FORESTRY MANAGEMENT TECHNIQUES

Applying forest management practices to increase forest productivity is called ***silviculture***. Prior to implementing forestry practices, a forester develops a ***forest management plan***. The forest management plan includes:

1. Objectives - Explains the desired outcome
2. Description - Describes plant communities, soil conditions, wetlands on site, and other forest characteristics
3. Plan of Action - Management practices that will occur to reach the objective
4. Maps - Gives the general layout of the site to be forested

The following describes forest management practices utilized in the field of forestry:

TIMBER STAND IMPROVEMENT

Tree farming involves a degree of undesirable tree control to allow for maximum timber production, just as agricultural operations involve weed control for maximum crop growth. In forestry, the weeds may be undesirable tree species or they may be trees of desirable species that are deformed, forked, or less vigorous than the crop trees.

Controlling undesirable trees to remove undesirable competition in the forest is called ***timber stand improvement*** (TSI). There are varying levels and methods of TSI in Florida, and each represents a substantial cost to the landowner. In many cases, the cost of a TSI operation can actually exceed the value of the timber crop.

In Florida, pine trees are the most profitable species to grow and hardwoods are generally viewed as undesirable trees in commercial stands of pine. In the discussion on succession, it was pointed out that hardwoods will crowd out pines without some outside factor, such as fire. If high-quality pine trees are to be grown, some degree of periodic hardwood control will be necessary. Where hardwoods are the crop trees, the undesirable trees might include pines or undesirable hardwoods.

Methods of TSI include thinning, prescribed burning, mechanical treatment, and chemical treatment.

Thinning

A given tract of forestland is capable of growing a limited volume of wood. This wood growth can be scattered among thousands of small trees, or it can be concentrated on a select number of superior trees through ***thinning***. Thinning results in faster growth for the remaining crop of trees, and they reach a marketable size at an earlier age.

Figure 8.1. Thinned pine plantation.

A typical forest that is naturally established contains thousands of young seedlings per acre. As the forest ages, the trees compete with each other for growing space. Faster-growing, superior trees crowd out the less competitive trees, which eventually die. Thinning mimics this natural development process of a forest.

The following are things to consider when determining whether a stand needs thinning:

- Growth rate — Core samples taken from a tree's trunk by an increment borer reveal growth rings in the wood. Declining growth rate over several years ususally indicates the need for thinning or a timber stand improvement operation.
- Tree condition — Tree crowns appear small in size, and they are closely packed together when a stand needs thinning. A rule of thumb to use when examining a stand of southern pine is, if the heights to the first green branches are greater than 60% of the average height of trees in the stand, then that stand needs thinning.

Once it is decided to thin, trees to be removed should include the following:

- Suppressed or dwarfed trees that have been overtopped by superior trees
- Trees with excessive crooks or forks
- Trees severely infested with insects or disease or trees heavily damaged by fire or other causes
- Large, excessively branchy trees called ***wolf trees*** that are shading out or crowding more valuable trees
- Selected trees from densely packed groups

In pine plantations, it is a common practice to remove every fifth row of trees to open up the stand and to allow access for heavy equipment. Trees in the remaining rows are then marked selectively for further thinning.

Precommercial thinning uses the concepts of thinning mentioned previously, except that the trees removed are unmerchantable, and therefore no money is recovered. Precommercial thinning is a labor-intensive and high-cost operation. Its application is usually confined to areas naturally reseeded, where there are too many stems per acre to allow good early growth. It can be accomplished by cutting, mowing, chopping, or herbicide application.

Prescribed Burning

Prescribed burning is the cheapest of these treatments. It is used regularly in stands of longleaf, loblolly, and slash pines to kill encroaching hardwoods. These hardwood trees are particularly sensitive to fires, especially when they are less than 3 inches in diameter. Pine plantations are burned mostly during the winter months due to stable wind conditions, low air temperatures, and favorable humidity. Summer burns may be implemented later in the life of the stand when pines are larger and more fire resistant. Spring and summer burning yields the best hardwood kill, but caution must be exercised to avoid damage to the pines.

State agencies are increasingly using summer prescribed burns. The theory is that summer prescribed burns closely emulate natural burns caused by lightning. It has been discovered that wire grass, an important native grass on drier sites, requires summer burns in order to flower. It is also believed that summer burns increase plant diversity within a forest ecosystem. Later in this chapter, more will be discussed on prescribed burning.

Mechanical Treatment

Mechanical TSI involves either hand labor or machinery such as a heavy disk, double drum chopper, or bush hog. These methods are very expensive. Other drawbacks include restricted equipment, maneuverability in the woods, possible damage to desirable trees in the stand, and unreliable kill of hardwoods, since they sprout back from the cut stumps. Mechanical TSI is being replaced gradually by

Figure 8.2. Double drum chopper.

chemical TSI methods, but is still justified on small tracts of forestland.

