Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

TREE/SHRUB ESTABLISHMENT

Code 612

(Ac)

DEFINITION
Establishing woody plants by planting seedlings or cuttings, by direct seeding, and/or through natural regeneration.

PURPOSE
Establish woody plants to—

- Maintain or improve desirable plant diversity, productivity, and health by establishing woody plants.
- Create or improve habitat for desired wildlife species compatible with ecological characteristics of the site.
- Control erosion.
- Improve water quality. Reduce excess nutrients and other pollutants in runoff and groundwater.
- Sequester and store carbon.
- Restore or maintain native plant communities.
- Develop renewable energy systems.
- Conserve energy.
- Provide for beneficial organisms and pollinators.

CONDITIONS WHERE PRACTICE APPLIES
Tree/shrub establishment can be applied on any site capable of growing woody plants.

CRITERIA

General Criteria Applicable to All Purposes
Select one or more species that are suited to soil and site conditions, and appropriate for the planned purpose(s).

Determine desired stocking levels for trees and/or shrubs based on ecological characteristics of the site and species, and landowner objectives. Plant, seed, and/or naturally regenerate at densities/rates that reflect anticipated seedling mortality, to achieve desired stocking levels in the established stand.

Use NRCS Conservation Practice Standard (CPS) Tree/Shrub Site Preparation (Code 490) to prepare sites for planting, seeding, or natural regeneration, if conditions are not suitable for establishing the desired plants.

When utilizing natural regeneration to establish trees and/or shrubs, ensure that a source of seed and/or vegetative propagules is or will be present, or that advanced reproduction exists, sufficient to achieve
objectives. Where natural regeneration relies on seed sources, apply any needed stand treatments and/or site preparation at appropriate times to facilitate germination and establishment of seeds from desired species. Modify forest stand conditions as needed, using CPS Forest Stand Improvement (Code 666), to create favorable stand structure for initiating natural regeneration. Use NRCS CPSs Prescribed Burning (Code 338), Brush Management (Code 314), and/or Herbaceous Weed Control (Code 315), as needed, to obtain the desired species composition, density, and arrangement of trees/shrubs in naturally regenerated areas. Implement coppice regeneration (originating from root shoots or stump sprouts) based on suitability of tree species, age, diameter, and site conditions. Determine the correct timing for coppice regeneration based on species characteristics.

Use tree/shrub planting to accomplish or supplement forest stand regeneration in locations where natural regeneration of desired species is not possible, or will not meet objectives.

Select only viable, high-quality, and adapted plant materials. Select planting stock that conforms to established seed transfer protocols within the State, and complies with minimum standards accepted by the American National Standards Institute (ANSI). Do not plant any species on the Federal or State invasive species or noxious weed lists.

Choose appropriate planting dates and handling methods to increase rates of survival. Select planting techniques and timing appropriate for soil and site conditions. Bare rooted stock may be planted from November 15 to May 1 when the ground is not frozen and prior to bud break in the spring.

Alter species selection and/or timing of planting/seeding to minimize potential effects of residual chemical carryover, as needed.

Evaluate the site to determine if mulching, supplemental water or other cultural treatments (e.g., tree protection devices, shade cards, brush mats, etc.) are needed to assure adequate survival and establishment. Minimize the need for supplemental water and/or nutrients by choosing site-adapted plant materials, planting methods, and planting seasons. Where supplemental moisture is needed to achieve tree/shrub establishment use NRCS CPS Irrigation System, Microirrigation (Code 441).

Protect tree and shrub plantings, seeded areas, and naturally regenerated areas, from unacceptable adverse impacts of pests, wildlife, livestock, and/or fire. Protect from pests, as necessary, by applying integrated pest management techniques for pest prevention, avoidance, monitoring, and suppression.

Removal of products (e.g., trees, biomass, medicinal herbs, nuts, fruits, etc.) is allowed, provided that conservation purpose(s) are not compromised by the loss of vegetation or by harvesting disturbance.

Refer to the KY Invasive Species Advisory list for those species that will not be included in planting mixtures. The list can be in Section II of the KY Field Office Technical Guide (FOTG) – NEPA – Special Environmental Concerns – Invasive Species Resources.

