

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

TREE/SHRUB ESTABLISHMENT
(Acre)

CODE 612

DEFINITION

Establishing woody plants by planting seedlings or cuttings, direct seeding, or natural regeneration.

PURPOSE

To establish woody plants for forest products, wildlife habitat, long-term erosion control and improvement of water quality, treat waste, reduction of air pollution, sequestration of carbon, energy conservation, and enhance aesthetics.

CONDITIONS WHERE PRACTICE APPLIES

On any area where woody plants can be grown.

GENERAL CRITERIA

Species will be adapted to site conditions and suitable for the planned purpose(s).

Planting or seeding rates will be adequate to accomplish the planned purpose.

Planting dates, and care in handling and planting of the seed, cuttings or seedlings will ensure that planted materials have an acceptable rate of survival.

Only viable, high-quality and adapted planting stock or seed will be used.

Site preparation will be sufficient for establishment and growth of selected species.

Adequate seed or advanced reproduction needs to be present or provided for when using natural regeneration to establish a stand.

Timing and use of planting equipment will be appropriate for the site and soil conditions.

The acceptability and timing of coppice regeneration shall be based on species, age, and diameter.

The planting will be protected from unacceptable adverse impacts from pests, wildlife, livestock damage, or fire.

Each site will be evaluated to determine if mulching, supplemental water or other cultural treatments will be needed to assure adequate survival and growth.

Comply with applicable federal, state, and local laws and regulations during the installation, operation, and maintenance of this practice

Additional Criteria for Improving or Restoring Natural Diversity

Species selected will be indigenous to the site and will reflect species composition of the desired stands.

Additional Criteria for Increasing Carbon Storage in Biomass and Soils

For optimal carbon sequestration, select plants that have higher rates of sequestration in biomass and soils and are adapted to the site to assure strong health and vigor. Plant the appropriate stocking rate for the site.

When using trees and shrubs for greenhouse gas reductions, prediction of carbon sequestration rates shall be made using current, approved carbon sequestration modeling technology.

CRITERIA FOR TREE/SHRUB PLANTING

Plant root collars one to two inches below ground level except for longleaf pine. Longleaf pine seedlings should be planted with root collars at ground level or slightly below ground level. When planting cuttings, 4 to 6 inches should be above the ground and 14 to 16 inches below the ground.

Roots should be planted straight down—not twisted, balled, or U-shaped. It is not necessary to prune roots unless they are too long to be planted properly. If pruning is necessary, prune only the tap root enough to properly plant the tree. Lateral roots should not be pruned.

Soil should be packed firmly around the planted seedlings. No air pockets should be left in either machine furrows or holes made by planting tools.

The roots of seedlings must be kept moist and cool at all times. After lifting, seedlings should not be exposed to sun, wind, heating, drying, or freezing before they are planted. Baled seedlings may be kept up to 3 weeks if they are properly stacked, watered, and kept in a cool, shady place. When planting is delayed longer than 3 weeks, the roots of seedlings should be covered with moist soil (heeled-in) or the seedlings should be put in cold storage.

During planting, the roots of seedlings must be kept moist; and only one seedling should be planted at a time. At the end of each day, loose seedlings should be either repacked in wet moss or heeled-in.

Proper planting dates and care in handling and planting of the seed or seedlings will ensure that planted materials have an acceptable rate of survival.

Pines planted for the production of wood products should usually be planted at spacings which allow 600 to 700 trees per acre. On badly eroded areas, it may be desirable to plant 900 to 1,200 pine seedlings per acre to provide quick cover and to control erosion. Hardwood seedlings and cuttings should be planted at spacings which allow 300 to 700 trees per acre. A survival of 65 percent or more of the seedlings at the end of the first growing season is considered acceptable. Christmas trees should be planted at spacings which allow 900 to 1,700 trees per acre. On areas where the survival of seedlings is expected to be low, the planting rate should be increased. Shrubs may be planted at rates as high as 9,700 shrubs per acre. See 422 - Hedgerow Planting.

Spacings should facilitate the use of equipment in controlling vegetation and in harvesting. Careful layout and spacing can help avoid problems at harvest time. Spacings for special purposes such as for beautification and for wildlife can be obtained from an appropriate specialist. Wider spacings are generally better for wildlife.

Spacings for interplanting will be the same as for open field plantings of the same species. Openings should be at least 1/4 to 1 acre in size. If replanting is needed, it should be done within the first year after the original planting.

Spacings for underplanting should be the same for open fields. Underplanted seedlings should be released from overtopping trees as soon as possible after planting, usually not later than the end of the first growing season. See 666-Woodland Improvement.

