

AMERICAN TREE FARM SYSTEM®

# LANDSCAPE MANAGEMENT PLAN

State of Louisiana



**SOUTHERN  
FORESTRY**  
CONSULTANTS



# Landscape Management Plan Creation

## Plan Development and Composition

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

## Natural Resource Professional Support Committee

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

- [Louisiana Forestry Association](#)
- [Louisiana Department of Agriculture and Forestry](#)
- [Drax Biomass](#)
- [National Resource Conservation Service](#)

## Additional Stakeholders

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

- [National Wild Turkey Federation \(NWTF\)](#)
- [Louisiana State University College of Agriculture](#)
- [Theus, Grisham, Davis & Leigh, L.L.C.](#)
- [Pheasants Forever](#)
- [Louisiana Department of Wildlife and Fisheries](#)
- [United States Department of Agriculture](#)
- [Trailblazer Resource Conservation & Development](#)
- [The Nature Conservancy](#)
- [US Forest Service](#)
- [National Fish and Wildlife Foundation](#)
- [Quail Forever](#)
- [U.S. Fish and Wildlife Service](#)

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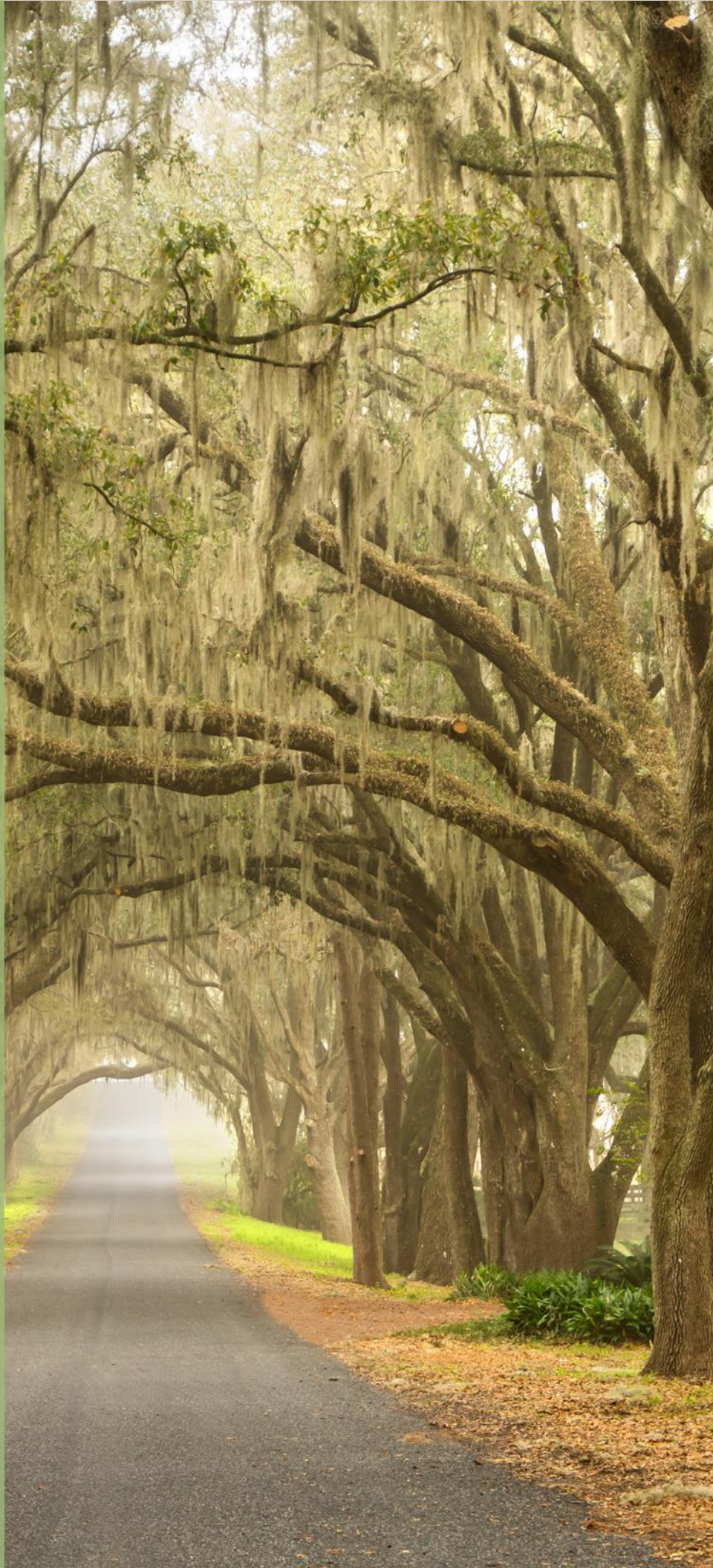
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# 1

## Introduction







## 1. INTRODUCTION

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

- Help family landowners overcome one of the biggest barriers to participating in forest certification and landowner assistance programs by eliminating the need for every landowner to develop and maintain an individual management plan.
- Support coordination of action on landscape-scale priorities across ownerships.
- Provide participating landowners with access to the benefits of the FSP and ATFS certification.
- Establish and strengthen relationships between landowners and their foresters.
- Be used by a diversity of forestry specialists, including LDAF district 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 Louisiana.
- 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 local forestry regulations that may not be addressed directly in this plan.

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



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

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

- [AFF 2015-2020 Standards of Sustainability for Forest Certification \(Standards\)](#)
- [Forest Stewardship Program \(FSP\) National Standards and Guidelines \(Standards\)](#)
- [Louisiana Forest Stewardship Program](#)
- Louisiana Wildlife Action Plan
- [Louisiana's Forest Action Plan](#) – National Priorities
- United States Department of Agriculture (USDA) National Woodland Owner Survey (NWOS) Results and Observations (Butler et al 2016)
- [Louisiana Department of Wildlife and Fisheries \(LDWF\) Best Management Practices for Scenic Rivers](#)
- [Louisiana Department of Agriculture and Forestry \(LDAF\) Recommended Forestry Best Management Practices for Louisiana](#)
- [National Register of Historic Places \(NRHP\)](#) and the [Louisiana Division of Historical Preservation \(LDHP\)](#)

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

## 1.1. Forest Resource Professionals

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

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

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



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

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

The [NRCS Louisiana Vendor List for Services and/or Products Supporting Conservation Practice Implementation](#) as well as the [Louisiana Certified Prescribed Burning Contractors List](#) are listings provided to assist landowners in finding forest management related service providers for implementation of forestry practices on their land. This database includes forest management consultants, tree seedling nurseries, and other vendors and forest product buyers.

## 1.2. Adaptive Management

All silvicultural options, management activities, and implementation measures provided in this LMP are predicated upon a narrow window of site, weather, time, and market conditions. Changes and variability associated with these conditions (especially weather and markets) can have significant impacts on the timing, feasibility, and success of all silvicultural implementation operations. For example, the decision of when and how to harvest timber could vary tremendously based on recent weather conditions and market conditions. A recent example of this need for adaptive management occurred in Florida and southern Georgia following the landfall of Hurricane Michael in 2018. An unprecedented storm for the panhandle of Florida and southern Georgia, Michael damaged an estimated 2.8 million acres of timber in Florida, 1 million acres in Georgia, and caused 95% damage to 34,000 acres within Bay, Calhoun, and Gulf counties in Florida; these damages amounted to approximately \$1.289 billion dollars in losses (Etters 2019). As these types of events can devastate the local timber industry, landowners may need to investigate assistance toward their recovery efforts in the form of available cost share programs. For example, the [Emergency Forest Restoration Program \(EFRP\)](#) offered by the USDA's Farm Service Agency (FSA) inspects land for eligible damage and provides payments to owners of private forests to restore qualified forests damaged by disasters. One example of this occurred recently in South Carolina following Hurricane Florence; the flooding caused by the storm destroyed many recently planted pine forests and washed out forest roads, bridges, and culverts. Available EFRP funds were used to reforest these planted stands and assist in the repair of forest infrastructure. The Georgia Department of Revenue in 2019 also began offering a [Timber Tax Credit](#) for eligible timber owners impacted by Hurricane Michael; other states offer similar programs and initiatives in the wake of natural disasters. Federal tax laws provide for casualty loss and income [tax considerations/deductions](#) as a result of natural disasters. State-specific programs should be sought to offset hurricane damage in every state affected.

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

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

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

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

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



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

## **STANDARD 1** Commitment to Practicing Sustainable Forestry

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

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

How the LMP Covers this Section:

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

## **STANDARD 2** Compliance with Laws

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

- Indicator 2.1.1 Landowner shall comply with all relevant laws, regulations and ordinances and will correct conditions that led to adverse regulatory actions, if any.

- Indicator 2.1.2 Landowner should obtain advice from appropriate qualified natural resource professionals or qualified contractors who are trained in, and familiar with, relevant laws, regulations and ordinances.

How the LMP Covers this Section:

All landowners certified under this LMP agree to meet all federal, state, and local regulations. Understanding that while mistakes may occur in carrying out forest management activities, landowners must be committed to correcting inadvertent violations. A pattern of willful violation of relevant laws, regulations or ordinances is not acceptable. If there is evidence of past nonconformance, then the landowner must show proof of a good-faith effort to remedy the nonconformance. If the matter is tied up in court, then the landowner is only disqualified when a final adverse judgment is rendered and the landowner refuses to comply with the ruling.

- Compliance with all relevant (applicable) laws can be verified by a three-tiered process:
  - Step 1 – Observation of conditions on the subject property
  - Step 2 – The landowner’s verbal or written claim of legal compliance
  - Step 3 – Research with the state Department of Natural Resources, local Natural Resource Conservation Service office or State Forestry Commission offices
  - If Step 1 and Step 2 do not raise any issues, then the qualified ATFS inspector or third-party assessor is not required to employ Step 3.

## **STANDARD 3** Reforestation and Afforestation

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

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

How the LMP Covers this Section:

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

## **STANDARD 4** Air, Water and Soil Protection

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

- **Indicator 4.1.1** Landowner shall implement specific state forestry BMPs that are applicable to the property.

- **Indicator 4.1.2** Landowner shall minimize road construction and other disturbances within riparian zones and wetlands.

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

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

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

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

How the LMP Covers this Section:

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

## **STANDARD 5** Fish, Wildlife, Biodiversity and Forest Health

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

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



- **Indicator 5.1.2** Forest management activities shall incorporate measures to protect identified threatened or endangered species on the property.

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

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

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

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

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

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

How the LMP Covers this Section:

- The LMP database provides valuable information about the fish, wildlife, biodiversity and forest health of the program area. The database includes spatial information about where there are known occurrences of threatened and endangered species, the regional soil types, and documented areas of invasive species incursion. Foresters and ATFS Inspectors can also use the database to include information specific to a Tree Farm regarding forest health, such as additional species composition information or treatment information.
- In addition to the information available in the LMP database, landowners operating under this LMP should walk their property with a qualified natural resource professional to identify occurrences of threatened and endangered species on or near their property. Landowners are also encouraged to work with natural resource professionals to identify possible occurrences of any disease, invasive species or pest outbreak on their property and discuss the range of recommended management techniques to address these issues. This LMP also outlines the variety of native and exotic pest species that landowners may interact with in this region, as well as tactics to address these issues.
- Integrated pest management (IPM) is an excellent approach to controlling, suppressing or preventing pests and can take many forms. Preventative measures, efforts to improve forest health or, in some other way, protect the property from injurious organisms are often the most practical and effective approaches. Pesticide applications may be used when other control measures are ineffective or impractical. While landowners and designated representatives are urged to take feasible actions to address pests, pathogens and unwanted vegetation, third-party assessors are advised that, in some cases, there may be no feasible options for controlling a pest or outbreak due to severity, scale and timing of onset. When herbicides are used, landowners are required to follow EPA regulations.

- When conducting prescribed burns, landowners operating under this LMP shall follow all state regulations and are encouraged to work with qualified professionals. Additional information about burning based on forest type is included in the following sections.
- Landowners are encouraged to maintain records of forestry related activities for at least three years.

## **STANDARD 6** Forest Aesthetics

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

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

How the LMP Covers this Section:

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

## **STANDARD 7** Protect Special Sites

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

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

How the LMP Covers this Section:

- Special sites of biological and geological significance may be identified through consultation undertaken related to the identification of FORIs and threatened or endangered species and communities (within Standard 5). In addition to publicly recognized special sites, landowners may designate sites of personal significance to them, such as a spot their grandparents cherished.
- Landowners or designated representatives shall identify special sites on management plan maps and, where appropriate, on the ground. However, some landowners may choose not to identify some special sites on a map or on the ground to protect these sites from vandalism or overuse. Landowners or designated representatives shall make efforts to protect any known special sites especially during forest management activities. These efforts may include creating a vegetation buffer, fencing the area or otherwise distinguishing it from surrounding areas. Because special sites are often in the ground, measures may be taken to control erosion and limit soil disturbance. Landowners and designated representatives are advised to review their special sites map and protection plan with qualified natural resource professionals and qualified contractors assisting in forest

management activities. After harvests, landowners and designated representatives are encouraged to follow up to ensure adequate protection.

## **STANDARD 8** Forest Product Harvest and Other Activities

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

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

**Performance Measure 8.2** Landowner shall monitor forest product harvests and other management activities (1, 2) 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 (1, 2).

How the LMP Covers this Section:

- When conducting forestry activities, landowners must ensure that their actions and those taken on their behalf are in conformance with both the landowner's objectives and the ATFS Standards. To safeguard landowners from liability risks and protect their assets, landowners are encouraged to work with qualified natural resource professionals and contractors and review the Standards before planning management activities. If the landowner's objectives do not specify directives as to harvest, utilization and removals, regional norms and accepted practices are expected.
- Examples of forestry activities requiring review for AFF Standards compliance:
  - Harvest operations including timber and nontimber products
  - Site preparation and reforestation
  - Forest road construction and maintenance
  - Mineral extraction
  - Hunting and fishing
  - Invasive species control
  - Pest management
- Landowners are encouraged to discuss liability issues with their insurance agent and their attorney to gain a perspective on appropriate insurance minimums that they might require of contractors. When agreeing upon the terms of the contract, landowners and designated representatives are encouraged to stipulate that contractors must follow all relevant laws and regulations and should specify that appropriate state forestry BMPs must be adhered to. A qualified natural resource professional can help with this process.



- Other contract specifications might include:
  - Protection of special sites or habitats
  - Adherence to labor laws
  - Requirements for adequate insurance
  - Protection of soil and water integrity
  - Residual tree damage
  - Forest road maintenance and restoration
  - Fence and gate protection and/or restoration
  - Litter control
  - Hazardous material spill prevention and clean-up
- Generally, landowners are encouraged to retain contracts or records for management activities for three years.

#### 1.4. Forest Stewardship Program Standards within the LMP

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

The FSP Standards were addressed and evaluated during the completion of this LMP. More specifically, in order to 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:

- Soil and water
- Biological diversity
- Range
- Agroforestry
- Aesthetic quality and desired Timber species
- Recreation
- Wood and fiber production
- Fish and wildlife
- Threatened and endangered species
- Forest health and invasive species
- Conservation-based estate planning / legacy planning information
- Archeological, cultural, and historic sites

- Wetlands
- Fire
- Carbon Sequestration & Climate Resilience
- Forests of Recognized Importance (FORI)

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

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

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

### Step 1 Preparing to Meet the Landowner

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

### Step 2 Meeting the Landowner

- Identifying Objectives:
  - Discuss the objectives of the landowner (during initial conversation and/or during onsite follow-up)
  - Probe each objective identified by the landowner to ensure you understand the underlying motivations and goals for the property. The landowner may have multiple objectives or difficulty articulating the objectives as they are described in the LMP. A clear understanding of the landowner's objectives streamlines the options needed to meet those objectives.
  - Review and suggest other objectives and how they may also meet the landowner underlying goals. This may initiate a re-evaluation of landowner objectives.
- Review and discuss potential landscape objectives (if applicable) to determine if any correlations or commonalities exist with the landowner's objectives to support wider conservation goals. The landowner may

be unaware or gain interest in specific landscape objectives, creating a re-evaluation of landowner objectives. Some landowners may not be interested or have objectives that share commonalities with landscape objectives. In either scenario, landowners are not required to commit to any landscape objectives or requirements.

