

# Trees for Conservation



planning • planting • care

Colorado  
State  
FOREST  
SERVICE

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### Stewardship. Caring for the land.

Each day, ever-increasing demands are placed upon our land and its natural resources. People can help lessen the impact of these demands by making a personal commitment to their own property through tree planting. Few conservation efforts provide the extensive and enduring benefits that a well-designed and installed tree planting does. Tree planting is a step anyone can take to become a better steward of the land.

Join the 5,000 Coloradan's who annually plant trees to benefit the environment, themselves, and their neighbors.

Tree plantings benefit land and people by:

- Protecting property and livestock from the wind.
- Restoring or enhancing natural beauty.
- Reducing soil erosion and improving crop yields.
- Providing food and cover for wildlife.
- Increasing property values.
- Increasing the number and health of forests.

- Reducing water evaporation, preserving winter moisture, and protecting and improving water quality.
- Controlling snow drifts.
- Reducing atmospheric carbon dioxide.
- Reducing heating and cooling costs. (By providing protection from sun and wind, trees can reduce energy costs by as much as 30 percent.)
- Protecting livestock from the elements, maintaining and improving livestock weight gain, and reducing calving losses.
- Increasing our supply of renewable resources.



*Conservation plantings can reduce heating and cooling costs for structures.*

### ***Conservation Plantings: Planning, Design, and Site Preparation***

Conservation tree plantings can provide many of the previously mentioned benefits. However, such successful plantings require well-defined objectives which help answer many questions. For example, where should the trees be planted; what are prevailing or troublesome wind directions; and what about drifting snow, water, and power lines?

Many factors must be considered in planning tree plantings, regardless of whether they are located in the mountains or plains, or whether they have been designed to benefit wildlife or control wind:

- Location
- Elevation, slope and aspect
- Soil type and alkalinity

- Prevailing wind direction(s)
- Weed control methods
- Irrigation needs
- Snow drifting
- Power lines
- Planting size and shape
- Species selection
- Site preparation method
- Underground utilities' locations
- Past land uses

Hobby gardeners would never consider planting a garden directly in grass sod. Yet many people do plant trees and shrubs with little or no site preparation. Preparation of the planting site is key to tree growth and survival. Site preparation involves removing all competing vegetation and loosening soil to allow easier planting and proper root development.

### **Windbreak**

Site preparation for windbreaks is similar to that used for gardens. Plows, disks, or garden rototillers can be used to achieve necessary tillage and are available at rental equipment stores and landscape companies.



*Plows, disks, and rototillers are available for rental at many rental equipment stores and landscape companies.*

Preparation of 4 to 8 foot wide row strips is sufficient for planting. For best results, allow the soil to mellow and store moisture by preparing the site in the fall prior to planting. Where there is danger of sandy soils blowing, site preparation may be delayed until just before planting.



Generally, the primary tree-planting objective of rural landowners is protection from the wind. A windbreak planting of trees and shrubs creates a "wind shadow" on its leeward (downwind) side, providing that protection. This protected area extends to a distance of 15 to 20 times the height of the windbreak's tallest trees; the most effective area extends to about 10 times the height (10H) of the windbreak. For example, if a windbreak is 30 feet tall, wind speed is reduced by 50 percent 300 feet downwind from the windbreak.

Because wind eddies form around the ends of a windbreak, the planting should extend 100

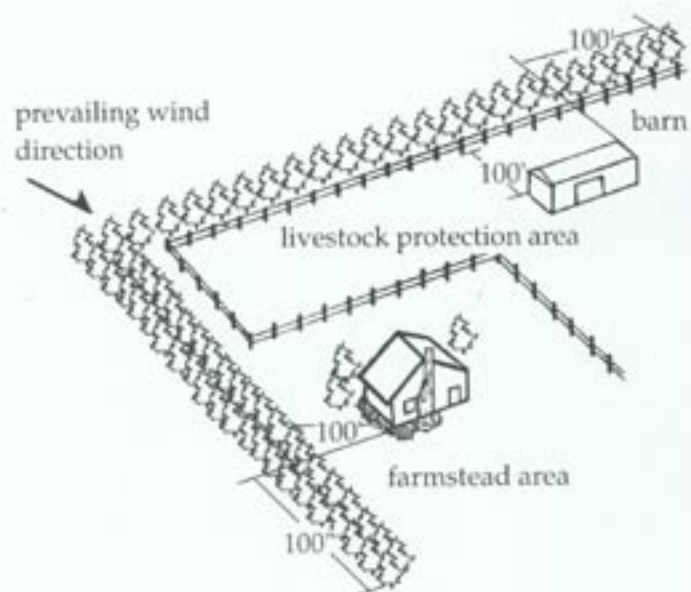


Figure 1: Windbreak area of protection

feet beyond the area to be protected. Any gaps or openings in the windbreak funnel and accelerate the wind and reduce windbreak effectiveness; planting different types of trees in the same row can create gaps and reduce windbreak effectiveness.

Windbreak rows do not have to be placed in straight east-west or north-south rows but generally should be **perpendicular to prevailing winds**.



Plant windbreak rows *perpendicular to prevailing winds*.

Do not plant trees closer than 100 feet to roads, driveways, buildings, or other areas being protected — snow drifts and blind corners created in these areas can be hazardous. (Note: Snow can drift a distance of approximately three times the height of the windbreak.)

