Producing Marketable Products From Living Snow Fences

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Preface

In 1999 the Minnesota Interagency Task Force on Living Snow Fences published a technical guide called *Catching the Snow With Living Snow Fences.* That guide presents the most up-to-date information available anywhere in the country on designing successful living snow fences (LSFs). To purchase a copy of *Catching the Snow With Living Snow Fences,* contact the University of Minnesota Extension Service at 800-876-8636 and ask for publication number MI-07311. The price is $65.00 plus shipping.

This publication is designed to serve as an additional chapter to *Catching the Snow With Living Snow Fences,* as well as a stand-alone publication for those who do not have the technical guide. It is not meant to repeat the topics covered in the technical guide, but rather to add information about producing marketable products in LSFs. The material presented here is the product of research by the Center for Integrated Natural Resources and Agricultural Management (CINRAM) at the University of Minnesota.

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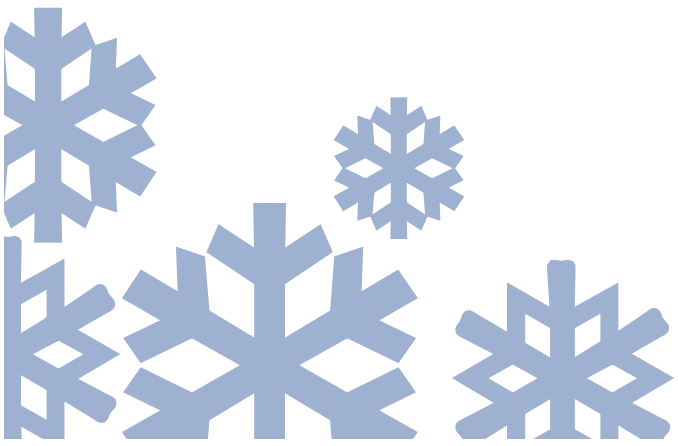


Producing Marketable Products From Living Snow Fences

The Case for Living Snow Fences

Winds blowing unimpeded across agricultural fields can strip away topsoil; pile up snowdrifts over roads, houses, and feedlots; and compromise public safety. During the winter of 1996–97, some places in Minnesota experienced drifts more than 25 feet high that buried houses, blocked roads, and cut off access to police, fire, emergency medical services, schools, and businesses. Snow removal costs can be tremendously high. In the 1995–96 winter, for instance, snow removal costs in Minnesota were estimated at about $215 million! It is obvious there is a great need for a sensible and cost-effective method for controlling blowing snow.

The Minnesota Department of Transportation (MN/DOT) estimates there are about 4,000 sites in the state—totaling 1,000 miles of interstate, state, and county highways—that currently need protection from drifting snow. Thousands of miles of township roads also are subject to drifting.

Living snow fences (LSFs) offer a promising solution to problems caused by wind-blown snow. They have many advantages over typical wooden-slatted structural fencing. For example, LSFs are often more cost-effective than structural snow control methods. They are more attractive and provide habitat for wildlife. On average, costs to establish an LSF are comparable to building a structural wooden snow fence. In the long run, however, LSFs are more cost-effective because they last longer than wooden structures, and, once established, require little maintenance for up to 50 years.

Perceived Disadvantages

One preconception that some people have is that LSFs just don't do the job. That's probably because in the past LSFs were often placed too close to the structures they

Figure 1. This green ash windbreak was planted too close to the roadway to be effective.

were designed to protect, or the rows within them were improperly spaced (Figure 1). Consequently, snow was deposited on roads and driveways—just what the LSFs were supposed to prevent.

Fortunately, experience and research have brought windbreak technology a long way in the past 30 years. By using proper methods for calculating offset distances, fetch distances, row heights, widths, and spacing (see *Catching the Snow With Living Snow Fences*, Chapter 3), LSFs can be made much more effective than in the past. Figures 2 and 3 provide examples of LSFs, and shows how each affects drifting.

Probably the biggest impediment to the large-scale adoption of LSFs has been reluctance of landowners to give up productive agricultural land. LSFs occupy land that could be producing an agricultural crop, and this can result in reduced profitability of the farm.

An LSF does not take up much space: 20 to 50 feet is a typical width of an LSF that consists of a single or double row of shrubs or trees or a strip of tall prairie grasses. However, the catchment area—the land leeward of the snow fence where the snow accumulates—does take up a substantial amount of land. For example, a 1,000-foot-long, single-tree-row LSF would occupy only about one-quarter acre, but its associated catchment area would take nearly four acres. The large amounts of melting snow that accumulate in this area could impede early cultivation, but the added moisture could also benefit crops in some situations.