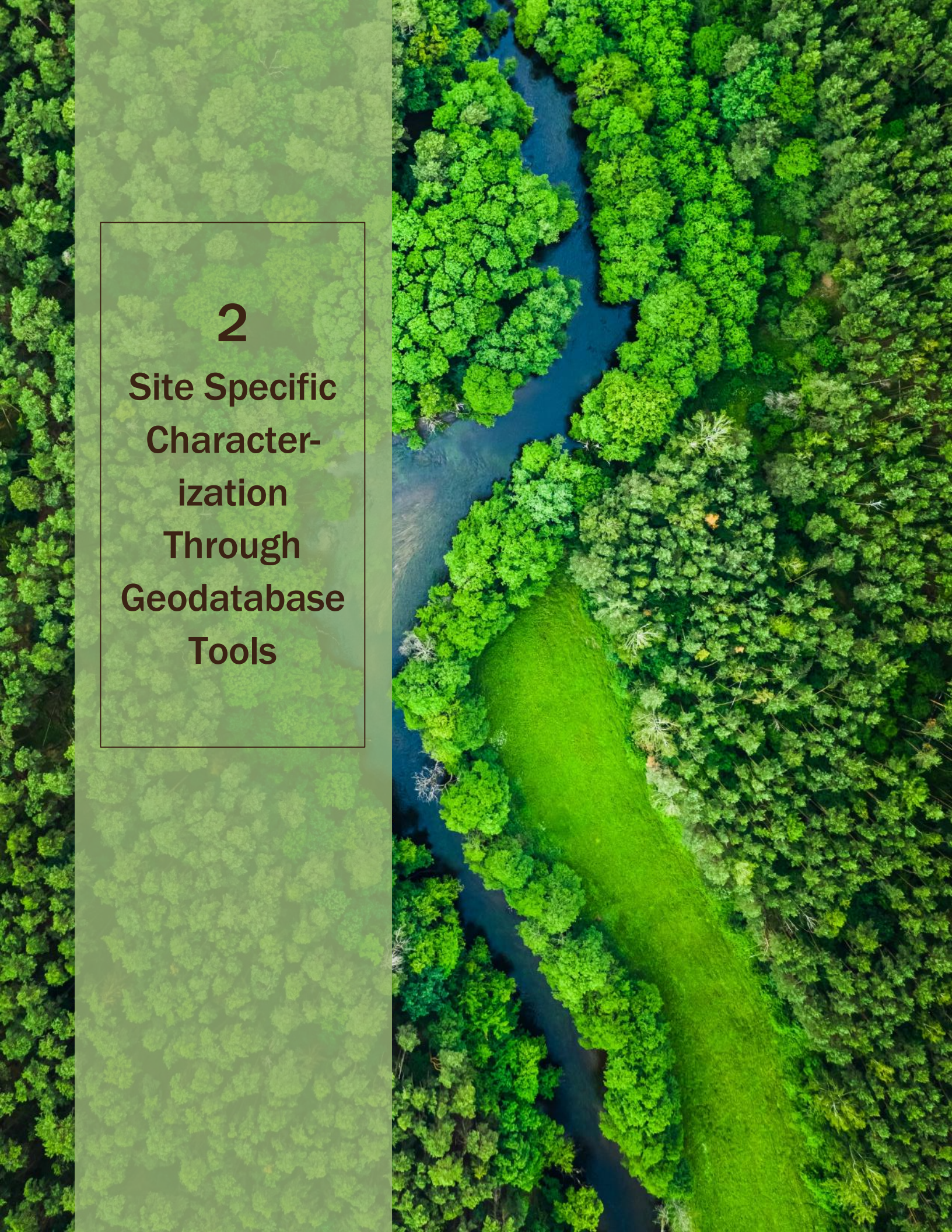
- Based on the review of the landowner and potential landscape objectives, and the analysis of current site conditions, determine a target forest type(s) and the forest resources available to landowner. This forest type(s) could be different or the same as the current forest type on the property.
- Based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

### Step 3 After the Visit

- Contact the landowner and provide answers to any questions you were unable to answer during the visit. Additionally, prompt the landowner if they had any additional questions or comments arise following the last meeting. Provide additional support and encouragement for implementing the activities identified during the meeting. This follow-up is encouraged to occur between one week and one month following the meeting.
- Complete and process any paperwork or certification submittals required following the meeting.
- Using a landscape management tool makes follow-up support to landowners even more important. With no written plan, the LMP depends on the relationship and engagement of the landowner and forest resource professional to meet the criteria for certification. This LMP allows landowners the flexibility to adaptively manage the property based on the results of silvicultural operations, gaining additional information (e.g. listed species), changing ecological (e.g. sea level rise) or market conditions (e.g. timber markets), and especially changing landowner (and landscape) objectives. Therefore, following up with the landowner not only promotes their engagement in active management but also allows them to modify their management strategies to meet these other dynamic conditions.
- Make a note in the relevant system of when follow-up should occur.
- Contact the landowner within 1 year to schedule a visit, assess activities implemented, determine if any changes have occurred to objectives, and determine if personal circumstances and/or the property have changed; this type of follow-through, is encouraged. Provide additional advice and technical support to the landowner, as needed. Depending on the forest type and the silvicultural options selected, a longer period between contact with the landowner may occur. Optimistically, landowner should be contacted annually to promote and foster their engagement in the active management of their property.

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



An aerial photograph of a lush green forest. A dark, winding river flows through the center of the image. To the right of the river, there is a large, bright green, grassy clearing. The rest of the image is filled with dense, vibrant green trees.

# 2

## Site Specific Character- ization Through Geodatabase Tools





## 2. SITE SPECIFIC CHARACTERIZATION THROUGH GEODATABASE TOOLS

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

### 2.1. Instructions for Use

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

### 2.2. Geodatabase Layer Descriptions

The following 15 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 layers' name, location, and a brief description of the content found within the layer.

#### 1. Historical Structures

- Layer Source Name: Louisiana Historic Standing Structures Individual Listings-July 2019, Louisiana Office of Cultural Development, Division of Historic Preservation
- Description: This dataset contains Louisiana standing structure, National Register, and district data.
- Layer Source Location: <https://www.crt.state.la.us/cultural-development/historic-preservation/louisiana-historic-standing-structures-survey/>

#### 2. Cemeteries

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



- Layer Source Location: <https://www.arcgis.com/home/item.html?id=86fe44297bf845da828abafeb95f9234>

### 3. Wetlands

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

### 4. Hydrology

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

### 5. Listed Species

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





## 6. Wildlife Management Areas, Refuges, and Conservation Lands

- Layer Source Name: Wildlife Management Areas, Refuges, and Conservation Lands, LDWF
- Description: Polygon data outlining the boundaries for all Wildlife Management Areas, Refuges, and Conservation Lands within the state of Louisiana.
- Layer Source Location: <http://www.wlf.louisiana.gov/wma-map-download>

## 7. Critical Habitat

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

## 8. Sea Level

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

## 9. EDDMaps

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

## 10. Parishes

- Layer Source Name: Louisiana Parish Boundaries February 5, 2007, LAGIC
- Description: This dataset contains the boundaries of Louisiana's 64 parishes. Parish boundaries extend 3 miles out into the Gulf of Mexico from the coastline. This dataset was derived from many data sources and conveys the best currently (2005) available representation of the parishes of Louisiana and as a consequence, the best currently available representation of the territorial bounds of the state.
- Layer Source Location: <https://catalog.data.gov/dataset/louisiana-parish-boundaries-geographic-nad83-ldotd-2007-parishes-ldotd-2007>

## 11. Roads

- Layer Source Name: Louisiana Highway Shapefile, 2019
- Description: This archive includes 6 filesets that contain data in ESRI shapefile format. ESRI shapefile is a digital vector storage format for storing geometric location and associated attribute information. This fileset represents the roads present within the state of Louisiana. Included are primary and secondary roads, highways, streets, paths, trails, and interstates.
- Layer Source Location: <https://mapcruzin.com/free-united-states-shapefiles/free-louisiana-arcgis-maps-shapefiles.htm>

## 12. 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>

### 13. Parcels > 10 acres

- For users of this LMP certifying landowners in the American Tree Farm System, parcel data is available in the state's CRM. All other users are recommended to search their state and local county's Geographic Information System (GIS) website to confirm the presence/absence of parcel data for their property of interest, as the availability of parcel data varies based on the state and county of residence. All other layers in Section 2's geodatabase are functional independent of parcel data being present.

### 14. Mills

- Layer Source Name: U.S. Wood-Using Mill Locations, 2005
- Description: Point location data of mills available in the Continental United States.
- Layer Source Location: US Forest Service – Southern Research Station  
<https://www.srs.fs.usda.gov/econ/data/mills/#downloads>

### 15. Imagery: World Imagery

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

### 16. Louisiana Land Use Data

- Layer Source Name: [Louisiana Land Cover Data Set](#)
- Description: The National Land Cover Database 2001 land cover layer for mapping zone 37A was produced through a cooperative project conducted by the Multi-Resolution Land Characteristics. This is the land cover dataset for the state of Louisiana.
- Layer Source Locations: <https://catalog.data.gov/organization/lagic-lsu-edu>

### 17. NRCS Environmental Easement Boundaries

- Layer Source Name: Easements
- Description: The Stewardship Lands Inventory (SLI) Program is conducted to develop strategies to monitor, adaptively manage, and ensure compliance of NRCS easements enrolled in the Emergency Wetlands Reserve Program (EWRP), Wetlands Reserve Program (WRP), Grasslands Reserve Program (GRP), Healthy Forests Reserve program (HFRP), Farm and Ranch Lands Protection Program (FRPP), Emergency Watershed Program - Floodplain Easements (EWP-FPE), Other Stewardship Lands (OSL), and Regional Conservation Partnership Program (RCP). Within each easement, data is collected on land cover and use, soil erosion, wetlands issues, and characteristics of other natural resources. The national Easement dataset, Easement Boundaries, is an aggregate layer of conservation easements received from each state, used to identify, monitor, and enhance the spatial accuracy of restoration program polygons. Easements Centroids are centroid points derived from each Easement Boundary.
- Layer Source Locations:  
<https://nrcsgeoservices.sc.egov.usda.gov/arcgis/rest/services/easements/easements/MapServer>





## 18. Wildland Urban Interface

- Layer Source Name: Louisiana Wildland Urban Interface\_1990 to 2010
- Description: The wildland-urban interface (WUI) is the area where houses meet or intermingle with undeveloped wildland vegetation. This makes the WUI a focal area for human-environment conflicts such as wildland fires, habitat fragmentation, invasive species, and biodiversity decline. Using geographic information systems (GIS), we integrated U.S. Census and USGS National Land Cover Data, to map the Federal Register definition of WUI (Federal Register 66:751, 2001) for the conterminous United States from 1990-2010. These data are useful within a GIS for mapping and analysis at national, state, and local levels. Data are available as a geodatabase and include information such as housing and population densities for 1990, 2000, and 2010; wildland vegetation percentages for 1992, 2001, and 2011; as well as WUI classes in 1990, 2000, and 2010.
- Layer Source Locations: <http://silvis.forest.wisc.edu/data/wui-change/>

## 19. Fire Boundaries - 2018

- Layer Source Name: 2018\_perimeters\_dd83
- Description: The Geospatial Multi-Agency Coordination Group, or GeoMAC, is an internet-based mapping tool originally designed for fire managers to access online maps of current fire locations and perimeters in the US. Perimeters are submitted to GeoMAC by field offices. The GeoMAC team attributes the perimeters using the IRWIN (Integrated Reporting of Wildland-Fire Information) system, and then posts them on the GeoMAC website and to an HTTP site for downloading. This file contains all fire perimeters that were processed by the GeoMAC team in 2018. The projection is geographic and the datum is NAD83.
- Layer Source Locations: [https://rmgsc.cr.usgs.gov/outgoing/GeoMAC/historic\\_fire\\_data/](https://rmgsc.cr.usgs.gov/outgoing/GeoMAC/historic_fire_data/)

## 20. Fire Boundaries - 2019

- Layer Source Name: 2019\_perimeters\_dd83
- Description: The Geospatial Multi-Agency Coordination Group, or GeoMAC, is an internet-based mapping tool originally designed for fire managers to access online maps of current fire locations and perimeters in the US. Perimeters are submitted to GeoMAC by field offices. The GeoMAC team attributes the perimeters using the IRWIN (Integrated Reporting of Wildland-Fire Information) system, and then posts them on the GeoMAC website and to an HTTP site for downloading. This file contains all fire perimeters that were processed by the GeoMAC team in 2019. The projection is geographic and the datum is NAD83.
- Layer Source Locations: [https://rmgsc.cr.usgs.gov/outgoing/GeoMAC/historic\\_fire\\_data/](https://rmgsc.cr.usgs.gov/outgoing/GeoMAC/historic_fire_data/)

## 21. Level III and IV Ecoregions of Louisiana

- Layer Source Name: Ecoregions\_EPA\_2004
- Description: Ecoregions by state were extracted from the seamless national shapefile. Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. They are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. These general purpose regions are critical for structuring and implementing ecosystem management strategies across federal agencies, state agencies, and nongovernment organizations that are responsible for different types of resources within the same geographical areas. The approach used to compile this map is based on the premise that ecological regions can be identified through the analysis of patterns of biotic and abiotic phenomena, including geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The relative importance of each characteristic varies from one ecological



region to another. A Roman numeral hierarchical scheme has been adopted for different levels for ecological regions. Level I is the coarsest level, dividing North America into 15 ecological regions. Level II divides the continent into 50 regions (Commission for Environmental Cooperation Working Group, 1997). At Level III, the continental United States contains 105 regions whereas the conterminous United States has 85 (U.S. Environmental Protection Agency, 2011). Level IV ecoregions are further subdivisions of Level III ecoregions. Methods used to define the ecoregions are explained in Omernik (1995, 2004), Omernik and others (2000), and Gallant and others (1989).

- Layer Source Location: <https://www.epa.gov/eco-research/ecoregion-download-files-state-region-6>





# **3**

## **Ecoregions (Level III)**





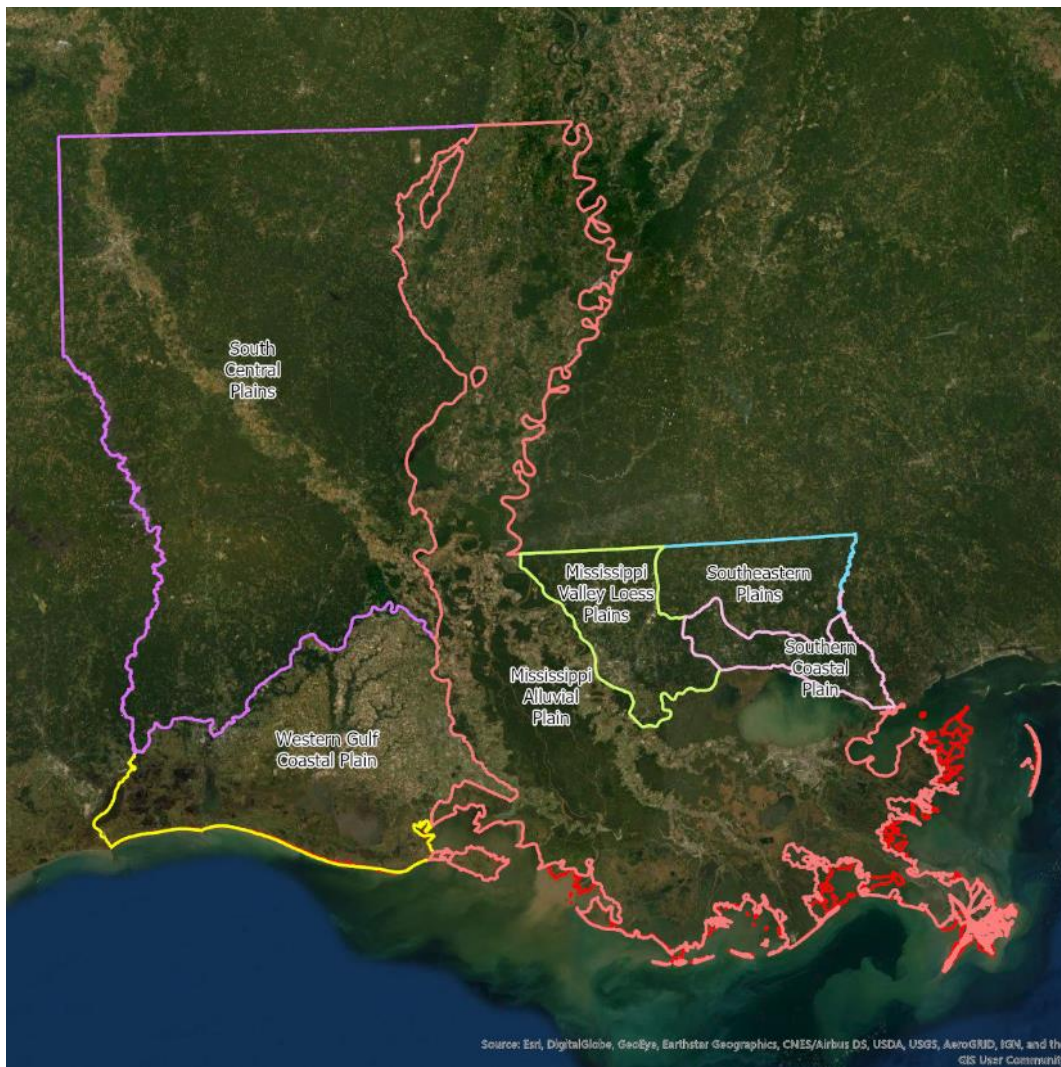
### 3. ECOREGIONS (LEVEL III)

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

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

Louisiana contains 6 Level III and 28 Level IV ecoregions within its borders (Figure 1). From north to south, these Level III ecoregions and their associated Level IV ecoregions are: South Central Plains (Tertiary Uplands, Floodplains and Low Terraces, Pleistocene Fluvial Terraces, Southern Tertiary Uplands, Flatwoods, Red River Bottomlands), Mississippi Alluvial Plain (Northern Holocene Meander Belts, Northern Backswamps, Arkansas/Ouachita River Holocene Meander Belts, Arkansas/Ouachita River Backswamps, Macon Ridge, Southern Holocene Meander Belts, Southern Pleistocene Valley Trains, Southern Backswamps, Inland Swamps), Mississippi Valley Loess Plains (Bluff Hills, Southern Rolling Plains, Baton Rouge Terrace), Southeastern Plains (Southern Pine Plains and Hills, Southeastern Floodplains and Low Terraces), Southern Coastal Plain (Gulf Coast Flatwoods, Floodplains and Low Terraces, Gulf Barrier Islands and Coastal Marshes), and Western Gulf Coastal Plain (Northern Humid Gulf Coastal Prairies, Floodplains and Low Terraces, Texas-Louisiana Coastal Marshes, Lafayette Loess Plains). It was determined that, while at times certain Level IV ecoregions may exhibit an important distinction in ecology of Louisiana, the Level IV ecoregions provided too high of a degree of specificity for a LMP designed to focus on landscape-level functions and difference; thus, the Level III ecoregions were selected as the main focus of the LMP.