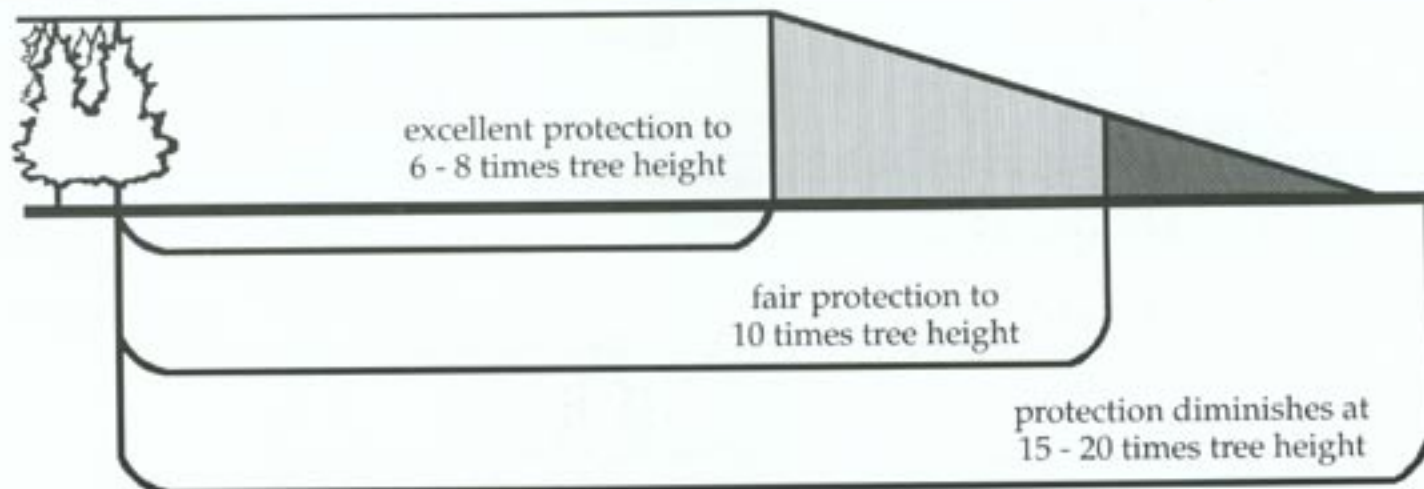


Figure 2: Windbreak area of protection

Plant at least three tree rows to achieve good wind protection — the greater the windbreak's density, the greater the reduction in wind velocity. Shrubs or shorter trees can comprise outer rows, while evergreens (the foundation of the windbreak) should make up at least one inside row. Do not use the same species of plant in every windbreak row; diversification of planting rows increases insect and disease resistance and enhances wildlife habitat. Different tree types should not be alternated or mixed **within** a row (to avoid plant overtopping by faster growing species).



Between-row spacing varies with tree type and weed control methods. When cultivation equipment is used (e.g. disks, rototillers, etc.), spacing should be at least 4 feet wider than the equipment. A minimum spacing of 12 to 20 feet between rows will prevent stunting or overtopping.

Shrubs	3'-6'
Juniper, Cedar	6'-12'
Pine, Spruce	8'-14'
Short deciduous trees	8'-12'
Tall deciduous trees	8'-18'

Table 1 - Recommended spacing between trees and shrubs

### Living Snow Fences

Properly designed windbreaks can keep driveways and roads free of drifting snow in winter — in this instance, the critical factor is location. When planted too close to roads or driveways, windbreaks can pile snow on these areas.

The first row of a windbreak should be planted at least 100 feet back from a road's centerline to eliminate any snow accumulation on the road. Additionally, windbreaks provide maximum snow storage when they have multiple tree rows spaced 40-150 feet apart.

### Field and Livestock Windbreaks

Single rows of tall growing trees planted perpendicular to prevailing winds prevent blowing soil and create better growing conditions for crops. Here, windbreak density is the most important attribute to consider. Tree rows with a 40 to 60 percent density will distribute snow moisture evenly across a field, enhancing spring growing conditions.

