Managing Pine Trees and Bahiagrass for Timber and Cattle Production

Allen B. Tyree and William E. Kunkle

Since the early 1950s many Southern landowners have grown pine trees and bahiagrass on the same land. Large areas of the federal government Soil-Bank-program pine trees were established on bahiagrass fields. Since the program's end in 1963, thousands of additional acres of bahiagrass pasture have been seeded naturally or deliberately planted into pines.

Bahiagrass has proven to be a very drought/flood tolerant grass that persists even under low fertilization and close grazing. This shade-tolerant grass species also lends itself very well to either improved open pastures or tree-covered pastures, allowing landowners to grow trees and grass simultaneously. Wood yields, in fact, are reported to be at their highest with bahiagrass (versus other grasses such as bermudagrass or dallisgrass). Research also shows that on many sites, tree growth increases where fertilizer is applied for grass production.

Planting pine trees for optimum wood and forage production and managing trees, forage, and livestock in a forestland pasture are the focus of this publication.

Planning

Initially, soils should be tested and other land resource factors examined to determine if the site is suitable for pine trees. The appropriate pine species should be identified for these conditions. Your local extension office, the Natural Resource Conservation Service (formerly SCS), and the Florida Division of Forestry can help determine suitability.

For best results, planting sites should be free from debris, woody sprouts, and weeds. The sites should appear much like freshly abandoned cropland or open pasture, unless bahiagrass is already well-established. Select the pine species best suited for the site. Slash, loblolly, or longleaf pine are species recommended in north Florida. If longleaf pine is chosen, a higher level of management will be needed, especially during the first four to five years because of the slower initial height growth of this species. At least every third row should be wide enough to allow truck passage for several years. Recent research has shown that a tree spacing of 4' x 8' x 40' (4' between trees within rows, 8' between rows, and 40' between pairs of rows) is an optimum spacing for wood yield and forage yield.

2. Allen B. Tyree, County Extension Director and Extension Agent II, Hamilton County Cooperative Extension Service, and William E. Kunkle, Professor, Department of Animal Science; Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611.
Managing Pine Trees and Bahiagrass for Timber and Cattle Production

Thirteen years after planting, a tree volume of 1,086 ft/acre and a forage yield of 1,264 lb/acre was obtained for native forage species. Higher yields would be expected for fertilized bahiagrass. The 4' x 8' x 40' spacing allows 454 trees/acre. Past studies on pulpwood yields document that a stand planted at 400 trees/acre will yield 85% as much as a stand planted at 1,000 trees/acre. The 40-foot spacing is good because closer row spacings may create access problems for fertilizer spreaders and mowers. Also, tree crowns tend to close too rapidly.

The following merit consideration:

• Think about the best tree row alignment for your objective. **Use an east-west row alignment for maximum sunlight exposure on grass.** Plant on the contour if erosion is a factor.

• Select genetically improved trees for planting, particularly those resistant to fusiform rust and other diseases of pines. Plan fertilization practices according to soil tests and grass production needs.

• Unless grass is already established, plant trees in the winter just before sowing the bahiagrass seed because newly sown grass does not affect initial tree survival. If trees are to be planted in established bahiagrass sod, severe moisture shortages in the summer may require some site preparation in 12- to 16-inch bands where trees are to be planted. If local moisture conditions are adverse, this step may be needed for the initial survival of pine species. Application of approved herbicides, scalping, or discing in strips are all effective methods.

• Planning for wildlife and other objectives may suggest unusual configurations, a change in the location, or altering the size of pastures. However, because fences and maintenance are large initial costs, any plan for modification should first consider such costs.

• Water for livestock, cattle working and loading pens, feeders, mineral feeders, and other improvements will be needed. Plan water locations for ease of installation, access, and use. If cattle are to be concentrated on small plots of ground for a lengthy period, trees should not be planted in those areas. To avoid trampling and rubbing damage to trees, supplemental feed dispensers should not be placed in or adjacent to pine plantations less than 5 years old.