Follow all applicable federal state, and local laws and regulations during the installation, operation and maintenance of this practice.

Types of Establishment:
Bare-root: Seedlings should exhibit a large number of first order lateral roots (FOLR) balanced to top growth. Root collar diameters should exceed 3/8 inches. Discard any diseased or damaged seedlings, and those not exhibiting the above qualities.

Cuttings: Use cuttings prepared during the dormant season from wood of the previous season’s growth. The cuttings should be taken from healthy, moderately vigorous stock plants growing in full sunlight. At least two nodes should be included in the cutting. Cuttings should be at least ¾ inch and preferably 3/8 to 3/4 inches in diameter. They should be at least 12 inches long and 15 to 20 inches where practical. The top should be horizontal and the bottom should be beveled at a 45 degree angle.
**Balled and burlap:** Shrub planting stock should be 18 inches or more in height. Tree stock should be 48 inches or more in height. Do not use plants with cracked or broken rootballs. Avoid "pot-bound" plants indicated by root systems that are visible on the rootball surface and that circle the trunk.

**Container grown:** Containerized stock shall be 3 gallon size (air pruned root stock), with 2 – 6 foot tree height and 3/8 – 5/8" caliper (diameter at ground level at root collar).

**Direct Seeding:** Use only viable, mature seed. Locally collected seed or that purchased from commercial sources may be seeded by hand or mechanical methods. Successful stands can be established by seeding oaks, yellow poplar, pine, and walnut. Consider some type of site preparation to prepare a bare soil seedbed to achieve success. Direct seeding should not be considered where the risk of seed predation by birds, rodents, or other mammals is likely.

1. **Broadcast:** On a well prepared seedbed, broadcast the seed evenly over the planting area and cover seeds with mineral soil (1/2 to 1 inch).
2. **Spot:** Plant 1 seed per spot, 2 to 3 inches deep. The spots should be 3 to 4 feet in the row to compensate for low germination rates. Cover with mineral soil.
3. **Machine:** Plant seeds 2 to 3 inches deep every 3 to 4 feet in the row to compensate for low germination rates. Cover with mineral soil.

**Natural Regeneration:** Sufficient seed trees should be nearby to furnish large amounts of viable seed. Light-seeded species such as ash, cottonwood, maple, pine, and yellow poplar are the best choices for this establishment method.

The following areas are more likely to have successful natural regeneration.

1. Areas that experience flooding that make plantings unlikely to succeed.
2. Depression areas too wet to machine or hand plant.
3. Sites likely to be invaded by soft-mast species that would likely out-compete planted hard mast species.
4. Sites that are within 200 feet of existing mature woodlands and adjacent to desirable seed sources on two sides.

**Spacing:**

Proper tree and shrub spacing is determined by such factors as the objectives of the planting, species, growth rate, expected thinnings, mortality rates, natural pruning, maintenance of initial site preparation, and planting costs. Therefore, the planner has the option to determine the correct spacing to use with reference to the following guidelines:

- **Direct seeding** – A minimum rate of 700 seeds per acre is required. A rate up to 1500 seeds per acre is recommended to compensate for predation and seedling mortality.

- **Containers** – Large container stock is capable of rapid height growth, allowing it to keep up with fast growing, light seeded native tree species that will soon invade abandoned sites. If natural regeneration is expected to fill in between container trees plant at 28 trees per acre minimum (approximately 40' x 40').

**Mixtures:**

Pure plantings are easier and more economical to establish, manage, and maintain. Pure stands are also easier to harvest and often result in higher stumpage values. Mixed plantings can produce higher yields and are preferred for wildlife plantings where species diversity is a goal. Hardwoods are more suitable for mixed plantings than pines. Mixtures of hardwoods and pines is not recommended. Use caution in planning mixed hardwood plantings, particularly where timber production is the goal. Following are species mixtures for consideration.

1. Northern red oak and yellow poplar
2. Northern red oak and sweetgum with black walnut
3. Black walnut and yellow poplar in row-group or block mixing
Additional Criteria for Reducing Nutrients and Pollutants
When plantings are used to remove excess nutrients from runoff or groundwater, select species that have fast-growth characteristics, extensive root systems, and a high-nutrient uptake capacity. Trees and shrubs used to reduce pollutants must be tolerant of the types of pollutants contained in effluent or soils at the site.