Potential Benefits

LSFs offer many benefits in addition to snow control.

Windbreak

LSFs act as windbreaks during the growing season. Various studies have documented that windbreaks

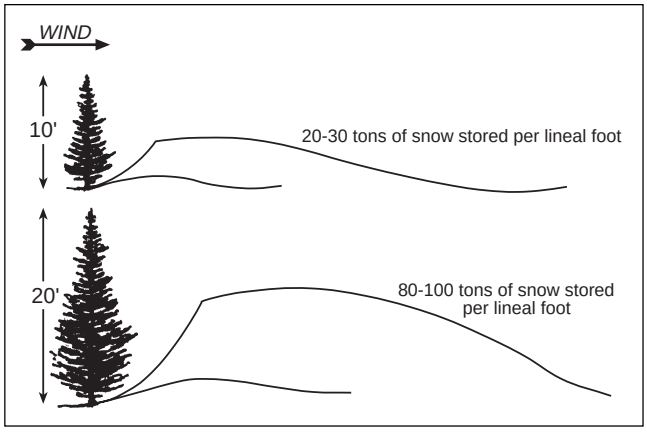


Figure 2. Snow fence height and snow storage capacity. Doubling the snow fence height quadruples the amount of snow stored.

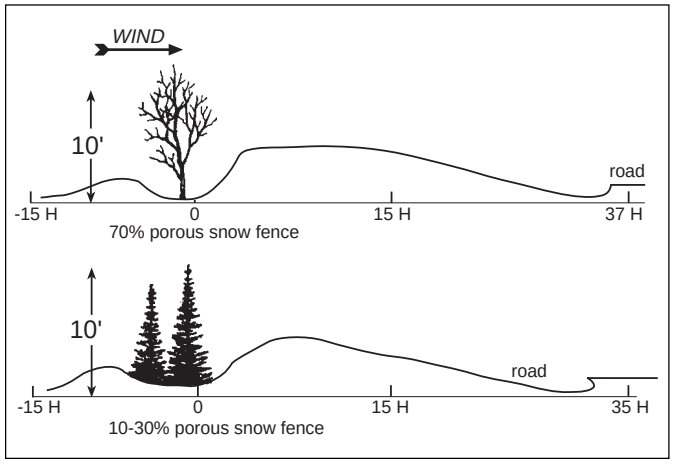


Figure 3. Snow fence density and LSF height (H) control snow deposition distance. The more porous the snow fence, the longer the deposition distance.

can enhance crop yields. For example, in some areas corn grown behind a windbreak can achieve yields about 12 percent more than corn grown without a windbreak.Windbreaks may also protect livestock and distribute snow evenly over an agricultural field.

During the 1930s, windbreaks were frequently planted to control wind erosion of topsoil. Today, windbreak use has declined. Many landowners are not maintaining their windbreaks; instead of replacing dead trees or shrubs, they let the windbreak go. In addition, landowners today have many other options for reducing erosion—for example, using no tillage, reduced tillage, contouring, grassed waterways, or crop rotation. In areas devoted to range, forage, or pasture, where land was or could be kept in prairie, windbreaks actually work less efficiently for distributing snow evenly throughout the field than do continuous prairie grasses or bands of grasses.

Habitat Diversity

Increasing the diversity of vegetation has positive effects on the ecosystem because it provides a diversity of habitat for insects, mammals, and birds. LSFs are a good way to increase the diversity of plant and animal life in rural areas.

Crop Production

It is possible to derive all of the traditional benefits from LSFs (snow control, erosion control, wildlife habitat, etc.) and simultaneously produce an "alternative" product that makes the land taken out of agricultural production profitable. We call this type of LSF a product-producing LSF system.

CRP Compensation

The usual means of encouraging farmers to pull land out of production has been to compensate them through programs such as the Conservation Reserve Continuous Signup Program (CRP). However, CRP often does not offer enough incentive to install an LSF (especially on highly productive land). Furthermore, at present harvesting is not allowed on CRP land. However, LSFs may become eligible in the future. See Appendix C for a summary of CRP information and regulations regarding LSFs.