• Because the pine/bahiagrass pasture is likely to be a part of a total grazing resource, tree planting and herd handling locations should be considered when thinking about access to native pasture, crop residue fields, and other improved pastures or hay pastures.

• Although timber harvest, prescribed burning, and other timber cultural practices will not be carried out for several years, design and implementation should be planned.

• When a particular pine species is selected for a site, review the past history of insect and disease problems in that area. Information for many areas is available from your county forester's office. If the risk of loss is very great for a given tree species, consider alternate sites or species.

• Are firebreaks needed for protection from wildfire or future prescribed burns?

**Establishment of Trees**

Sites should be prepared as cleanly as possible because woody sprouts and weeds will sap moisture and nutrients from trees and grass. Stumps, unburned windrows, brush piles, and other debris will complicate management. If possible, they should be removed by piling, chopping, burning, or decaying before the trees are planted.

The spacing of 4' x 8' x 40' will keep the trees pruned well and provide easier access for fertilization, mowing and harvesting. Open conditions remain for a longer period of time under such spacing, which will enhance grass production. Trees should be carefully planted to ensure the row alignment and spacing desired for good survival and initial growth.

Plant improved varieties of pines on suitable sites. Because slash pine has fewer limbs and prunes better than loblolly, it should be seriously considered if the site and other conditions, such as resistance to local insects and diseases, are suitable. Longleaf pine may also be planted on recommended sites; however,
because of the slow initial growth of longleaf pine and the possibility of damage to young trees, cattle stocking rates should be low until the trees reach a height of four feet, which could take a few years.

Prescribed burns may also be required at an earlier age for brown spot disease control on the longleaf pine species.

Plant trees during the months recommended by the Florida Division of Forestry. If tree seedlings are to be stored longer than one day before planting, follow suggested storage and handling instructions.

**Establishment of Grass**

Seeding is the most efficient way to establish a stand of bahiagrass. If the area is clean and loose soil for good seed germination is available after tree planting, seed should be sown at the rate of 12 to 15 pounds per acre. The seeding date is from February 15 to August 15. Soil pH for bahiagrass should be measured and increased to a pH of 5.5 by applying dolomite.

Seeding can be done by any method that avoids damage to young pine seedlings. Farmers have successfully used conventional farm equipment, hand seeders, or aerial application to establish grass. Observations and comments from landowners in the eastern Gulf Coast area indicate that Pensacola bahiagrass is the preferred species because of its tolerance to adverse conditions.

Cattle should remain off the newly planted grass for about one year. Trees, on the other hand, should be protected from livestock grazing for at least 18 months. Insects and grass diseases should be treated as in any open, improved pasture. Take care to protect trees from damage by equipment.

**Fertilization of Forage and Trees**

Although different in appearance, a tree-covered pasture can be managed much like any improved pasture. Fertilization rates for bahiagrass should be handled as if the trees were not present. Take soil samples periodically and apply fertilizer accordingly for grass production. A light application of fertilizer, such as 30 pounds of nitrogen, 13 pounds of phosphorous, and 25 pounds of potash per acre, should be applied the first year, according to recent tests. After that, a fertilizer containing half of the nitrogen and all of the phosphorous and potash should be broadcast in the spring. The other half of the nitrogen should be applied in the summer. Recent research showed that the highest net returns were received from pasture and pines when 100 pounds of nitrogen, 50 pounds of phosphorous, and 65 pounds of potassium were applied annually. Because bahiagrass tends to be of low quality by midsummer if not grazed closely, some nitrogen may be needed.

However, this should be determined by management practices and local conditions. Periodic mowing, especially during the second or third year, may be needed to control weeds and brush.

