SHELTERBELTS

WHAT ARE THEY ?

WHAT DO THEY LOOK LIKE ?

HOW DO THEY WORK ?

WHAT ARE THE BENEFITS ?

HOW DO YOU DESIGN THEM ?

WHERE DO YOU PUT THEM ?

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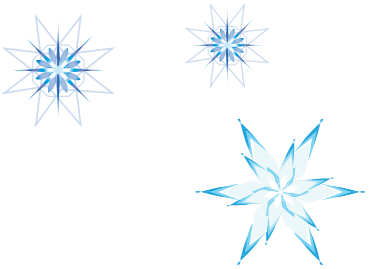

SHELTERBELTS

A HISTORY - WHAT ARE SHELTERBELTS?

Shelterbelt is a generic term that encompasses wind breaks and living wind breaks, snow fences and living snow fences. All perform the same basic function - reduce the damage or problems created by wind.

Constructed wind breaks or snow fences are typically made of slatted wood fences, wood, plastic webbing, or metal materials. Living wind breaks and snow fences are a combination of strategically placed tree and shrub plantings. Both are landscape structures designed to manipulate drifting snow by guiding it to accumulate in a designated location.

Shelterbelts originated in Scandinavia where the first written recorded use of snow fence was in Norway in 1852. Farmers would use the collected melt water from the snow fence drifts to water their livestock. Railroad companies were among the first in the United States to use living barriers or slatted wood fences to control blowing snow.

From 1905 to 1909 the Great Northern Railway Company planted over 96,000 trees and shrubs for snowdrift control along rights-of-way in North Dakota. In 1914 the Minneapolis, St. Paul, and Saulte St. Marie Railway Company experimented with tree plantings for snow control in North Dakota and Montana, using buffalo berry, buckthorn, and willows. The Canadian Pacific Railway Company planted miles of living fences, using cedar, pine and spruce.

During the winter of 1925-26 the Wyoming State Highway Department (now WYDOT) installed slatted wood and picket snow fences to reduce the effects of wind and blowing snow on State highways.

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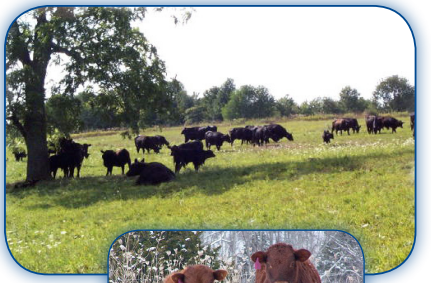
In 1983, Wyoming State Forestry Division and WYDOT, established two experimental living snow fence plantings near Cheyenne. Since then, state and federal agencies, in cooperation with the USDA Natural Resources Conservation Services (NRCS), conservation districts such as Natrona County Conservation District, private industry, and landowners have established living snow fences along many of Wyoming highways and roads. Today, living snow fences and wind breaks can be seen on farms and ranches, incorporated into urban landscaping, and established along highways, roads and railroad tracks.

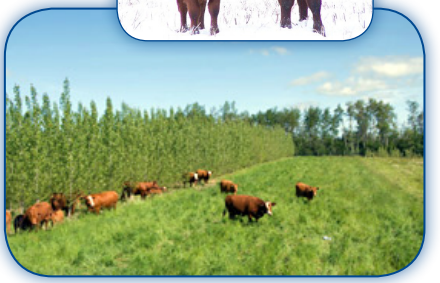
WHY ARE SHELTERBELTS USED?

Whether, constructed or living, shelterbelts provide multiple benefits, from protecting the traveling public to creating livestock ponds. Wind breaks and snow fences provide valuable shelter for livestock, farm animals and wildlife in the summer by providing cooling shade, and in winter by protecting them from cold winter winds. Livestock and farm animals protected from the cold can convert more of their food to body mass rather than converting it to energy for warmth. Vegetation flourishes with the extra moisture provided by the stored snow. In Wyoming's high desert climate, the extra moisture gathered by snow fences can nurture feed grasses and tree growth, or provide water for wildlife and livestock reservoirs.

Farmers and ranchers have planted living wind breaks and snow fences to shield crops from damaging wind and snow for centuries. Farmstead wind breaks reduce energy bills by shielding homes and

SHELTERBELTS





out-buildings from cold prevailing winds during the winter and to help cool in the summers by establishing microclimates with reduced rates of evaporation and higher concentrations of soil moisture. A wind break protects building exteriors, shielding them from abrasion by wind-blown particles such as sand or other debris. In areas where winters are severe, these same wind breaks serve as natural snow fences, helping to prevent snow drifts from blocking roads or walkways.