Chemical Treatment

Chemical TSI involves the application of plant-killing chemicals called ***herbicides***. Most herbicides used in forestry are designed to kill broadleaf vegetation and can be applied with no effect on existing pine trees. Herbicides can be sprayed onto the leaf, injected into or painted on the trunk, or broadcast as granules on the ground.

A combination of TSI methods can be utilized within the same year. For example, prescribed burning followed by an herbicide application debilitates and kills competition from hardwoods.

TIMBER HARVESTING

Clear-cutting

Clear-cutting is the practice of removing all timber from a stand in one cutting. It is a commonly used method of harvesting timber in Florida because it offers several advantages. It is the most economical method of harvest. It allows replanting of genetically improved trees. It allows the growing of trees that require full sunlight, and it can be used to check forest insects and diseases by removing the infested trees. But clear-cutting also has its drawbacks in that wildlife habitat is damaged or severely altered, soil erosion may be accelerated, and the clear-cut areas are left with a marked, if temporary, appearance of devastation.

Clear-cutting is often the final harvest at the end of a rotation. A rotation is the amount of time for trees to grow from seedling to final harvest. Short pine rotations of 25 years or less are typical for growing ***pulpwood***, while rotations of 30 to 60 years are common for pine for ***sawtimber*** poles, pilings, and plywood peeler logs.

Normally, thinnings are conducted on a planted pine stand at age 12 to 15 years and every 5 years or so thereafter. As trees become more mature, growth slows and fewer thinnings are necessary. At the end of the rotation, the stand is either clear-cut or heavily thinned to promote seed production for ***natural regeneration***.

Select Cutting

Select cutting or selection cuts involve the select removal of timber as single trees, scattered trees or trees in small groups at short intervals.

Successful selection cutting depends upon the ability of reproducing trees to become established and to survive in the openings left by harvested timber.

Seed Tree Cutting

In ***seed tree cutting***, the site is clear cut except for a few desirable "seed" trees. Approximately 10-15 seed trees per acre are left to cast seed over the entire area. The number of seed trees left depends on size, species, site conditions, and seed-bearing characteristics.

Shelterwood cutting

Shelterwood cutting employs the same technique as seed tree cutting except that more seed trees are left per acre (approximately 20-40). All seed trees are harvested once natural regeneration is complete.

Diameter-limit cutting

Diameter-limit cutting, widely used in the past, is no longer recommended. It involves removing trees of a certain diameter and larger. This system has fallen into disuse because it leads to highgrading the stand - removing the best and leaving the poorest trees.

REGENERATION

Regeneration is the establishment or reestablishment of a forest. Management activities for regeneration usually follow a timber harvest or a natural disaster such as fire, hurricane, or insect attack. Regeneration can occur naturally, or it can occur artificially through tree planting or direct seeding.

Natural regeneration occurs from natural seeding or from stump or root sprouts. It has the advantage of low cost. Natural regeneration from seed involves a heavy thinning, called a seed cut, at the end of a rotation. Five to 15 seed-bearing trees per acre are left following this thinning. These trees should be straight, disease-free, and have full crowns for maximum seed production. Seed trees for southern pine natural regeneration should be at least 10 inches in diameter for producing good crops of seed.

In order for the pine seeds to germinate, they need to come in contact with bare mineral soil. Occasionally, harvesting operations associated with the seed-tree cut will sufficiently expose the soil to allow adequate germination, but usually an area will require some sort of site preparation. Normally, burning is sufficient to prepare a seedbed, but other times, disking or

chopping will be necessary to remove competing brush and vines or debris from timber harvesting operations.

Once seedlings are established, the mature seed trees are harvested to allow full sunlight for the young trees. This may occur from 1 to 7 years following the seed-tree cut, depending on seed production and the tree species.

Coppicing is natural regeneration through stump sprouts and root suckers. It is used in hardwood regeneration, primarily in northern states. Coppicing cannot be practiced on southern pine stands since these trees do not sprout from cut stumps. Common exotic pest plants that benefit from coppice are Australian pine, Brazilian pepper, rosewood, and Melaleuca.

Artificial regeneration is the most common method of establishing forests in Florida. Planting seedlings is more common, although ***direct seeding*** does take place in isolated locales in the state. Direct seeding involves sowing seeds which usually are treated to repel animals and insects. Seedbed conditions for direct seeding are similar to those in natural regeneration. Some site preparation of seedbeds may be necessary.

More acres of forestland in Florida are established through planting seedlings than by any other method. Planting provides a higher degree of seedling survival, provides control of tree spacing, and allows the use of genetically improved seedlings. The major drawback to seedling planting is the relatively high cost.