Besides increasing and improving forage yields, nitrogen fertilization has also been shown to increase loblolly wood production on all but one out of 11 soil types in the coastal plains of several Southeastern states. Slash pine has shown similar responses. Limited research work has been done on repeated fertilization of pine-pasture combinations; however, actual examples of annual fertilization from over 28 years show no harm to trees and increased wood growth. At one test plot, wood growth was 30% more on fertilized versus non-fertilized land.

Longleaf pine has also shown to greatly respond to phosphorous fertilizer. Soil type determines tree response to fertilization. Wood production should increase in most instances. However, until trees are over a year old, keep in mind that nitrogen fertilizers should be limited to only those needed for bahiagrass establishment. As trees and grass get older and establish better root systems, there is much less possibility of damage.

Fertilizer application techniques include a truck-mounted fertilizer spreader, tractor spreader and aerial application. Care should be taken to minimize limb breakage and avoid tree trunk damage to reduce the potential for buildup of forest insects and the spread of pine diseases.
Replanting or Reinforcement Planting of Trees and Grass

Trees and grass should be checked in the fall after the first growing season to determine if more work is needed to obtain a satisfactory stand. If additional grass or trees are needed, the area to be treated should be excluded from grazing until satisfactory stands are obtained, unless livestock grazing is deferred on the entire tract. Bahiagrass spreads rapidly; usually seeds will cover the remaining open ground without additional expense.

Firebreak Construction and Maintenance

The extent and width of firebreaks should be determined by the history of wildfire, and the types and supply of fuels (dead branches, brush, and other burnable plant material or debris) in the area. Plan the locations for firebreaks to coincide with the layout of planting rows and fence construction, because some firebreaks will likely parallel fences. Construct firebreaks in conjunction with fence building.

The firebreak surface should be clean of burnable fuels when the line is completed. Base the width of firebreaks on the adjacent fuel quantity. Exterior boundary lines should be 10 or more feet wide, unless fuels are very light. Interior lines need not be as wide because the fuel buildup will be minimal after the end of the second year. However, trees are most susceptible to destruction by wildfire in the first five years. After trees are 10 to 12 feet tall, they should be able to withstand fires if forage is grazed closely in the late fall before removal of livestock. Interior firebreaks can be used for prescribed burning, but need not be maintained annually after trees are about 10 feet tall unless the areas are not grazed adequately.

Initial Cattle Stocking

Grazing of pine stands has shown some benefits. Longleaf pines, for example, have been shown to come out of the "grass stage" of tree development earlier when grazed. At 9 years of age, longleaf pines were 50% taller in grazed areas than those that were not grazed. Grazing should be delayed until trees are about 18 months old and the grass is well-established. During the first three years of grazing, cattle stockings should be applied cautiously, beginning with about one cow and calf to three acres for a seven to nine month grazing season.

By the time trees are three to five feet in height, stocking should be based on forage production, because trees are out of danger from major damage by livestock. Stocking rates on fertilized bahiagrass could go to 3/4 to 2 acres per cow and calf. Do not use these areas for bull pastures; bulls can damage pines until they are 10 to 12 feet tall. Cows can remain on pine land year-round, including the winter. Bahiagrass can and should be grazed closely (1/2- to 1-inch high).

Annual fertilization of grass is necessary for good forage production. If fertilizer is not applied, cattle stocking must be adjusted downward, depending on the forage production, probably to one cow and calf on five or more acres for a nine month season. Stocking rates should be based on forage yields and cattle condition.

Cattle Management Requirements

In forestland grazing, beef cattle require a similar type of management as with conventional/traditional grazing systems. The following areas of management should be considered essential to a successful commercial cow-calf operation in north Florida:

- Limited breeding season
- Adequate nutrition program
- Water requirements
- Concentrate and mineral supplement placement
- Parasite control
- Vaccinations against disease
- Implants
- Dehorning and neutering
- Breed selection
• Breeding, calving, and culling

• Adequate working facilities

Each area will be discussed in more detail below.