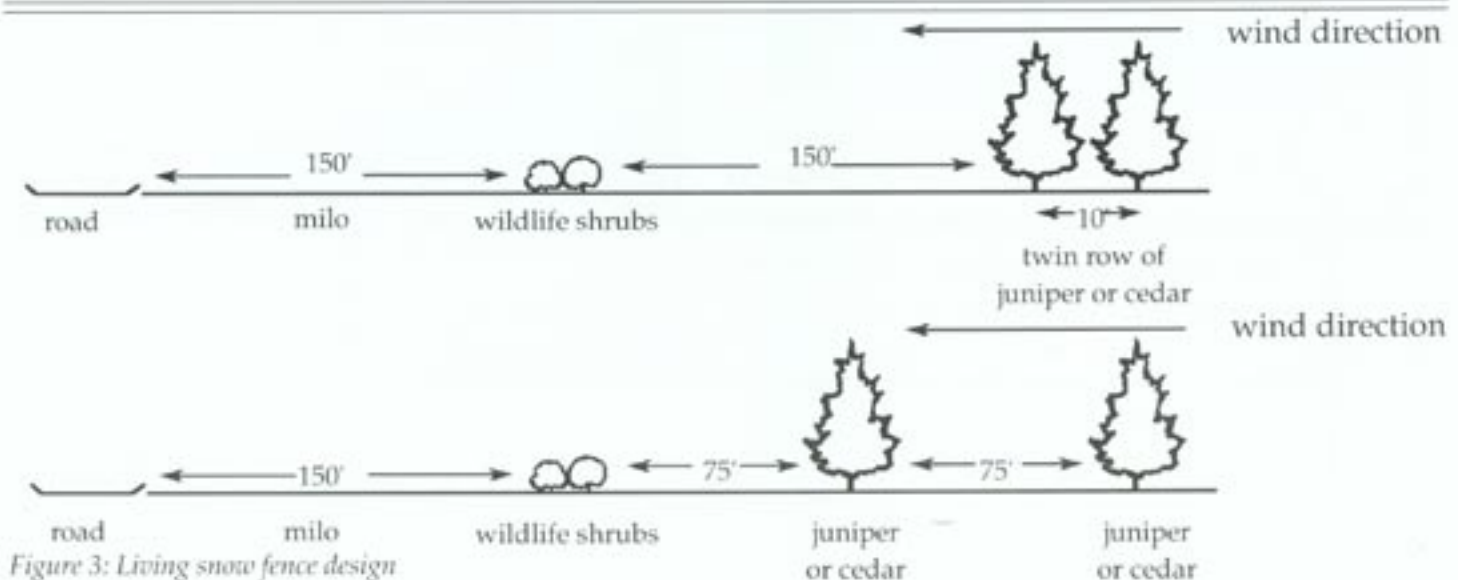


Figure 3: Living snow fence design





*Twin-row, high density windbreak.*

Three-row evergreen windbreaks provide rangeland livestock protection from winter winds when planted in pastures where livestock congregate during severe weather. During the summer, group plantings of large deciduous trees provide shade for rangeland livestock.



*Trees provide winter and summer protection for livestock.*

As with all windbreak plantings, trees should be fenced to prevent livestock damage.

## Planting a Forest

Mountain valley and forest plantings have unique requirements. Species selection is dependent on elevation and slope aspect. Species which do well in mountain valleys may grow poorly on ridge tops. Species which favor cool, moist north and east facing mountain slopes may do poorly on hot, dry south or west facing slopes. As elevation increases, sunlight intensity also increases; several conifer species native to higher elevations in Colorado require partial or full shade for establishment.



Planting within an existing forest (or where a forest once existed) is called **reforestation**. Reforestation increases wildlife habitat diversity, provides for future forest production, diversifies forest species composition, and replaces those trees lost to insects, diseases, or fire. Many reforestation projects involve minimal site preparation and tree maintenance and may involve planting large numbers of trees per acre with the assumption that all will not survive. Generally, irrigation is not used to supplement natural moisture, but the use of plastic and natural mulches is effective.



**Afforestation** is the establishment of trees where they previously have not grown; establishing trees on sage brush-covered hillsides is an example. Planting on such sites requires correcting problems which inhibit natural tree growth. Two primary reasons trees do not naturally grow on such sites are lack of moisture and lack of shade. If planting sites are located near homesites, drip irrigation may be used. If the planting is too remote for this, plastic, fabric, or organic mulches must be used to help retain soil moisture. Shade can be provided by using existing vegetation. For example, trees may be placed on the north-east side of existing sage brush for protection from the hot afternoon sun.



*Where natural shade is not available, shingles can be used to protect young trees.*

If your objective is to replace dead forest trees, first determine why the original trees died. Many tree species are susceptible to specific insects and diseases. If tree species resistant to specific insects and diseases are planted, the impact of infestations and epidemics in a forest can be minimized due to greater tree species diversity.



*Dwarf mistletoe affects many of Colorado's forest trees, decreasing overall forest health.*

Long term forest health is often enhanced by increasing the diversity of trees and shrubs. However, completely replacing native trees and shrubs with resistant species is not desirable. Planting resistant tree species is a single component in an integrated management approach which may include selective tree pruning and removal. Contact a resource professional for advice on the best mix of management activities for your property.

For many mountain landowners, the management goal is to reestablish or create a forest similar to surrounding areas, including the various shrubs found below the forest canopy. While maintaining a natural appearance may be of primary importance, planning, design, site preparation, and wildfire considerations are also concerns. (*Note: Do not plant vegetation too close to structures; forest stand density should decrease with proximity to the home.*)





Figure 4: Defensible space diagram

When selecting tree species for afforestation projects, establish “best bets” first — those species doing well on similar, nearby sites. To improve harsh planting sites, plant hardy shrub species first; this increases shade and soil moisture and decreases soil temperature. Once vegetation has been established on a previously bare site, additional species may be planted.

A typical planting for foothills areas might include trees such as Rocky Mountain juniper, ponderosa pine, and Colorado blue spruce with shrubs such as chokecherry, sumac, and Woods rose. A mixture of 400 to 600 trees and shrubs is recommended to establish an acre of forest. Recommended plant spacing is 10 feet by 10 feet for trees and 3 feet by 4 feet for individual or clumps of shrubs; however, spacing can be varied for a natural look. The following might be the species distribution when planting for diversity: 90 Rocky Mountain juniper, 210 ponderosa pine, 30 Colorado blue spruce, 50 sumac and 50 Woods rose.

The degree of site preparation required for mountain plantings varies from minimal hand labor to the use of heavy equipment such as a backhoe. For areas with light soils and minimal vegetation, site preparation may be simply determining adequate tree spacing, clearing a 4 foot circle of competing vegetation, and providing protection on the south-west side for those conifer species requiring shade for establishment. A backhoe is useful when rocky soils and heavy vegetation such as sage brush are present. It can be used to remove brush and large rocks, haul mulching materials, and terrace steep hillsides. Terracing steep hillsides provides a level planting site to aid moisture collection and retention, reduce soil erosion, and minimize the loss of mulch.



Some areas require minimal site preparation.

Planting in riparian areas often involves dealing with heavy sod and tall grass; sod and grass compete with deciduous trees and shrubs for sunlight and moisture. Placing a weed barrier mat around each seedling helps ensure proper growth.