The number of trees/shrubs per acre for various spacings are:

1.5' x 3' - 9680	7' x 7' - 889
2' x 3' - 7210	7' x 10' - 622
3' x 3' - 4840	8' x 10' - 544
3' x 4' - 3630	8' x 12' - 454
3' x 5' - 1742	9' x 9' - 538
5' x 7' - 1244	9' x 10' - 484
6' x 6' - 1210	9' x 12' - 403
6' x 7' - 1037	10' x 10' - 436
6' x 8' - 908	11' x 11' - 360
6' x 10' - 726	12' x 12' - 302

Site preparation shall be sufficient for establishment and growth of selected species.

The type and intensity of site preparation will vary according to ground cover, soils, and the species to be established. Areas with plow pans or compacted soils should be subsoiled. See 490 - Forest Site Preparation.

When planting bare root plants, spread the roots in the hole and gradually add soil. Firm the soil, being careful to avoid breaking roots. Fill the hole with water, and allow it to drain. Then fill the hole with soil, and water again thoroughly. Small shrubs may be planted with a dibble bar.

When shrubs are planted in beds, the bed areas are usually tilled or spaded to a depth of 8 to 12 inches. Soil amendments, such as peat or compost at a rate of 1 part amendment to 3 parts native soil, provide a uniform root environment across the bed area. The hole for shrubs planted in a bed should be a few inches wider in diameter than the root ball.

With container plants, once the plant is removed from the container it will need scoring if the plant is root-bound (roots circling the outside of the root ball). For individual shrubs provide as large an area as possible for initial root development. The planting hole should allow the root ball to extend one inch above the soil surface, and should be as big around as three to five times the diameter of the root ball.

For burlapped plants, remove any wire or string around the plant's stems. Do not remove the burlap; fold it back so it will be buried by the soil. Burlap which is allowed to remain exposed after planting can act as a wick, causing the root ball to dry out. Follow the same procedures for filling the hole as that described for container plants.

Add mulch after the shrubs are planted. Mulch is very important for new plantings. It conserves soil moisture, prevents soil crusting, and suppresses weeds. This results in more water being available to the plant, which helps reduce stress conditions in the first year planting.

Water is essential for growth in a new planting. If possible plants should be watered frequently for the first few months in the area over and beyond the root ball if rainfall does not supply one inch of water per week.

Tree and shrub seedlings may be planted either by hand or by machine. On sloping land, planting should be done on the contour where possible. Hardwood seedlings can be planted either by machine, specifically designed for planting hardwood seedlings or by a dibble bar, shovel, power auger, or a post hole digger. An acceptable planting machine for hardwood seedlings would be one that has a coulter diameter of at least 32 inches and a planting foot and trencher plate assembly to allow for the creation of a trench of four inches in width and fifteen inches in depth.

Any tool or piece of equipment that gives satisfactory results may be used. Planting should be done when the soil is neither too dry nor too wet. Planting should be avoided during freezing weather and when the ground is frozen. Seedlings should be planted from December to March 15. Survival of seedlings planted after March 15 will depend largely on adequate rainfall. Special care, handling, and storage must be used for any planting beyond March 15. Late winter is the best time to plant deciduous shrubs. Early fall is the best for evergreens. Shrubs grown in containers can be planted anytime, except when the ground is frozen.

Adequate seed or advanced reproduction needs to be present or provided for when using natural regeneration to establish trees or shrubs.

Timing and use of equipment will be appropriate for the site and soil conditions.

The acceptability and timing of coppice regeneration shall be based on species, age, and diameter.

Plantings will be protected from adverse impacts such as livestock damage or fire.

Grazing should be excluded from stands of desirable hardwoods and shrubs and overgrazing should be prevented on areas planted to pine.

Young stands of trees, shrubs, and stands of hardwoods should be protected from fire. Post-planting herbicides may be used to increase seedling survival and accelerate tree and shrub growth. Lists of recommended herbicides are available from the Alabama Cooperative Extension System and the Alabama Forestry Commission. Caution: Use herbicides according to instructions on the label.

CRITERIA FOR NATURAL REGENERATION

A. Pine:

1. Seed Tree Cut: Seed trees should be dominant trees of good quality that are at least 9 to 10 inches in diameter. Seed trees should be removed within 3 to 5 years to reduce damage to seedlings.

Minimum Recommended Number of Seed Trees (Per Acre)

DBH =	9	10	12	14	16+
Shortleaf		20	14	12	12
Loblolly		12	9	6	4
Slash		12	9	6	4
Longleaf**		55	38	28	21
Virginia	6	5	4	4	4

** Shelterwood cut of 30 sq. ft. of basal area.

2. Shelterwood Cut: A shelterwood cut involves leaving a large number of seed trees per acre. The trees are thinned to approximately 30 to 60 sq. feet of basal area depending on species. The residual stand of trees should be removed within 3 to 5 years to reduce damage to seedlings.