**Limited Breeding Season Highly Recommended**

Research indicates that summer-born (June-August) calves are, on average, 70 lbs. lighter at weaning than those dropped at other times of the year. Some studies have shown that 40% of the calves from herds on a year-round calving program are born in the summer. This figure indicates a tremendous economic loss resulting from summer-born calves.

A limited breeding season would eliminate this problem of summer-born calves. It also has several other advantages over a year-round program:

• **Money can be saved on winter nutrition.** Winter feeding of the brood cow is the most expensive phase of a cow-calf operation. If some of the cows are dry and some are nursing calves during the winter, the herd cannot be fed in the most efficient manner. Cows nursing calves require at least 25% higher digestibility and 50% more protein than dry cows. So, to have either all dry cows or all nursing cows, you need a controlled breeding program.

• **Herd health and management is easier and cheaper.** There are many jobs which are important to the health and management of a herd. Some of these practices are vaccination, castration, dehorning, deworming, and implanting. If a cattleman could perform all these jobs one or two times during the year (which he could, if he had a controlled breeding program), calves would be born at the same time (within 2-3 months); the labor and time requirement would be less than with an open breeding program, where calves are born all year long.

• **Culling and selection of replacement heifers based on their production is easier.** Comparisons among calves are much more accurate when calves are born within a 90-120 day period. One of the main points for culling cows is the performance of their calves. Good comparisons between cows cannot be made if the calving season is all year long. Acceptable performance includes not only weaning weight, but production of a calf each 12 months. This factor cannot be easily checked under a year-round breeding program.

• **Marketing of calves is improved.** A calf crop which is uniform in age and size can be marketed at an advantage. Large, uniform groups of calves can bring 3-5 cents per pound more than those sold individually, or in groups with large variations in weight or breed type.

For more information on switching your beef cattle operation from a year-round to a controlled breeding program, contact your local county extension agent.

**Calving Season**

What is the best time of year for your cows to calve? Extension research has shown that the best time to calve is fall or spring. What are the advantages and disadvantages of each season?

Fall-calving cows can utilize cool season grasses during early lactation. Supplemental feeding during December to March is greater than for spring calving, since cows need to rebreed and maintain lactation during this time. However, fall calving avoids calving during the busy spring planting season. At the time of weaning for fall-born calves (late winter to early spring), calf market prices are traditionally at their peak. On the other hand, when spring-born calves are ready to be weaned, market prices are at their lowest.

Winter and spring calving require less winter annual pasture and supplemental feeds than fall calving. Breeding cows between May and August and calving between February and May best synchronizes the cows’ changing nutrient requirements with forage availability. Forage becomes available during the early postpartum period, when lactation is greatest and the cow requires the greatest amount of dietary energy. In winter and spring calving, the only necessary supplemental feeding period is during the winter months, after the cows start calving. At the time of weaning for spring-born calves, however, calves are traditionally at their lowest price during the year.
After deciding which time of year you want your cows to calve, fit your controlled breeding program and your nutrition program to that schedule.

**Adequate Nutrition for the Herd**

The digestibility of bahiagrass under pines was measured at 56%. In full sun, the digestibility of bahiagrass has been shown to be only slightly higher. Therefore, there does not appear to be a major decrease in digestibility of bahiagrass under shade. The crude protein content of bahiagrass was measured at 8%, similar to the level recommended for good brood cow nutrition. Therefore, no additional protein should be needed during the summer months. Of course, during the winter months (November-March), the cattle diet often needs to be supplemented with protein.