*Figure 1 The Level III Ecoregions of Louisiana*

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

### 3.1. South Central Plains

The South Central Plains (SCP) ecoregion is mainly composed of rolling landscape that is occasionally interspersed with rivers and their surrounding landscape, as well as sandhills. In Louisiana, the South Central Plains is comprised

of parts of Allen, Avoyelles, Beauregard, Bienville, Bossier, Caddo, Calcasieu, Caldwell, Catahoula, Claiborne, De Soto, Evangeline, Grant, Jackson, Jefferson Davis, La Salle, Lincoln, Morehouse, Natchitoches, Ouachita, Rapides, Red River, Sabine, St Landry, Union, Vernon, Webster, and Winn parishes. The majority of this ecoregion is comprised of forests or woodland, with less than 20% of its area consisting of cropland. The SCP ecoregion is distinct from the Mississippi Alluvial Plains, due to its increased topography and greater landscape variability due to this topography. Soils in this ecoregion vary between acidic sandy loams, silt loams, sands, and sandy clay loams, with uplands largely underlain by tertiary coastal plain silty deposits. Within the ecoregion, longleaf pine woodlands and savannahs were historically dominant in the southern portion, with shortleaf pine and hardwoods dominated the northern edge, moving into the state of Arkansas. Cropland dominates the portion of the ecoregion bordering the Red River due to its fertile soil. See Table 1 for the federally listed species present within the South Central Plains. Species ranges were taken from USFWS species range data through map graphics. Information regarding the forest types inhabited by these species can be found below in Section 5.2.3 Wildlife and Habitat Conservation.

*Table 1 Federally-threatened and endangered species present with the Louisiana Level III Ecoregions*

Species	South Central Plains	Mississippi Alluvial Plains	Mississippi Valley Loess Plains	Southeastern Plains	Southern Coastal Plains	Western Gulf Coastal Plain
American chaffseed	X					X
Bald eagle	X	X	X	X	X	X
Earthfruit	X	X				
Fat pocketbook		X				
Gopher tortoise		X				
Gulf sturgeon		X	X	X	X	X
Inflated heelsplitter		X	X		X	
Least tern	X	X		X	X	
Louisiana black bear	X	X		X	X	X
Louisiana pearlshell	X					
Louisiana pine snake	X	X				
Louisiana quillwort		X				X
Northern long-eared bat	X	X				
Pallid sturgeon	X	X	X	X	X	X
Pink mucket		X				
Piping plover	X	X	X	X	X	X
Rabbitsfoot		X	X			
Red-cockaded woodpecker	X	X	X		X	X
Ringed map turtle		X				X
Tan riffleshell		X	X	X	X	
West Indian manatee	X	X	X	X	X	X

### 3.1.1. Forest Types Within Ecoregion

The SCP ecoregion is primarily recognized for its longleaf pine woodlands. These pine habitats occur in association with hardwood slope forests and mixed hardwood-loblolly forests. Loblolly and shortleaf pine are found to a lesser extent within this ecoregion, while slash pine is very scattered. Pine-hardwood mixed, upland hardwood, and the variety of bottomland hardwood forest types can also be found within the SCP to a lesser extent.

## 3.2. Mississippi Alluvial Plains

The Mississippi Alluvial Plains (MAP) ecoregion is a large landscape that borders the Mississippi River throughout its entirety, where it drains all or part of 31 states and 2 Canadian provinces. In Louisiana, the Mississippi Alluvial Plains is comprised of parts of Ascension, Assumption, Avoyelles, Caldwell, Catahoula, Concordia, East Baton Rouge, East Carroll, East Feliciana, Franklin, Iberia, Iberville, Jefferson, LA Salle, Lafayette, Lafourche, Livingston, Madison, Morehouse, Orleans, Ouachita, Plaquemines, Pointe Coupee, Rapides, Richland, St. Bernard, St. Charles, St. James, St. John the Baptist, St. Landry, St. Martin, St. Mary, St. Tammany, Tangipahoa, Tensas, Terrebonne, Union, Vermilion, West Baton Rouge, West Carroll, and West Feliciana parishes. The vast majority of the ecoregion is Mississippi River floodplains, with river terraces, swales, and levees providing topographic relief. Soils in this ecoregion are generally fine-textured and poorly drained due to their presence in a floodplain. This ecoregion was historically covered by bottomland forest before a majority was cleared to convert to cropland through levees that restrict the natural flow of the Mississippi. While the vast majority of this ecoregion is covered by cropland, areas between the Mississippi River levees that are connected to the river are a unique bottomland hardwood habitat known as “battures” and contain flood-tolerant hardwood species. See Table 1 for the federally listed species present within the Mississippi Alluvial Plains.

### 3.2.1. Forest Types Within Ecoregion

The MAP is characterized mainly by its abundance of bottomland hardwood forest types. All three of the bottomland hardwood forest types (mixed floodplain, tupelo-cypress mixed, and cottonwood, sycamore, birch) are found to varying degrees within the MAP. Due to the flood-generated silty soils and frequent flooding regime, the different pine-dominated and upland forest types are not present to a notable degree within this ecoregion.

## 3.3. Mississippi Valley Loess Plains

The Mississippi Valley Loess Plains (MVLP) ecoregion largely borders the Mississippi Alluvial Plains, as you move away from the river toward the East, and consists of some irregular plains, rolling hills, and bluffs. In Louisiana, the Mississippi Valley Loess Plains is comprised of parts of Ascension, East Baton Rouge, East Feliciana, Livingston, St. Helena, Tangipahoa, and West Feliciana parishes. As a whole, the ecoregion is a mixture of natural forest, pine plantations, pasture, and crops. The western portion contains the “Bluff Hills” region with its deep, silty, and erosive soils, while the eastern portion has soils with a smoother substrate. Upland mixed forests dominate the eastern section, with oaks, hickory, and both shortleaf and loblolly pine present, while the western section is southern mesophytic forest composed mainly of hardwoods (beech, southern magnolia, and American holly). See Table 1 for the federally listed species present within the Mississippi Valley Loess Plains.

### 3.3.1. Forest Types Within Ecoregion

The MVLP supports a wide range of different forest types and natural communities. The flat topography and fertile soils of the region make good habitat for both upland and bottomland forest types, with the bottomland forests occurring mainly in riparian areas. Some varying pine forest types are found in the eastern portion of the MVLP, further away from the Mississippi River.

## 3.4. Southeastern Plains

The Southeastern Plains (SP) ecoregion consists of a mixture of cropland, natural woodland, pasture, and forests, with the majority of it covered by trees of some variety. In Louisiana, the Southeastern Plains is comprised of parts

of St. Helena, St. Tammany, Tangipahoa, and Washington parishes. Within the state of Louisiana, this ecoregion is predominantly comprised of longleaf pine forest, although pine-oak and mixed hardwood forests exist to a lesser extent. Soils in this ecoregion are mainly acidic sandy loams, silt loams, and sandy clay loams. Topography in the Southeastern Plains differs more widely than both the Southern Coastal Plain and Mississippi Alluvial Plain, due to this ecoregion being further removed from the coast and the plains associated with the Mississippi River. Commercial pine plantations are prevalent and extensive, as timber and cattle farming are the predominant land uses in the ecoregion. See Table 1 for the federally listed species present within the Southeastern Plains.

#### 3.4.1. Forest Types Within Ecoregion

The SP supports a wide range of different forest types and natural communities. The flat topography and fertile soils of the region make good habitat for both upland and bottomland forest types, with the bottomland forests occurring mainly in riparian areas. Some varying pine forest types are throughout the SP, further away from the Mississippi River.

### 3.5. Southern Coastal Plain

The Southern Coastal Plain (SCP) ecoregion is an extensive portion of land, stretching from southern South Carolina west to Eastern Louisiana, stopping at the Mississippi Alluvial Plain ecoregion. In Louisiana, the Southern Coastal Plains is comprised of parts of Livingston, St. Helena, St. Tammany, Tangipahoa, and Washington parishes. Along with the coastal plains and lowlands, this ecoregion also encompasses barrier island, coastal lagoons, marshes, and swampy lowlands along the coast. This low, flat ecoregion supports a variety of habitats that thrive on its sandy soil, which once included longleaf pine flatwoods and savannas in addition to a variety of other pine and hardwood species tolerant of wet, sandy soils. Current land cover in this ecoregion now mainly consists of mainly loblolly and slash pine with scattered instances of hardwood forests, bottomland hardwoods, and pastureland. See Table 1 for the federally listed species present within the Southern Coastal Plains.

#### 3.5.1. Forest Types Within Ecoregion

The SCP supports a wide range of different forest types and natural communities and represents a transition in forest types from the more western MVLP and SP. While the SCP has flat topography similar to the MLVP and SP, the soils of this ecoregion are much less fertile due to an increased distance from the Mississippi River floodplains. These depleted, infertile soils are more suitable for predominantly longleaf pine forest types, although the other pine forest types may be found to some degree. Besides scattered pockets in Western Louisiana, the SCP represents the western edge of slash pine forest types. All the other Louisiana forest types are found within the SCP to a varying degree, with their locations dependent mostly on topography.

### 3.6. Western Gulf Coastal Plain

The Western Gulf Coastal Plain (WGCP) ecoregion is largely a continuation of the Southern Coastal Plain that is continued on the western side of the Mississippi River. In Louisiana, the Western Gulf Coastal Plains is comprised of parts of Acadia, Allen, Calcasieu, Cameron, Evangeline, Iberia, Jefferson Davis, Lafayette, St. Landry, St. Martin, St. Mary, and Vermilion parishes. Like the Southern Coastal Plain, this ecoregion contains relatively flat topography and a mixture of forest and grassland vegetation. Due to the flat topography and relatively fertile soils compared to surrounding ecoregions, a large percentage of the WGCP is occupied by cropland. Some scattered forest lands can





be found in the Floodplains and Low Terraces Level IV ecoregion with the WGCP. The oil and gas industry thrives in this ecoregion. See Table 1 for the federally listed species present within the Western Gulf Coastal Plain.

### 3.6.1. Forest Types Within Ecoregion

The WGCP is mainly devoid of Louisiana forest types due to its lack of forest habitat. Aside from the coastal marsh habitat that comprises the majority of the WGCP, upland hardwood forest types (in the form of cheniers, or coastal live oak forests) represent the majority of upland forest types while scattered tupelo-cypress mixed forest types represent the majority of hydric forest types. Pines are largely absent from the WGCP due to soil salinities and the hydric nature of the habitat.

## 3.7. Conservation Initiatives Within Ecoregions

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

The National Resource Conservation Service (NRCS) has established the Environmental Quality Incentives Program (EQIP) to “provide financial and technical assistance to forestry producers to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, reduced soil erosion and sedimentation, and improved or created wildlife habitat”. Through this EQIP program, NRCS is able to provide guidance and financial resources to implement environmental improvements. This EQIP program can be used throughout all ecoregions in Louisiana; depending on where your land is located, any number of 200 different forest and farm-focused land improvement practices may be available.

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

Another large-scale, national program designed to assist forest landowners is the Conservation Stewardship Program (CSP). CSP is the largest conservation program in the United States, containing more than 70 million acres of agriculture and forest land. A major focus within the CSP is developing wildlife habitat within forested lands. This is accomplished through assisting forest landowners manage their land in a way that benefits wildlife habitat. This CSP program can be used throughout all ecoregions in Louisiana; depending on where your land is located, any number of different forest and farm-focused land improvement practices may be available.



An aquatic initiative active within Louisiana is the [National Water Quality Initiative \(NWQI\)](#). Through this program, the NRCS provide both financial and technical assistance to landowners interested in improving the quality and habitat structure of impaired streams; in Louisiana, the four watersheds meeting the criteria to be classified as “priority watersheds” are the Indian Bayou, Lake Louis, East Fork Big Creek, and Big Creek watersheds. A main method of improving these watersheds is the control of nutrient and manure runoff into the water bodies. This control may be accomplished through assistance installing cover crops, filter strips, and tailwater recovery systems, which will aid landowners in protecting natural resources voluntarily while also receiving a profit. In Louisiana, the above-mentioned priority watersheds are found to a certain extent in all of the Louisiana ecoregions.

One particular CI is the [Coastal Forest Conservation Initiative \(CFCI\)](#) set forward by the [Coastal Protection and Restoration Authority \(CPRA\)](#). The CFCI’s goal is to conserve and protect coastal forest resources in Louisiana. This is accomplished through the CPRA attempting to acquire forested land from landowners meeting one of three criteria: direct storm damage reduction or protection potential from hurricanes (i.e., levees, cheniers), areas of high ecological significance, or tracts of land in danger of conversion to non-forested use (CPRA CFCI 2013). The coastal protection initiative considers all natural coastal forest types, with Tupelo-Cypress Mixed, Mixed Floodplain, Upland Mixed Hardwood-Pine, Upland Hardwood, and Longleaf Pine Dominated representing forest types from this LMP included in the initiative. Ecoregions within Louisiana that have the potential for these forest types to be present in a coastal setting are the [Western Gulf Coastal Plain](#), [Mississippi Alluvial Plain](#), and [Southern Coastal Plain](#). The CFCI is a voluntary program; enrollment provides numerous benefits to landowners, although the true nature of them would depend on how land is acquired.

Another CI available within Louisiana is the [Migratory Bird Habitat Initiative \(MBHI\)](#) developed through the National Resources Conservation Service (NRCS). The MBHI in Louisiana was launched after the 2010 Deepwater Horizon oil spill in an effort to help landowners create more than 470, 000 acres of alternative habitat for migratory birds along the Mississippi River. This initiative creates habitat through landowners either flooding farm fields or wooded habitats to create habitat or placing lands into a conservation easement; these actions create habitat for the millions of ducks, geese, or shorebirds each year that use the Mississippi River as a migratory route. Landowners receive financial assistance to convert their lands to potential habitat, and also receive income from transitioning their land to an easement. With the Mississippi River bring the focal point for their efforts due to its migration corridor, the [Mississippi Alluvial Plains](#) is a main focus of this initiative; however, the entire coastline of the state, including the [Western Gulf Coast Plain](#) and [Southern Coastal Plain](#), are eligible for benefits from the MBHI.

A statewide initiative in Louisiana is the [Forest Productivity Program \(FPP\)](#), administered by the Louisiana Department of Agriculture and Forestry (LDAF). This program provides financial assistance to eligible landowners for both establishing and improving a crop of trees. Financial assistance through the plan involves cost sharing of certain agricultural practices required for timber production, such as [planting or seeding](#), [site preparation](#) for natural regeneration, and [vegetative release](#). This program is available to all Louisiana landowners who own a minimum of 5 contiguous acres that are suitable for timber production and are willing to enter into an agreement with LDAF to maintain the land’s forestry usage for at least 10 years.

A wildlife-focused conservation initiative within Louisiana is the [National Bobwhite Conservation Initiative \(NBCI\)](#) (2015). The NBCI is a 25-state effort to restore bobwhite quail to the whole of America’s landscape. The NBCI is focused on developing an ever-evolving strategy to approach bobwhite revival on a landscape scale as opposed to a small-scale, individual farm-based approach as previously utilized. Through the NBCI Technical Committee, representatives from the 25 states are able to lend their biological, scientific research, and private conservation



expertise to the protection and restoration of bobwhite quail. Methods for promoting the reestablishment of bobwhite quail include advancing the establishment of native grasses and flowers along cropland and rural land edges to promote habitat connectivity, converting up to one-third of existing pasture to native grasses beneficial to both cattle and bobwhite, and managing pine and other forests to promote forest habitat connectivity. The NBCI is available to landowners with appropriate acreage and suitable habitat that are deemed to qualify for a NBCI Focal Area, and area where quail populations can be studied more in depth. NBCI provides coordination, design, training, data management, reporting tools, and nationwide outreach. All ecoregions within Louisiana are able to qualify under the NBCI.

