**
Trees with broad, flat leaves as opposed to coniferous or needled trees. Wood hardness varies among the hardwood species, and some are actually softer than some softwoods.

**Heartwood**
The central core of a tree, which is made up of dense, dead wood and provides strength to the tree.

**High-Grading**
A harvesting technique that removes only the biggest and most valuable trees from a stand and provides high returns at the expense of future growth potential. Poor quality, shade-loving trees tend to dominate in continually high-graded sites.

**Hypsometer**
Any device used for measuring tree height.

**Increment Borer**
A hollow auger-like tool with a screw bit used to remove core samples from trees.

**Indicator**
Identifies specific actions or activities that demonstrate conformance.

**Integrated Pest Management (IPM)**
A pest control, suppression or prevention approach that utilizes a suite of complementary strategies including mechanical, biological, cultural, physical, genetic, and chemical approaches.

**Invasive Species**
Plants, animals, or pathogens that are non-native to the ecosystem under consideration and whose introduction causes or is likely to cause harm (USDA National Invasive Species Information Center, 2014).

**Landowner**
Entity that holds title to the property to be certified.

**Landowner’s Objectives**
The stated landowner desires, reasons for ownership, and potential activities that guide the management of the property.

**Latewood**
Wood cells produced at the end of the growing season that make up the darker section of an annual ring. Also called summerwood.

**Limiting Factor**
Any requirement for wildlife survival that is in limited supply.

**Mammal**
Any of a class of higher vertebrates whose bodies are covered with hair, who give birth to live young, nourish their young with milk from mammary glands, regulate their body temperature internally, have four types of well-developed teeth, and typically have four well-developed legs with toes that have nails, claws, or hoofs.
**Management Plan**
Documents that guide actions and that change in response to feedback and changed conditions, goals, objectives, and policies. Management plans may incorporate several documents including, but not limited to, harvest plans, activity implementation schedules, permits, research, etc. For the purposes of the American Tree Farm System® eligible management plans, plan amendments may include letters, notes, and other forms of informal updates in addition to formal plan revisions. The term “management plan” is inclusive of stewardship plans and other similar documents that describe resources, landowner objectives, and management strategies.

**Mast**
Fruits or nuts used as a food source by wildlife. Soft mast includes most fruits with fleshy coverings, such as persimmon, dogwood seed, or black gum seed. Hard mast refers to nuts such as acorns and beech, pecan, and hickory nuts.

**Multiple-Use Management**
The management of land or forest for more than one purpose, such as wood production, water quality, wildlife, recreation, aesthetics, and clean air.

**Natural Regeneration**
The growth of new trees in one of the following ways without human assistance: (a) from seeds carried by wind or animals; (b) from seeds stored on the forest floor; or (c) from stumps that sprout.

**Performance Measure**
Refines the standard’s intent and describes considerations and pathways for conformance.

**Pesticide**
Pesticides include chemicals commonly known as fungicides, herbicides, insecticides, and rodenticides.

**Phloem**
The part of a tree that carries sap from the leaves to the rest of the tree. Also called inner bark.

**Photosynthesis**
The process by which a plant or tree combines water and carbon dioxide with energy from the sun to make glucose and oxygen.

**Plant Succession**
The progression of plants from bare ground to mature forest.

**Prescribed Burning**
The practice of using regulated fires to reduce or eliminate material on the forest floor, for seedbed preparation or to control competing vegetation. Prescribed burning simulates one of the most common natural disturbances. Also called controlled burning.

**Prescribed Fire**

**Pulpwood**
Wood used in the manufacture of paper, fiberboard, or other wood fiber products. Pulpwood-sized trees are usually a minimum of 4 inches in diameter.

**Qualified Contractor**
Forest contractors who have completed recommended certification, licensing, training or education programs offered in their respective states.

**Qualified Natural Resource Professional**
A person who by training and experience can make forest management recommendations. Examples include foresters, soil scientists, hydrologists, forest engineers, forest ecologists, fishery and wildlife biologists, or technically trained specialists in such fields.

**Qualified ATFS Inspector**
A qualified natural resource professional who has completed ATFS-required training for certifying forested properties and is eligible to inspect properties on behalf of ATFS. ATFS requires all trained inspectors meet approved eligibility requirements.