Additional Criteria for Restoring or Maintaining Native Plant Communities
Species selected for planting, or those favored in natural regeneration, will be native to the site and will create a successional state that progresses toward the identified target plant community. A minimum planting density of 300 trees per acre is required. Refer to Section IV of the KY FOTG – Tools – KY Tree and shrub Establishment Guide, for selection of species that are considered native.

Additional Criteria for Sequestering and Storing Carbon
For shorter term, rapid carbon sequestration, select species that have high-growth rates, recognizing that they are typically short-lived. For longer term storage of carbon, select plants with a long life span, the ability to reach a large size, high-wood density, and potential for use in long-lived products. Establish and maintain a fully stocked stand. Plant species at a high density, at least 1210 trees per acre (6’ x 6’ spacing). Refer to Section IV of the KY FOTG – Tools – KY Tree and shrub Establishment Guide, for selection of species that exhibit fast growth capabilities.

Additional Criteria for Developing Renewable Energy Systems
Select plants that can provide adequate types and amounts of plant biomass to supply identified bioenergy needs.

Manage the intensity and frequency of energy biomass removals to prevent long-term negative impacts to the site.

Harvest biomass for energy in a manner that will not compromise other intended purpose(s) and functions of the site.

Additional Criteria to Conserve Energy
Increase energy efficiency by planting trees to provide shade for buildings.

Select plants with a potential height growth that will be taller than the structure or facility being protected.

Use proper plant densities to optimize the shade produced.

Design tree and shrub plantings to avoid damage to structures, and to allow adequate space for maintenance access to walls and windows. Plant at a distance that is greater than mature crown spread, and select species that develop deep root systems.

To protect structures from heat loss due to wind, use NRCS CPS Windbreak Establishment (Code 380).

Additional Criteria for Habitat for Beneficial Organisms
Plant trees and shrubs that provide habitat and food sources for beneficial organisms, such as pollinators, predatory and parasitic insects, spiders, insectivorous birds and bats, raptors, and terrestrial rodent predators. Select plant species that meet dietary, nesting, and cover requirements for the intended beneficial organisms during the critical period for control of target pests and, if possible, for the entire year.

Protect beneficial organisms from harmful pesticides.
Additional Criteria to Control Erosion

On bare or critically eroding areas, trees alone will not effectively control erosion for a period of 5 to 10 years. Follow guidance provided in the Critical Area Planting (342) to establish herbaceous vegetation for immediate ground cover. Trees need time to attain adequate size to produce sufficient ground litter and root systems to hold the soil in place and provide long term erosion control protection.

Planting rates for tree seedlings should be between 605 seedlings per acre (approximately 6’ x 12’ spacing) and 681 seedlings per acre (approximately 8’ x 8’ spacing) to provide sufficient canopy closure. Consider using the 12’ row widths to accommodate equipment access during post planting management activities. Use an 8’ x 8’ spacing when it is anticipated that the planting will not receive mechanized post planting treatments.

Annual Criteria to Improve Wildlife Habitat

The objectives for wildlife plantings are to produce food (nuts, berries, or other fruits) and to provide cover for birds and animals. Consider the target wildlife species and landowner objectives in selecting tree/shrub species. Refer to Section IV of the KY FOTG – Tools - Tree and Shrub Establishment Tool - KY Tree and Shrub Establishment Guide, for selection of species that are best suited to wildlife plantings.

CONSIDERATIONS

Consider utilizing plant materials that have been selected and tested in the Plant Materials Program or in similar tree/shrub improvement programs.

Consider using diverse tree and shrub species combinations which best meet the needs of desired wildlife and pollinator species.

When selecting plant materials, consider whether the species, variety, or cultivar possesses aggressive traits, and whether it poses a potential threat to the existing or desired plant community.

Consider the potential impacts of extreme weather events (e.g., drought, flooding, wind, late spring frosts) when selecting plant species and sites for planting.

When using trees and shrubs for carbon sequestration and storage, consider using modeling tools to predict carbon sequestration rates and amounts of stored carbon.