3. Clearcutting: All merchantable trees are removed. Site preparation is usually needed to enhance regeneration. See 490-Forest Site Preparation. Natural regeneration methods such as seed-in-place, seedlings in place and seeding from the side may be used with clearcuts.

4. Individual Tree Selection: The removal of trees individually or in small clumps. This type of harvesting creates an uneven-aged stand of timber. The stand is regulated by periodic volume removal. Regeneration occurs either continuously or periodically.

B. Hardwood:

1. Clearcutting: Clearcutting is one method of regenerating bottomland hardwoods. All merchantable trees should be harvested and small trees should be removed either mechanically or by the use of herbicides.

Yellow-poplar is a species which is easily managed by clearcutting if a seed source has been present for 3 to 5 years. Yellow-poplar seeds remain viable in the forest litter for up to 8 years. Normal harvesting operations will expose mineral soil and allow germination.

2. Shelterwood Cut: The shelterwood system can be used to obtain oak regeneration. The shelterwood system is preferable from a wildlife perspective. Stand density is reduced to 60% stocking to allow seedling establishment. When a stand of 500 or more seedlings per acre is 4.5 feet or higher, the overstory stand should be removed. It may take as long as 15 to 20 years to obtain the desired reproduction once stand density is reduced.

CRITERIA FOR DIRECT SEEDING

The following specifications are given for longleaf, loblolly, slash, shortleaf, Virginia pine, and oak. These species are adapted to, and can be seeded on, a wide variety of soils. Direct seeding should be avoided on adverse sites, especially on sites that dry rapidly.

A. Longleaf Pine

1. Seedbed Preparation: Exposed mineral soil is a good seedbed. A sparse cover of grass on a seedbed is not objectionable. Several weeks before seeding, the seedbed should be prepared by either burning, disking, or chopping. This preparation should be in either solid bands or strips 6 to 8 feet wide and 6 feet apart. Sites prepared by shearing and root raking are usually suitable for direct seeding after the soil is firmed by rain.

2. Time of Sowing: Longleaf seed may be sown from late October to early December when soil moisture is plentiful and maximum temperatures are below 75 degrees F. Longleaf may be seeded also during February and March. Seeding during hot weather must be avoided. Hot weather stops germination and destroys seeds.

3. Rate of Seeding: Broadcast 3 pounds of seed per acre. When seeding disked strips, restrict seeding to the disked ground which is assumed to be 50 percent of the total ground area; the rate of seeding is 1.8 pounds per acre. When seeding in rows, the rate of seeding is 1.6 pounds per acre, based on a spacing of 1 foot between seed in the rows and 6 feet between rows. Spot seeding, assuming 1,000 spots per acre and 6 seeds per spot, should be 1.33 pounds per acre.

4. Seed Treatment: Use viable seed that have been treated with a registered rodent repellent.

B. Loiblolly Pine

1. Seedbed Preparation: Same as for longleaf pine except that grass cover is objectionable in dry years.

2. Time of Sowing: Sow when maximum temperatures are below 75 degrees F. The best months are January, February, and March. About mid-February is the best time for sowing seed.

3. Rate of Seeding: The following seeding rates should be used:

- 1) Broadcast - 1 lb. per acre
- 2) Disked Strips - .60 lb. per acre
- 3) Rows - .40 lb. per acre
- 4) Spots - .40 lb. per acre

The methods of seeding are the same as for longleaf pine.

4. Seed Treatment: Use stratified viable seed treated with a registered rodent repellent.

C. Slash Pine

1. Seedbed Preparation: Same as for loblolly pine.

2. Time of Sowing: October and November within 50 miles of the Gulf of Mexico and the last of January to the middle of March in the remainder of South Alabama. Slash pine should not be seeded in the northern half of Alabama.

3. Rate of Seeding: The following seeding rates should be used:

- 1) Broadcast - 1 lb. per acre
- 2) Disked Strips - .60 lb. per acre
- 3) Rows - .50 lb. per acre
- 4) Spots - .50 lb. per acre

The methods of application are the same as for longleaf pine.

4. Seed Treatment: Same as for loblolly pine.

D. Shortleaf Pine

1. Seedbed Preparation: Same as for loblolly pine.

2. Time of Sowing: Sow from December to March when soil moisture is plentiful and maximum temperatures are below 75 degrees F.

3. Rate of Seeding: The following seeding rates should be used:

- 1) Broadcast - .40 lb. per acre
- 2) Disked Strips - .30 lb. per acre
- 3) Rows - .20 lb. per acre
- 4) Spots - .20 lb. per acre

Methods of application are the same as for longleaf pine.