As expected, several minerals in forages were found to be deficient or marginal during the cool part of the year. Therefore, supplementation is necessary. A free choice mineral should be provided all year long. A complete mineral supplement containing salt, calcium, phosphorous, and trace minerals is recommended. Mineral consumption varies across pastures, seasons, and cattle, but an average consumption of 2 ounces per head per day of a mineral containing 25% salt, 14 to 18% calcium, 8% phosphorous, 0.4% zinc, 0.2% iron, 0.2% manganese, 0.15% copper, 0.016% iodine, 0.01% cobalt, and 0.002% selenium has been sufficient. The supplement should not have more than 30% salt and 20% calcium in it, and should contain 8% or more phosphorous. Cows should consume 2 to 4 ounces per head per day. Vitamins A, D, and E can be marginal in months when green forage is not available. Therefore, feed a mineral supplement that contains vitamins A, D, and E. Mineral consumption is critical since too high a level is expensive and too little can result in deficiencies. Mineral levels need to be adjusted for different situations, such as additional supplements, forage type concentrations, soil type, etc. While grazing winter pasture the cattle mineral supplement should be replaced with a high (over 10%) magnesium mineral.

**Winter Feeding**

Winter feeding of your cow herd is your most expensive input. It makes up 40% of your total costs. Because of its magnitude, consider the following factors which will allow the cow herd to be carried through the winter at least cost:

- Grouping of cattle that have similar nutrient and management requirements. The groupings generally are:
  - Dry, mature pregnant cows
  - Cows nursing calves, weaning replacement heifers, bred yearlings
  - Bulls

- The time of year to breed your cows and heifers to calve (already discussed)

- The body condition (fatness or thinness) of your cows and heifers

- Supplemental feeds for fall/winter feeding

**Body Condition**

The income and profit of a beef cattle operation is closely related to the rebreeding and reproduction rate of the herd. The body condition (fatness or thinness) of the beef cow is related to reproductive performance. The condition of the cows at calving and breeding is closely related to:

- The percentage of open cows
- The calving interval of cows that breed
- Milk produced by the cow
- Weaning weight of calf.

Body condition affects the amount and type of supplements needed during winter feeding. For instance, the primary reason for low gains and pregnancy rates in young heifers is inadequate nutrition following weaning, especially during the winter period.

Fat cows can lose body reserves. Feeding 1/2 to 1 lb per head per day of a 30 to 40% protein
supplement, plus minerals and vitamins, is sufficient in situations where cows have good body condition, have not calved, and have plenty of forage available.

On the other hand, thin cows have little body reserves. They need 2 to 3 lb per head per day or more of a high energy supplement with 12 to 16% protein, plus minerals and vitamins, to avoid flesh loss and reduction of pregnancy rates. Keep this factor in mind when you are feeding your herd during the fall and winter. Find out more about determining the body condition of your cows and how much they need to be fed by contacting your county extension agent. Do not waste feed on fat cows, and don’t lose calves next year by not feeding your thin cows enough to produce a good calf every year.

**Supplemental Feeds for Fall/Winter Feeding**

**Mature Cows.** Feed residual pasture and/or hay free-choice, plus one of the following options daily:

- **Option 1.** Feed 1 pound of 32% crude protein liquid supplement per head per day (or an equivalent amount of crude protein from other supplements) until calving, then 5-8 pounds of 16% crude protein liquid supplement per head per day after calving.

- **Option 2.** Feed 1/2 pound to 1 pound of cottonseed or soybean meal per head per day (or an equivalent amount of protein from other supplements) until calving, then 4 pounds of corn and 1 pound of cottonseed or soybean meal per head per day after calving.

- **Option 3.** Feed the same as in Options 1 or 2 until calving, then 0.8 to 1 acre of winter annual forage (rye, oats, etc.) per head after calving.

**First Calf Heifers** (Can be kept in cow group until calving, if in good flesh.). Feed residual pasture and/or hay free-choice, plus one of the following options: **Option 1.** Feed 1 pound of 32% crude protein liquid supplement per head per day (or an equivalent amount of natural protein from other supplements) until calving, then 5-8 pounds of 16% crude protein per head per day after calving, with most of this protein from a natural protein source, such as soybean or cottonseed meal.

- **Option 2.** Feed 1 pound of soybean or cottonseed meal per head per day (or an equivalent amount of natural protein from other supplements) until calving, then 6 pounds of corn and 1 1/2 pounds of soybean or cottonseed meal per head per day after calving.