Tree/shrub arrangement and spacing should allow for and anticipate the need for future access lanes for purposes of stand management and fire control.

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

Consider establishing species with growth rates and at densities that make them competitive with weeds and undesirable plants.

Consider using species that provide subsistence and cultural values, (e.g., as used by Tribes).
Consider designing plantings to enhance visual quality in farmsteads, recreation areas, and along public rights-of-way, by applying foliage color, season and color of flowering, mature plant height, edge-feathering, and other landscaping techniques.

Planting stock will be of a hardiness zone adaptable in Kentucky counties. Consider acquiring planting stock from suppliers located in or adjacent to the state of Kentucky.

**Considerations for Organic Systems During Vegetation Establishment**

Natural mulches, such as wood products or hay, can be used to support tree/shrub establishment by controlling competing vegetation, as a viable alternative to using herbicides. Certified weed-free mulches are preferred. NRCS Use CPS Mulching (Code 484).

Pests may be managed through augmentation or introduction of predators or parasites and development of habitat for natural enemies of pests; non-synthetic controls such as lures, traps, and repellents may be used.

Invasive plant species may be controlled through mulching with fully biodegradable materials; mowing; livestock grazing with protection for plantings; hand weeding and mechanical cultivation; pre-irrigation; flame, heat, or electrical means. Use NRCS CPS Prescribed Burning (Code 338), as needed.

**Considerations for Reducing Energy Use**

When trees are planted to reduce summer energy use in buildings, consider prioritizing their placement on the west side of the building, where the greatest daily solar heat gain occurs. The second priority is the east side. Trees or shrubs planted within 30 to 50 feet of a building generally provide effective shade to windows and walls, depending on tree height potential.

Deciduous tree or shrub species planted adjacent to the south side of buildings in cool climates can provide shade in the summer yet allow sun to reach the building in winter.

**PLANS AND SPECIFICATIONS**

Prepare plans and specifications that describe requirements for applying the practice to achieve its intended purpose, and obtain any required permits.

Use job sheets or other acceptable documentation. At a minimum, provide—

- Objective(s)/Purpose for establishment.
- Sketches, drawings, and detail drawings, field location.
- Map showing the location of plantings and/or natural regeneration areas.
- Site conditions prior to establishment
- Soil amendments (if needed)
- Site preparation methods (if applicable)
- Soils map, and description of soils and Ecological Sites (if available).
- Establishment method by species or vegetation type.
- Number of trees/shrubs per acre to be planted, by species.
- Timing of planting and/or natural regeneration relative to considerations for seasonal factors, plant physiology, disease, insects, and wildlife impacts.
- Mitigation measures, if needed, to reduce wildfire hazard or the potential for disease and insect pests.
- Stock size (id applicable)
- Establishment method(s)
- Protection methods and details if installation (if applicable)
- Cultural practices (i.e. pruning, forest stand improvement, etc.) (if any)
- Operation and maintenance requirements
  - Replacement strategies
OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for this site. As a minimum, include the following activities:

- Burn or mow the area periodically, if needed to maintain the health of the plant community. Do not conduct maintenance practices and activities during the primary reproductive period of wildlife (May 15 – August 1). Exceptions can be considered to maintain the health of the vegetative community if such exceptions do not conflict with agency requirements.
- Control access by vehicles and/or equipment during or after tree/shrub establishment to protect new plants and minimize erosion, compaction and other site impacts.
- Inspect the site at an appropriate time following planting, seeding, and/or natural regeneration to determine whether the survival rate for tree and shrubs meets practice and client objectives. Replant or provide supplemental planting when survival is not adequate.
- Inspect the trees and shrubs periodically, and protect them from adverse impacts of insects, diseases, competing vegetation, fire, livestock, wildlife, non-functioning tree shelters and/or weed barriers, etc.
- If needed, control competing vegetation until the desired trees/shrubs are established. Control plant species on the Federal or State invasive species and noxious weed lists.
- If needed, apply nutrients to maintain vigor of desirable trees/shrubs.
- Control competing vegetation during the first 2-3 years by mowing, cultivating, mulching, herbicides, and/or plant mats.

REFERENCES