A good field wind break will shield and protect a crop or pasture for a distance up to 30 times its height. Wind breaks reduce crop damage, catch wind-blown debris, reduce soil loss due to wind erosion, and reduce soil moisture loss. A thick, mature wind break can also act as a sound barrier, helping to reduce noise from multiple types of ground level sources.

Wildlife benefit from shelterbelts year round whether the main goal is to shelter crops, livestock, roads, a home, the environment or out-buildings. Living windbreaks and snow fences provide nesting sites, food and forage for numerous birds and animals. They provide shelter from severe weather and protection from predators, and can be essential for wildlife survival. The long linear nature of shelterbelts provides protected routes and travel corridors from one habitat to another. A living shelterbelt planted with a variety of native tree and shrub species will attract a great diversity of wildlife.

SHELTERBELTS

WHAT IS A LIVING SNOW FENCE?

Structural barriers, such as horizontal or vertical slatted snow fences, are a proven technique for reducing the impact of blowing and drifting snow, but a more permanent, cost effective solution is often desired or needed.

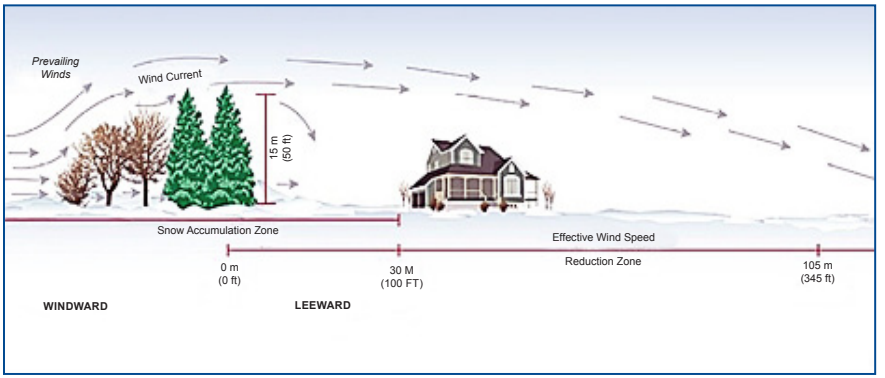
An alternative to a structural snow fence is a living snow fence; strategically placed trees, shrubs, and perennial or annual grasses planted in rows along highways and roads, on farms and ranches, and in urban landscaping. Similar in design and function to a structural snow fence, they are specifically designed to reduce wind speed and strategically disperse drifting snow

The structure (length, density, height, number of planting rows, species composition, orientation, and continuity) determines the effectiveness of a snow fence. As wind blows against the snow fence, air pressure builds up on the windward side (the side towards the wind) and large quantities of air move up and over the top or around the ends of the snow fence. This wind and air pressure manipulation causes blown snow to settle to the ground downwind from the fence.

Snow fences actually create snow drifts, rather than prevent them, but in more desirable locations. Snow flying on high winds past a snow fence

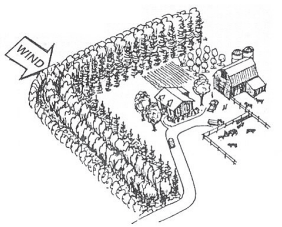
will get caught in the turbulent eddies created by the fence. As the air slows, the snow will drop on the downwind side of the fence. Over time a large pile of snow will accumulate downwind of a snow fence.

Snow fences are strategically placed to cause the snow drift to form in a designated area, away from undesirable areas such as roadways or walkways. With careful planning, in consultation with local professionals, the placement of living snow fences and resulting snow drifts can be used to create more desirable environments for growing crops, protecting and watering livestock, sheltering roadways, and protecting homes, out-buildings and urban dwellings.



HOW TO DESIGN AND PLANT A LIVING SHELTERBELT

For the greatest protection, the shelterbelt should be oriented perpendicular to the prevailing winds. In Natrona County, the prevailing winds blow from the southwest, so the shelterbelt should be planned in a southeast to a northwest direction. A living shelterbelt can be straight or curved to match the land or space restrictions. The reduced wind speed on the downwind side of the shelterbelt modifies the environmental conditions within the protected zone. The greatest wind reduction occurs downwind between two to five times the height of the shelterbelt, with wind reduction occurring up to 10 times the height of the shelterbelt. For maximum wind protection, the wind break should be dense and tall.