Designing a Producing LSF System

What to Plant

Many plant species can produce marketable products in an LSF. Table 1 (Appendix A) describes those that offer the most promise for use in LSF systems in Minnesota. Many plants not included here may also work in a limited way. For example, many species of hickory trees produce edible nuts; however, most of Minnesota is too far north for them to grow well.

These plums are a good example of a crop that can be produced in an LSF system.

Before deciding what to plant, consider each species' weaknesses and strengths. For example, some species (e.g., elderberry and chokecherry) sucker readily and would have to be managed accordingly. Also consider optimum growing conditions. Different species are affected differently by environmental factors such as drought, soil drainage, soil pH, or competition. Some (e.g., hazelnuts and sumac) tolerate a wide range of environmental factors; others (e.g., blueberries and black walnut) do not.

Many specific factors (e.g., length of growing season, site, and species interaction) may affect the success of various species and combinations of species. For example, you wouldn't want to plant black walnut in northwestern Minnesota, or in soils that do not drain well, because it will not grow well under such conditions. Nor would you want to plant gooseberries near white pines, especially in central and northeastern Minnesota, because of the potential for spreading white pine blister rust.

Before planting any of the species listed in Table 1, consult resources that provide detailed information on growing, harvesting, processing, and marketing the particular species you are interested in, or consult your county extension service or soil and water conservation district. For a list of good references, see Appendix B.

Planting Strategies

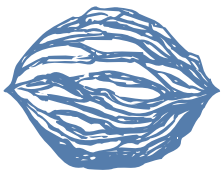
Many species of plants can be grown profitably in an LSF system, and there are a huge number of possible planting strategies. Strategies may differ by plant, spacing, height, width, and so on, depending on the site and your management objectives (see *Catching the Snow With Living Snow Fences*, Chapter 3). Of these many possibilities, the most common are:

- Twin row tall-grass prairie snow catchments (p. 47)
- Twin shrub row (p. 48)
- Deciduous tree windbreak (p. 49)
- Vertical side community shelterbelt (p. 50)

Setback distances are calculated according to the formula on page 40 of *Catching the Snow With Living Snow Fences*. Setbacks may range from about 100 to about 500 feet, depending on the site. Basic designs can be adapted to suit each landowner's purposes.

Establishment Costs

Chapter 4 of *Catching the Snow With Living Snow Fences* explains how to establish an LSF, covering such aspects as site preparation, fertilizer usage, weed control, and planting suggestions. Chapter 7 describes seeding, cover crops, weed control, and other factors in establishing native prairie grasses and forbs.



Estimates of establishment costs for each species listed are given here in Table 2 (Appendix A). These estimates are based on 1999–2000 prices of nursery stock, labor, and typical site preparation (as described in chapters 4 and 7 of *Catching the Snow With Living Snow Fences*).

The following circumstances apply to Table 2:

- Shrubs are planted in a twin row with 4-foot-by-4-foot spacing, in a strip of land 10 feet wide by 4,356 feet long (equals one acre). This results in about 2,178 shrubs per acre.
- Trees are planted in a single row with 15-foot spacing, in a strip of land 10 feet wide by 4,356 feet long (equals one acre). This results in about 290 trees per acre.
- Assume a typical catchment area to be about 5 acres. Prairie grasses may be seeded in the catchment area and in buffer zones around trees and shrubs at a rate of 30 pounds per acre. Alfalfa or any other traditional forage may be seeded in the catchment area at a rate of 15 pounds per acre.

Maintenance Costs

Maintenance costs vary depending mainly upon mulching, fertilization, and weed control. Mulching is a fixed cost per year, especially if black plastic mulch is used. The cost of fertilization depends on factors such as soil nutrient levels and soil texture, but is not usually that high. Weed control can be a significant expense, especially if geotextile weed barrier is not used. Without proper weed control, plants will not flourish and yields will decline substantially. The cost of labor is usually a major factor and varies greatly by region, season, and type of work. Some crops demand much more attention than others. Blueberries, for example, need a lot of weeding, cultivating, mulching, and soil preparation, so their costs are considerably higher than average.

Table 3 (Appendix A) shows estimated maintenance costs after the first year for various species. There are no maintenance costs the first year because plants are being established. Maintenance costs are relatively high in the second year, but they get progressively lower over the following years as the plants become established, fill in, and are better able to withstand competition and stress. Since most of the species listed in Table 3 have not been tried in LSF systems, these maintenance figures will need refining as we gather more data.