Another wildlife initiative within Louisiana is the [Conservation Easement Program](#) through Ducks Unlimited (Ducks Unlimited 2019). This initiative is focused on the conservation and preservation of duck habitat used in migration or overwintering; the "America's River Initiative is also provided within Louisiana along the Mississippi River. Duck's Unlimited accepts conservation easements through its affiliate Wetlands America Trust and agrees to monitor the property on a yearly basis to ensure the protection of its natural resources. The development of this partnership between Duck's Unlimited and the landowner may provide the landowner with the reduction of income and estate taxes, while also allowing the ability to protect the landscape for future generations. This program is available through all ecoregions of Louisiana.

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

Another longleaf-based initiative within Louisiana is the [America's Longleaf Restoration Initiative](#) (ALRI; America's Longleaf Restoration Initiative, 2019). The ALRI is a program across nine southern states focused on range-wide creation and conservation of longleaf ecosystems. The goal of the ALRI Conservation Plan is to increase longleaf coverage nationwide from 3.4 to 8.0 million acres nationwide, through the efforts of regional and sub-regional actions by landowners, resource managers, scientists, and policy makers. The 2019-2021 Strategic Priorities and Actions outline the objectives to: significantly increase acres of longleaf pine through establishing new longleaf forests, improve and maintain existing acreage of longleaf ecosystems with an emphasis on increasing the amount of prescribed fire annually, and identify and convert existing mixed pine stands with a longleaf component to longleaf-dominant stands. Landowners that are eligible for the program receive both financial and technical assistance to work toward these objectives through various conservation practices (prescribed burns, site preparation, reforestation, and forest stand improvement. Enrollment in this program is open in eligible parishes until all funds have been spent.

The [Shortleaf Pine Initiative \(SPI\)](#) is another forest restoration initiative, with the SPI having the goal to address the multiple threats facing the increasingly imperiled shortleaf pine forest (Shortleaf Pine Restoration Plan, 2016). Recently, factors such as pine beetle outbreaks, changes in timber management practices, altered fire regimes, and land use changes have contributed to the decline of this specific ecosystem. In 2013, the SPI was formed to address these issues through policy formed by key federal and state agencies from the 22 states affected by the shortleaf pine decline. Shortleaf pine restoration depends on site-specific efforts by regional practitioners and partners to



educate landowners interested in restoration on their lands. These efforts include the demonstration of shortleaf pine restoration practices, the sharing of technical information, and the promotion of site-based conservation. This initiative is available throughout all Louisiana ecoregions.





# 4

## Hydrologic Categories







## 4. HYDROLOGIC CATEGORIES

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

Louisiana contains all or part of 11 4-digit subregions (Figure 2): 0318-Pearl, 0803-Lower Mississippi-Yazoo, 0804-Lower Red-Ouachita, 0805-Boeuf-Tensas, 0806-Lower Mississippi-Big Black, 0807-Lower Mississippi-Lake Maurepas, 0808-Louisiana Coastal, 0809-Lower Mississippi, 1114-Red-Sulphur, 1201-Sabine, and 1204-Galveston Bay-San Jacinto. Within these 4-digit subregions, Louisiana has 59 distinct 8-digit watersheds. These 8-digit HUCs, as mentioned above, represent too specific an area for a Landscape Management Plan due to no large-scale landscape differences existing within these divisions. These 8-digit HUCs can be viewed through the geodatabase tool (see Section 2.2.3). Also, geospatial analysis of the geodatabase layers listed above in section 2 will provide insight into features that are or may be present within a landowner's parcel. The boundaries of each HUC, 2-to-16-digit, can be displayed with all natural/environmental features shown overlain in order to give the landowner information about their land as well as the surrounding watershed.



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

Within the Mississippi River drainage basin, there exists the Mississippi River Basin Healthy Watersheds Initiative (MRBI). This initiative was started in 2009 and, in conjunction with the Environmental Quality Incentives Program (EQIP) and Agricultural Conservation Easement Program (ACEP), strives to assist landowners in sustaining America's natural resources through voluntary conservation. The overall goals of MRBI are to improve the environment surrounding the Mississippi River on multiple fronts, by improving water quality, restoring wetlands, and improving wildlife habitat while ensuring the economic viability of agricultural land. Efforts to improve water quality involve the development of state-specific nutrient limitation strategies, which include either trapping, avoiding, or regulating the amount of nutrients traveling from agricultural lands into the Mississippi River and other tributaries.

The National Water Quality Initiative (NWQI) is another NRCS initiative applicable to forest lands throughout the U.S. (NRCS 2019). The NWQI program offer financial and technical assistance to forest landowners that are interested in improving water quality as well as aquatic habitats if their land falls within priority watersheds with impaired streams. A main focus of the program is to provide conservation measures to landowners that will effectively control and trap





nutrient and manure runoff, thereby decreasing nutrient loads to already impaired stream habitats. In Louisiana, the priority watersheds are the Indian Bayou Watershed, Lake Louis Watershed, East Fork Big Creek Watershed, and Big Creek Watershed. If living within one of these watersheds, enrolling in this program provides financial assistance while also improving water quality within the state.



# 5

## Objectives





## 5. OBJECTIVES

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

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

### 5.1. Landowner Objectives

The following common landowner objectives considered under this LMP were derived from the USDA NWOS Results and Observations (Butler et al 2016) and the Louisiana Forest Stewardship Program. A general description of 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 forest type in the Common Louisiana Forest Types Section.

#### 5.1.1. Aesthetics

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

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



prescribed fire event. Likewise, the long-term aesthetic value gained from performing [timber thinning](#) operations far outweighs the short-term optics following harvesting operations. Landowners are rewarded with a sense of pride when their hard work and investment in management activities results in aesthetic accomplishments.

#### 5.1.1.1. Pine Forest Aesthetics

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

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

#### 5.1.1.2. Hardwood Forest Aesthetics

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

Most uplands in Louisiana are pine dominated and even-aged, and provide their own type of beauty, but these hardwood forests are less common, natural, uneven-aged and possess a lot of character. These aesthetic characteristics often provide Louisiana 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 regional unique character and beauty.

[Silvicultural tools](#) can be used to maintain and enhance aesthetics. Forest operations should be planned with aesthetics in mind to ensure these objectives are met. For example, when clearcutting hardwood stands, a strip of hardwoods can be left as a buffer against adjacent high visibility areas such as roadways or neighboring homes.

#### 5.1.2. Wildlife Management and Protection

Louisiana is rich in both game and non-game wildlife species. Many landowners are interested in managing, conserving and protecting these species and their habitat. Simply [conserving](#) forestland is a form of wildlife habitat

protection. Some landowners wish to take a more active wildlife management role by maintaining, enhancing and restoring wildlife habitat and its components: food, cover, water and space.

Private lands in the state of Louisiana provide valuable habitat to imperiled species such as red-cockaded woodpecker, Northern long-eared bat, gopher tortoise, and Louisiana pine snake. Many silvicultural tools are available to maintain, enhance and restore habitat for game and non-game species including prescribed fire, timber harvests, groundcover restoration, food plots and wildlife openings.

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

#### 5.1.2.1. Pine Forest Wildlife Habitat Management and Protection

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

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

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

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

#### 5.1.2.2. Hardwood Forest Wildlife Habitat Management and Protection

The 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. Game species are actively managed on private lands while non-game species are managed to a lesser extent. Some game species utilize the cottonwood, sycamore, birch forest type for cover.

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

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

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

### 5.1.3. Recreation

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

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

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

### 5.1.4. Conservation

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



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

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

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

### 5.1.5. Preservation

For this LMP, preservation is defined as the removal of anthropogenic influences to create an untouched “wilderness” condition. This definition can also be summarized as the protection of the forested ecosystem from use. In its purest form, preservation excludes activities such as silvicultural applications, ecological restoration, and maintenance. Like the conservation ethic espoused by Gifford Pinchot, preservation was first championed by John Muir and the Sierra Club also in the early 20th century (McPhee 1971). His preservation ethic has since become the basis for the Wilderness Act of 1964 and the National Park Service.

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

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

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

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

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

### 5.1.6. Legacy Planning

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

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

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

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

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

#### 5.1.6.1. Ownership

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

##### 5.1.6.1.1. Basic Ownership Types

###### **Sole Ownership**

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

## Co-Ownership

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

### 5.1.6.1.2. Business Ownership Types

#### LLC

A way that forest owners can create a preserved property to pass down through generations is the creation of a corporation (including Limited Liability Company [LLC]). Having forest land under an LLC reduces liability from the IRS and strives to ensure that the property is less likely to be divided by heirs into the future. There are four different mechanisms to keep ecosystems intact and in the family for future generations: a family partnership, closely-held S-corporation, qualified trust for conservation purposes, or, as discussed here, an LLC (McEvoy 2003). LLCs offer a level of flexibility to landowners, as the LLC can be dedicated to any purpose (investment, business, conservation, or any combination of motives). LLCs can also offer the benefits similar to the 3 other aforementioned mechanisms for property ownership: the liability protection of a corporation, pass-through taxation aspects of a partnership, and the ability to limit ownership in the family forest provided by a closely-held S-corporation. Also, LLCs can grow as a family does, as the founders of the LLC can set either fractional family membership, having more than one membership class, or having no limitations in regards to the number of owners.

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

Further information for creating and registering a business in Louisiana for a property can be found at the [Louisiana Secretary of State](#).

#### Partnerships

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



## Corporations

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

### 5.1.6.1.3. Forest Legacy Challenges

#### Estate Planning

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

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

#### 5.1.5.1.3.2 Heirs' Property

Another potential challenge when dealing with forest legacy planning is the issue of Heirs' Property. Heirs' Property is any land or associated dwellings that are owned jointly by descendants of a deceased person whose estate proceedings were not handled in Probate Court (Watts Law Firm PA, 2019). After the Civil War, many former slaves purchased or were deeded land throughout Louisiana; when these lands were passed down through descendants, the property rights for many lands were passed down orally and no written contract was devised. Due to this ambiguity of ownership and lack of written contract, the land in question may be considered heirs' property.

An often overlooked aspect of heirs' properties is that the land in question doesn't just belong to the family that resides on or pays taxes on the land, but to all heirs regardless of their location. This creates a land management challenge, as some descendants may wish to sell their particular portion of the land while others may wish to keep it their entire life. Further complicating the distinction of land ownership is the issue of each new generation further skewing the family tree; if one particular branch of the family has more descendants, they own a larger portion of the property.

The ideal solution to heirs' property issues is to have all heirs gather to discuss preferences regarding the property and come to an amenable conclusion for how to handle the land. If the lineage of the original landowner is unknown, research must be conducted to determine each heir of the property and their share. Title to the property can be cleared by one party's renunciation of property ownership or the transfer of their share to another heir; if no agreement can be reached among the heirs, litigation is an option. Once a cleared title is owned by a party, there is the freedom to build a home or mortgage the property.

For additional information regarding heirs' property, visit the [Center for Heirs' Property Preservation for South Carolina](#).

### 5.1.7. Ecological Restoration

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

The [longleaf pine](#) and bluestem community is a good restoration example. Many landowners in the southern portion of Louisiana 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 Louisiana Forest Types](#).

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

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

### 5.1.8. 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 more large-scale types of projects may affect adjacent landowners or those miles up or downstream.

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

### 5.1.9. Forest Health Management

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

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

Various [cost share programs](#), grants and services aid Louisiana 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.

#### 5.1.9.1. Pine Forest Health Management

[Slash](#) pine is second to [longleaf](#) as the most overall insect and disease resilient of Louisiana pine species. The most detrimental disease is fusiform rust but resistant seedling stock can be planted and the alternate host – *Quercus* spp. can be reduced where infection is excessive. Fusiform rust can become a major issue following over-fertilization of slash pine, vegetation control and on old field sites that were heavily fertilized or grazed. Pitch canker can cause damage in planted stands and resistant seedlings are available. Annosus root rot can be an issue following thinning, but only on well drained sites. 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.

The most destructive insect pests to loblolly pine are southern pine beetle and Ips. 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 (i.e. drought, lightning strikes, 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. Fusiform rust affects loblolly as well; in addition, loblolly pines suffer from black root rot. 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 trees.

Longleaf is the most overall insect and disease resilient of Louisiana 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.

The most detrimental disease to shortleaf pine is littleleaf disease. Infection is high on poorly drained sites, on poor soils, and following root damage and drought. Littleleaf mostly occurs in 30-50-year-old stands and seldom in stands less than 20 years old. It can result in slow growth and high mortality. Proper shortleaf pine site selection and appropriately timed thinning or clearcutting can reduce chances of infection with littleleaf. 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 (i.e. drought, lightning strikes, fire).

Pales weevil, feral hogs and livestock can cause damage to seedlings of slash and longleaf pine. Lightning and subsequent southern pine beetle and Ips beetles causes severe damage in mature stands, where otherwise these are not a major concern. Southern pine beetle is not a major concern in younger, well managed slash stands. It can become a concern in offsite, overstocked and senescent stands, especially during drought conditions and following fire stress. Longleaf is most vulnerable to external pests and environmental factors in its first year of establishment, particularly during droughts or the typically dry months of Spring.

Slash, loblolly, and shortleaf pine cannot handle prescribed fire until the bark thickens and they reach about 10-15 feet tall (depending on fuel load). They are susceptible to crown and inner bark scorch, especially in younger stands. Longleaf is naturally fire-resistant at this early life stage, except when candling.

With appropriate seedling and site selection and release and thinning regimes, pines generally have minimal issues following successful establishment.

#### 5.1.9.2. Hardwood Forest Health Management

Pine-hardwood mixed, upland hardwood, mixed floodplain, tupelo-cypress mixed, and cottonwood, sycamore, and birch 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 bays in mixed floodplain, tupelo-cypress mixed, and cottonwood, sycamore, birch forest types. It can only be slowed by actions such as limiting transport of firewood. This disease will likely eventually eliminate most red bay trees.

Another major threat to natural communities within Louisiana is the emerald ash borer (EAB). This beetle, native to Asia, is responsible for the death or decline of tens of millions of Ash trees within the United States in 13 states, ranging from New York to Indiana (USDA Program Aid 769). Larvae of this beetle feed on the tissue between the bark and sapwood of the tree, which disrupts the transport of nutrients within the tree and eventually kills it. The emerald ash borer has currently received 3 positive reports within Louisiana (EDDMapS 2019). The USDA has attempted to prevent spread on the EAB by quarantining areas where it is known to exist.





Non-native invasive species should be monitored and treated. See [NNIS](#) section.

### 5.1.10. Revenue

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

#### 5.1.10.1. Timber Management

Landowners have strong, diverse [timber markets](#) in Louisiana, 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.

#### 5.1.10.2. Non-Timber Forest Products

Forestland owners have many revenue sources aside from timber products. Louisiana's forests provide various non-timber forest products ([NTFP](#)). These are wide-ranging and include pine straw to honey and silvopasture to saw palmetto drupe or cypress knee sales. These markets can provide landowners with revenue between timber harvests or may be their main source of revenue generation from their forests (Chamberlain and Predny 2003).

#### 5.1.10.3. Non-Forest Associated Land Uses

The following land uses may prevent or cause loss of ATFS certification.

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 boat rentals and tours along the many scenic waterways adjacent to Louisiana's forests. Hunting leases are another example.

Various aggregate materials can be mined for construction, development, concrete, forest roads, and many other uses. These include but are not limited to sand, clay, stone and gravel. This will entail local and state permitting. These activities can be conducted in conjunction with pond construction. Both activities will alter nearby hydrology which will likely have ecological impacts

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. Both 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-way's due to full sunlight. Many utilities are cooperative in maintenance methods and timing. The open nature of right-of-way's can also benefit many wildlife species.

Timberland real estate can be a lucrative source of revenue for many landowners, but is often in conflict with [ATFS Standards](#) and [FSP Standards](#). 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.

#### 5.1.10.4. 4 Timber Tax

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

##### 5.1.10.4.1. Timber Property Types

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

##### 5.1.10.4.2. Deductions of Timber Expenses and Taxes

Timber expense and tax deductions are calculated differently depending on the property type in question. For timber on a business property, if one is materially participating in the business, expenses such as forester/accountant/attorney fees, precommercial thinning, firebreak maintenance, vegetation-competition control, insect/disease/fire control, or depreciation from equipment used are all fully deductible through Form 1040. If the property is an investment, however, starting in the 2018-2025 cycle timber expenses are no longer deductible, although state and local property taxes on these investment properties are still deductible. Also, Louisiana has an agricultural use tax exemption for farmers, foresters, or other agricultural land users.

##### 5.1.10.4.3. Timber Basis and Depletion Deduction

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

##### 5.1.10.4.4. Reforestation Costs

Reforestation costs are tax deductible as well. Landowners can deduct up to \$10,000 per year for land designated as qualified timber property (QTP). If it costs more than \$10,00 per year for reforestation, the cost may be deducted over the span of 84 months (amortized); trusts are only available for the amortization method.