## Wildlife Habitat Plantings

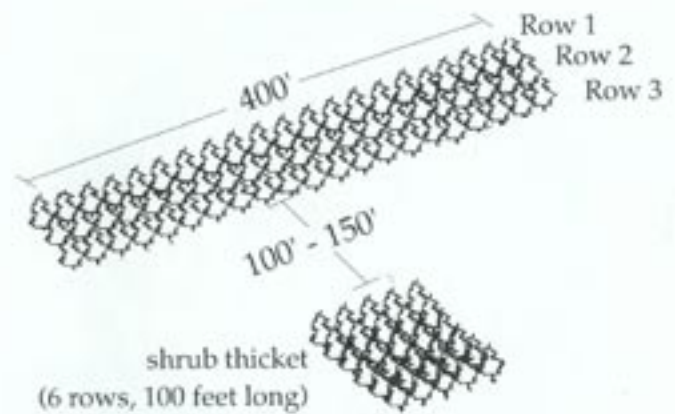
Planting windbreaks to attract wildlife is a common objective for many landowners. Each wildlife species has its own habitat requirements, and landowners can attract individual species by planting trees and shrubs to enhance wildlife food and cover. For example, pheasant (and other game birds) are attracted to windbreaks having a fruit bearing shrub row such as plum or Nanking cherry. In addition, the following shrubs bear edible fruit that can be used to make jams or jellies:

- chokecherry
- native plum
- sand cherry
- Nanking cherry
- buffaloberry
- currant



A more complex windbreak design for game birds incorporates a "thicket" planting. The windbreak keeps the thicket free of snow in winter and creates a snow storage area that can be planted with milo, millet, or sunflowers to provide game birds a winter food source and a hidden loafing area. Thicket plantings are usually square in shape with fruit bearing shrubs spaced 4 to 6 feet apart (from the center of one shrub to the center of the next).

When planting to increase wildlife habitat, decide first which species you wish to attract. To attract deer and elk, plant tree and shrub species which provide them with a winter source of food and cover. Big game animals seek feeding areas that are out of view of humans and roadways, so select planting



*Basic habitat is food plots with a shrub thicket. Rows 1 and 2 may be added to keep snow out of thicket and add cover. Row 3 is sometimes added to add species diversity. These rows may be straight, curved or L-shaped and as long as desired.*

*Figure 5 - Plains wildlife habitat design*

sights that are near a mature stand of timber. If this is not possible, interplant trees and shrubs within the browsing area. Also, when planting to provide a source of browse for wintering deer and elk, protect the seedlings from browsing during the first several years; an electric fence enclosure can offer effective protection.

If song birds and rabbits are preferred, but deer and elk frequent the area, select less desirable browse species or fence the area; otherwise the planting will be destroyed by excessive browsing.





## Seedling Care and Planting

Seedlings shipped from the Colorado State Forest Service Nursery are packaged in protective wraps or containers. Included is a moisture holding medium, usually sphagnum moss or polymers to keep the roots moist. Exposure to air and sunlight for even a brief period can kill a tree's root system and, eventually, the tree. Immediately upon receiving seedlings, add water to the moss for absorption and thoroughly water any container plants. For best results, go directly home after picking up seedlings and promptly plant them. (*Note: seedlings can be extremely stressed in a vehicle, particularly on a sunny day.*)



*Water seedling stock immediately upon receiving.*



If seedlings cannot be planted immediately, keep them (still packaged) in a cool, shady place until planting. A refrigerator (not freezer!) is an ideal storage location. For potted stock, the north side of a building provides cool shade. When planting must be delayed for more than one week and cold-storage is not available, bareroot trees and shrubs can be "heeled-in."

Heel in seedlings in a cool shady place. Dig a small trench, remove seedlings from the shipping bundle, spread them out in the trench, cover the roots with soil, and water. The soil around the roots should be kept moist but not saturated.

Transplant survival rapidly diminishes during the spring as buds swell and break, therefore, heeled-in stock should be planted long before this occurs.



*"Heeling in" bareroot trees.*



When you are ready to plant, remove bareroot seedlings from the shipping package and immediately place the roots in a bucket of a hydrated polymer or soil and water (mud) slurry. Fine seedling roots are extremely susceptible to drying; it takes only a few seconds of exposure to hot, dry conditions to damage roots. Carry plants in this slurry and remove one seedling at a time, planting immediately.



*Polymers protect roots from drying while planting.*

Polymer root dips coat the seedlings' roots and minimize drying. They also protect roots placed in extremely dry soil until the plants can be watered. Never take a number of trees from the bucket and carry them from place to place with the roots exposed. **Do not store** seedlings in a bucket of water; the plants will not charge themselves with additional moisture and may "drown" from lack of oxygen.

Container grown seedlings should remain in the styrofoam block or tarpaper container until holes are dug and you are ready to begin planting. When you are ready to begin planting, grasp the seedling at the base of the stem (for styrofoam blocks) and gently pull; the seedling should come free easily. For seedlings in a tarpaper pots, carefully slit the paper with a knife and gently remove. Do not break the root ball or leave seedlings in sun or wind following removal from styrofoam block or tar paper. Once the seedling is free, plant immediately. (*Note: styrofoam blocks containing piñon and bristlecone pine seedlings should be cut apart with a knife to remove seedlings.*)



*For styrofoam block seedlings, grasp at the base of the stem and gently pull.*



*Carefully slit the tarpaper and gently remove the seedling.*

Use a shovel to dig planting holes that are at least as deep as the roots are long and four inches wider than the root system is **in its natural form**. This procedure loosens the surrounding soil, allowing for better root establishment. Root ends should not be curled upward and should spread naturally. Excessively long roots may be pruned.

Pay close attention to planting depth; plant trees to the depth they were grown at the nursery. Be sure that the root ball of container stock is not exposed; check after watering as the soil will settle.



