Practice Specification
Tree-Shrub Establishment (Code 612)

Section

GENERAL SPECIFICATION

Procedures, technical details and other information listed below provide additional guidance for carrying out selected components. This material supplements the criteria and considerations listed in the conservation practice standard.

DEFINITION

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

PURPOSES

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

CONDITION WHERE PRACTICE APPLIES

On any area where woody plants are desired.

CRITERIA

General Criteria Applicable to all Purposes

On forest and woodlands in New Mexico the New Mexico Energy, Minerals and Natural Resources Department provides technical assistance through local district foresters. A landowner harvesting over 25 acres per year must obtain a state permit from the district forester and have a regeneration plan. The local district forester can produce the regeneration plan or a consultant can do the work. The local district forester maintains a list of state certified consultant foresters. Tree and Shrub Establishment is usually an integral component of a forest and woodland management plan. Always check with the local district forester when making site-specific specifications on forestland.

Species will be adapted to soil-site conditions.

Species will be suitable for the planned purpose(s).

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

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

Only viable, high quality, and adapted-trees, shrubs, seedlings, cuttings, or seed will be used.

Site preparation shall 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, soil moisture and other soil considerations.

The acceptability 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.

Supplemental water will be required to assure adequate survival unless special circumstances exist (e.g.., planting conifers in 30 inch precipitation zone)

All practices and procedures that involve ground- disturbing activities will be in compliance with applicable Cultural Resource Protection laws, regulations, and policies.

All activities under this practice will comply with applicable laws and regulations, including New Mexico Best Management Practices (BMPs).

Additional Criteria for Maintaining or RestoringNatural genetic diversity.

Species selected will be indigenous to the site and will reflect species components of the desired stands. Local ecotypes will be used when available.

Additional Criteria For The Purposes of Landscape beautification. To Provide Shade and Wildlife Habitat

CONSIDERATIONS

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

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

Where multiple species are available to accomplish the objective, consideration should be given to selecting species which best meet wildlife needs.

Tree arrangement and spacing should allow for access lanes.

Residual chemical carryover should be considered prior to planting.

Source for irrigation water and method of application should be identified prior to planting.

Frequent monitoring of planting should be planned which is necessary for irrigation and pest management.

CONSIDERATIONS ON PLANT QUALITY AND PLANTING DENSITIES.

Plant adapted species as indicated by the soil-woodland correlation or windbreak suitability guide. If those references are not available use species that are native on the same soil series.

For best results, plant only stock grown from a local seed source (seed collected within 100 miles radius of planting site and differing not more than 1,000 feet in elevation).

If a local seed source is not available, use stock from seed having the same length of growing season, the same mean temperature during the growing season, the same pattern and quantity of precipitation, the same latitude, and a similar environment.

Plant materials should be ordered as early as possible In order to have the best selection, Insure availability, and be cost effective.

CONSIDERATIONS ON PLANTING DENSITIES FOR WINDBREAKS, WILDLIFE HABITAT AND RIPARIAN FOREST BUFFERS.

All planting stock and seed should be purchased from nurseries that are known to be using adapted seed, seedlings or cuttings. Priority will be given to plant materials that have been selected and tested in tree improvement programs and local ecotypes. All plant materials should comply with the minimum standards established by the American Nursery and Landscape Association, 1250 I Street Northwest, Suite 500, Washington, DC.

Initial plant-to-plant densities for trees and shrubs will depend on their potential height at 20 years of age.

Heights may be estimated based on: 1) performance of the individual species (or comparable species) in nearby areas on similar sites, or 2) predetermined and documented heights using Conservation Tree/Shrub Suitability Groups, Section II of the Field Office Technical Guide. Planting density specifications are:

Plant Types/Heights:	Plant-to-Plant Spacing in feet:
Shrubs less than 10 feet in height	3 to 8
Shrubs and trees from 10 to 25 feet in height (includes columnar trees)	6 to 10
Trees greater than 25 feet in height	8 to 18

CONSIDERATIONS ON CARE AND HANDLING OF PLANTING STOCK.

Bareroot stock will be stored in a cool, moist environment (34-38 degrees F) or heeled in for long term storage. During all stages of handling and storage, keep stock tops dry and free of mold and roots moist and cool. Destroy stock that has been allowed to dry, to heat up in storage (e.g., within a bale, delivery carton or container), or that has developed extreme mold or other pests.