Seedlings for planting are grown in state or forest industry nurseries. There are nearly a dozen nurseries in Florida, producing almost 200 million seedlings annually. A two-person crew, a planting machine, and a tractor can plant 5,000 to 6,000 seedlings per day. Hand planting is used on areas too small to justify the use of machinery or in areas where machine planting is impractical due to the terrain. Most hand planting in Florida is acomplished through use of a spadelike tool called a dibble.

When preparing to plant trees, the forester must determine how many trees will be needed per acre. A common spacing for pine seedlings is six feet apart with ten feet between the rows, or a 6' x 10' spacing. This allows 60 square feet for each seedling to grow until the first thinning. There are 43,560 square feet per acre. The forester can now determine how many trees are needed per acre:

(43,560 sq. ft./1 acre) divided by (1 tree/60 sq.ft.) = 726 trees per acre

Consider the following problem:

Ms. Borfitz, a private landowner, wants to plant trees on 80 acres of land. The local forester recommends planting the trees on a 6' x 12' spacing. How many trees will Ms. Borfitz need?

First, each tree will be given 72 square feet to grow; 6' x 12' = **72 sq. ft.**

Second, determine how many trees will be needed *per acre*:
(43,560 sq. ft./1 ac.) divided by (1 tree/**72 sq.ft.**) = **605 trees per acre**

Lastly, multiply the size of the site and the number of trees per acre:
(605 trees/acre) x 80 acres = **48,400 trees!**

Other spacings and trees per acre are shown below:

Table 8.1. Number of tree seedlings planted per acre

Space Between Rows (feet)	Space Between Seedlings in Each Row (feet)						
	4	5	6	7	8	9	10
	Number of Seedlings per Acre						
4	2,722	2,178	1,815	1,556	1,361	1,210	1,089
5		1,742	1,452	1,245	1,089	968	871
6			1,210	1,037	908	870	726
7				889	778	691	622
8					681	695	544
9						538	484
10							436

PRESCRIBED BURNING

One of the cheapest and most effective practices used in the management of pines, except fire-intolerant sand pines, is a well-planned and -executed prescribed burn.

Prescription burning objectives are numerous and varied, such as
- Reducing hazardous fuel buildup
- Improving wildlife habitat
- Controlling undesirable competitive plant species
- Preparing sites for regeneration
- Controlling brownspot disease of longleaf pine
- Improving forage for livestock

Reduction of Fuel Buildup

In Florida, forest fuels such as leaves, grasses, shrubs, and small trees accumulate rapidly in pine stands. These fuels are significant fire hazards to pines, especially during periods of drought. The prescribed burn reduces these fuels by burning them under ideal conditions in a controlled manner. If a wildfire later occurs, the damage is less severe on an area that had previously undergone prescribed burning.

Figure 8.3. Note how this prescribed fire has reduced the height of forest fuels.

Fuel reduction burns are normally conducted during the winter when temperatures are cooler and the pines are dormant. The pine trees themselves should be at least 4 inches in diameter and measure 10–15 feet from the ground to the lowest green branches. Otherwise, the young trees may be severely injured or killed by prescribed fire.

Wildlife Habitat Improvement

Prescribed burning is used to improve timberlands for a variety of preferred wildfire food plants. This includes plants established as a result of seeding on bare soil as well as young succulent hardwood sprouts. Different benefits to wildlife and their habitats come from burning during different seasons. Time is important to benefit specific species.

Figure 8.4. Grass growth is stimulated by fire, which increases forage for this elk in Wyoming

Control of Undesirable Species

The use of fire for TSI has already been mentioned. Spring or summer burns provide the best kill of hardwood competition, but a fuel reduction burn may be needed during the preceding year to prevent heavy damage to the pine trees. Fire is the cheapest method of TSI available, but careful planning is needed to avoid damage to valuable trees.

Site Preparation

Figure 8.5. Note the pine needle-covered soil before the fire, versus the exposed mineral soil after the fire.

Site preparation burns to expose mineral soil or to reduce debris, logging residue, or competing vegetation may be required for planting, direct seeding, or natural regeneration. In open stands, burning is often the only site preparation needed. Burning in early spring prior to seed drop in the fall allows pine seeds to become established in a light grass, which should result in excellent seedling establishment.

Longleaf Pine Brownspot Disease Control

Brownspot is a serious fungus disease of young longleaf pines. The disease can kill or delay height growth in the grass stage of the trees for up to 10 years. Fire burns off infested needles and destroys the fungus. This burning is usually conducted in the winter. The fire does not destroy the tree's terminal bud which is protected by the cluster of green needles around it. This allows the seedling to survive during prescribed burns.