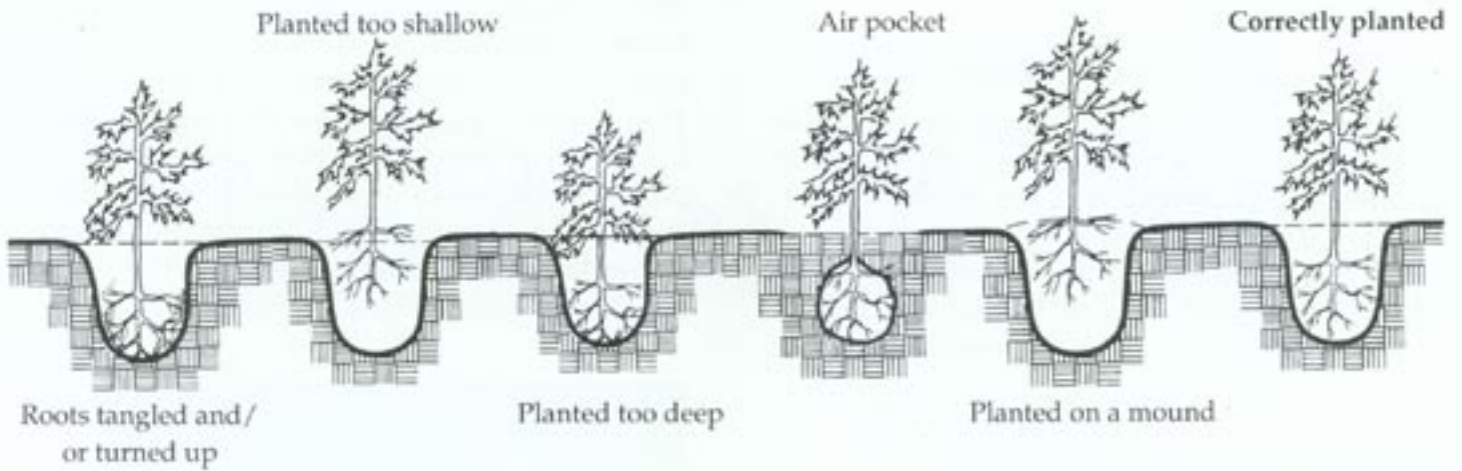


Figure 6: Proper and improper tree planting

Avoid pre-digging the holes too far in advance; winds may evaporate moisture from the planting site. If holes are pre-dug, recharge them with water 24 hours prior to planting.



Plant trees to the depth at which they were grown in the nursery.



Gently pack the soil so that no air pockets exist.



Mechanical tree planters may be necessary for large tree planting projects.

Gently pack the soil from the bottom of the hole upward so that no air pockets exist. A good practice is to fill the hole half full of soil, pack it, finish filling with soil, pack again and water.

Mechanical tree planters may be available from your local Colorado State Forest Service or Soil Conservation District office; mechanical planters are recommended for planting 200 or more trees. In addition, chain-saw augers can be used to make planting easier and help speed up the process. However, when using an auger, rough up the sides of the hole with a shovel.

## Care and Maintenance

### Weed and Moisture Management

Weed control is an extremely important factor for tree growth and survival. Weeds are better competitors than seedlings for moisture, nutrients, and sunlight. They also provide fuel for fires and habitat for tree-injuring pests. Mulch, cultivation, and herbicides are three basic methods for controlling weeds.

### Plastic Mulches and Landscape Fabrics



Woven plastic mulches and landscape fabrics have significantly improved the survival of tree plantings. Mulches reduce competition from weeds and are woven in a pattern that helps conserve soil moisture. This pattern allows moisture to pass through to the soil but minimizes evaporation. Additional moisture can be made available to seedlings by planting them within a depression.



Mulches come in various widths (six foot wide is recommended) and can be installed by hand or by machine. Mulches are installed after seedlings have been planted. If seedlings are in a row or closely spaced, lay mulch over the entire tree row. Pull seedlings through "X" shaped holes (no larger than 6 inches by 6 inches) cut into the fabric. ("X" cuts ensure the fabric will not rub against the seedling stem and will minimize heat buildup.) If seedlings