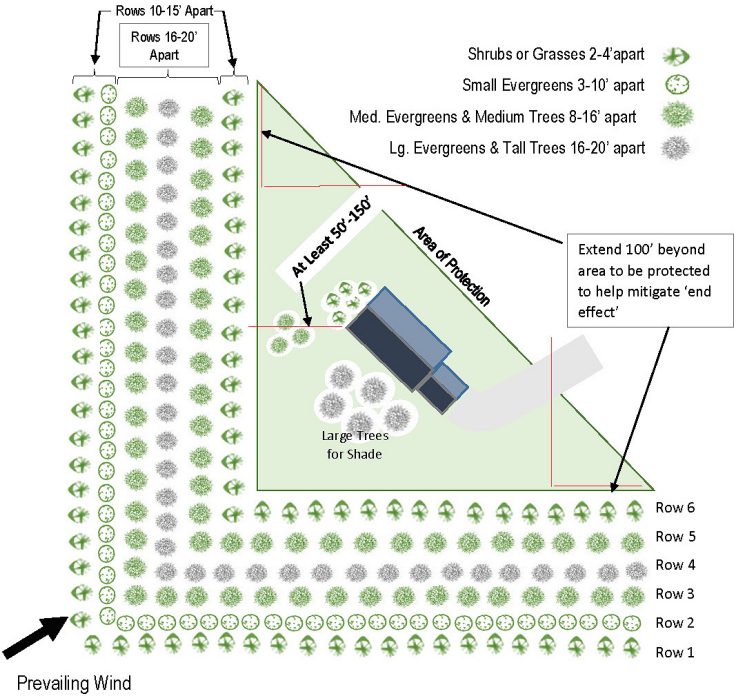


Site Selection

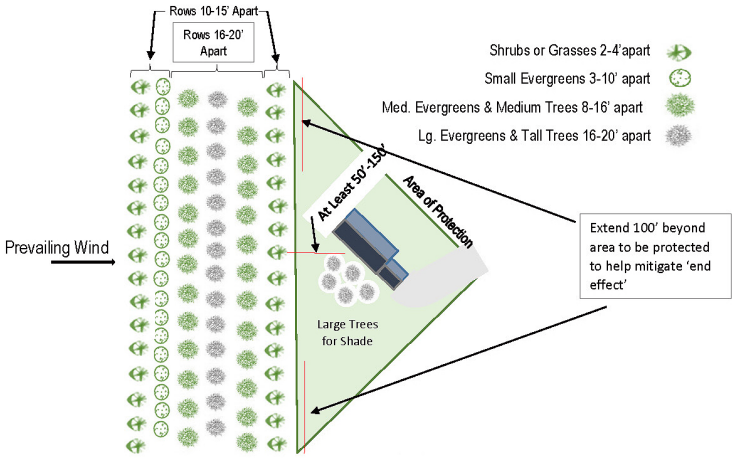
The first step is to draw a rough sketch of your property. Indicate the direction of **prevailing winds, property lines, irrigation source, and the area to be protected.** The area of protection can be seen in the diagrams, whether the shelterbelt is planted in a line, or in an "L" shape.

Before planning your shelterbelt, know what is underground where you plan to plant. Always "call before you dig" by dialing 811. The people at One Call of Wyoming will let you know if there are underground lines or wires that will need to be avoided.

Next, determine the desired number of rows to plant. The number and length of rows are dependent upon land restrictions and desired results. The decision will be affected by space, topography, water availability and



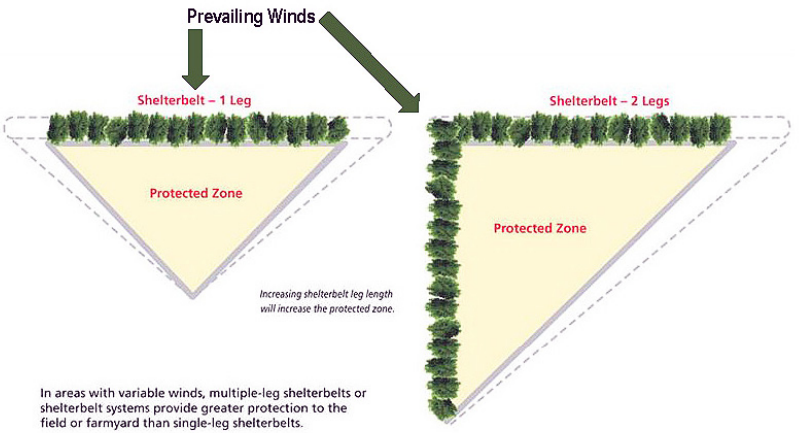
time to obligate caring for the shelterbelt. A very common shelterbelt design consists of three rows: one shrub row for the row that will be hit first by the wind, a medium height deciduous or evergreen row in the middle, and then a large evergreen row on the downwind side, closest



to the area to be protected. Six rows are shown on this diagram, and on Page 13 there are suggestions for other numbers of rows along with suggestions for trees that are hardy for Natrona County.