4. Seed Treatment: Same as for loblolly pine.

E. Virginia Pine

1. Seedbed Preparation: Same as for loblolly pine.

2. Time of Seeding: Same as for shortleaf pine.

3. Rate of Seeding: The following seeding rates should be used:

- 1) Broadcast - .40 lb. per acre
- 2) Disked Strips - .30 lb. per acre
- 3) Rows - .20 lb. per acre
- 4) Spots - .20 lb. per acre

Methods of application are the same as for longleaf pine.

4. Seed Treatment: Same as for loblolly pine.

F. Oak

1. Seedbed Preparation: Site preparation is not always necessary, but it is recommended if the area to be planted has a plowpan, compacted soils or if the site has extensive weed cover. The seedbed is usually prepared by disking. This should be done no more than 2 months prior to seeding. However, disking may need to be done somewhat earlier if seeding is to be done mid to late winter or early spring and if flooding is a possibility. Two passes with the disk plow or harrow should be made, and disking should be to a depth of at least 6 inches, but preferably 8-15 inches. In some cases burning or sub-soiling may be needed. Burning alone may be adequate on a field that has been fallow for a couple of years and does not have a plowpan. Sub-soiling may be needed on compacted soils.

2. Time of Seeding: The most common times to seed are fall, spring, and early summer. It is not recommended to seed during the months of July through September.

3. Rate of Seeding: Spacing for sowing 1,000 acorns per acre should range from 4.5 feet by 10 feet to 3 feet by 15 feet. Spacing for sowing 1,500 acorns per acre should range from 3 feet by 10 feet to 2 feet by 15 feet. Acorns should be sown at a depth of 2-3 inches.

4. Seed Quality: If you buy seed, viability should be at least 80 percent. If you are collecting seed, conduct a "float test". The float test helps eliminate unsound acorns; it works for every species of oak except overcup, which floats even when sound. To test, place the acorns in a large container of water, stir them a couple of times, and skim off the floating acorns and other material. Then completely drain the water.

G. Ways of Seeding: Broadcast by plane, by tractor, or by hand seeder of the "Cyclone Seeder" type. Sow by either a cultipacker-seeder combination or by furrow seeders. Spot plant by hand with either "walking stick" planters, hoes, or rakes.

H. Adequate Stand: A stand of pine is considered adequate when there are about 1,500 evenly spaced, free-to-grow seedlings per acre. Overstocked stands may need precommercial thinning. See 666-Woodland Improvement. Oak stands may be considered adequate with 500 to 600 free to grow seedlings per acre.

CONSIDERATIONS

Where possible give priority to planting native trees and shrubs. Species considered locally invasive or noxious should not be used.

Species used to treat waste should have fast growth characteristics, extensive root systems, capable of high nutrient uptake, and may produce wood/fiber products in short rotations.

When underplanting, trees should be planted sufficiently in advance of overstory removal to ensure full establishment.

Prescribed burning may be needed for site preparation.

All planting stock and seed should be purchased from nurseries that are known to be using locally adapted seed, seedlings or cuttings. Priority will be given to plant materials that have been selected and tested in tree improvement programs. All plant materials should comply with the minimum standards established by the American Nursery and Landscape Association, U.S. Forest Service, or state-approved nursery.

Plans for landscape and beautification plantings should consider foliage color, season and color of flowering, and mature plant height.

Where multiple species are available to accomplish the planned objective, consideration should be given to selecting the species which best meet wildlife needs. Tree arrangement and spacing should allow for access lanes.

Residual pesticide carryover should be considered prior to planting.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

Plans and specifications will include the following: adapted tree species for the purposes outlined, spacing, planting methods, cultural practices, maintenance requirements, and variations in methods and species between interplanting, underplanting, and planting in open areas. Separate specifications can be prepared for each of these planting methods.

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance).

If needed, competing vegetation will be controlled until the woody plants are established. Noxious weeds will be controlled.

Replanting will be required when survival is inadequate.

Supplemental water will be provided as needed.

The trees and shrubs will be inspected periodically and protected from adverse impacts including insects, diseases or competing vegetation, fire and damage from livestock or wildlife.

Periodic applications of nutrients may be needed to maintain plant vigor.

REFERENCES

Alabama Cooperative Extension Service. October 1988. Herbaceous Weed Control in Young Pine Plantations. Circular ANR-518.

Alabama Forestry Commission. November 1997. Seedling Care and Reforestation Standards.

United States Department of Agriculture - Forest Service. April 1971. Direct Seeding Pines in the South. Agriculture Handbook No. 391.

United States Department of Agriculture - Forest Service. September 1989. Bottomland Hardwood Reforestation in the Lower Mississippi Valley.

United States Forest Service. December 1989. A Guide to the Care and Planting of Southern Pine Seedlings. Management Bulletin R8-MB39.