- **Option 3.** Feed the same as in Options 1 or 2 until calving, then 0.8 to 1 acre of winter annual forage (rye, oats, etc.) per head after calving.

**Weaned Heifers** (Goal: to gain 1 1/2 pounds per head per day from weaning until spring.). Feed residual pasture and/or hay free-choice, plus one of the following options daily: **Option 1.** Feed 1 pound of soybean or cottonseed meal per head per day (or an equivalent amount of natural protein from other supplements) until calving, then 3 pounds of corn or 4 pounds of black-strap molasses per head per day from weaning until you can place them on winter pasture (0.6 to 0.8 acre of winter annual forage--rye, oats, etc.--needed per head).

- **Option 2.** Feed 1 pound of soybean or cottonseed meal per head per day, or an equivalent amount of natural protein from other supplements. Gains will depend on pasture and hay quality and availability. Adjust supplement levels to get desired gains.

**Bulls.** The following options are for bulls that have been separated from cows due to a controlled breeding season program until breeding time: **Option 1.** For bulls in good flesh, feed good hay and/or residual pasture and 1 pound of soybean or cottonseed meal per head per day (or an equivalent amount of natural protein from other supplements); or feed good hay and/or residual pasture, plus 1/2 acre of rye per head.

- **Option 2.** For bulls that are thin, feed good hay and/or residual pasture and 2 pounds of soybean or cottonseed meal per head per day (or an equivalent amount of natural protein from other supplements) plus 10 to 15 pounds of corn per head per day. Bulls should gain 1 pound per day on this diet. When a high level of supplement is
fed, use smaller pastures where bulls are more accessible.

In terms of dollars, the best protein buys are usually winter annual forages (during a good growing season) or natural protein concentrates, like soybean, cottonseed meal, or whole cottonseed. The best energy buys are usually from corn or winter annual forages (if a good growing season).

Also, don’t forget to adequately supplement minerals/vitamins to your herd during the winter. Contact your local county extension agent for more information.

Water Requirements

A successful beef cattle enterprise requires a plentiful supply of good quality water supply. Each adult animal needs a minimum of 20 gallons of water per day. Water from ponds or ditches is usually adequate but the water supply needs to be checked daily, especially during dry weather and when moving cattle to new pastures.

Concentrate and Mineral Supplement Placement

Water supply, feed, and mineral/vitamin supplement should not be placed in the immediate area of young pine plantations. This high traffic area could cause significant damage to trees. Locate feed and water in an area away from the trees.

Parasite Control

Research has shown that 50 more pounds can be gained by young cattle if they are properly dewormed. Mature cattle are affected also, but parasite infections are usually more severe in young animals.

To prevent dollar losses from worms, cows should be dewormed in early spring. If a high fecal worm egg count reappears in late summer, deworm in the fall, too. This is especially important in thin cows and younger cows. Calves should be treated to control worms at the age they start grazing. There are many excellent dewormers available. Contact your local veterinarian or your livestock supply store about the various dewormers that are available. Use a different dewormer each time, so parasites do not build up a resistance to one dewormer.

The house fly, stable fly, and horn fly are three major external pests of Florida cattle. The horn fly is the most serious and injurious to beef cattle. Reduced weight gains of 0.3 to 0.5 pounds per day can be experienced from horn flies. Research has shown that calves gain 0.1 to 0.3 pounds more per day when flies were controlled. There are several ways to control the horn fly. These include dust bags/backrubbers, sprays, and ear tags. Many fly control pesticides can be used in dust bags/backrubs and sprays. And several non-pyrethroid ear tags are also available. Contact your local veterinarian or your livestock supply dealer about what fly control products are available.