#### 5.1.10.4.5. Cost-Share Payments

Cost-share programs are essential to landowners, and some applications of cost-share can be excluded from your income. Part or all of a qualified cost-share payment you received can be excluded from your income if it was used for capital expenditure (purchases of land, timber, or equipment, expenditures for bridge or road construction, or expenses for tree planting or seeding; Jones and Jacobson 2000). Qualified Federal programs that accept income inclusion are the [Forest Health Protection Program](#), [Conservation Reserve Program](#), Conservation Security Program, and [Environmental Quality Incentives Program](#). There are also multiple state programs that qualify for exclusion, depending on the state. The excludable amount is calculated as the present value of which is greater: \$2.50 per acre or 10 percent of the average annual income from affected areas over the previous 3 years.

#### 5.1.10.5. Long-Term Investment

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

There are a few main reasons that a landowner may choose to use their timberland as an investment. Firstly, timberland rises with inflation, thereby hedging the risk of devaluation by inflation and keeping timber prices stable relative to the index. Secondly, trees continue to grow in volume over time, as well as value, completely independent of the current economic state. Therefore, if the timber market is currently in an unfavorable state, the trees can remain in the ground to retain their value until the prices become more favorable; this is an option not available with other investments such as stocks or gold. A third more intrinsic value of timberland as an investment is that the land can be enjoyed recreationally while waiting to make a profit. This “bonus” can even be as valuable to landowners as the profit they will eventually make from the timberland investment.

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

## 5.2. Common Landscape Objectives

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

### 5.2.1. Support Healthy Forest Products Industry

This LMP promotes maintaining a healthy forest products industry in Louisiana through sustainable forest management practices. This can be achieved through carefully planned [timber harvests](#) and timely [site preparation](#) and [reforestation](#). Certification through the [American Tree Farm System](#) also supports sustainable forestry and adds value to timber markets.



Silviculture BMPs also supports sustainable silvicultural through practices that protect and enhance water and soil quality. By voluntarily conducting safe, responsible, and sustainable forestry practices, government regulation is avoided which keeps timber markets alive and thriving. Landowners may also submit to LDAF a Notice of Intent to Implement these BMPs. This is a one-time notification per landowner and not required for each silvicultural activity.

### 5.2.2. Watershed Protection and Restoration

Louisiana contains several major watersheds including the Mississippi, Red, Ouachita, Pearl, Sabine, Tensas, Atchafalaya, Calcasieu, and Cane Rivers among many others. Well managed forests protect these watersheds and ensure clean drinking water, waterways and healthy aquatic habitats.

Silvicultural and Agricultural best management practices 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 (SMZ's), enhance water quality, helping to restore watersheds. Silviculture BMPs are voluntary yet widely followed, which helps avoid mandatory regulation on these practices while protecting watersheds. Watershed restoration also involves other forest operations such as replacing and improving culverts and installing hard-surface low water crossings.

### 5.2.3. Wildlife and Habitat Conservation

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

Louisiana is home to many rare species found only in this region and contains several global populations. Louisiana forests provide vital habitat to many imperiled plant and animal species. Table 3 shows United States Fish and Wildlife Service's (USFWS) listed species (threatened, endangered, and at-risk) found in the forested habitats of Louisiana by LMP forest type. This table was created using the USFWS Louisiana species list and their habitat of occurrence. Not all listed Louisiana species are shown, only those with the potential to utilize some portion of forested habitat within their life cycle. These habitats were then associated with each LMP forest type. Additional information on current listing status for each species can be found in the geodatabase.

Table 2 United State Fish and Wildlife Service (USFWS) Listed Species by Louisiana Forest Type

Common Name	Scientific Name	Longleaf Pine	Slash Pine	Loblolly Pine	Shortleaf Pine	Pine-hardwood mixed	Upland hardwoods	Mixed floodplain	Tupelo-cypress mixed	Cottonwood, sycamore, birch
<b>Birds</b>										
<b>Black rail</b>	<i>Laterallus jamaicensis</i>							X	X	X
<b>Golden-winged warbler</b>	<i>Vermivora chrysoptera</i>	X	X	X	X	X	X	X	X	X
<b>Least tern</b>	<i>Sterna antillarum</i>							X		
<b>Piping plover</b>	<i>Charadrius melodus</i>							X		
<b>Red-cockaded woodpecker</b>	<i>Picoides borealis</i>	X	X	X	X	X				
<b>Fish</b>										
<b>Gulf Sturgeon</b>	<i>Acipenser oxyrinchus desotoi</i>							X		
<b>Frecklebelly madtom</b>	<i>Noturus munitus</i>							X		
<b>Pallid sturgeon</b>	<i>Scaphirhynchus albus</i>							X		
<b>Saltmarsh topminnow</b>	<i>Fundulus jenkinsi</i>							X		
<b>Sicklefin chub</b>	<i>Macrhybopsis meeki</i>							X		
<b>Sturgeon chub</b>	<i>Macrhybopsis gelida</i>							X		
<b>Invertebrates</b>										
<b>Alabama hickorynut</b>	<i>Obovaria unicolor</i>							X		
<b>Big thicket emerald dragonfly</b>	<i>Somatochlora margarita</i>							X	X	X
<b>Calcasieu crayfish</b>	<i>Orconectes blacki</i>							X	X	X
<b>Fat pocketbook</b>	<i>Potamilus capax</i>							X		
<b>Frosted elfin</b>	<i>Callophrys irus</i>	X	X	X	X	X	X	X	X	X
<b>Inflated heelsplitter</b>	<i>Potamilus inflatus</i>							X		
<b>Kisatchie painted crayfish</b>	<i>Orconectes maletae</i>							X	X	X
<b>Louisiana pearlshell</b>	<i>Margaritifera hembeli</i>							X		
<b>Monarch butterfly</b>	<i>Danaus plexippus plexippus</i>	X	X	X	X	X	X	X	X	X
<b>Pink mucket</b>	<i>Lampsilis abrupta</i>							X		
<b>Pink pigtoe</b>	<i>Pleurobema rebrum</i>							X		
<b>Rabbitsfoot</b>	<i>Quadrula cylindrica cylindrica</i>							X		

Common Name	Scientific Name	Longleaf Pine	Slash Pine	Loblolly Pine	Shortleaf Pine	Pine-hardwood mixed	Upland hardwoods	Mixed floodplain	Tupelo-cypress mixed	Cottonwood, sycamore, birch
<b>Rayed creekshell</b>	<i>Anodontoides radiatus</i>							X		
<b>Schoolhouse springs leucran stonefly</b>	<i>Leuctra szczytkoi</i>							X	X	X
<b>Southern snaketail</b>	<i>Ophiogomphus australis</i>							X	X	X
<b>Tan riffleshell</b>	<i>Epioblasma Florentina walkeri</i>							X		
<b>Texas heelsplitter</b>	<i>Potamilus amphichaenus</i>							X		
<b>Western fanshell</b>	<i>Cyprogenia aberti</i>							X		
<b>Mammals</b>										
<b>Northern long-eared bat</b>	<i>Myotis septentrionalis</i>	X	X	X	X	X	X	X	X	X
<b>Plains spotted skunk</b>	<i>Spilogale putorius interrupta</i>	X	X	X	X	X	X	X		
<b>Tricolored bat</b>	<i>Perimyotis subflavus</i>	X	X	X	X	X	X	X	X	X
<b>Reptiles</b>										
<b>Alligator snapping turtle</b>	<i>Macrochelys temminckii</i>							X	X	X
<b>Eastern diamondback rattlesnake</b>	<i>Crotalus adamanteus</i>	X	X	X	X	X	X	X	X	X
<b>Gopher tortoise</b>	<i>Gopherus polyphemus</i>	X	X	X	X	X	X			
<b>Louisiana pine snake</b>	<i>Pituophis ruthveni</i>	X	X	X	X	X				
<b>Pascagoula map turtle</b>	<i>Graptemys gibbonsi</i>							X	X	X
<b>Ringed map turtle</b>	<i>Graptemys oculifera</i>							X	X	X
<b>Western chicken turtle</b>	<i>Deirochelys reticularia miaria</i>							X	X	X



### 5.2.3.1. Working Lands for Wildlife

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

In Louisiana, a main target species of the initial WLfW program is the gopher tortoise. WLfW will assist landowners in the state to voluntarily create, restore, or enhance gopher tortoise habitat, and also to improve habitat connectivity to allow the tortoise a greater range of habitat availability. Three parishes within Louisiana, Tangipahoa, Washington, and St. Tammany, have been targeted as high-priority areas for the conservation of gopher tortoise habitat. Throughout these parishes, NRCS funds will share the cost of conservation practices with landowners, as more than 80% of gopher tortoise habitat in the state is within private or corporate ownership.

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

In recent years, additional species have been added to the WLfW program, with new programs developed within Louisiana. One of these additional species is the [Louisiana pine snake](#) (*Pituophis ruthveni*), a reptile that inhabits the longleaf pine savannas of Louisiana and east Texas. The Louisiana pine snake is rarely seen above ground, spending a majority of its life in pocket gopher burrows. A main threat to its population is the loss of open, herbaceous-dominated habitat within longleaf pine understories. The goal of this specific WLfW project is the creation of favorable conditions for diverse herbaceous understory within pine stands, with the NRCS providing technical and financial assistance for landowners to voluntarily improve their land toward these conditions.

Another group of species recently added to WLfW is [Louisiana shorebirds](#), including the lesser yellowlegs (*Tringa flavipes*), buff-breasted sandpiper (*Calidris subruficollis*), stilt sandpiper (*Calidris himantopus*), and short-billed dowitcher (*Limnodromus griseus*). These species are not only present along the shore, but use Louisiana's wetlands along the Mississippi River as habitat. These species are assisted through landowners temporarily creating shallow wetland habitats on forested or agricultural land to provide habitat for these migrating birds. NRCS provides technical and financial support to landowners willing to create these wetland habitats on their property.

### 5.2.3.2. Forests of Recognized Importance

Forests of Recognized Importance (FORI) represent globally, nationally, and regionally significant large landscape areas of exceptional ecological, social, cultural, or biological values (2015-2020 Standards of Sustainability for Forest Certification, ATFS). These forests are evaluated at the landscape level, not the individual stand level, and must have a combination of unique properties, rather than just one, to qualify as a FORI. Some attributes that may include a landscape in the FORI designation include:

- Protected, sensitive, or rare forest type habitats such as riparian areas or wetland biotopes,
- Areas including endemic species and critical habitats of multiple different Threatened and Endangered species as recognized by the USFWS,
- Recognized large-scale cultural or archaeological sites,
- Areas containing identified and protected water resources that serve large metropolitan populations, or
- Areas containing unique or geologic features such as geysers, waterfalls, lava beds, caves, or craters.

While there is no central repository for information on FORI and no state or federal agency that regulates them on private lands, there are multiple different resources (state natural heritage database, state wildlife action plan, local NRCS office, state archaeologist) to verify whether private forests are or include a FORI.

In order to support and facilitate identification and protection of FORIs, AFF developed the Forests of Recognized Importance Resource (<https://www.treefarmssystem.org/forests-of-recognized-importance>) to serve as a reference guide for landowners and qualified natural resource professionals. There is also an AFF committee, the National Standards Interpretation Committee (NSIC), that advises the consultation of state forest action plans, wildlife action plans, and natural heritage databases as resources for the identification of lands that may be FORIs. If a landowner or qualified professional has identified some or all of their property as FORI, that area should be delineated on maps within the individual land management plan. At that point, management activities on the landowner's property or in the vicinity of the FORI should contribute or support the resources that led to the area being designated as a FORI.

#### 5.2.4. Urban Sprawl and Wildland Urban Interface

A landscape objective that has come under focus more recently than some is managing urban sprawl and its associated wildland-urban interface (Louisiana Statewide Forest Resource Assessment and Strategy, 2015). The wildland urban interface (WUI) is composed of both interface (housing present in the vicinity of wildland) and intermix (housing and wildland vegetation are continuous) communities, where housing is present at or over one structure per 40 acres.

This increasing threat of wildland urban interface in the state of Louisiana can be attributed to the increased population growth statewide, especially with a large portion of the population leaving urban areas and moving into the rural frontier. This ingress into rural areas has been targeted as a factor that can affect forest sustainability in the near future. Below are listed some of the factors listed in the Forest Resource Assessment and Strategy plan.

##### 5.2.4.1. Water

The conversion of forest land to urban use poses a threat to the sustainability of Louisiana's water quality and quantity. With less forestland to effectively process rainfall, impervious, urban surfaces generate an increase in storm runoff and streamflow that can lead to increased erosion rates, overbank flooding, and sedimentation rates. An additional effect of forest loss is that pollutants and fertilizers are able to reach larger water bodies through flow over impervious surfaces. Also, development in rural areas tends to occur near the headwaters of streams and rivers, which may affect all of Louisiana's aquatic species located downstream of development that are susceptible to pollutants and changes in water composition/temperature.

#### 5.2.4.2. Biodiversity

While some species have been able to adapt over time to the gradual encroachment of urbanization into their rural habitats and the changes this has caused to the natural resources they require, others are much more susceptible to changes in or around their habitat. These species require management to help prevent further population declines due to encroachment of anthropogenic effects and their subsequent habitat loss. For example, a group of species that once populated longleaf pine savannas, such as gopher tortoise, red-cockaded woodpecker, and other species, have found their populations become threatened as their home habitat has been lost and degraded due to urban growth and development.

#### 5.2.4.3. Wildfire

As the urban sprawl encroaches on natural forest habitats, the proximity of civilization to habitat that encounters frequent wildfires places more lives and properties at risk from the damages of fire. This proximity demands that safeguards and precautions are in place to ensure public safety. Two major methods to accomplish this safety are wildfire suppression and prescribed fire. Wildfire suppression is a reactive measure, ensuring that all forestry personnel are properly trained in the logistics and strategy needed to properly contain a wildfire once it is burning.

Prescribed burning, however, is a preventative measure to proactively control fuel loads within forest habitats and help to limit the intensity that wildfire may reach when they occur. The increasing scope of the WUI presents challenges to this in the form of increased planning time needed to adequately prepare citizens for pending prescribed burns, as well as the complexity of planning burns to limit the impacts of smoke on surrounding communities.

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

There are many non-native invasive plant (NNIP) and animal (NNIA) species in the state of Louisiana. [Error! Reference source not found.](#) provides a list of the most common NNIS and nuisance species that impact forest management. Additionally, there are numerous native species which can function as nuisance species when their abundance and distribution impact historic and healthy forest conditions. For example, the absence of historic wildfires and the lack of prescribed burning in some areas develops conditions where titi (*Cyrtilla racemiflora*), fetterbush (*Lyonia lucida*), and wax myrtle (*Morella cerifera*) limit forest regeneration, increase wildfire risk, and reduce biodiversity. Forest resource professionals can accurately assess which native species are serving in a nuisance capacity to inhibit the achievement of landscape objectives. Management and control of both NNIS and nuisance species is often most successful when it is integrative and adaptive (Miller et al 2015).

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

While not yet drastically infected by cogongrass, Louisiana is on the advancing front on the infestation across the Southeast. As of 2010, multiple counties on the eastern side of Louisiana had at least 2-10 infestations (EDDMapS 2019). The LDAF has been geolocating cogongrass infestations for annual monitoring and assessments. Landowners in the vicinity of these cogongrass infestations are being made aware of the issues with cogongrass and the

importance of its control. In 2015, the LDWF released a public advisory on cogongrass to make the public aware of its presence and dangers.

#### 5.2.5.1. Prevention and Monitoring

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

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

#### 5.2.5.2. Documentation and Planning

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

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

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

#### 5.2.5.3. 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)
- 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](https://www.srs.fs.fed.us/pubs/gtr/gtr_srs131.pdf)

#### 5.2.5.4. NNIA treatment methods:

- Feral hogs
  - Do not transport onto property and prohibit hunting lessees from doing so, as transport of any hogs to the wild or private land is illegal in the state of Louisiana
  - Property boundary fencing
  - Promote year-round aggressive hunting and trapping
    - Licensed contract trappers available
  - Careful game species food plot crop selection
  - Consultation and additional information through USDA Wildlife Services

#### 5.2.5.5. Nuisance animal treatment methods:

- White-tailed deer
  - Do not transport onto property and prohibit hunting lessees from doing so, as it is illegal in the state of Louisiana
  - Modify and increase deer harvest to control population abundance and sex ratios
  - Maintain property boundary fencing
  - Individual tree protectors for vulnerable seedlings
  - Install exclusionary fencing around young plantations and/or regeneration areas
    - Licensed contract trappers available
  - Practice time logging activities and use uneven aged stands to provide continual availability of browse and forage options.
- Beaver
  - Do not transport onto property and prohibit hunting lessees from doing so
  - Monitor all water sources and potential impoundment locations frequently for activity
  - Promote year-round aggressive hunting and trapping
    - Licensed contract trappers available
  - Destroy any dams or impoundments in conjunction with trapping and harvesting efforts
  - Consultation and additional information through USDA Wildlife Services

Table 3 Common Louisiana non-native invasive, plant (upland) and animal species list.