Live cuttings that will not be immediately planted shall be promptly placed in controlled storage conditions (34-38 degrees F) for long term storage and protected until planting time. The selected material for cuttings must be vigorously growing and a minimum 2 years old to assure the material is woody. All live cuttings must be taken during the dormant season. Side branches should be removed but the branch collars should be left undamaged. Two to Three terminal branches should be left on the cutting. Cutting lengths should be long enough to reach adequate soil moisture required by the individual species during the growing season with 4 feet of stem above the surface to prevent shading by common weeds. Most species suitable for planting of cuttings or poles must be planted to a depth of permanent water or will require temporary water until the root system develops down to permanent water. Dormant cuttings of many species, particularly cottonwood and willows, may be stored with the butt end submerged in water for as long as three weeks, which must be prior to the buds breaking. At a minimum, the butt end must be kept cool, dark and moist until the stock is planted.

Seedlings shall not be less than 1/4” in caliper at 1” above the root collar. Rooted planting stock must not exceed a 2:1 shoot-to-root ratio unless it is a species that can root from its stem and will be planted with the root collar well below the ground surface to enable roots to reach subsurface moisture. Preferable shoot-to-root ratio for the New Mexico environment is 1:1. (See figure 1.) Minimum container size for rooted seedlings should be 10 cubic inches. There are no restrictions for maximum container size. The preferred container shape is long and narrow so the taproot system of the transplant can begin to develop. For example, tallpots(see Tall-Pot, Plant Technology Fact sheet) are containers 30 inches in length with a 4 inch diameter. The long root system that develops in this pot can be planted into the moist soil of the capillary fringe of the water table in a riparian plant community and may never have to be irrigated.

Consideration should be given to provide protection to seedlings from wind and/or heat damage by placing snow fence, shingles, or other suitable materials on one or more sides.

Consideration should be given to increasing available moisture by making a depression around the base of a plant and placing tar paper squares or weed barrier fabric in this depression or using a “super slurper” moisture holding compound.

Consideration should be given to providing enough water for optimum growth through the use of drip irrigation (Specification 441 - Trickle irrigation), or other proven irrigation strategies. Irrigation may also be achieved by embedding watering tubes with transplants and bareroot plants at time of planting. These tubes may be PVC pipe, 1-3 inches in diameter, perforated at the bottom 1/3, and its length at least 1/3 longer than the current root system of the transplant. Plants may be irrigated with portable water tanks or automated systems. With the deep watering provided by the embedded tubes, less watering will be required. Also, their usually will be less weeds to contend with since the watering is subsurface.

Consider tree planting only on those areas where livestock can be managed (Specification 472 – Use Exclusion).

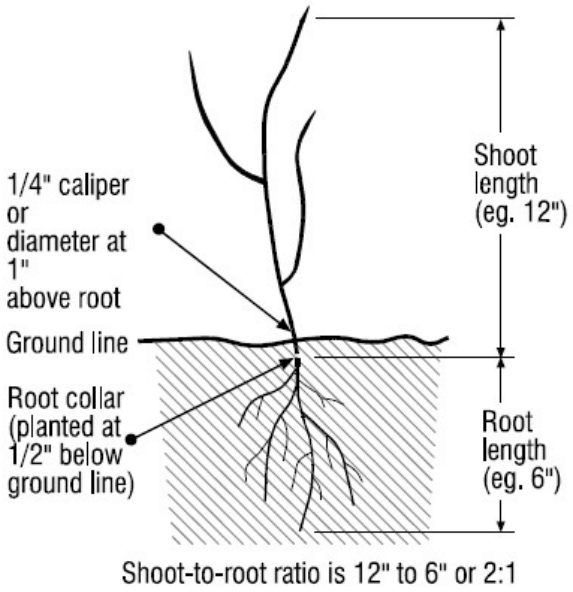

Figure 1. Plant or stock size requirements.

Roots of bareroot stock shall be kept moist during planting operations by placing in a pail of water, a water-soil (mud) slurry, damp peat moss, super-absorbent (e.g., polyacrylamide) slurry or other equivalent material. Rooting medium of container or potted stock shall be kept moist at all times by periodic watering. Pre-treat the stored cuttings with a- three to seven day water soaking just prior to field planting. Stock shall not be planted when the soil is frozen or dry.