Length

The shelterbelt length will determine the maximum area that can be protected. Snow accumulation at the ends of the shelterbelt is significantly less than near the center. Shelterbelt design should extend far enough beyond the protected area to intercept winds that deviate 25 degrees from either direction of perpendicular. Extending a snow fence at least 100 feet beyond the area to be protected will help mitigate this 'end effect.'

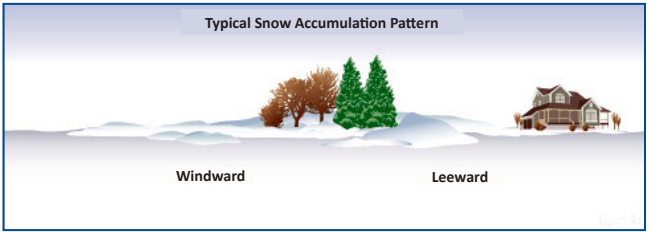


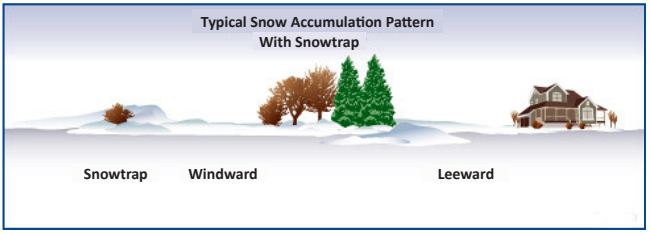
Density

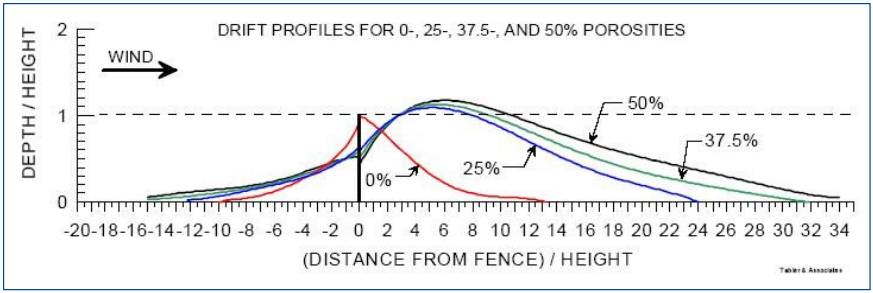
The density of a living shelterbelt is determined by the species, number of rows, spacing between rows and spacing between plants in each row. It is the proportion of solid material, such as foliage and branches within the windbreak. A 50% density stores the greatest amount of snow. Spacing between rows can vary depending on design criteria and objectives. In general, small shrubs should be planted 2-4 feet apart; medium shrubs and small evergreens 3-10 feet apart; and large trees (evergreen or deciduous) 8-16 feet apart. Rows should be placed 16-20 feet apart. The more rows that are planted, the denser the shelterbelt will become, and ultimately, the more protection it will provide. Twin-row, high-density plantings are recommended for maximum efficiency. Porosity is the measure of how much space is between the branches and the trees, which is opposite of density.

Height

Determine the shelterbelt height (expected height at 20 years) by using the tallest row in a planting. Shelterbelt height affects snowdrift depth and length. As a wind break, fields, plants and buildings are protected within an area 10 times the height of the tallest trees on the leeward side and two times the height on the windward side of the windbreak. As a snow fence, a barrier that is 50-percent dense will cast a downwind drift equal to approximately 30 times its height. When twin-row plantings of an evergreen is planted and density increases to 60 to 70 percent, drift lengths of 10-12 times the barrier height can be expected. Snow accumulation potential can be manipulated by selecting evergreen species





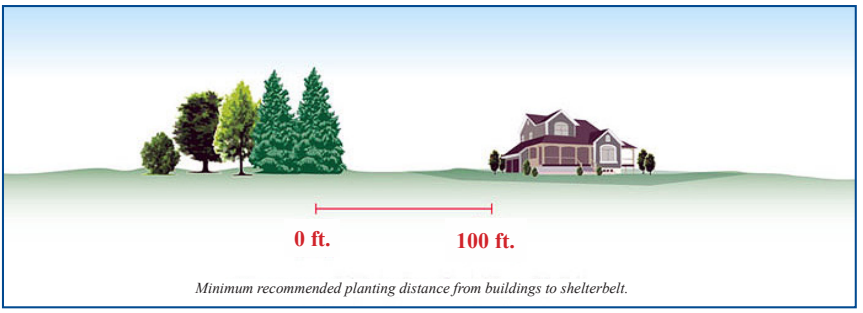


by mature height. Doubling the shelterbelt height will increase snow accumulation by four times; an important factor to consider in species selection.