Common Name	Scientific Name
<b>Animal Species</b>	
Apple Snail	<i>Pomacea canaliculate/Pomacea maculata</i>
Argentine Ant	<i>Linepithema humile</i>
Carp (Common, Grass, Black, Silver)	<i>Ctenopharyngodon Idella/Cyprinus carpio/Hypophthalmichthys molitrix/Hypophthalmichthys nobilis/Mylopharyngodon piceus</i>
European Starling	<i>Sturnus vulgaris</i>
Feral cat	<i>Felis catus</i>
Feral dog	<i>Canis lupus familiaris</i>
Feral hog	<i>Sus scrofa</i>
House Sparrow	<i>Passer domesticus</i>
Lionfish	<i>Pterois volitans</i>
Norway/Black Rat	<i>Rattus norvegicus/Rattus rattus</i>
Nutria	<i>Myocastor coypus</i>
Red Imported Fire Ant	<i>Solenopsis invicta</i>
Rio Grande Cichlid	<i>Herichthys cyanoguttatus</i>
<b>Plant Species</b>	
Air Yam	<i>Dioscorea alata</i>
Bermuda Grass	<i>Cynodon dactylon</i>
Brazilian Waterweed	<i>Egeria densa</i>
Camphor Tree	<i>Cinnamomum camphora</i>
Cherokee Rose	<i>Rosa laevigata</i>
Chinese Parasol Tree	<i>Firmiana simplex</i>
Chinese privet	<i>Ligustrum sinense</i>
Chinese tallow	<i>Triadica sebifera</i>
Cogon grass	<i>Imperata cylindrica</i>
Common Salvinia	<i>Salvinia minima</i>
Coral ardisia	<i>Ardisia crenata</i>
Elephant Ear	<i>Colocasia esculenta</i>
Giant Salvinia	<i>Salvinia molesta</i>
Holmwood Grass	<i>Paspalum modestum</i>
Hydrilla	<i>Hydrilla verticillate</i>
Japanese climbing fern	<i>Lygodium japonicum</i>
Japanese Twin-Sorus Fern	<i>Deparia petersenii</i>
Kudzu	<i>Pueraria montana var. lobata</i>
McCartney Rose	<i>Rosa bracteata</i>
Smut Grass	<i>Sporobolus indicus</i>
Torpedo Grass	<i>Panicum repens</i>
Trifoliate Orange	<i>Poncirus trifoliata</i>
Vasey Grass	<i>Paspalum urvillei</i>

Common Name	Scientific Name
<b>Water Hyacinth</b>	<i>Eichhornia crassipes</i>
<b>Yellow Flag Iris</b>	<i>Iris pseudacorus</i>

#### 5.2.5.6. Biological Control

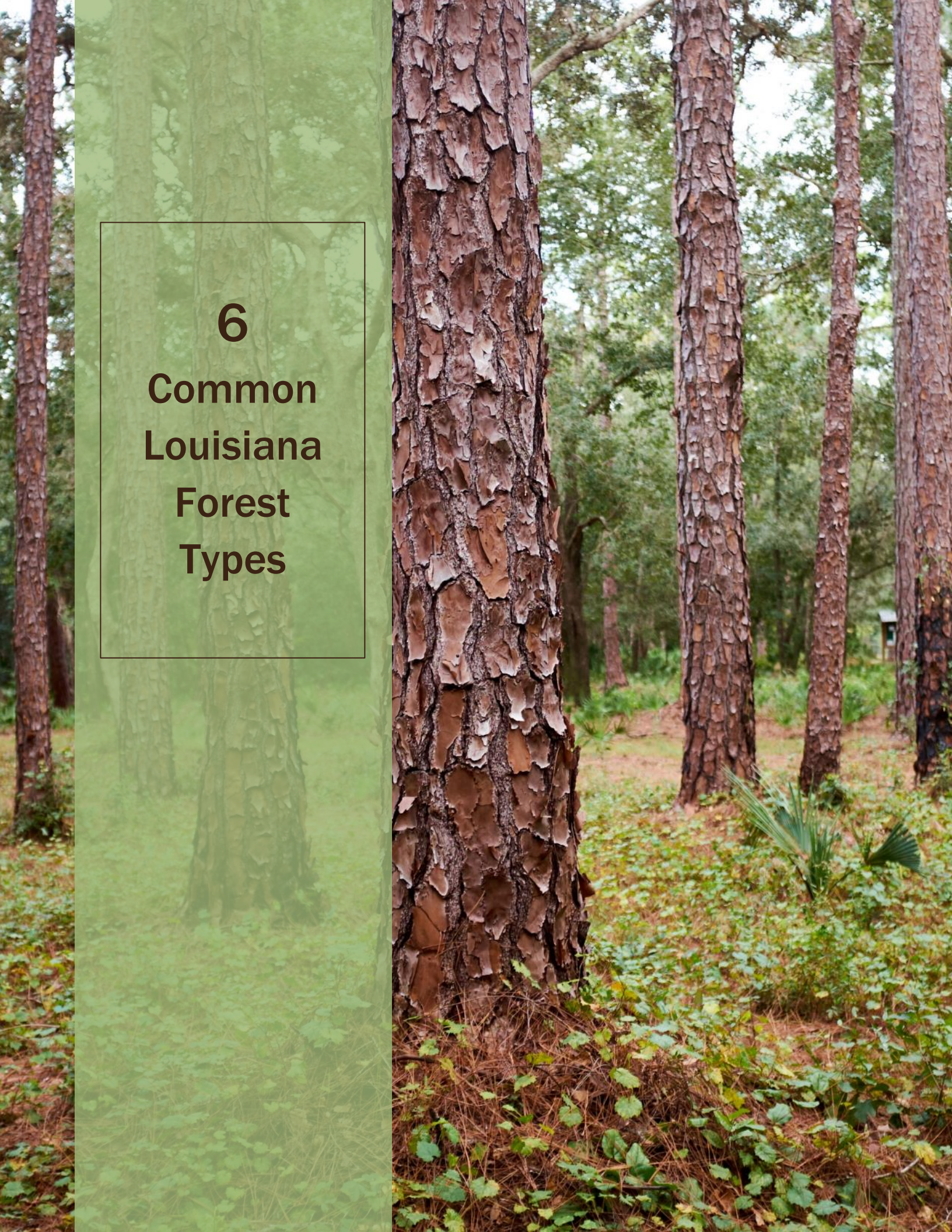
Per the USDA Forest Service's Forest Health Technology and Enterprise Team ([FHTET](#)), a biological control is “the reduction of an organism’s population density through use of its natural enemies”. The [FHTET](#) recognizes biological control as being one of the most effective and cost-efficient long-term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

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

#### 5.2.6. Lack of Mill Capacity

A major issue identified through collaboration with various Louisiana forest-related professionals and stakeholders is the lack of lumber mills available within the state. An article in the AgFax online publication, written by a member of the Louisiana State University AgCenter, echoes this sentiment and makes mention that the lumber mill shortage across the state, as well as the new market demand for smaller trees used in producing cardboard boxes, is altering the type of product landowners are attempting to produce through their timber. This lack of mills is causing as much as 2 million tons of wood to lay idle in Louisiana due to the lack of production capacity through mills (Osborne, 2019). The closure of a Georgia-Pacific paper mill north of Baton Rouge in early 2019 is indicative of the current Louisiana dilemma; there is more supply than capacity for production in the Louisiana forestry industry (Morgan, 2019).





# **6**

## **Common Louisiana Forest Types**



## 6. COMMON LOUISIANA FOREST TYPES

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

An example would be the mesic pine flatwoods natural community which in east Louisiana could be dominated by longleaf pine, slash pine, or a codominance of both, while in west Louisiana this changes to longleaf, loblolly, or a codominance (LDWF). Therefore, the mesic pine flatwoods natural community could occur in either the longleaf pine, slash pine, or loblolly pine forest types. Therefore, referring to The Natural Communities of Louisiana as well as the accompanying Natural Communities Fact Sheets distributed by the Louisiana Department of Wildlife and Fisheries may be useful in meeting landowner objectives. Detailed natural community descriptions, photos, species lists and other information on all the natural communities of Louisiana can be found in the two documents. Louisiana natural communities associated with the LMP Common Louisiana Forest Types are discussed within each respective forest type section. Refer to Table 5 for a listing of the common, dominant overstory species by associated LMP forest type. For this table, the respective species composition for the different forest types was found within the Louisiana Department of Wildlife and Fisheries' Natural Communities of Louisiana. Multiple Communities of Louisiana comprise each LMP Forest Type (i.e. Bottomland Hardwoods Forest Type contains wet hardwood flatwood, tupelo-blackgum swamp, and bottomland hardwood forest Communities of Louisiana).

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

Table 4 Common, dominant overstory tree species by LMP Forest Type

Common Name	Scientific Name	Slash dominated	Loblolly dominated	Longleaf dominated	Shortleaf dominated	Pine-hardwood mixed	Upland hardwoods	Bottomland hardwoods
<b>Species</b>								
<b>Loblolly pine</b>	<i>Pinus taeda</i>		X			X	X	
<b>Longleaf pine</b>	<i>Pinus palustris</i>			X		X		
<b>Shortleaf pine</b>	<i>Pinus echinata</i>				X	X	X	
<b>Slash pine</b>	<i>Pinus elliotii</i>	X				X		
<b>Spruce pine</b>	<i>Pinus glabra</i>						X	
<b>Hardwood Species</b>								
<b>American beech</b>	<i>Fagus grandifolia</i>					X	X	
<b>American elm</b>	<i>Ulmus americana</i>					X		X
<b>American sycamore</b>	<i>Plantanus occidentalis</i>							X
<b>Bitternut hickory</b>	<i>Carya cordiformis</i>					X	X	
<b>Blackjack oak</b>	<i>Quercus marilandica</i>					X		
<b>Cedar elm</b>	<i>Ulmus crassifolia</i>							X
<b>Cherrybark oak</b>	<i>Quercus pagoda</i>					X		X
<b>Cypress</b>	<i>Taxodium sp.</i>							X
<b>Florida maple</b>	<i>Acer barbatum</i>							X
<b>Flowering dogwood</b>	<i>Cornus florida</i>					X	X	X
<b>Green ash</b>	<i>Fraxinus pennsykvan</i>							X
<b>Horse sugar</b>	<i>Symplocos tinctoria</i>					X	X	X
<b>Laurel oak</b>	<i>Quercus laurifolia</i>						X	
<b>Live oak</b>	<i>Quercus virginiana</i>						X	
<b>Magnolia</b>	<i>Magnolia sp</i>					X	X	
<b>Mockernut hickory</b>	<i>Carya tomentosa</i>					X	X	X
<b>Nuttall oak</b>	<i>Quercus texana</i>							X
<b>Overcup oak</b>	<i>Quercus lyrata</i>							X
<b>Pignut hickory</b>	<i>Carya glabra</i>						X	X
<b>Planertree</b>	<i>Planera aquatica</i>							X

Common Name	Scientific Name	Slash dominated	Loblolly dominated	Longleaf dominated	Shortleaf dominated	Pine-hardwood mixed	Upland hardwoods	Bottomland hardwoods
Post oak	<i>Quercus stellata</i>					X	X	
Red maple	<i>Acer rubrum</i>					X		X
Red mulberry	<i>Morus rubra</i>							X
Sand live oak	<i>Quercus virginiana</i> var. <i>geminata</i>					X	X	
Shagbark hickory	<i>Quercus ovata</i>							X
Shumard oak	<i>Quercus shumardii</i>					X	X	X
Southern red oak	<i>Quercus falcata</i>					X	X	
Sugarberry	<i>Celtis laevigata</i>							X
Swamp chestnut oak	<i>Quercus michauxii</i>					X	X	X
Swamp dogwood	<i>Cornus foemina</i>							X
Swamp tupelo	<i>Nyssa biflora</i>							X
Sweetgum	<i>Liquidambar styraciflua</i>					X	X	X
Tulip tree	<i>Liriodendron tulipifera</i>					X	X	
Tupelo	<i>Nyssa sylvatica</i>							X
Turkey oak	<i>Quercus laevis</i>					X	X	
Water hickory	<i>Carya aquatica</i>							X
Water locust	<i>Gleditsia aquatica</i>							X
Water oak	<i>Quercus nigra</i>					X	X	X
White oak	<i>Quercus alba</i>					X	X	X
Willow oak	<i>Quercus phellos</i>							X
Winged elm	<i>Ulmus alata</i>							X
Fire Dependent (Fire Return Interval)		No	No	Yes	Potentially	Yes (2-20)	Yes (1-3)	



## 6.1. Slash Pine Dominant

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

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

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

## 6.2. Loblolly Pine Dominant

Loblolly pine is a highly valuable commercial species in Louisiana. It is often planted in dense, productive plantations with genetically improved seedling stock. It is often even-aged-managed on revenue-maximizing short rotations although it can also be managed on an uneven-aged basis, although to a lesser degree than longleaf. Loblolly is not as long-lived as [longleaf](#) or [slash pine](#). It is generally managed on shorter rotations for [pulpwood, oriented strand board and chip-n-saw](#). However, it can be managed on longer rotations for high-value products such as [saw timber, poles and ply logs](#).

Loblolly pine is third behind longleaf and slash pine in terms of disease, insect, and fire resistance, and is not very drought tolerant. Loblolly pine is not only economically valuable but is a key ecological component in upland pine and several wetland natural communities. Revenue and conservation objectives can be balanced or achieved individually through loblolly pine management.

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

## 6.3. Longleaf Pine Dominant

Longleaf pine is a popular forest type due to its high regional ecological, social, cultural and biological values. Longleaf pine is the most disease, insect and fire resistant of all the southern pine species and is very drought tolerant (Burns and Honkala 1990). Louisiana longleaf pine historically grew in mesic savannahs, mesic/wet/scrubby flatwoods,

upland pine, and upland mixed natural communities (LSU [AgCenter 2006](#)). Longleaf pine is a long-lived species with relatively slower growth characteristics compared to slash and loblolly pines, particularly for the first one to five years. Once it reaches the “rocket stage” (rapid vertical growth), growth rates are comparable to other pine species. This relatively slower growth habit and other physiological characteristics produce high quality saw timber and pole products. It is often managed on longer rotations for these high-value products compared to slash and loblolly pines.

Longleaf favors moderately to well-drained, deep, sandy, acidic, nutrient poor soils but also thrives on rich, moderately well drained clay hills (Burns and Honkala 1990). It grows in nearly pure stands on sandhills aside 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 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. Landowners may become a valuable part of the landscape-level restoration of longleaf pine. Longleaf is an ecologically and commercially valuable species that allows for single-use or multiple-use management.

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

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

## 6.4. Shortleaf Pine Dominant

Shortleaf pine is not a highly productive commercial species in Louisiana. Shortleaf pine is most productive on the dry hills of central and northern Louisiana, and was historically the most prevalent natural community of the upper [Western Gulf Coastal Plain](#) (Natural Communities of Louisiana 2009). It is offsite on deep, sandy soils.

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

Shortleaf pine exhibits relatively good disease and insect resistance, although the littleleaf disease is known to affect the health of shortleaf pine. However, like other pine species the shortleaf pine is susceptible to southern pine beetles (SPB). It is also similar to [slash](#) and [loblolly](#) in fire resistance and sprouts from the base following excessive fire damage. Shortleaf is not highly valuable economically, but is a minor ecological component in upland pine, upland

mixed woodland and dry upland hardwood forest [natural communities](#) ([Natural Communities of Louisiana 2009](#)). 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. This section will focus on shortleaf pine on upland pine sites. It grows alongside longleaf, oaks and hickories on upland mixed woodland sites ([Table 3](#)). Within dry upland hardwood forest, shortleaf can be found scattered with loblolly pine and dominant mixed hardwoods.

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 Louisiana. It has been successfully uneven-aged-managed, which can be a good fit for natural stands of shortleaf on private lands.

## 6.5. Pine-Hardwood Mixed

Pine-Hardwood Mixed (PHM) is a combination of uneven-aged, natural [forest types](#) which includes multiple upland [natural communities](#). Refer to Table 4 for a listing of the common, dominant overstory species by associated forest type comprising PHM. The natural communities within PHM are each similar in silvicultural operability to other xeric sites in Louisiana. The associated natural communities include: mixed hardwood-loblolly forest and loblolly pine-hardwood. This community type is found state-wide within the uplands of Louisiana and varies based on hydrology and elevation from site to site. This section will focus on the hardwood component of the hardwood-dominated natural communities that compose PHM. 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 PHM forests have relatively low timber productivity and generally are not actively managed, aside from upland pine. They are not fire tolerant/dependent, aside from upland pine and upland mixed woodland. Each has a closed canopy except upland pine and some upland mixed woodlands. Soils, productivity, and timber quality vary greatly across these hardwood sites. PHM forests produce mostly low value products such as hardwood pulpwood and fuelwood. These forests are dominated by shade tolerant hardwoods which are best suited for uneven-aged management. PHM allows the flexibility to manage for timber while also meeting [aesthetic](#) and [wildlife](#) objectives.