CONSIDERATIONS ON PLANTING TECHNIQUES.

Generally, rooted stock will be planted in a vertical position with the root collars approximately 1/2-inch below the soil surface. However, many riparian woody species may be planted down to the capillary fringe of the water table as long as the stems are at least two feet above the soil surface which will limit detrimental shading by common weeds. Woody species that may be buried include, but are not limited to, New Mexico olive, indigo bush, false willow, and sumac. They are able to root from their stems and are adapted to being buried in sediments or deeply planted well above their root collar. Insert cuttings to the depth required to reach adequate soil moisture. The planting trench or hole must be deep and wide enough to permit roots to spread out and down without J-rooting or L-rooting. After planting of rooted stock or cuttings, pack soil around each plant firmly (See figure 2) and irrigate plant liberally to eliminate air pockets.

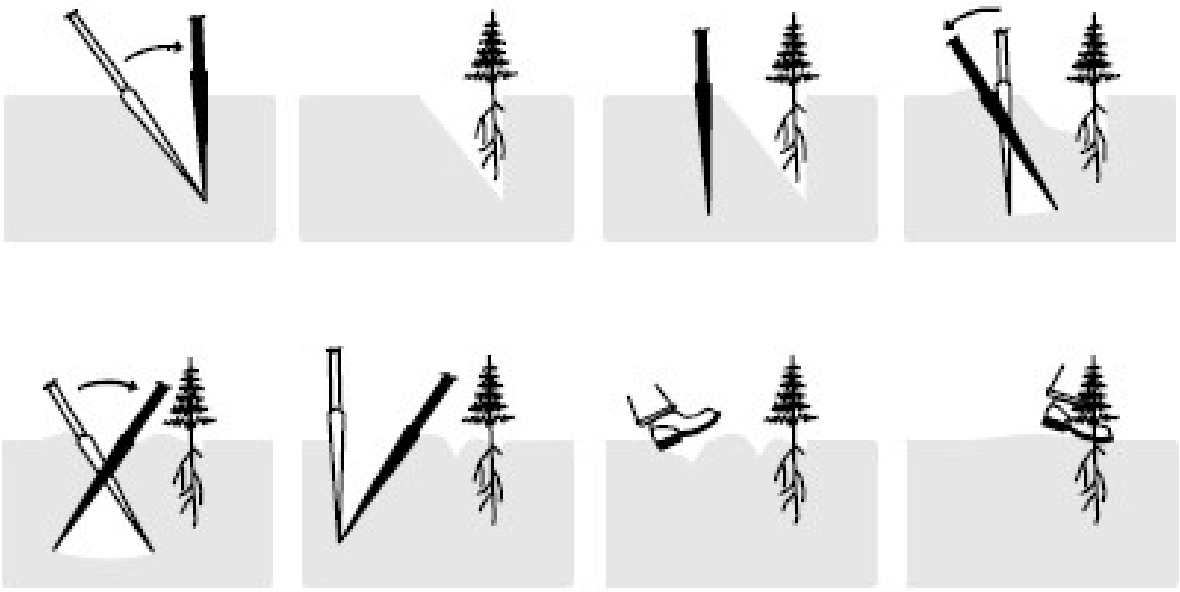

Figure 2. Proper plant and root placement of rooted stock using a planting bar.

Bare root trees will be kept moist at all times before planting by covering with moist burlap or carrying in a pail containing water.

Containerized stock should be kept moist enough that they slip out of the containers and the soil medium remains attached to the roots.

Avoid planting on hot windy days.

CONSIDERATIONS ON TREE PLANTING ON FORESTLAND.

Adapted Species for forestland reforestation purposes include but are not limited to:

Colorado blue spruce	Douglas-fir
White-fir	Ponderosa pine
Engelmann spruce	

Site Preparation will be accomplished prior to planting and will include the elimination of fire hazards in heavy slash areas.

Spacing is an important consideration to assure that all the purposes desired from accomplishing this practice are acquired with the least amount of management inputs.

The number of trees planted per acre is dependent upon soil characteristics, site index of the species to be planted, and whether precommercial and commercial thinnings are planned.