Harvest Costs

Harvest costs vary depending upon the price of labor and whether the harvest is by machine, hand, or buyer (you-pick). Most of the woody plants described here are hand harvested or you-pick. For some of the new crops, such as saskatoons and hybrid hazels, machine-harvesting technologies are being adapted from those used with conventional crops, such as blueberries. Machine harvesting requires special equipment that most growers do not have, so it may require renting equipment or

hiring someone to do the job. Right now, however, most harvesting is still done by hand. The advantage of you-pick harvesting is that costs associated with harvesting are often lower because the harvesting is done by the buyers themselves. The disadvantages are haphazard harvesting (often much fruit is left on the plant) and having to make accommodations for people picking on your property.

Prairie grasses can be harvested with a mechanized harvester (e.g., a combine) to produce both seed (to sell for conservation purposes or to prairie companies) and stalk (for native grass mulch). Harvesting prairie forbs (wildflowers), however, can be very labor intensive. Most prairie forbs need hand collecting for a variety of reasons. In some species the seeds explode out of shells when ripe, so the collector must get there before the seed is lost. Others have seed heads that do not ripen all at once, so the collector must visit the plants frequently and harvest a bit at a time. Still other species lose their seed before harvest to deer or other kinds of problems. Sometimes the seed is simply hard to find.

Harvest costs also vary with the amount of time it takes to harvest. Factors involved here include skill of the harvester, yield of the crop, access to the crop, difficulty of harvesting the plant itself, and harvesting window (when the fruit, nut, etc., is ready to pick). It is important to remember that as a general rule, land enrolled in the CRP program cannot be harvested until the contract expires.

Yields

Yields can vary tremendously in most of the plants described here. For many, yields have never been tracked from year to year as have yields of traditional crops such as corn, soybeans, or strawberries. Also, the fruit yield typically cycles, so that one year it is high and the next it is low. This cycling may be quite unpredictable, depending upon weather, stress, insect and disease impacts, and other factors. Therefore, it is not realistic to count on a given yield every year. If most factors remain fairly stable, however, an average can be calculated over a period of years. This average is the value reported in Table 3.

Native grass seed can be produced in catchment areas downwind of LSFs.

Because the plants in an LSF are continually exposed to wind, yields are likely to be less than comparable yields from plants grown in fields or plantations. Thus, values in Table 3 are conservative estimates of yield. However, you can modify the LSF design to compensate for the negative effects of wind. For example, you might plant a strip of prairie grasses or a row of nonproducing trees or shrubs windward of the producing trees for protection.

Prices

Prices in Table 3 are based on 1999–2000 prices. Many are for the raw product (berries, nuts, seed, etc.) without value-added processing. Value-added steps often are well worth the effort. For more information see the fall 1998 issue of CINRAM's newsletter, *The Agroforestry Advantage* (available through www.cnr.umn.edu/FR/cinram/).

The products produced by the species listed here are for the most part niche products—that is, they are specialty items aimed at a small market and are in short supply. Niche items usually fetch quite high prices because they are hard to find—for example, some prairie forb seeds bring $30 per ounce. Thus, it would seem a good proposition to try to grow them. But be aware that finding a buyer is not always easy. It's wise to line up a buyer before committing yourself to a particular niche product, so you do not have to eat all of your costs. It is also important to remember that some seeds must be certified *before* harvest to obtain the best price. Remember, too, that prices can fluctuate considerably depending on changes in supply and demand.

Calculating Profitable Combinations

Because there are an almost infinite number of combinations of species and planting designs, it is practically impossible to accurately predict the financial outcome of producing a specific product in an LSF. For example, just combining one tree species with one shrub species could create more than 20 possibilities; if these 20 possibilities are combined with a variety of soil productivity classes, product prices, and so on, the possibilities are limitless. Therefore, the Center for Integrated Natural Resources and Agricultural Management (CINRAM) developed interactive PC software that calculates estimated profitability of living snow fences. You can use the software to compare profitability for various scenarios, then choose the one that makes the most sense for your circumstances.

The software is available for free download at www.cnr.umn.edu/rose/shelterinstall.html. The author will provide technical support for a fee. Future upgrades and enhancements also will be available for a fee. Contact the author from the Web site for more information.