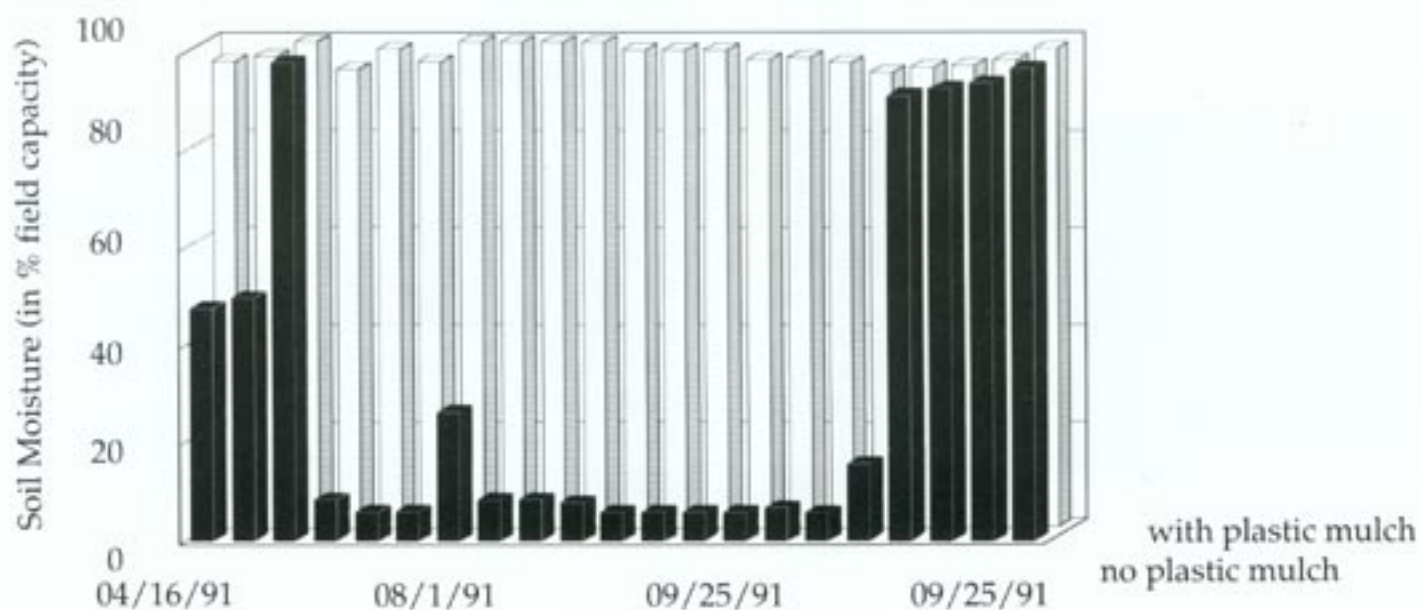


Figure 7: Plastic mulch moisture retention study (Highplains Grasslands Research Station)



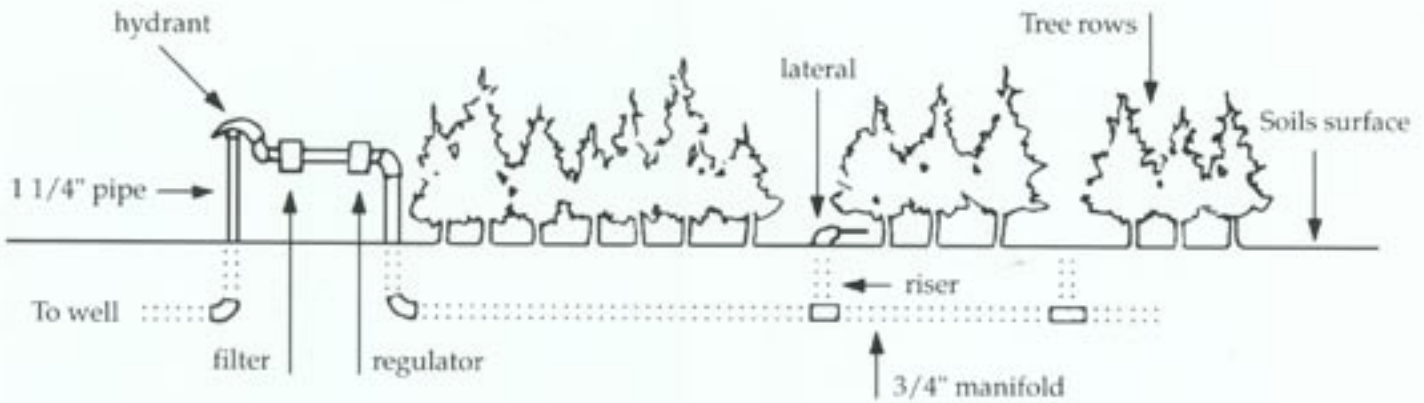


Figure 8: Drip irrigation basics

are spaced far apart, a six foot square piece of mulch is often placed around each seedling. Ultraviolet resistant brands require only the edges of the fabric to be secured with a covering of soil. Wire staples, rocks, old fence posts, etc. can also be used to hold mulch in place. Fabric should also be "walked down" to ensure good soil/fabric contact.

Plastic films (6 mils thick) are effective mulches but must be covered with a 2 to 4 inch thick overlay of other material to prevent damage from sunlight. Organic mulches such as wood chips, old straw, and hay can also be used; apply 4 to 6 inches of mulch within a four foot diameter circle around each plant.

### Watering Needs and Drip Irrigation

Irrigation is needed at planting time and is often helpful throughout the first several growing seasons at about 10 day intervals. A good guideline is to thoroughly soak the soil and allow it to partially dry before irrigating again. First-year seedlings require 1 gallon of water per week; second year, 2 gallons; third year, 4 and so forth. To help conserve water, drip irrigation systems can be used.

Irrigating just before freeze-up is helpful for all trees — especially evergreens. Also, during extended winter dry periods, trees often need irrigating.

### Protection from Wind and Sun

Most high elevation and evergreen plantings require protection from wind and sun — especially during winter months. Sunlight reflected off snow, while soils are frozen, can quickly dry unprotected conifer foliage. Many high elevation tree species such as spruce and fir grow best under the partial shade of north and east facing mountain slopes. Shading seedlings and blocking wind from the south and west is critical.

Shade can be provided using a number of items. Existing vegetation, rocks or logs are the easiest and cheapest to use, shake shingles work well, and commercially manufactured shade products are also available.

Plants vary in their tolerance to direct sunlight. Deciduous trees and shrubs are better able to withstand direct sun than are conifers. However, of the conifers, pine and juniper species are generally more tolerant of direct sunlight than fir and spruce species.



Seedlings need protection from the sun and wind.

## Animal Protection

Deer, elk, and rodents can destroy plantings in a short amount of time. Fencing is the most effective method to minimize this damage, and while fencing is expensive, the development of electric systems has decreased costs over traditional wire.

Animal damage can also be minimized by using individual plastic seedling protectors. Some consist of plastic nets which are effective for 2 to 3 growing seasons. Others are corrugated plastic tubes which completely enclose the stem. The disadvantage with tube enclosures is that they may not allow the main stem to properly harden, and thus the seedling may need to be staked once the tube is removed.