Vaccinations Against Disease

A minimal vaccination program recommended for north Florida costs approximately $1 per cow each year. The following minimal vaccination program is recommended:

1. Vaccinate all females exposed to bull against leptospirosis (5-ways) and vibriosis 30 days before rebreeding.

2. Vaccinate all calves for blackleg/clostridium (7-way) at 4-6 months of age and for brucellosis at weaning.

Several other diseases may cause losses in your herd. For a more comprehensive program, contact your local veterinarian or extension office.

Implants

Beef cattle growth implants (placed in ear) have shown to yield an economic return of $15 to $25 per head. Implants increase weight gain an average of 20 to 30 pounds with 1 implant, and 30 to 50 pounds with 2 implants. Ralgro, Synovex, Compudose, Heifer-oid, Steer-oid, and Finaplix are the different brands of implants available. Read and follow the manufacturer's label closely, or contact your local veterinarian or extension office for more information on implants.
Dehorning and Neutering

Cattle should be dehorned and neutered prior to weaning. Bulls and calves with horns receive a lower price when sold. It's less stressful on the animal and causes less weight loss to castrate and dehorn at an early age. Dehorn and castrate calves at birth or up to 2 to 3 months of age.

Breed Selection

If the cattle offered for sale are 1/2 blood Brahman or greater, you can expect a discount from $5 to $10 per cwt., depending on hump, development, hair coat, bone structure, or other characteristics, according to Ronnie Thomas, a Florida order buyer. The number of buyers for heavy Brahman-type calves has dropped during the past several years due to previous bad winters, which resulted in a higher death loss. These cattle are sold primarily in warmer climates such as California, Arizona, and southern Texas. Yet, year after year, thousands of "Brahman" type cattle are purchased on a discount basis. As a general rule, crossbreds with 3/8 Brahman or less will bring higher prices. English breeds such as Angus or Hereford, and continental breeds such as Simmental and Limousin crossed with Brahman will have good salability.

Breeding, Calving, and Culling

Heifers should be bred at 14-15 months of age; no earlier. If they are bred before this, which some are capable of doing, they might have trouble calving. Remember, a cow can carry a calf for 280 days. In other words, if your cow was bred on July 1, then she should deliver around April 11. If your cow was bred on January 1, then she should deliver around October 12th. It takes cows 21 days to come into estrus (to be able to get pregnant) if she hasn’t gotten pregnant yet. But a cow can only become pregnant 2 days out of the 21-day estrous cycle. When cows or heifers are near calving, they should be moved out of the woods and into an area where they can be watched closely. A cow that no longer produces a calf every year, or cannot support herself and the calf, should be culled.

Adequate Working Facilities

A successful beef cattle operation requires adequate working facilities. A corral, chute, headgate, and good fencing are needed to work cattle properly. Cattle should be worked 2 to 3 times a year when convenient. For more information on these topics, contact your local extension agent.

Control of Brush and Weeds

Bahiagrass will not produce well if weeds and woody sprouts and seedlings are allowed to dominate the understory. Sprouts and seedlings become especially troublesome to access if allowed to develop. Even with very intensive site preparation and grazing, some control of weeds and woody sprouts will likely be needed during the first four years when trees are too young to withstand heat from prescribed fire.

If weed control is needed, take care to avoid equipment damage to trees. If a herbicide is needed, select one approved for grazing pastures and with the ability to kill hardwood sprouts without harming pine trees. As livestock grazing rates increase, little if any control is needed. Ordinarily, cattle will browse and "bush back" sprouts, thus retarding development until prescribed fire can control them. Brush and weed control can be minimized by:

- Preparing planting sites intensively
- Applying maximum grazing pressure as early as possible without excessive damage to pine trees
- Burning as soon as possible in the rotation
- Continuing grazing pressure at the optimum level, and prescribed burning at three year intervals

Prescribed Burning

In situations where the grass fuel is removed each year by grazing, prescribed fire can usually be applied after trees are 12-feet tall. The first two or three burns should be winter back-fires, with fire lines at no more than 1,300 feet apart. After that, frequency and type of burning will depend on the
amount of fuel and the extent or type of woody brush. Even though these pastures appear to have little fuel, buildup of pine straw on the forest floor can cause fire damage to trees if the burn is not conducted carefully. Also, needle-scorching burns can greatly increase needle fall following burns.