For the purpose of example, this model was used to estimate the financial results of three possible combinations of plants and spacings in LSF systems. The three examples are as follows:

System A: A single row of walnut and a single row of high-bush cranberry, with no crop in the catchment area

System B: A single row of hawthorn, a single row of chokecherry, and a 200-foot wide catchment area planted in prairie cord grass

System C: A single row of paper birch and a single row of hybrid hazelnut

In each of the three cases, the assumptions used in the model are as follows:

Real interest on start-up capital:	3%
Life of practice:	20 years
Length of LSF:	400 feet

Results of applying the LSF Profitability Model are as follows:*

	System:		
	A	**B**	**C**
NPV ($)	11,240	54,374	–12
Annual Equivalent Value ($)	784	3,796	–0.88
Payback Period (yrs.)	5	4	21
Real IRR (%)	43	51	–2

As you can see, the profits projected by the model vary dramatically for the three examples. However, before you accept these projections, you should review all the assumptions used in the model. For example, these results will change dramatically if the yield for high-bush cranberry is lower than projected, or the price for high-bush cranberry fruit is higher than $0.90/lb.

* The NPV is the value of the practice in today's dollars, and thus is a good way to compare investments with different time periods. The IRR is the annual rate of return from the investment, and can be compared to other investment options.

Marketing

Markets for LSF products in most cases either do not exist or are at best tenuous. It is always advisable to identify potential buyers before beginning the venture. However, if you can't find buyers, there are other options for marketing your product. Some potential markets:

- You-pick
- Local farmers' markets
- Overseas markets (e.g., Turkey for hazelnuts) either directly or through a broker
- Companies that buy raw product for value-added processing (e.g., jam and jelly makers, craft shops, restaurants)

It is possible to make a profit even on a small amount of land with niche products. However, economy of scale issues also come into play in determining profitability: Usually, the bigger the volume, the larger the profit. To make an LSF system profitable, you may need to create harvesting or marketing cooperatives that take advantage of economies of scale. Marketing cooperatives can help in areas such as reducing the cost of delivering or storing the product. Ultimately, cooperatives may be a key to the success of your LSF venture.

Appendix B includes sources of more information on marketing specialty products.

Conclusion

Many products and combinations of products can be produced in an LSF system. Careful analysis is necessary to determine what systems show the potential to be profitable. In most cases it is likely that a coordinated effort among landowners will be necessary to obtain the volume of product necessary to create a viable business. Nevertheless, there are some situations that appear to be very profitable—if the landowner is able to harvest anticipated yields, access markets, and receive anticipated prices for the product.

The environmental advantages of living snow fences are clear, and the benefits they provide to motorists and road maintenance departments are also well defined. But it is important to remember that LSFs may also prove to be profitable for the landowner.

Appendix A: Tables

Table 1 LSF Plants That Produce Marketable Crops

PLANT	PRODUCT	PLANT CHARACTERISTICS[1]	ECOREGION	OPTIMUM GROWING CONDITIONS	NOTES
Shrubs					
blueberry *Vaccinium* sp.	berries for eating, preserves, etc.		north-central and northeast		
buffaloberry *Sheperdia argentea*	fruit preserves, flavorings for ice cream and drinks	H: 6–16 ft. W: 3–15 ft. fruit red, drupelike, 1/6–1/4 in. long, June-July; fixes nitrogen	all	tolerates poorest of soils and dry or alkaline situations; prefers moist soil; prefers open, sunny positions	• harvest berries for preserves when slightly underripe • harvest berries for eating fresh after a light frost (makes them sweeter) • berries contain saponin, a stomach irritant, so don't eat too many at once
cherry, Nanking *Prunus tomentosa*	fruit preserves	H: 6–10 ft. W: 15 ft. Fruit scarlet, 2/5 in. diameter, June-July	all but northern (best in southeast and southwest)		• nonnative; lives 15–30 years
cherry, pin *P. pennsylvanica*	fruit preserves		all		• susceptible to a fungal disease called "x"
chokecherry *P. virginiana*	fruit preserves, wine	H: 12–25 ft. W: 12–20 ft.	all		• susceptible to fungal diseases (black knot and "x")
dogwood, red-osier *Cornus stolonifera*	branches for wreaths, floral arrangements	H: 3–9 ft.; W: 4–8 ft. has slender, erect or ascending purplish to bright red, smooth branches	all, but not as well in the southwest	adapted to wet conditions, but thrives on drier soils under cultivation; one of the most pH-tolerant shrub species (pH 3.2–8.5); likes full sun	• when dormant, can tolerate temperatures well below 0°F, but once out of dormancy, is easily killed by late spring frosts; favored deer browse; fruits attract birds
elderberry *Sambucus canadensis*	fruit preserves, wine	H: 5–12 ft. W: 5–12 ft. fruit purple-black, flat-topped clusters 6–10 in. wide, Aug.-Sept.; flowers profusely; fast grower	all	moist soils, but will tolerate dry soils; full sun or partial shade	• suckers profusely; tends to have an unkempt habit; protect from birds for good yields
gooseberry *Ribes* sp.	fruit preserves		all but north-central and northeast		• do not plant near white pine *(Pinus strobus)* due to risk of spreading white pine blister rust
hazelnut, hybrid *Corylus americana* x *C. cornuta* x *C. avelena*	nuts, oils, flavorings (for coffee, honey, etc.)	H: 10–12 ft. W: 16 ft. nut (without husk) about 1–2 in. diameter	all (best in southeast)	tolerates broad range of soils, but avoid shallow hard-pan; prefers pH of about 5.0–8.0; full sun or shade, but best nut production in full sun; broad range of sites	• keep competing weeds down on at least one side of row; apply 10-10-10 fertilizer every couple of years for best growth