Proximity to Roads and Buildings

Location of the living snow fence in relation to the distance from the road is critical. Snow fences placed too close to the road can result in drifts being deposited on the road. Snow fences should be compatible with farming practices, farm operations and local conditions. Typical setbacks range from 100-600 feet depending on site conditions and geographic locations. To allow normal farm machinery and snow removal operations, the innermost row should be no closer than 50 feet from the nearest building, feedlot or roadway.

Shelterbelts should extend at least 50 feet beyond the buildings or field to be protected. This keeps snow drifts that develop near the end of the shelterbelt away from buildings. Spacing between and within rows is



Minimum recommended planting distance from buildings to shelterbelt.

specifically designed to aid cultivation, provide adequate room for tree growth and maximize the effectiveness and longevity of the shelterbelt. Field wind breaks used for feedlot protection should be at least 200 feet long to prevent livestock overcrowding.

PLANT SELECTION

When selecting shrub and tree species suitable for shelterbelt plantings contact a local wildlife or forestry professional. Plants must be matched with local conditions, including soil types, specific site problems and climate.

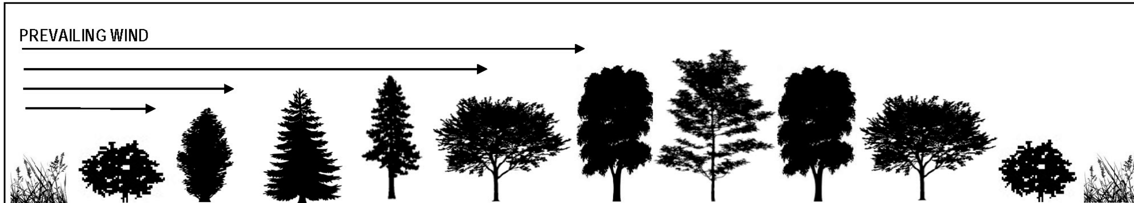
Select trees that will be the most successful for your region. Several factors should be considered. Soil types (sandy, loamy, and clayey) and soil quality (pH, alkalinity, salinity, and nutrient availability) have a significant impact on the success of trees and shrubs. Being aware of local soil characteristics will assist in determining which tree and shrub species are best adapted to the site and will have the best chance for survival. In Natrona County, alkali and salty soils are a large issue and tree and shrub species need selected accordingly. Use of site-adapted plant species is critical to the success of a living shelterbelt. Please refer to the table at the on Page 13 for suggested species for Natrona County.

The Natrona County Conservation District, NRCS, or the University of Wyoming Cooperative Extension Service can assist in determining your soil type and site specific advice. It is also important to choose species that are either native to the area or a hardy non-native that will survive Wyoming winters. Consider the drought tolerance of the species.

Fast Growing Trees?

While everyone wants trees to grow quickly, be aware that many of the fast- growing trees that are advertised have brittle wood, suffer from insect and disease problems and are prone to dieback from early fall frosts. Most fast growing trees are short-lived with some reaching their useful lifespan in as little as 20 years. Many fast-growing trees were developed for pulp and paper production and are not desirable landscape trees. Better-adapted trees with slower annual growth will require less maintenance and provide greater benefits for many decades. Patience is a virtue while watching your shelterbelt grow!