Figure 8.6. Longleaf pine in the grass stage.

Livestock Forage Improvement

Just as wildlife is benefitted when prescribed burning produces new forage, so too is domesticated livestock. Years ago, cattle ranches made burning the woods an annual practice. Unfortunately, many of those fires were as damaging as wildfires. Today, however, modern burning techniques are used to improve forested rangeland.

Prescribed Burning Techniques

Various firing techniques can be used to accomplish the prescribed burning objectives. Almost all of these techniques incorporate backfiring. A ***backfire*** is started along a prepared firebreak, such as a road or fireline, and allowed to burn *against* the wind. As the backfire moves into the wind, it increases the width of the firebreak by creating a ***blackline***. A blackline is an area that has just burned and prevents the potential start of a wildfire. If embers are carried aloft, they usually fall harmlessly into the blackline. ***Headfires*** are allowed to burn *with* the wind. The major cause of unsuccessful control burns and killing desirable trees is trying to burn too much area too fast. Backfire is the safest, coolest, and slowest method of control burning.

Figure 8.7.

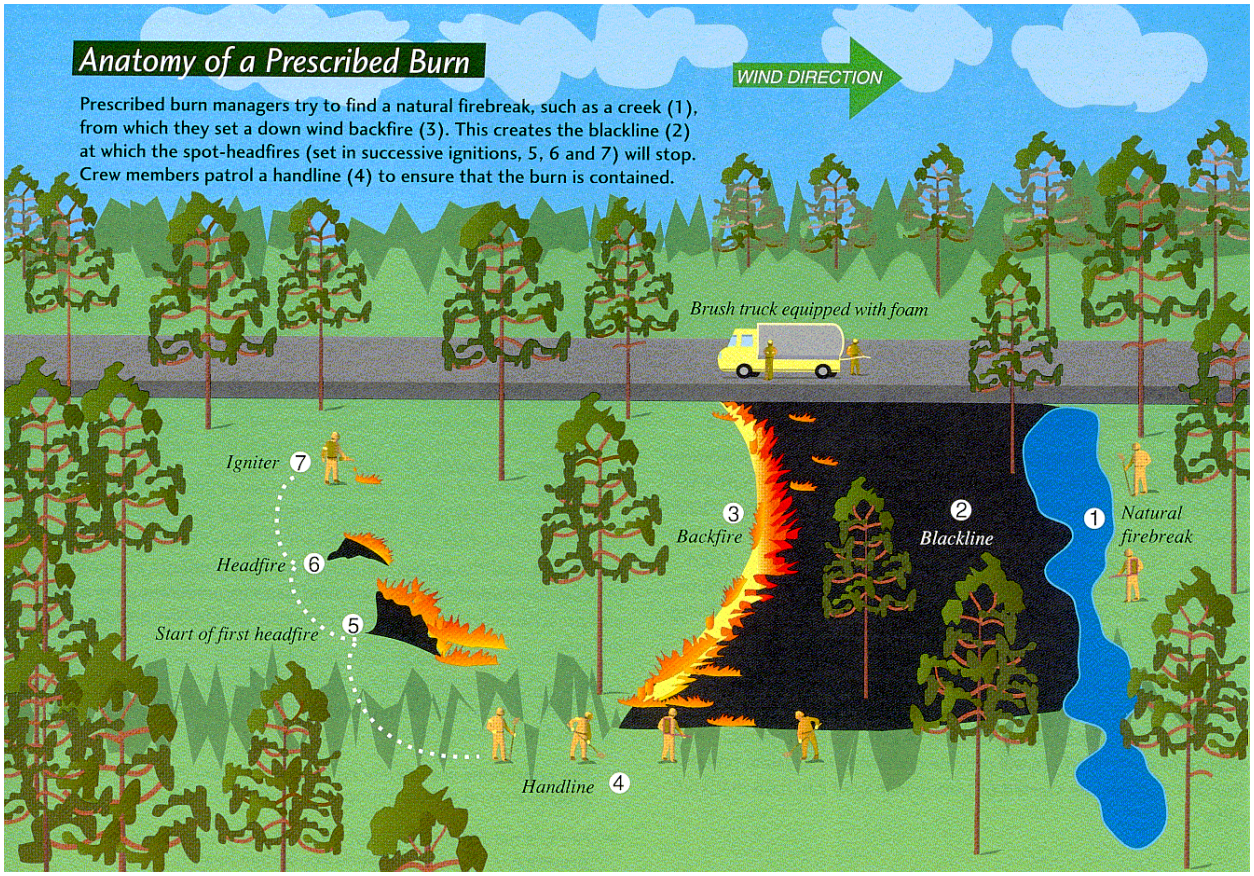

Figure 8.8. A backfire is lit using a drip torch or firepot.