(Table 1: shrubs, continued)

PLANT	PRODUCT	PLANT CHARACTERISTICS[1]	ECOREGION	OPTIMUM GROWING CONDITIONS	NOTES
hazelnut, wild *C. americana* or *C. cornuta*	nuts, oils, flavorings (for coffee, honey, etc.)	H: 10–12 ft. W: 16 ft. nut (without husk) about 1/2 in. diameter	all	tolerates broad range of soils and sites; avoid shallow hardpan; prefers pH of about 5.0–8.0; full sun or shade, but best nut production in full sun	
high-bush cranberry *Viburnum trilobum*	fruit preserves, wine	H: 8–12 ft. W: 8–12 ft. fruit is red drupes in 4-in.-wide, flat-topped clusters, Sept.– fall	all	prefers good, well-drained soil; full sun or partial shade	• protect fruit from birds; transplants well
nannyberry *V. lentago*	fruit preserves	H: 15–18 ft. W: 6–10 ft. fruit is bluish-black drupes in 6-in.-wide, flat-topped clusters, Sept.–fall	all	very adaptable to soil conditions; sun or shade	• protect fruit from birds
plum, wild *Prunus americana*	fruit preserves, wine	H: 10–30 ft. W: 8–25 ft.	all		• susceptible to fungal disease (plum pockets, leaf fungi, etc.)
pussy willow *Salix discolor*	floral arrange-ments	H: 6–12 ft.; W: 10 ft. attractive catkins on developing flowers that bloom in early spring before the leaves begin to grow	all but southwest	natural habitat is swamps and wet places, but grows quite well on dry soils and is often cultivated; full to partial sun	
raspberry *Rubus* sp.	berries for fresh eating, preserves, flavoring, etc.		all		
rose, rugosa *Rosa rugosa*	jelly	H: 4–6 ft.; W: 4–6 ft. fruit is red hip, about 1 in. diameter, August into fall	all	well-drained soil; pH adaptable, but prefers slighly acid; sunny and open	• not as disease-prone as hybrid roses; introduced species
rose, woods *R. woodsii*	fruit preserves	H: 4–6 ft.	all	prefers rich, well-drained, high-organic-matter soil, but will tolerate poorer soils; sun to partial shade	• fruit is very seedy; contains high levels of vitamin C
saskatoon *Amelanchier alnifolia* 'Theissen'	fruit preserves	H: 16-1/2 ft.; W: 10–15 ft. fruit is deep blue, 1/2–3/4 in. diameter, berrylike pome, in pendulous clusters	all but southeast	tolerates broad range of soils, but best on deep, sandy to loamy, well-drained soils with a pH of about 6.0–7.5; full sun or partial shade	• keep fruit protected from birds with netting or the like; suffers from some rust diseases; native to Saskatchewan
serviceberry *Amelanchier* sp.	fruit preserves	H: 5–25 ft.; W: 10–25 ft. fruit varies from red to dark blue and purple; small, berrylike pome, in pendulous clusters	all	tolerates broad range of soils, but best on deep, sandy to loamy, well-drained soils with a pH of about 6.0–7.5; full sun or partial shade	• protect fruit from birds with netting or the like; native varieties are probably more suited to Minnesota