Species: Ponderosa pine or Douglas fir Type stock: B=Bareroot C=Container Trees/acre to be planted

Site Index	Type Stock	Precommerical Thinnings Planned (Min No./Acre)	Pulpwood Harvest Planned (Min No./Acre)	Sawlog Harvest (Min No./Acre)
50-60	B	640	575	350
50-60	C	420	375	295
70-80	B	575	500	350
70-80	C	370	325	275
90	B	625	555	400
90	C	410	360	265
100+	B	600	500	350
100+	C	490	325	225

Species: Engelmann Spruce or Corkbark fir Type stock: B=Bareroot C=Container Trees/acre to be planted			
Site Index	Type Stock	Pulpwood Harvest Planned (Min No./Acre)	Sawlog Harvest (Min No./Acre)
50-60	B	700	350
50-60	C	455	300
60-85	B	700	300
60-85	C	455	200
85-100	B	800	550
85-100	C	455	400
100+	B	900	630
100+	C	585	450

Species: White fir Type stock: B=Bareroot C=Container Trees/acre to be planted			
Site Index	Type Stock	Pulpwood Harvest Planned (Min No./Acre)	Sawlog Harvest (Min No./Acre)
50 +	B	650	400
50 +	C	422	260

*These planting rates are based on 50 percent mortality for bareroot and 30 percent mortality for container seedlings for years 1 and 2.

When trees are to be grown for harvested as sawlogs, a wider spacing may allow trees to grow to merchantable size earlier than when planted closer together. However, there is less allowance for loss. Competing vegetation may not be controlled, and trees may be of lower quality because self-pruning of lower limbs will not occur.

For higher quality timber, manual pruning of lower limbs will be required. Opening the canopy will allow more understory herbage production.

All plantings will be according to plans approved by the District Forester, New Mexico State Forestry.

Trees will be planted by hand or with a planting machine. Plant as early in the spring as possible.

Operation and Maintenance on Forestry Plantations.

Rodents can be managed by a number of methods. Repellents or seedling barriers are examples.

Exclude livestock until the planted trees have been in the ground for 3 to 5 years or until the trees are established enough to withstand minor trampling damage.

Replant, if necessary, to maintain a fully stocked stand and achieve all the desired practice goals.

Additional Planning Considerations on forest tree planting:

Tree stock can generally be 1-0, and over 8 inches in total length and vigorous. However, the harsher the site the more important it is for use of 2-0, 2-1, or 1-2 stock. The numbering system referred to is the total age of the seedling and where it was grown. Ex. 2-1 refers to the seedling having been grown for 2 years in a green house and then an additional year in an outside planting bed so in this case the seedling is three years old.

In species selection, consideration should be given to aesthetic values in scenic corridors.

References on forest tree planting:

W. H. Meyer, “Even-aged Stands of Ponderosa Pine USDA Technical Bulletin, 630, 1938.

Carleton Edminister and Lew Jump, “Site Index Curves for Douglas-fir In New Mexico,” USDA Forest Service Research Note, RM-326, 1976.

Bulletin, No. 407, Agricultural Extension Station, California, 1926.

R. R. Alexander, “Site indexes for Englemann Spruce,” USFS Research Paper, RM-32, 1967.

CONSIDERATIONS ON PLANTING CUTTINGS FOR RIPARIAN HABITAT PURPOSES.

Adapted species for creation and restoration of riparian habitat purposes include but are not limited to:

Cottonwoods - (Narrowleaf, Rio Grande, Plains) Willows - (Peachleaf, Black, Coyote)

Depth to water table considerations for riparian habitat:

Water table must not be greater than 10 feet from the surface during anytime of the year. The site cannot be subject to ponding for more than four consecutive weeks. Trees and shrubs need aerated soil. Generally, many mature willow species can tolerate a surface water table up to 6” for a prolong period of time. Mature Cottonwoods can tolerate a surface water table up to 24” for a prolong period of time. If the surface water table averages higher, do not plant woody species.

Site Preparation and Planting considerations for riparian habitat:

See the NRCS publications Guidelines for Planning Riparian Restoration in the Southwest, The Pole cutting Solution and Considerations on Care and Handling of Planting Stock for additional information.

Spacing is site and species specific.

Maintenance and protection considerations for riparian habitat:

Protect all plantings from grazing and browsing animals as needed to protect planting functions.

Protect the site from fire.

CONSIDERATIONS ON CHRISTMAS TREE SELECTION AND PLANTING.