The preceding recommendations for burning should not be applied where most of the grass fuels are not removed by livestock before burning. Greater precautions are required where there are large amounts of burnable fuel.

Although prescribed fire is an efficient tool for removing pine needles, dead grass, and unwanted woody sprouts or weeds from the area, it should always be applied with caution. In most states, forestry agencies are responsible for smoke control from prescribed fire and require a burning permit. Before planning and conducting such burns, contact the Florida Division of Forestry and other appropriate agencies in your area.

**Commercial Thinnings**

Commercial harvest of pines may be possible as early as 10 years from time of planting. The timing depends on several factors such as site capability, tree spacing markets, and the owners' objectives for timber growing. If bahiagrass production and a sawtimber-rotation is the objective, stands should be thinned to 70 square feet of basal area at 5- to 10-year cutting cycles (where markets are available). Such thinnings ideally should be frequent and leave a stand of the most healthy, dominant trees.

By the time the stand is old enough to thin, truck access may be difficult. Removal of selected trees may be a good solution. If row thinning is done, make every possible effort to remove all other trees that will die before the next thinning, in addition to those in rows. If there is a choice, select wood buyers who use whole tree chippers during harvests. This type of operation removes almost all limbs, leaving very little debris to inhibit grass growth or provide breeding material for pine engraver beetles. Take care to protect the "leave" trees regardless of the harvest method used.

**Tips on Overall Management Flexibility**

Management of trees, cattle, and forage is more complex than management for single products, but can yield profitable returns for many years. Markets for beef and timber vary over time and the needed action cannot always be taken at the most beneficial time for all products. For example, you may not have enough livestock to eat the available forage. The grass will build up; mow or burn it before the next grazing season. The best time for burning is winter, but mowing can occur during the growing season. Established bahiagrass is highly shade tolerant, so it will persist even if left unfertilized and can be quickly restored to a grazable quality and quantity by timber thinning and prescribed burning.

If fertilization becomes too costly, reduce cattle stocking accordingly. The pasture can be managed without fertilization for many years without destroying the bahiagrass but only, of course, with reduced beef production.

**Coordination with Other Users**

Wildlife use of improved pastures is limited by the intensive grazing by livestock of all existing vegetation within their reach. However, tree canopies provide additional diversity, vertical structure, and cover. Although limited in potential use by many species, pine-bahiagrass pastures can be designed and managed to favor conditions for several wildlife species. For example, annual winter forage species may be planted in the pasture or in firebreaks. You may adjust the size and configuration of pastures and the location of water holes in relation to other types of forest habitat to benefit certain wildlife species.

Boundary firelines, if seeded to plants that supply green browse and forage in the winter, will provide very attractive food sources for wildlife such as the wild turkey, white-tail deer, rabbit, and quail. Local, state or consulting wildlife management specialists, your local county extension office, the Natural Resource Conservation Service (formerly SCS), the Florida Division of Forestry, and other state agencies can be helpful in planning for wildlife objectives.
Economics

The economic feasibility of establishing and managing a cattle herd on bahiagrass-pine pastures is determined by many factors. The existence of water, fences and nearby security features such as ranch or farm homes are plus factors. High site preparation and tree/grass establishment costs, lack of water, remote locations, and a lack of expertise and equipment are negative factors. Each opportunity must be examined on its own merits to determine if the operation is likely to prove profitable. The unique requirements for such multiple-use operations are expertise in both timber and cattle management.

Acknowledgments

Comments and suggestions of reviewers Doug Longshore, Hamilton County Forester, and Dr. George Tanner, Department of Wildlife and Range Sciences, University of Florida, are appreciated.