Plant Selection



Row Suggestions	SHRUBS or GRASSES	EVERGREENS (Conifers)	MEDIUM TREES (Deciduous)	TALL TREES (Deciduous)	MEDIUM TREES (Deciduous)	SHRUBS or GRASSES
3 Rows	Row 1	Row 2		Row 3		
6 Rows	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6
8 Rows	Row 1	Row 2, Row 3	Row 4	Rows 5 & 6	Row 7	Row 8
10 Rows	Row 1	Row 2, Row 3, Row 4	Row 5	Row 6, Row 7, Row 8	Row 9	Row 10

SHRUBS or GRASSES	EVERGREENS	EVERGREENS	EVERGREENS	MEDIUM TREES	TALL TREES	MEDIUM TREES	SHRUBS or GRASSES
Buffaloberry	Cedar, Eastern Red		Pine, Austrian	Apricot, Hardy	Cottonwood, Native	Apricot, Hardy	**Buffaloberry**
Caragana	Juniper, Rocky Mtn.		Pine, Eastern White	Ash, Green	Elm, American	Ash, Green	Caragana
Cherry, Nanking			Pine, Ponderosa	Boxelder	Elm, Siberian	Boxelder	Cherry, Nanking
Cherry, Sand			Pine, Scotch	Buckeye, Ohio	Honeylocust	Buckeye, Ohio	Cherry, Sand
Chokeberry, Black				Buffaloberry	Linden, American	Buffaloberry	Chokeberry, Black
Cotoneaster		Cedar, Eastern Red		Cherry, Black	Maple Varieties	Cherry, Black	Cotoneaster
Crab, Siberian		Spruce, Black Hills		Chokecherry	Willow, Golden	Chokecherry	Crab, Siberian
Currant, Golden		Spruce, Colorado Blue		Elm, Siberian	Cherry, Black	Elm, Siberian	Currant, Golden
Dogwood		Spruce, Norway		Hackberry	Oak Varieties	Hackberry	Dogwood
Elderberry				Honeylocust	Poplar, Hybrid	Honeylocust	Elderberry
Honeysuckle				Oak, Bur		Oak, Bur	Honeysuckle
Lilac				Pear, Ussarian		Pear, Ussarian	Lilac
Maple, Amur				Willow, Peachleaf		Willow, Peachleaf	Maple, Amur
Potentilla							Potentilla
Plum, American							Plum, American
Rose, Hansen Hedge							**Rose, Hansen Hedge**
Rose, Wood's							**Rose, Wood's**
Sage, Russian							**Sage, Russian**
Serviceberry							**Serviceberry**
Silverberry							**Silverberry**
Sumac, Aromatic							Sumac, Aromatic
Sumac, Skunkbush							Sumac, Skunkbush
Tall Field Grasses							Tall Field Grasses

Plant Diversity

Select at least six and preferably eight or more tree and shrub species for each shelterbelt. Remember, a shelterbelt with an array of plant species will attract a greater variety of wildlife and have a better chance of surviving a wide range of environmental conditions. Species diversity, including use of native species, should be a major consideration to avoid loss of function due to species-specific pests or diseases.

Using only one species can be devastating when a species-specific disease hits (as shown above). A combination of conifers, shrubs and broadleaf trees can provide multiple benefits. Other plant species can be incorporated that provide functions such as wildlife and pollinator habitat, aesthetics and potential added income from woody floral products or food producing plants.

Planting Stock

NCCD offers an Annual Conservation Seedling Tree Program to encourage the planting of effective living shelterbelts and erosion control barriers. Natrona County residents can order bare root (non-potted) seedling trees through NCCD from October through April, with delivery in early May just in time for spring planting. The seedlings NCCD offers vary in size from 18" to 6'. These bare root trees are an affordable option to establish a shelterbelt with Wyoming winter hardy species. For larger potted trees, be sure to purchase from the local nurseries that are knowledgeable on the trees that grow in this area, and preferably have grown the trees locally.

Seedling trees can also be purchased through the University of Wyoming Ag Extension office, commercial nurseries or online.

Bare Root Seedlings

Bare root seedlings are an economic choice for establishing shelterbelts. Bare root seedlings are not-potted and are received when dormant. Some rules for dealing with bare root seedlings:

- Never expose seedling roots to air for long periods.
- Protect bundles from freezing and/or high temps.
- Keep seedlings damp in a mulch, sand or soil mixture until ready to plant, preferably within 24-48 hours of receiving them.
- Do not keep seedlings in water only as roots need oxygen.
- Schedule planting before new growth starts.
- Try to plant on calm cool days.