Adapted Species for Christmas tree plantation purposes include but are not limited to:

Colorado blue spruce	Douglas-fir
Pinyon pine	Ponderosa pine
Engelmann spruce	Scotch pine

White fir	Arizona cypress
Southern white pine	
Afghanistan pine (Do not plant where temperatures fall below –10 degrees Fahrenheit.)	

Site preparation should be conducted as follows:

In areas that have a preponderance of soils that are not susceptible to wind erosion and that will not be irrigated prepare the site in the following manner. Plow in late spring followed by a fallow period during the year prior to a spring planting. Disk and harrow immediately before planting as necessary.

In areas that have a preponderance of soils that are not susceptible to wind erosion and that will be irrigated prepare the site in the following manner. Fall plowing prior to a spring planting. Disk and harrow immediately before planting as necessary

In areas that have a preponderance of soils that are susceptible to wind erosion prepare the site in the following manner. Treat vegetation with a contact non- residual herbicide the summer before planting or scalp an area 48 inches in diameter free of competing vegetation. Do the scalping in the fall prior to planting.

CONSIDERATIONS ON CHRISTMAS TREE PLANTING AND TREE SPACING.

Christmas trees will be spaced depending on tillage equipment, moisture availability, and markets. Common spacing is 5 feet x 5 feet and 6 feet x 6 feet (for 66 percent taper). The 5 feet x 5 feet spacing allows room for development of a six to eight foot tree. The 6 feet x 6 feet spacing allows for a larger tree. 4 feet x 4 feet spacing is used when smaller trees are desired or if especially narrow (50 percent or less) taper trees are planned for production.

Number of Christmas trees per acre.

Spacing in feet	Number of stems per acre
4 x 4	2,722
5 x 5	1,472
6 x 6	1,210

Christmas tree spacing patterns

Trees may be planted in either a standard grid or an offset pattern. The offset pattern allows for more crown development with a slightly closer spacing between rows (not within the row).

Trees may be planted by hand or with a planting machine. **Operation and Maintenance on Christmas trees:** Clean till within 3 or 4 feet of the seedlings.

Control rodents and deer. Repellents or the installation of rodent and deer proof fences may be required.

Exclude livestock (see Specification' 472 -Livestock Exclusion).

Protect from fire. A firebreak can be constructed around the plantation. Weed management within the plantation will also reduce the fire hazard.

Additional Planning Considerations on Christmas trees:

Replant as necessary and practicable to maintain a fully productive plantation. Preferably, replacement seedlings should be of the same age as the plantation seedlings.

Control noxious weeds prior to planting.

Locate access lanes about 200 feet apart prior to planting.

If irrigation is to be used, have irrigation systems in place before planting. To increase seedling survival, irrigate after planting to aid in packing the soil around the roots and assure enough water to begin growth.

References on Christmas trees

Tree and Shrub Planting Handbook for Arizona and New Mexico. Cooperative Extension Service. Department of Agricultural information. New Mexico State University, Las Cruces, New Mexico 88003. 1983.

New Mexico State Forestry Division. Reforestation Guidelines for Private Forest Landowners in New Mexico. 1982.

New Mexico State Forestry Division. Guidelines for Growing and Marketing Christmas Trees in New Mexico. 1980.

Barrett, J. W., Regional Silviculture of the United States. Ronald Press Company, New York. 1962.

CONSIDERATIONS ON PLANTING CUTTINGS AND POLES.

For planting of cuttings where no supplemental water is planned, the site must be evaluated for the maximum depth of the water table. Any cutting must be long enough to reach that maximum water table depth and have a minimum of 4 ft. of stem above ground to limit shading by common weeds.

A hole can be dug by a mechanical auger or by hand with a bucket auger. In cases where the soil is extremely moist and there is no rock or other impeding layer and the water table is near the surface year round, do not plant cuttings for this is a wetland plant zone. The entire length of holes dug for cuttings must be filled with soil to enhance the potential for rooting.

Avoid planting cottonwood or willow cuttings in soils with electrical conductivity (EC) measurements of greater than 3 - 4 ds/m at the soil surface and at the capillary fringe of the water table. Both locations are the typical rooting zones for pole cuttings. Instead, plant salt tolerant transplants at these locations.

Avoid planting cuttings in the shade of a gallery forest. Poles perform best under conditions of direct sunlight.