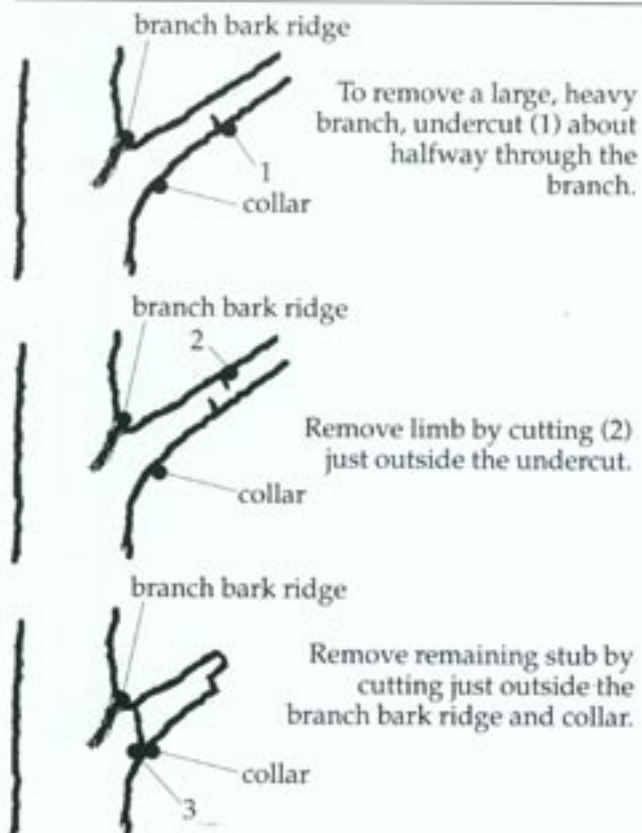
*Plastic nets are effective for 2 to 3 growing seasons.*

Many commercial repellents can also be used to protect plantings from animal damage. The effectiveness of commercial brands varies and often is dependent on repeated application. An effective home remedy is to mix whole eggs with tap water to form a 1:5 solution of eggs to water, strain the solution and spray on the seedlings. Another method, which has been used effectively to eliminate pocket gopher problems, is to place a half stick of chewing gum into the animal's burrow.



## Pruning

Never prune live, healthy limbs from windbreak trees. An effective wind and snow barrier must have tree and shrub foliage as close to the ground as possible; pruning low-growing material defeats a windbreak's purpose. However, broken or diseased branches should be removed. Give particular attention to the branch collar; this tissue will completely "heal" the wound if the limb is properly pruned. (*Note: Sanitize pruning shears between cuts with rubbing alcohol or other household disinfectants.*)



*Figure 9: Proper pruning technique*



## Seedling Selection and Ordering



The Colorado State Forest Service (CSFS) Nursery, located at Colorado State University in Fort Collins, grows more than 2,000,000 trees and shrubs annually for conservation planting. Landowners with two or more acres may purchase seedlings from the nursery with the requirement that they be used strictly for conservation plantings. (Note: For ornamental, landscape plantings, or land holdings less than two acres, contact a local nursery or the Colorado Nurserymen's Association.)



Seedlings are available either as bareroot or large or small container-grown plants. Most broadleaf deciduous plants are available only as bareroot seedlings. Evergreens are available as both bareroot and potted seedlings. Potted plants suffer less transplant shock because their roots are exposed less during handling and are well established in a potting mix which carries reserves of moisture and nutrients. (Since evergreen root systems are fragile, potted stock is recommended for best survival.) Minimum seedling lot sizes are 50 for bareroot and 30 for potted.

Seedling order forms are available each fall, and seedlings are distributed from March through May, depending on the area. In nearly every county in the state, CSFS, Cooperative Extension Service, or Soil Conservation District offices compile seedling orders, offer technical assistance and often tree care supplies, and distribute nursery seedlings. For seedling order forms contact a local CSFS district office or the CSFS Nursery at 303-491-8429.

## *Insect and Disease Problems*

### **Insects**

Insects normally don't do a great amount of damage in healthy trees. When trees are growing slowly or losing vigor because of drought or trampling by livestock, insect attacks may then become serious.

Keeping the windbreak clean, healthy and growing rapidly helps prevent insect attacks. Elimination of livestock assists in keeping trees healthy and able to withstand most insects.

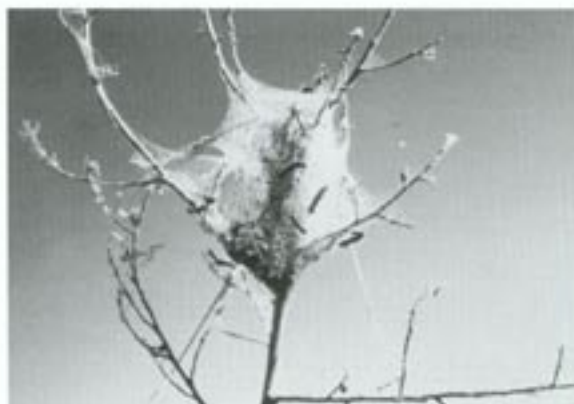
The most common insects which attack windbreaks are:

**Aphids** — The insects seldom kill windbreak plants but severe infestations may weaken trees and shrubs so that other insect pests or diseases may successfully attack. Ants, which feed on aphid secretions, are often a clue to their presence.

Aphids are soft-bodied and white, green, or black. Their bodies are pear-shaped with relatively long legs. They are sucking insects which usually feed in colonies on the underside of foliage.

Treatment is best performed when aphids are first noticed.

**Western tent caterpillars** — Western tent caterpillars vary considerably in color, but usually are a combination of black, yellow, and powder blue with a stripe running down the back. Caterpillars congregate in a silk tent formed between small branches.



*Western tent caterpillar.*

The forest tent caterpillar, a relative of the western tent caterpillar, has a row of diamond- or oval-shaped white spots down the back. The forest tent caterpillar does not make a tent.

Control of tent caterpillars is usually more necessary than control of fall webworm because they occur early in the summer. Chemical treatments would be the same, but should occur in June.

**Bagworms** — These caterpillars live in a silken, cocoon-like bag which is attached to bits of leaves from the host plant. Females are wingless and spend their lives in the cocoon. Young hatch in late May or early June — this is the time to begin control.