## 6.6. Upland Hardwoods

Upland hardwood (UH) communities represent a mixture of hardwood tree species with little to no presence of pine species. The associated natural communities according to [The Natural Communities of Louisiana](#) (2009) include: beech-magnolia forest, mixed hardwood forest, beech-mixed hardwoods, upland hardwood forest, hammock, and mixed mesic hardwood forest. This forest type is variable depending on location and usually found on slopes rising from stream floodplains dissecting pineland habitat in northern, western, central, and southeastern Louisiana ([The Natural Communities of Louisiana 2009](#)). This forest type is similar in composition to other mesophytic and riparian forests found throughout the state. Soils within upland hardwoods are typically mesic and acidic, varying from quite sandy to clayey depending on where they are found within Louisiana and the surrounding habitat. See Table 5 for a listing of the common, dominant overstory tree species for the upland hardwoods forest type.

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

## 6.7. Bottomland Hardwoods

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

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

The associated natural communities within the BH designation according to The Natural Communities of Louisiana (2009) include: overcup oak-water hickory forest, hackberry-American elm-green ash forest, batture, sweetgum-water oak forest, and live oak forest. After conferring with a group of natural resource professionals from Louisiana, however, it was determined that for the purpose of landscape management within this plan, the BH designation should apply to 3 distinct forest types: mixed floodplain, cypress-gum dominant, and cottonwood, sycamore, and birch.

### 6.7.1. Mixed Floodplain

Mixed floodplains are a combination of forest types which includes multiple wetland natural communities that are associated with riverine or creek systems. They are each similar in silvicultural operability and hydrology. These are uneven-aged, natural forested wetlands with long hydroperiods. They are not fire tolerant/dependent and each has a closed canopy. The associated natural communities include: hardwood flats and flatwoods. See Table 4 for a listing of the common, dominant overstory tree species for the mixed floodplain forest type.

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

### 6.7.2. Tupelo-Cypress Mixed

Tupelo-cypress mixed communities are relatively small, isolated, non-fire dependent wetlands embedded within various upland, pyrogenic natural communities. Pond cypress (*Taxodium distichum* var. *nutans*) and swamp tupelo (*Nyssa sylvatica* var. *biflora*) are relatively slow-growing and dominate this forest type together or in pure stands.



These wetland ponds have a hydroperiod that lasts most of the year, with gum-dominated ponds having a longer hydroperiod than cypress. Cypress-dominated stringer swamps occur along intermittent streams that only flow following heavy rainfall. They occur on relatively unproductive organic muck, heavy clay, wet sand and peat soils. However, these typically even-aged forest types can be managed sustainably by using the Louisiana [Silviculture BMPs](#).

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

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

### 6.7.3. Cottonwood, Sycamore, and Birch

Cottonwood, sycamore, and birch (CSB) is a community located in still water depressions or lowlands and not associated with rivers or creeks. This is an uneven-aged, natural forested wetland with a varying hydroperiod. CSB communities are not fire tolerant/dependent and they have a closed canopy. CSB's typically have dense over/mid/understories and are sometimes impenetrable. See Table 4 for a listing of the common, dominant overstory tree species for the cottonwood, sycamore, birch 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 Louisiana's [Silviculture BMPs](#).



# 7

## Forest Resources







## 7. FOREST RESOURCES

The forest resources discussed below are applicable resources from all forest types in the LMP and may be considered for each landowner. They are summarized below, rather than included in the forest types discussion due to their relative uniform applicability across all forest types. The forest resources particular to each forest type are given in Section 7.2.

### 7.1. Common Forest Resources

#### 7.1.1. Conservation Incentives

There are several programs and markets available to landowners that can reward them and provide incentives for their conservation efforts. The most widely used programs are cost-shares. 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 \(EQIP\)](#), [USFWS Partners for Wildlife \(PFW\)](#), 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 Louisiana Office of Forestry (LOF) administers a number of programs including the [Forest Legacy Program \(FLP\)](#), [Southern Pine Beetle Prevention Program \(SPBP\)](#), and the [Louisiana Forestry Productivity Program](#). The United States Department of Agriculture (USDA), through various Louisiana state organizations, provides technical and financial assistance through the [Conservation Reserve Enhancement Program \(CREP\)](#) to remove environmentally sensitive cropland and grazing land. 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. In Louisiana, these agreements are also recognized as conservation servitudes. Landowners can enter their property into a conservation servitude agreement through various entities such as the [Louisiana Department of Wildlife and Fisheries \(LDWF\)](#) or [Land Trust for Louisiana \(LTL\)](#). The LDWF maintains its Natural Heritage Fund to cover the costs associated with stewardship of its servitudes, and LTL is a non-governmental entity accredited by the national Land Trust Alliance Commission and state certified by the Louisiana Department of Natural Resources. Conservation servitudes vary, but most ensure the land is never developed, while allowing the landowner to continue management activities such as timber harvests, and in return they receive a property tax break. This option also allows many landowners a strategy during the estate planning process. Some landowners may also be available to earn credits on private mitigation banking markets through the enhancement or restoration of wetlands and/or threatened and endangered species habitat.

#### 7.1.2. Ecosystem Services

Forests provide ecosystem services to society that are wide ranging and difficult to value. These ecosystem services include clean air and water, carbon sequestration, aquifer recharge, climate resilience, and biodiversity. There are currently no significant markets for these services in Louisiana, but they may develop in coming years. However, lack of financial incentives does not discount the crucial services ecosystems provide us, making ecological maintenance and restoration an important objective for many landowners.

### 7.1.3. Historical and Cultural Sites

Many private lands contain various historical and cultural resources, also known through ATFS as “special sites.” Therefore, forest management activities are often developed to consider and maintain any special sites relevant on the property. Landowners may be aware of these sites or their locations may be documented and mapped with federal, state or local agencies and organizations. [Forest resource professionals](#) could discuss known sites with landowners. If the landowner is unaware of any sites or the land is newly acquired, there are many resources available to review potential recorded sites such as the [National Register of Historic Places](#) (NRHP) or the [Louisiana Office of Cultural Development](#) (LOCD) 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 LOCD 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.

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

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

- Significance:
  - Site has made a significant contribution to the broad patterns of our history;
  - Associated with the lives of significant persons of the past;
  - Embody distinctive characteristics of a type, period or method of construction, or represent the work of a master, or possess high artistic values, or represent a distinguishable entity whose components may lack individual distinction;
  - Yielded or likely to yield information important in history or pre-history
- Age: Minimum 50 years-old
- Integrity:
  - Site must retain its historical physical integrity with its character-defining features still present.
  - Building, structure or landscape feature must be relatively unchanged.
  - Archeological site must be relatively undisturbed, with its patterns and layers of artifacts relatively intact.
  - Traditional cultural site must be recognizable to today’s affiliated cultural group, evidenced through tradition and still used or revered today.
- Personal Significance: such as a location, structure or artifact with a family importance or meaning.



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

Historic, cultural, and special sites may include:

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

#### 7.1.4. Recreation

One of Louisiana's state mottos is "Sportsman's Paradise", and that illustrates its statewide pride in its abundance of natural resources. Louisiana 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:

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

#### 7.1.5. Aesthetics

From a towering pine stand with a sea of grasses to a lush, mixed Bottomland Hardwood forest draped with Spanish moss, the wide range of forest types, topography and aquatic features throughout Louisiana provide unique forest aesthetic values. The forests themselves vary from open, pine-dominated rolling hills to dense cypress ponds. North Louisiana boasts hardwood forests more fitting of the Ozark mountains as you move toward the Arkansas border. These dense forests are composed of many northern species, providing a different aesthetic than the southern Louisiana lowlands, where the cypress lined rivers and ponds have their own prehistoric beauty.

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



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

#### 7.1.6. Forests of Recognized Importance

Forests of Recognized Importance (FORI) represent globally, nationally, and regionally significant large landscape areas of exceptional ecological, social, cultural, or biological values (2015-2020 Standards of Sustainability for Forest Certification, ATFS). These forests are evaluated at the landscape level, not the individual stand level, and must have a combination of unique properties, rather than just one, to qualify as a FORI. Some attributes that may include a landscape in the FORI designation include:

- Protected, sensitive, or rare forest type habitats such as riparian areas or wetland biotopes,
- Areas including endemic species and critical habitats of multiple different Threatened and Endangered species as recognized by the USFWS,
- Recognized large-scale cultural or archaeological sites,
- Areas containing identified and protected water resources that serve large metropolitan populations, or
- Areas containing unique or geologic features such as geysers, waterfalls, lava beds, caves, or craters.

While there is no central repository for information on FORI and no state or federal agency that regulates them on private lands, there are multiple different resources (state natural heritage database, state wildlife action plan, local NRCS office, state archaeologist) to verify whether private forests are or include a FORI.

##### 7.1.6.1. FORI Designation within Region

In the United States, because of their significance, FORIs have generally been identified and protected by federal or state governments or are under conservation easement by an environmental nonprofit organization. There is 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 state while consulting the area conservation priorities. As a state, Louisiana has chosen to designate no land as FORI at this time. Sites that are federally protected or have conservation items should still receive the required protection as given by law; however, none of these lands have a FORI designation.

## 7.2. Forest Type-Specific Forest Resources

### 7.2.1. Fish & Wildlife

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

The [Silviculture BMPs](#) compile strategies and considerations for managing and protecting these species and their habitat during silvicultural operations. For example, marking a rare plant or animal area with flagging, paint or signage to protect during harvest operations, regular active monitoring and following up with post-harvest inspection(s).

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

### 7.2.2. Timber Products

Timber merchantability, whether planted or natural, pine or hardwood, will depend on local timber markets and mill product specifications. The [LMP Geodatabase](#) can be utilized to locate and contact local mills and calculate haul distance. Louisiana timber markets are in Alabama, Mississippi, Texas, and Arkansas and currently include these products:

- Pulpwood:
  - Pine and Hardwood
    - Tree-length and clean chips
- Oriented strand board (OSB): pine
  - Similar price as pulpwood
- Chip-n-saw: pine
- Sawtimber: pine and hardwood
- Poles and pilings: pine
- Mulch: hardwood and cypress
- Fuelwood:
  - Pine, hardwood and large woody shrub species
    - Chips for energy production
  - Hardwood
    - Firewood
- Other hardwood products: Pallets, mats, small diameter saw timber for furniture

#### Pine forest products

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

### Hardwood forest products

All the major timber product groups can be harvested from [Pine-Hardwood Mixed](#), [Upland Hardwood](#), and [Mixed Floodplain](#) forest types including pulpwood, chip-n-saw, saw timber and fuelwood. Pine-Hardwood Mixed and Mixed Bottomland forests are commonly managed for hardwood pulpwood, various pine products and fuelwood. Mixed Bottomlands also allow for fuelwood harvests, especially utilizing natural regeneration and hardwood reduction treatments.

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

### 7.2.3. Non-Timber Forest Products

Many non-timber forest products (NTFP) opportunities exist within pine forests, including pine straw ([slash](#) and [longleaf](#) pine) silvopasture (all pine forests), bee-keeping (all pine forests) and saw palmetto drupe harvests (all pine forests). NTFPs exist to a certain scale within hardwood forests as well. [Pine-hardwood mixed](#), [upland hardwood](#), [mixed floodplain](#), [tupelo-cypress mixed](#), and [cottonwood, sycamore, birch](#) all provide opportunities for bee-keeping and fruit harvests, while tupelo-cypress mixed forest types provide opportunities for the collection of cypress knees as well.

### Pine-specific forest types

#### *Pine straw*

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

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

Visit [“LSU AgCenter: Raking Pine Straw \(2005\)”](#) and [“Lifting Longleaf Pine Straw: An Option to Balance Income and Wildlife”](#) for more information.



### *Silvopasture*

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

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

Silvopasture provides economic security by reducing risk through diversification of products. However, prior to establishing a new silvopasture system, local land-use, cost share and tax regulations should be reviewed. Forestry and agriculture may have different land use and zoning regulations which may be tied to separate tax structures. Some states consider silvopasture cost sharable through Environmental Quality Incentive Program (EQIP).

Silvopasture is generally established in pastures. Existing timber stands can be thinned or clearcut to provide 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).

### **Hardwood-specific forest types**

#### *Cypress knees*

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

### **Pine and hardwood forest types**

#### *Honey*

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

Beekeeping and honey production is considered a valuable industry by the Louisiana Department of Agriculture. In order to protect this industry from pests and unwanted species of honey bees, they require beekeepers to resister honey bee colonies through their website.

## Fruits

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

Palmetto drupes are a primary dietary staple of Louisiana black bear (US Fish and Wildlife Service 2019) 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*), bobwhite quail (*Colinus virginianus*), black bear (*Ursus americanus*), feral hog, and various birds such as American robin (*Turdus migratorius*), northern mockingbird (*Mimus polyglottos*), yellow-rumped warbler (*Dendroica coronata*) and pileated woodpecker (*Dryocopus pileatus*) (Anderson and Oakes 2012). If wildlife management is an objective, landowners may wish to avoid or limit palmetto drupe harvests.

Mayhaw (*Crataegus* spp.) can be collected from mixed bottomland forests as a group and is often made into a jelly and sold commercially. Blueberry, blackberry and other native fruits grow in several forest types 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





# 8

## Silvicultural Options





## 8. SILVICULTURAL OPTIONS

### 8.1. Timber Harvest

The following silvicultural and land management tools are available to Louisiana [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](#) compile voluntary guidelines, strategies and considerations for managing, enhancing and protecting: timber and [NTFP](#) resources, rare plant and animal species/habitat, aquatic ecosystems and air and water quality, during silvicultural operations. [Silviculture BMPs](#) apply to: timber harvest, [site preparation](#), [reforestation](#) and forest operations (roads, water control structures, etc.) activities. [Historical and cultural resource protection](#) and [recreation](#) management are also considered during planning and active silvicultural operations.

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

#### 8.1.1. Thinning

##### 8.1.1.1. Pine Forest Types

Thinning is a primary land management tool used in Louisiana 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](#) related to thinning harvests, particularly in wetlands and streamside management zones.

Several types of merchantable release thinning are utilized in pine stands within Louisiana. Merchantable release thinning includes row thinning in un-thinned planted pine stands. The most common row thinning methods are every third and fifth row thinnings. Every other and 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 also mark 1+ acre demonstration areas on logger-selection first thinnings to walk through and discuss with logging crews how the stand will be thinned.





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

If wildlife, aesthetics or biodiversity are primary objectives, stands should be 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, a decision must be made on final harvest or conducting a natural regeneration cut. Natural regeneration and under-planting harvests utilize thinning and will be discussed in Reforestation.

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

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

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

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

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

Natural regeneration harvests are discussed in the reforestation section.

#### 8.1.1.2. Upland Mixed Hardwood-Pine Forest Type

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

Thinning from above can be used as a [natural regeneration](#) method.

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

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

Pre-merchantable thinning or fuelwood [chipping](#) harvests can be used in UMHP stands.

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

[Natural regeneration](#) harvests are discussed in the [reforestation](#) section.

#### 8.1.1.3. Upland Hardwoods Forest Type

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

#### 8.1.1.4. Bottomland Hardwoods Forest Types (Mixed Floodplain, Cypress-Gum Dominant, Cottonwood/Sycamore/Birch)

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

#### 8.1.2. Clearcut

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

Another primary use of clearcutting is for [salvage harvests](#) which are discussed in that section.

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

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

### 8.1.3. Chipping

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

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

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

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

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



#### 8.1.4. Salvage

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

The primary purpose of a salvage harvest is to utilize as much of the damaged timber resource as possible 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 pine stands as well as hardwoods. A variety of natural and anthropogenic factors could cause the need for a salvage harvest. For example, a hurricane may wind-throw an entire stand that would need to be salvaged, southern pine beetle outbreaks may require a clearcut for salvage, or an improper prescribed burn may cause mortality.

##### 8.1.4.1. Edge Feathering

Edge feathering is a technique used within thinning to create forest edges that gradually transition from forest to the surrounding habitat, especially if the adjacent land is managed land such as cropland or pasture. Within this practice, three different zones are created with each containing increased levels of thinning (75% thinned, 50% thinned, 25% thinned) moving from the forest edge into the forest (Habitat How-To's 2019). This method of thinning creates a gradual transition from larger trees in the forest to smaller grassy vegetation, while creating habitat for various wildlife species that need brushy cover for nesting. A broader edge between forest and pasture/cropland gives more room for these species to establish a home and is a major technique utilized in bird-friendly forestry.

## 8.2. Reforestation

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

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

### 8.2.1. Artificial Vs. Natural Regeneration

A selection between artificial and natural regeneration must be made during the stand and property-level silvicultural planning process. This selection is driven by landowner objectives and site-specific circumstances. However, there are pros and cons to each reforestation strategy (Table 5).