Land Preparation

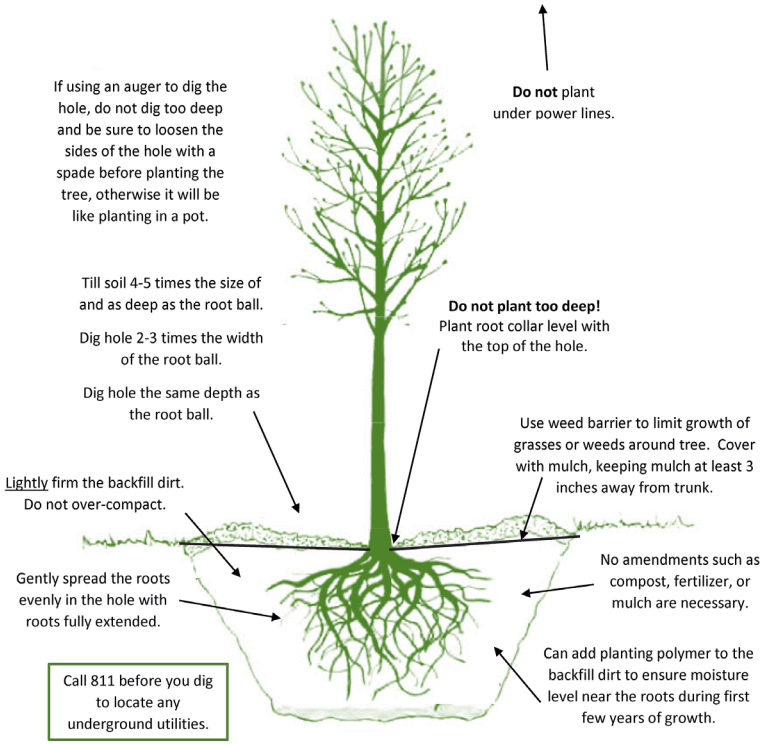
An important factor in establishing a shelterbelt is proper seedbed preparation. Summer fallowing or maintaining the land in a cultivated crop, such as soybeans, the year before will help produce a weed free, loose seedbed. Grass or existing alfalfa fields are difficult choices unless the soil has been plowed and disked at least one year prior to planting. Minimally, till the planting area to loosen the soil and make way for tree or shrub roots to establish and grow. A week prior to planting, apply a pre-emergent herbicide specifically approved for the tree species to be planted in order to get rid of grasses and weeds that will compete with the new tree for moisture and nutrients.

Planting Protection

If livestock and wildlife can access the shelterbelt site, fencing will be necessary to protect plantings. Significant damage can occur from trampling, rubbing and browsing. Fencing will avoid soil compaction as well as physical damage to the irrigation systems and weed barriers that may be present. If wildlife damage is likely, use tree shelters or other forms of protection.

Planting Techniques

The best time to plant is after the frost leaves the ground and before the weather becomes steadily hot. On average in Wyoming, this would be the month of May, but each year can vary. Be sure to order seedlings between October and March so that the planting stock will arrive during this critical time while the plants are still dormant.

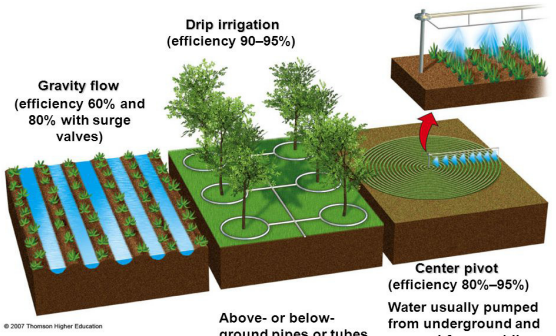


Before planting, stake out the rows for proper location and spacing. Dig each hole at least twice the width of the root ball so that the backfill will be loose for root growth, but only dig the hole as deep as the root ball of the tree. Do not plant too deep. A tree should be planted only as deep as the original soil line, which will be a darkened area at the base of the tree, also called the collar. Plant the seedling in the hole so that the collar is level with the top of the hole, and then begin backfilling the hole, lightly firming the soil as you backfill. Amendments such as compost, peat moss,

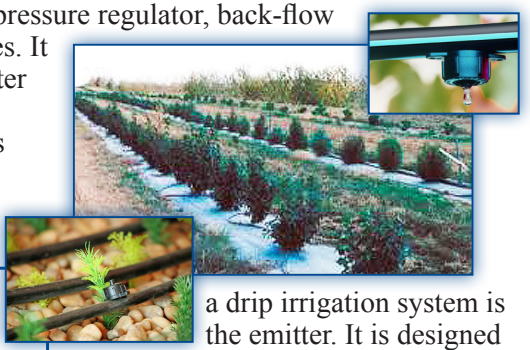
or fertilizer are not necessary, as the plant needs to acclimate to the soil in which it is planted. Do not allow any vegetation growth within 2 feet of the trees during the first 5 years of growth. Grass and weeds rob the trees of moisture and nutrients in the soil and growth rates are reduced significantly. Placing weed fabric along shelterbelts or around each tree reduces competition for resources by other grasses or weeds and aids in establishing new plantings. Weed fabric also keeps the roots cooler and more damp than if exposed to the direct sun.