**Reforestation**
Reestablishing a forest by planting or seeding an area from which forest vegetation has been removed.

**Release**
To free a tree from competition with its immediate neighbors by removing the surrounding trees. This occurs naturally and artificially.
Glossary of Forestry Terms

Renewable Resource
A naturally occurring raw material or form of energy that has the capacity to replenish itself through ecological cycles and sound management practices.

Reptile
Any of a class of vertebrates that regulates its body temperature externally, has dry, glandless skin covered with scales, breathes through lungs, and lays large eggs that develop on land.

Resin
A group of sticky liquid substances secreted by plants that appear on the plant’s external surface after a wound.

Roots
The underground portion of a tree that helps anchor the tree in the ground and absorbs water and nutrients from the soil.

Rotation
The number of years required to establish and grow trees to a specified size, product, or condition of maturity. A pine rotation may range from as short as 20 years for pulpwood to more than 60 years for saw timber.

Salvage Cut
The harvesting of dead or damaged trees, or the harvesting of trees in danger of being killed by insects, disease, flooding, or other factors in order to save their economic value.

Saw Timber
Wood of large enough size to be used to produce lumber for construction and furniture.

Scale
The extent of forest operations on the landscape or certified property.

Sedimentation
The deposition or settling of soil particles suspended in water.

Seed Tree Cut
A harvesting method in which a few scattered trees are left in the area to provide seeds for a new forest stand. Selection of seed trees is based on growth rate, form, seeding ability, wind firmness, and future marketability. This harvesting method produces an even-aged forest.

Selective Cutting
The periodic removal of individual trees or groups of trees to improve or regenerate a stand.

Serotinous
Refers to resinous coating on cones such that seeds are not released until resin is melted by fire.

Shade-Intolerant Species
Trees that require full sunlight to thrive and cannot grow in the shade of larger trees.

Shade-Tolerant Species
Trees that are able to grow in the shade of other trees and in competition with them.

Shall
Responsibilities or obligations that include the word “shall” are considered core elements that are required for certification under the American Tree Farm System.

Shelterwood Cut
Removing trees in the harvest area in a series of two or more cuttings so that new seedlings can grow from the seeds of older trees. This method produces an even-aged forest.

Should
Responsibilities or obligations that include the word “should” are directives that draw on personal and professional judgment of foresters, landowners, and assessors. These directives allow for latitude in implementation to the greatest practical extent in given circumstances and are justifiable in a third-party verification process.

Silviculture
The art, science, and practice of establishing, tending, and reproducing forest stands of desired characteristics. It is based on knowledge of species’ characteristics and environmental requirements.

Site Index
A relative measure of forest site quality based on the height (in feet) of the dominant trees at a specific age (usually 25 or 50 years, depending on rotation length). Site index information helps estimate future returns and land productivity for timber and wildlife.
Snag
A standing dead or dying tree.

Softwood
A tree belonging to the order Coniferales. Softwood trees are usually evergreen, bear cones, and have needles or scale-like leaves. Examples include pines, spruces, firs, and cedars. See conifer.

Special Sites
Those areas offering unique historical, archeological, cultural, geological, biological, or ecological value. Special sites include:

- Historical, archaeological, cultural, and ceremonial sites.
- Sites of importance to wildlife such as rookeries, refuges, fish spawning grounds, vernal ponds, and shelters of hibernating animals.
- Unique ecological communities such as springs, glades, savannas, fens, and bogs.
- Geological features such as terminal moraines, cliffs, and caves.
- Sites of importance to the landowner.

Species
A group of related organisms having common characteristics and capable of interbreeding. Loblolly and Virginia pine are common tree species that can interbreed.

Springwood
See earlywood.

Stand
A group of trees that are sufficiently the same in species composition and arrangement of age classes and condition so that they can be managed as a unit.

Standard
An overarching principle of sustainability.

State Forestry Best Management Practices (BMPs)
Forestry BMPs are generally accepted forest management guidelines that have been developed by state forestry agencies with broad public stakeholder input.

Streamside Management Zone (SMZ)
An area adjacent to a stream in which vegetation is maintained or managed to protect water quality.

Summerwood
See latewood.

Suppression
The process by which a tree loses its vigor due to inadequate light, water, and nutrients.