Bagworms are common in states east of Colorado. They occur on junipers and many deciduous species.

**Sawflies** — These wasp relatives can quickly strip the needles from pines. The larvae feed in large colonies and appear as hairless, yellow (or yellow with black stripes) worms. June is the month when most damage is done.

**Tree borers** — Boring insects usually don't attack healthy, fast-growing trees. Trees



*Tree borers.*



weakened by grazing, weed competition, drought, or other injury are most likely to suffer borer attack. Planting only those species adapted to a particular site and keeping them healthy is the best insurance against borers.

Borers damage trees by working just under the bark or in the wood. Attacks may be above or below the soil surface. Small holes in the tree, sawdust-like particles clinging to the bark, or sap "bleeding" can indicate borer infestation.

**Grasshoppers** — Grasshoppers damage trees by eating leaves, buds, and bark. In junipers, grasshoppers kill branches by making a complete or partial girdle (usually not noted until sometime after it occurs and dead spots of foliage appear throughout the tree.)

If grasshoppers are found in windbreak trees, spray with a registered material. Remember, small "hoppers" are easier to control than full-grown adults, so inspect trees in late spring and early summer.

**Spider mites** ("red spiders") — These tiny pests are difficult to see with the unaided eye. These mites suck juices from foliage, and usually the damage is first noted, especially in junipers, in midsummer when yellow clumps of foliage appear throughout the tree. Close examination reveals mottled yellow areas where mites are feeding. Tiny, hairlike webs may be present.

One method of checking for spider mites is to hold a sheet of plain white paper under a branch and tap the branch vigorously against the paper. If mites are present they can be seen as tiny moving red dots. Otherwise detection requires at least 10x magnification.

Mite control consists of spraying affected trees with a miticide or a specific insecticide with proven miticidal action.

**Scale insects** — Scales are tiny insects that feed on the sap of trees and shrubs. Newly-hatched scale insects are known as "crawlers" and this is the only mobile stage in the pest's life. After the crawler stage, the insect settles down to feed on a leaf or twig. It becomes

immobile and covers itself with a waxy secretion.

Scale insects that attack windbreak trees and shrubs include oystershell scale, Kermies scale, juniper scale, European elm scale, and pine needle scale.



*Oystershell scale.*

Damage by scale insects is usually first noted in spring and is evidenced by wilting foliage. Close examination shows the scale as small, whitish or grayish dots clustered on twigs.

**Elm leaf beetles** — These insects feed on all species of elms, skeletonizing leaves and causing them to turn brown and drop. This unsightly defoliation usually is not harmful to the tree. Adults may overwinter in attics, basements, or sheds and can be a nuisance.



*Elm leaf beetles.*



The adult beetle is about 1/4 inch long, yellowish to olive-green, with a black stripe along the edge of the wings. The larvae are about 1/2 inch long at maturity and are dull yellow or brownish with two dark stripes down the back. The head and legs of larvae are black. The beetles produce at least two generations per year.

For control to be effective, all elms in the area may require treatment and, even then, repeat treatments are often necessary.

**Fall webworms** — These leaf-eaters are approximately 1 inch in length at maturity. Larvae are pale yellow to green with a broad, dusky stripe down the back and a yellow stripe along the side. They are covered with long hairs which may be white, yellow or brown. Larvae live and feed inside a dirty, white web.

Control is rarely needed other than for maintaining tree beauty.



*Fall webworm.*

**Tip and shoot insects** — These insects, mostly moth species, damage the buds and young branch growth of conifers. Damage is usually heaviest early in a tree's life and may result in deformity, or after several consecutive years of infestation, death. Insects such as the tip moths and "Zimmerman pine moth" group are of particular concern. Control usually involves detecting the insects via damage assessments or pheromone traps and then applying chemical insecticides at the appropriate time for the insect involved. Chemicals are best applied at the time of adult egg-laying.

### Diseases

**Canker diseases** — Primarily caused by fungi, these diseases produce a broad range of symptoms. Some canker fungi are aggressive and kill trees quickly while others are weaker and contribute to gradual dieback of branches. Infections occur through foliage wounds in weakened trees. Most cankers are associated with wounds (broken branches, bark abrasions, pruning wounds, etc.)



*Ceratostyis canker or black canker.*





*Canker: western gall rust.*

Cankers can be prevented by avoiding physical damage to the trees. Remove existing cankers during the dormant season (usually in early spring before warm temperatures and bud break occurs). Prune branches with cankers and remove cankers on main trunk by carving out the infected area. Use sterile tools and make all cuts in healthy tissue some distance from the canker. Do not touch the cankered area with any tool and then touch healthy tissue. Failure to clean tools may spread fungus and cause additional canker formation.

**Decay and rot fungi** — Deterioration of wood within living trees is due to the action of various fungi. These rots can be separated into top (or trunk) rots and root rots. They are introduced into the trees through wounds or root contacts. Most rots contribute to health decline or structural weakening in trees. During storms, severely weakened trees may be broken or uprooted.



*Artist's conk, a type of rot.*

Although control of rot or decay fungi is difficult, preventive measures lessen their impact. Avoid tree wounds and use cultural practices which keep trees healthy and growing vigorously to prevent or decrease the effects of decay organisms.

**Foliar diseases** — Fungi, bacteria, viruses and air pollutants may cause discolored spots or blotches on leaves or needles. Problems appearing early in the growing season may require control to avoid growth loss or unsightliness. Usually, those diseases which appear on foliage late in the growing season do not pose a threat to trees.

Control is based on proper identification of the problem. Take samples and submit them to a laboratory for diagnosis before considering treatment.



*Juniper-hawthorn rust, a foliar disease.*

### **Insect and Disease Reference Material**

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