Where supplemental water is provided to cuttings that are not established in a permanent water table, the cuttings must have a minimum of 6”in the soil and a minimum of 3 buds above the ground. Cuttings more than 2 feet long will have to have at least 1/3 of the total length in the soil to support the top growth. In New Mexico it is optimum to have 2/3 of the cutting in the ground and 1/3 in the air.

Supplemental water will be required to provide moisture for the entire depth of the cutting. This may be required for the life of the plant or until the root system can reach the maximum depth of the capillary fringe of the water table.

Considerations on when to plant

Cottonwood and willow pole cuttings, and bareroot plants will be planted while they are dormant which is generally from December to March. Containerized rooted plants will be planted in October through March in all but montane areas. In montane areas they will be planted during the summer rain period which may begin as early as June and continue through August.

Considerations on how to irrigate plants

Supplemental water is required for plant survival on most sites for two years. This can be achieved by soaking the soil profile within the drip line of the plants to a depth of 3 to 5 feet and do not irrigate again until the profile has drawn down to 50 to 60 percent of available water holding capacity. This can be

efficiently achieved by embedding watering tubes with containerized transplants or bare root plants at time of planting. These tubes may be PVC pipe, 1 – 3” in diameter, perforated at the bottom 1/3, and its length at least 1/3 longer than it current root system of the transplant. Plants may be irrigated with an elaborate drip irrigation system or by hand with a portable water tank.

With deep watering provided by the embedded tubes, less watering will be required. Also, their will be less weeds to contend with since the watering will be subsurface.

Super absorbent polymers may also be used to reduce the frequency of irrigation applications.

On all sites and all plant species that may he subject to unacceptable damage, planning will include preparing estimates of the occurrence of animal populations that have the potential of causing damage. Use of sightings of pocket gopher mounds, animal trails, frequency of scats, and evidence of browsing on native plants will yield data that can help determine the need for plant protection.

On certain sites all species will be subject to unacceptable damage while on other sites no species may he subject to damage and plant protection may not be necessary.

Based on limited observations the following species normally require protection to manage damage to an acceptable level

Native Plum	Golden Willow
Skunkbush Sumac	Green Ash
Fourwing Saltbush	Lilac
Douglas-Fir	Mulberry
Ponderosa Pine	Redosier Dogwood
Aspen	Western Sandcherry
Poplar spp.	Afghanistan Pine
Birch spp.	Arizona Cypress
White Fir	Willow spp.

Physical Barriers for Seedling Damage Management.

Poultry wire. For small mammal protection poultry wire with a mesh that does not exceed one inch will he shaped to form a cylinder a minimum of 5”in diameter and 18” in height. A minimum of one 24” long, I” by 2” stake with 18” extending above the ground will he used to support the chicken wire. The chicken wire will he fastened to the stake by 2 evenly spaced staples or 2 tie wires. The bottom of the chicken wire will he flush with the ground. The barrier must be removed when the trunk diameter is within one-half inch of the chicken wire diameter.

For beaver protection of pole cuttings a poultry wire tree guard Cylinder 5 feet high, with a 5-10” air space between the trunk and the wire, is an effective defense. Bury the bottom 4-6” of this treeguard so it supports itself without leaning into the cutting. Do not wrap the trees in wire for it will not prevent beaver predation and will also be detrimental to the tree when the bark begins to grow into the wire.

Rigid polypropylene - mesh tubes. Tube mesh will be of a diamond pattern with a minimum 30-mil strand diameter. The tubes will be a minimum of a 5” diameter and 18” high. The tubes will be fastened to a 24-inch long, I x2” stake with 18” extending above the ground by one staple or a tie wire. The bottom of the tubes will be flush with the ground.

Protection from cattle will require adequate fencing and periodic monitoring of fence integrity. Elk-proof fences (e.g., 8 foot tall) are required to protect large riparian restoration tracts or small exclosures made from welded rod cattle panels can be placed around individual plants or clumps of plants have proven to provide effective elk protection.

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 trees for the purposes outlined, spacing, planting methods, cultural practices, and maintenance requirements that are applicable; 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):

Resprouting of noxious weed species often requires continued spot spraying for an indefinite period. Common weeds may need to be controlled if they are densely shading planting while competing for water and nutrients.

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 insects and diseases. Controlling defoliating insects such as cottonwood leaf beetle is crucial for pole plantings during the first two growing seasons.

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

Specific Site Requirements