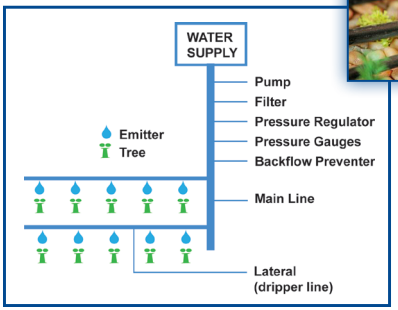
IRRIGATING SHELTERBELTS

Due to the nature of the shelterbelt orientation (rows of trees), surface drip (trickle) irrigation is the most commonly used irrigation method. It is a controlled system of watering that makes **the most efficient use of available water.**



A drip irrigation system consists of a "head" and a distribution network. The head of the system is composed of the water source, pump, filter system, pressure regulator, back-flow preventer and pressure gauges. It may also include a water meter or electronic controller. The distribution network includes the main line and laterals or dripper lines located down the plant rows. The heart of a drip irrigation system is the emitter. It is designed to release water at a slow rate so that the emitters drip water directly to an area around each tree seedling. This allows the water to be precisely applied only where it is needed with **little loss to seepage or evaporation**. The water application rate should be





less than the infiltration rate of the soil to prevent runoff. Emitters are available in sizes of ½-gallon per hour (gph), 1-gph, 2-gph and 4-gph. A recommended watering schedule will depend on your soil properties and seasonal climate. Visit your local Natural Resources Conservation Service or Natrona County Conservation District office for information on growing conditions in your area, and system design assistance.

The drip system should be maintained and used for five to seven years, at which time the trees and shrubs, if properly chosen for the site, should survive. A drip irrigation system can be a tremendous aid in establishing trees in arid areas like Natrona County, and it is suitable for a wide range of soils and topography. The extra moisture, besides increasing survival rate will also increase the tree growth and help them become effective windbreaks at an earlier date than non-irrigated trees.

HOW SHELTERBELTS BENEFIT OUR WATER

Water is one of our most precious resources in Wyoming and Natrona County. So we need to look at all opportunities available to improve our water quality and maximize water use efficiency. Living shelterbelts are one method that can provide a significant impact on both water quality and use.

- Trees and shrubs prevent water pollution by forming a buffer between agriculture and rivers and streams. They provide storm water and irrigation run off control, slowing down polluted water, reducing pesticide drift and sedimentation run off into streams and rivers.
- Improve ground water quality. Shelterbelts can take up nutrients, reduce nitrogen, nitrates and phosphates, and mitigate selenium migration in ground water.
- Prevent waterlogging of soils by improving the infiltration of rainwater deeper into the ground. This will reduce the amount of water needed for irrigation by storing more rainwater within the soil and preventing surface run-off.
- Increase water use efficiency. Shelterbelts trap and spread snow across adjacent fields where the drift can melt slowly and soak into the ground, improving future clean water crop irrigation.
- They also help reduce transpiration during the growing season.
- Living shelterbelts sequester carbon from atmospheric carbon dioxide and store it in plant tissue and the soil.

RESOURCES - REFERENCES

Natrona County Conservation District (NCCD)
5880 Enterprise Drive, Casper Wyoming 82609
307-261-5436, Ext. 103
http://natronacountyconservationdistrict.com/

Barnyards and Backyards – University of Wyoming
http://www.uwyo.edu/barnbackyard/magazine/

Colorado State Forest Service, Colorado State University
http://csfs.colostate.edu/

Shrubs for Wyoming – UW Ag Extension
http://www.uwyo.edu/mastergardener/_files/docs/b1108.pdf

Trees for Wyoming – UW Ag Extension
http://www.uwyo.edu/mastergardener/_files/docs/b1090.pdf

University of Nebraska Extension
http://lancaster.unl.edu/

University of Wyoming Cooperative Extension Service
http://www.uwyo.edu/uwe/

USDA National Agroforestry Center,
http://nac.unl.edu/

USDA Natural Resources Conservation Services (NRCS)
http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/

Utah State Cooperative Extension
https://extension.usu.edu/

Wyoming Tree Owner's Manual - Wyoming State Forestry Division
https://drive.google.com/file/d/0B-8xYrQv1jQbZHBjdkh3cWZHdHc/view?pli=1

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