*Table 5 Comparison summary of artificial and natural regeneration methods of reforestation.*

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

### 8.2.2. Site Preparation

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

Vegetative competition varies across sites and the appropriate site preparation technique(s) should be selected to adequately control it. Vegetative competition control *prior* to planting increases the stand establishment success. With adequate site preparation, slash, loblolly, and shortleaf pine will initiate fast, early vertical growth. For longleaf pine, adequate site preparation is essential for seedling survival.

### 8.2.2.1. Chemical Site preparation

The use of herbicides over mechanical treatments in site preparation has increased in the last couple decades for a variety of reasons, including increased machinery and fuel costs, increased chemical specificity, the ability of herbicides to kill the entire root of unwanted hardwoods, and the minimal impact of herbicides on soils (UF IFAS Extension 2009). Herbicide is applied based on the recommended site preparation label rate for the target and crop species and site conditions. The appropriate herbicide and chemical site preparation technique is selected to effectively target the primary woody and herbaceous vegetative competition. Site preparation herbicide is typically applied aerially by helicopter or through ground application using the broadcast or banded techniques. There are site-specific [Silviculture BMPs](#) related to site preparation, particularly in wetlands and streamside management zones.

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

Each herbicide used has different characteristics that allow it to be used in specific situations and to target specific forms of vegetation. The active ingredient present within the herbicide has the greatest influence on the effectiveness of the herbicide, as it is the portion of the herbicide that negatively affects the desired vegetation (Osiecka et al. 2005). A listing of common active ingredients, along with the species targeted by the herbicide, the species resistant to the herbicide, and the proper application period can be found through the [NC State 2017 Quick Guide to Forestry Herbicides Used for Softwood and Hardwood Site Preparation and Release](#). It is important to consult a professional forester prior to herbicide use in order to ensure correct application and usage.

Chemical site preparation techniques and application methods are varied, depending on the species present and the desired outcome of the chemical application. Herbicide labels give the types of application methods registered for each herbicide. Factors such as tract size, stand density and structure, the needed application rate, and the proper application timing are also essential to determine before selecting the proper herbicide (Osiecka et al. 2005). Below are common techniques for the application of herbicides; also, [Manual Herbicide Application Methods for Managing Vegetation in Appalachian Hardwood Forests](#) provides details concerning the chemical composition of and application methods for various herbicides.

#### 8.2.2.1.1. All Herbicide Types

##### **Broadcast**

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

## **Band**

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

## **Spot**

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

### **8.2.2.1.2. Foliar-active Herbicides**

#### **Directed Spray**

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

#### **Basal Bark Spray**

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

#### **Hack and Squirt**

The hack and squirt application method involves cutting or drilling into the sapwood of the tree and immediately applying herbicide to the interior of this cut. This application method is most effectively for treating large-diameter trees and does not require the herbicide to be in an ester formulation.

#### **Injection**

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

#### **Cut Stump**

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



#### 8.2.2.1.3. Soil active Herbicides

##### **Grid Application**

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

##### **Spot-Around**

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

##### **Individual Stem**

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

#### 8.2.2.2. Mechanical Site preparation

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

##### 8.2.2.2.1. Bedding

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

##### 8.2.2.2.2. Roller drum chopping

Roller drum chopping is used on various pine flatwoods sites to reduce woody and herbaceous competition. 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, bull dozers, or more commonly, skidding machines, depending on horsepower requirements and site conditions.

##### 8.2.2.2.3. Scalping and ripping/subsoiling

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

#### 8.2.2.2.4. Root raking and piling

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

#### 8.2.2.2.5. Mowing and mulching

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

#### 8.2.2.2.6. Harrowing/disking

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

#### 8.2.2.2.7. Shearing

Shearing involves a heavy bulldozer equipped with an oversized V-blade that shears off stumps and 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.

#### 8.2.2.2.8. Logging

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

#### 8.2.2.2.9. Anchor chain/dragging

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

### 8.2.2.3. Prescribed Site Preparation Burn

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

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

### 8.2.3. Artificial Regeneration

Artificial regeneration follows [clearcutting](#). Table 5 provides 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 accurately evaluated during artificial regeneration planning. A density is selected that meets primary objectives such as timber, wildlife, aesthetics and recreation. If timber management is an objective, a relatively higher density may be selected.

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

Artificial regeneration generally involves planting seedlings in rows that are spaced at a desired density. However, a random or natural pattern can be established as well using hand planting. High survival rates depend on selecting appropriate species for the site, adequate site preparation, suitable planting method, proper care of quality [seedlings](#) and natural factors such as climate and pests. A seedling survival check can be conducted following the first growing season to determine if the stand was successfully established, to document initial stocking and decide if supplemental planting is required to achieve desired stocking.

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

[Longleaf](#) is a good alternative on less productive, sandy soils for landowners interested in managing for multiple uses. The dichotomy between managing [slash](#) and longleaf on flatwoods sites can be reviewed with the landowner prior to species selection. This decision is driven by the typical species selection considerations but landowner objectives will ultimately determine the appropriate species to plant.

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

#### 8.2.3.1. Hand Planting Vs. Machine Planting

##### 8.2.3.1.1. Hand planting

Hand planting entails crews planting seedlings by hand. Refer to Table 6 for more information on this method and a comparison with machine planting.

### 8.2.3.1.2. Machine planting

Machine planting involves two main methods (flatwoods planting (rubber-tired tractor) or V-blade planting). Flatwoods planting requires a cleaner site, hence more mechanical site preparation. This is due to limitations of the planting machine itself and the rubber-tired farm tractor commonly used to pull it. V-blade machine planting generally uses the same planting machine, but is pulled behind a bulldozer with a large heavy duty “V”-shaped blade that clears large debris and creates a vegetation-free strip that seedlings are planted in. V-blade planting can handle rougher sites, and therefore does not require as much mechanical site preparation. V-blade is essentially planting and site preparation in-one, but costs more than flatwoods planting. If contract specifications allow it, V-blade planting can result in planting seedlings in a trench on wetter sites. This can result in high mortality. V-blade is particularly useful if mechanical or chemical site preparation plans are not completed prior to scheduled planting, or where chemical site preparation methods conflict with landowner objectives. Refer to Table 6 or more information on machine planting. Any of these planting methods can be used to plant pine species.

*Table 6 Comparison summary of hand and machine planting methods of artificial regeneration.*

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

### 8.2.3.2. Under-Planting

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



### 8.2.3.3. Seedlings

This section will focus on pine seedlings. Hardwood and cypress seedlings are available in local nursery markets, both in containerized and bare root form. Reforestation with these species is not large-scale in Louisiana and is costly, especially hardwoods. Pond and bald cypress are available in traditional, “cell” containerized form, while hardwood seedlings generally start in larger 1-3 gallon containers for landscaping markets. Hardwoods are more commonly planted on a smaller-scale, focusing on wildlife management. For example, planting white oaks adjacent to food plots for enhancing hunting programs. Cypress is planted near pond edges for wildlife or aesthetics and small-scale wetland restoration.

#### 8.2.3.3.1. Containerized Vs. Bare Root

##### 8.2.3.3.1.1 Containerized seedlings

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

##### Bare root seedlings

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

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

### 8.2.3.4. Afforestation

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

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

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

## 8.2.4. Natural Regeneration

Pine, hardwood and cypress stands can be naturally regenerated to meet various objectives, including uneven-aged management. This section will examine both hardwood and pine natural regeneration site preparation processes, although hardwood management activities are far less common within Louisiana. 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 6 for general information on pine natural regeneration and a comparison between this method and [artificial regeneration](#).

[Premerchtable thinning](#) is often required in natural regeneration management regimes and is discussed in the [release](#) treatment section.

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

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

### 8.2.4.1. Site preparation

#### 8.2.4.1.1. Pine forest types

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

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

#### 8.2.4.1.2. Hardwood forest types

For [Pine-Hardwood Mixed](#) and [Upland Hardwood](#) forest types, timing of site preparation activities such as a prescribed burn does not matter to the overall survival of natural recruitment. Different forms of site preparation are recommended for hardwood forests, such as a natural regeneration harvest or clearcut. A carefully timed natural

regeneration harvest typically serves as site preparation when attempting to naturally regenerate hardwood stands, while coppice can also be utilized to reforest a clearcut. Other forms of site preparation previously discussed may also be utilized.

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

#### 8.2.4.2. Shelterwood

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

#### 8.2.4.3. Seed Tree

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

#### 8.2.4.4. Group Selection

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

#### 8.2.4.5. Thinning from Above

This method of thinning can be used to release existing natural regeneration in Pine-Hardwood Mixed and Upland Hardwood forest types. This entails removing all or part of the dominant overstory trees, releasing the suppressed

natural regeneration already in place within the midstory. This requires carefully planned logging operations as to not destroy the desired trees being released during overstory harvest.

## 8.3. Release

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

### 8.3.1. Chemical

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

These early and mid-rotation methods include:

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

#### 8.3.1.1. Herbaceous Weed Control

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



#### 8.3.1.2. 8.3.1.2 Woody Stems/Understory

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

#### 8.3.2. Mechanical

Early and mid-rotation mechanical release treatments targeting vegetative competition are utilized where additional competition control is required. This is sometimes due to insufficient site preparation. These treatments are similar to [site preparation](#) and include: mowing, chopping and mulching. All three can be used for early-rotation release but caution should be used to avoid damaging young pines. Chopping may damage feeder roots in mature pines and should be avoided mid-rotation.

#### 8.3.3. Prescribed Fire

[Prescribed fire](#) can be used as an early rotation release in [slash pine](#) stands once they can handle fire. Broadcast prescribed burning serves as a mid-rotation release in slash stands.

#### 8.3.4. Premerchantable Thinning

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

### 8.4. Prescribed Fire

#### Pine forest types

Louisiana'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 Louisiana 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, biodiversity, and reducing the risk of wildfire.

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

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

## Hardwood forest types

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

Research, however, has shown that certain hardwood types, particularly oak-dominated communities as seen in the uplands of Louisiana, can benefit from prescribed burning although they are not necessarily fire-dependent (Van Lear et al. 1999). As fire was gradually removed from oak-dominated and other upland hardwood communities, shade-tolerant species began to dominate the understory and then the overstory as disturbance allowed them access to sunlight. On better quality sites, frequent burning has been seen to create oak-favorable environments by removing shade-tolerant understory species. This creates a bare forest floor that promotes oak regeneration through squirrel and blue jay acorn burying and also reduces soil moisture, keeping oaks at an advantage over mesophytic shade-tolerant species such as birch, maple, or hickory.

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

As prescribed burning within hardwood forests is dependent on a variety of factors, it is essential to consult a resource professional prior to attempting a burn. This consultation can provide further information on how and when the burn will be the most effective for a specific purpose.

[Bottomland Hardwoods](#) forest types are not fire dependent and burn infrequently, with cypress dominated ponds slightly more frequent than gum-dominated. However, their ecotones generally burn along with the fire dependent uplands they are embedded within. Burning these ecotones is crucial for the many rare species found there. The interior portions of the BH forests 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

### 8.4.1. Advantages of Prescribed Fire

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

Prescribed fire opens the mid and understories by consuming overgrown vegetation and dead fuels. This stimulates many species of grasses, forbs and herbs. The result is an open, lush, scenic understory that is aesthetically pleasing. Stands maintained with prescribed fire have more plant and wildlife biodiversity compared to fire suppressed stands. Even old field sites planted with pines develop a more diverse understory compared to those without fire. This diverse, open understory is also beneficial to many species of wildlife, 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. This also improves outdoor recreational experiences and helps reduce the spread of tick-borne illnesses such as Lyme disease and rocky mountain spotted fever.

#### 8.4.2. Disadvantages of Prescribed Fire and Ways to Mitigate

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

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

Fire is inherently dangerous so a certain level of risk comes along with conducting prescribed burns. Tied to that risk is the liability if a burn does not go as planned which causes many landowners to avoid prescribed burning. Landowners have the option to transfer that liability by hiring a state or private contractor to conduct their burning; the preference would be an individual that is a Louisiana Certified Burn Manager to ensure compliance with state law and to give liability protection in the event of a burn accident. Louisiana Certified Burn Managers can be found at the following link: <http://www.ldaf.state.la.us/wp-content/uploads/2016/02/2016-Prescribed-Burning-Contractors-List.pdf>. Louisiana 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 may include:

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

Documentation and record keeping of prescribed fire planning and activities is encouraged.

### 8.4.3. Methods of Prescribed Fire

#### 8.4.3.1. Broadcast Burning

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

#### 8.4.3.2. Site Preparation Burns

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

#### 8.4.3.3. Pile Burns

Pile burning is a form of site preparation burning. Large post-harvest debris within clearcuts are raked into scattered piles and burned. The objective is reducing logging slash to improve access and operability for [machine planting](#). Pile burning is not used to reduce vegetative competition. A site preparation burn may incorporate pile burning.

### 8.4.4. 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, while the other 3 pine species should have prescribed fire every one to three years. This can be adjusted based on the factors listed in the previous paragraph.

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

However, growing season burns are challenging due to increased potential for scorch caused by higher ambient temperatures. Growing season prescribed burns are ideal for sites with lighter fuel loads or those with a history of prescribed fire. April-June is Louisiana'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. This transition from dormant to growing season burns is also dependent on the accumulation of duff layers around the base of the trees. It may take multiple dormant season burns to eliminate this duff layer and ensure a safe growing season burn's fuel load. 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 Louisiana (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.

The pine species can be prescribed burned year-round.

#### 8.4.6. Fire Weather

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

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

## 8.5. Fertilization

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



# 9

## Acronymic Key







## 9. ACRONYMIC KEY

Abbreviation	Name
004 Form	ATFS Inspection Form
ACEP	Agricultural Conservation Easement Program
ACF	Association of Consulting Foresters
AFF Standards	AFF Standards of Sustainability
ALRI	America's Longleaf Restoration Initiative
ATFS	American Tree Farm System
ATV	All-Terrain Vehicle
BH	Bottomland Hardwoods
BMP	Best Management Practice
CFCI	Coastal Forest Conservation Incentive
CI	Conservation Initiative
CPRA	Coastal Protection and Restoration Authority
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CSP	Conservation Stewardship Program
EAB	Emerald Ash Borer
ECOS	Environmental Conservation Online System
EIN	Employee Identification Number
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESA	Endangered Species Act
FGDL	Florida Geographic Data Library
FHTET	Forest Health Technology and Enterprise Team
FLP	Forest Legacy Program
FMV	Fair Market Value
FORI	Forests of Recognized Importance
FPP	Forest Productivity Program
FSA	Farm Service Agency
FSP	Forest Stewardship Program
FSP Standards	FSP National Guidelines and Standards





Abbreviation	Name
GIS	Geographic Information System
GPS	Global Positioning System
HUC	Hydrologic Unit Code
IOBC	International Organization for Biological Control
IPM	Integrated Pest Management
KBDI	Keech-Byram Drought Index
LDAF	Louisiana Department of Agriculture and Forestry
LDHP	Louisiana Department of Historic Places
LDWF	Louisiana Department of Wildlife and Fisheries
LLC	Limited Liability Company
LLPI	Longleaf Pine Initiative
LMP	Landscape Management Plan
LOCD	Louisiana Office of Cultural Development
LOF	Louisiana Office of Forestry
LSU	Louisiana State University
LTL	Land Trust for Louisiana
MAP	Mississippi Alluvial Plains ecoregion
MBHI	Migratory Bird Habitat Initiative
MRBI	Mississippi River Basin Healthy Watersheds Initiative
MVLP	Mississippi Valley Loess Plains ecoregion
NBCI	National Bobwhite Conservation Initiative
NCREIF	National Council of Real Estate Investment Fiduciaries
NNIA	Non-Native Invasive Animal
NNIP	Non-Native Invasive Plant
NNIS	Non-Native Invasive Species
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NTFP	Non-Timber Forest Product
NWF	National Wildlife Federation
NWOS	National Woodland Owner Survey
NWQI	National Water Quality Initiative
NWTF	National Wild Turkey Federation
OHV	Off-Highway Vehicles

Abbreviation	Name
OSB	Oriented Strand Board
PEFC	<u>Programme for the Endorsement of Forest Certification</u>
PHM	Pine-Hardwood Mixed
QTP	Qualified Timber Property
RH	Relative Humidity
SAF	Society of American Foresters
SCP	South Central Plains ecoregion
SER	Society of Ecological Restoration
SFC	Southern Forestry Consultants
Silviculture BMPs	Louisiana Office of Forestry Best Management Practices for Silviculture
SMZ	Streamside Management Zone
SP	Southeastern Plains ecoregion
SPB	Southern Pine Beetle
SPBP	Southern Pine Beetle Prevention Program
SPI	Shortleaf Pine Initiative
Support Committee	Landscape Management Plan Development Support Committee
T&E	Threatened and Endangered Species
UH	Upland Hardwoods
UMHP	Upland Mixed Hardwood Pine
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WBD	Water Boundary Dataset
WGCP	Western Gulf Coastal Plains ecoregion
WLFW	Working Lands for Wildlife
WUI	Wildland Urban Interface





# 10

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