Sustainability

Sustainable Forest Management (SFM)
Sustainable forest management is a holistic approach defined as the stewardship and use of forests and forestland in a way and at a rate that maintains their biodiversity, productivity, regeneration capacity, vitality, and potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national and global levels, and does not cause damage to other ecosystems (Programme for the Endorsement of Forest Certification, Sustainable Forest Management, PEFC ST 1003:2010).

Thinning
A tree removal practice that reduces tree density and competition between trees in a stand. Thinning concentrates growth on fewer, high-quality trees, provides periodic income, and generally enhances tree vigor. Heavy thinning can benefit wildlife through the increased growth of ground vegetation.

Third-Party Assessor
A qualified natural resource professional who has completed ATFS-required training for third-party assessors and is contracted or employed by an International Accreditation Forum (IAF)-accredited certification body.

Threatened or Endangered
Defined and listed under the U.S. Endangered Species Act (ESA) and listed under applicable state or provincial laws as requiring protection.

Transpiration
The loss of water through leaves.
Glossary of Forestry Terms

**Tree Caliper**
A metal or wooden device consisting of an arm and two prongs one of which is free to slide along a graduated scale on the arm. The prongs are placed against opposite sides of a tree to read its diameter on the scale.

**Turpentine**
A distilled chemical produced from tapping into a living pine and harvesting the sap.

**Understory**
The area below the forest canopy that comprises shrubs, snags, and small trees. Because the understory receives little light, many of the plants at this level tolerate shade and will remain part of the understory. Others will grow and replace older trees that fall.

**Visual Quality Measures**
Modifications of forestry practices in consideration of public view, including timber sale layout, road, and log landing locations, intersections with public roadways, distributing logging residue, tree retention, timing of operations, and other factors relevant to the scale and location of the project.

**Wildlife**
A broad term that includes non-domesticated vertebrates, especially mammals, birds, and fish.

**Wood**
The solid interior of a tree.

**Xylem**
The part of a tree that transports water and nutrients up from the roots to the leaves. Older xylem cells become part of the heartwood. Also called sapwood.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Name</th>
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<tbody>
<tr>
<td>004 Form</td>
<td>ATFS Inspection Form</td>
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<tr>
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<td>Association of Consulting Foresters</td>
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<td>AFF</td>
<td>American Forest Foundation</td>
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<td>AFF Standards</td>
<td>AFF Standards of Sustainability</td>
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<td>ATFS</td>
<td>American Tree Farm System®</td>
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<td>BMP</td>
<td>Best Management Practice</td>
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<td>CGPS</td>
<td>Cypress-Gum Ponds and Stringers</td>
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<tr>
<td>DBH</td>
<td>Diameter at Breast Height</td>
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<tr>
<td>DLG</td>
<td>Digital Line Graph</td>
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<td>ECOS</td>
<td>Environmental Conservation Online System</td>
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<td>ESA</td>
<td>Endangered Species Act</td>
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<td>Efficient Transportation Decision Making</td>
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<td>FNAI</td>
<td>Florida Natural Areas Inventory</td>
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<td>FORI</td>
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<td>GPS</td>
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<td>International Accreditation Forum</td>
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<tr>
<td>IOBC</td>
<td>International Organization for Biological Control</td>
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<td>IPM</td>
<td>Integrated Pest Management</td>
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<td>KBDI</td>
<td>Keech-Byram Drought Index</td>
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<tr>
<td>LMP</td>
<td>Landscape Management Plan</td>
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<tr>
<td>MFW</td>
<td>Mixed Forested Wetland</td>
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<td>NFWF</td>
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<td>NGO</td>
<td>Non-Governmental Organization</td>
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<td>NNIP</td>
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<td>NRCS</td>
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<td>NRHP</td>
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<td>Non-Timber Forest Product</td>
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<td>OHV</td>
<td>Off-Highway Vehicle</td>
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<td>OSB</td>
<td>Oriented Strand Board</td>
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<td>PEFC™</td>
<td>Programme for the Endorsement of Forest Certification</td>
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<td>RH</td>
<td>Relative Humidity</td>
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<td>FDACS Best Management Practices for Silviculture</td>
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<td>Support Committee</td>
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<td>T&amp;E</td>
<td>Threatened or Endangered Species</td>
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<td>TNC</td>
<td>The Nature Conservancy</td>
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<tr>
<td>UF/IFAS</td>
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<td>UMHP</td>
<td>Upland Mixed Hardwood-Pine</td>
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