(Table 1: shrubs, continued)

PLANT	PRODUCT	PLANT CHARACTERISTICS[1]	ECOREGION	OPTIMUM GROWING CONDITIONS	NOTES
strawberry *Fragaria* sp.	berries for fresh eating, preserves, flavoring, etc.		all		
sumac *Rhus typhina*	tea	H: 15–25 ft.; W: 15–30 ft. fruit crimson, small, densely hairy drupe, in tight, upright clusters	southeast, central, northern	adapted to many soil types, but prefers well-drained soil (not a plant for poorly drained soils); tolerates dry, sterile soil; full sun	
sumac, smooth *Rhus glabra*	tea	H: 9–15 ft; W: 9–15 ft. fruit crimson, small, densely hairy drupe, in tight, upright clusters	all	adapted to many soil types, but prefers a well-drained soil (not a plant for poorly drained soils): tolerates dry, sterile soil; full sun	• suckers profusely
Trees					
birch, paper *Betula papyrifera*	ornamentals (branches, birch "cones"), birch drink	H: 25–40 ft.; W: 25 ft. has attractive bark that, when mature, is white, exfoliating, and papery	all but Red River valley	moist, cool, well-drained soil; full to part sun (fairly intolerant to shade)	• if soil gets too dry or hot, roots get stressed and tree becomes susceptible to disease and insect problems, especially bronze birch borer, a tree killer
birch, river *B. nigra*	ornamentals (branches, birch "cones"), birch drink	H: 20–35 ft.; W: 25 ft. when young, bark is attractive, coppery, exfoliated, and papery	better in the south	adapts to wetter conditions (edges of wetlands) but grows quite well on upland sites, too; full sun to part sun	• the most resistant of all birches to bronze birch borer attack; when tree matures, the bark turns a dull brown
crabapple, manchurian *Malus* sp.	fruit preserves				
crabapple, other *Malus* sp.	fruit preserves	H: 15–25 ft.; W: 20 ft. red (some yellow or green) fruit, 1–2 in. diameter, ripen in fall	all	heavy loam, pH 5.0–6.5, well drained, moist; full sun for maximum flower development	• plant disease-resistant cultivars only
hawthorn *Crataegus* sp.	fruit preserves	H: 20–30 ft. W: 20–35 ft. red, pomelike drupe, 3/8–1/2 in., September into late fall	all	tolerates many soils and pHs, but should be well drained; full sun	• can be very thorny, depending on cultivar
maple, sugar *Acer saccharum*	maple syrup	H: 30–50 ft. W: 45 ft. fall foliage bright yellow to brilliant crimson-orange	all	deep, rich, moist, well-drained soils; prefers pH about 5.5–7.2; full sun to heavy shade	• difficult to grow successfully; sensitive to soil compaction, sunscald, high pH, salt spray, and improper water balance; irrigation a must if open grown
poplar, hybrid *Populus nigra* x *P. deltoides*	fuel biomass, pulp & paper, OSB, fodder	H: 60 ft.; W: 15 ft. a cultivated hybrid, prized for its fast growth (easily puts on 6 ft./year)	all	adapted to floodplains and wetter areas, but will grow well on drier soil, especially if water table is not too far from surface. Avoid pH over 7.6; prefers full sun (does not tolerate shade well)	• for additional information on hybrid poplar, see www.auri.org, www.mgo.umn.edu, www.ruralmn.org

(Table 1: trees, continued)

PLANT	PRODUCT	PLANT CHARACTERISTICS[1]	ECOREGION	OPTIMUM GROWING CONDITIONS	NOTES
walnut, black *Juglans nigra*	nuts, shells, lumber	H: 50–75 ft.; W: 50–75 ft. (open grown) nut 2–4 in. diameter with a husk that stains brown and a very hard shell	southeast (best), southwest	prefers deep, rich, moist soils; will tolerate but grows much more slowly in dry soils; full to partial sun (fairly intolerant to shade)	• produces nuts when about 10 years old; not mature enough for lumber until about 50 years old
willow, hybrid *Salix* sp. x *Salix*. sp.	fuel biomass, pulp & paper, OSB, fodder		all	soil requirements similar to hybrid poplar; full sun	• similar to hybrid poplar in management requirements
Forage					
alfalfa *Medicago sativa*	biomass, forage, green manure	H: 12–18 in. leguminous; good soil builder	all	deep loam soils with porous, well-drained subsoils; adequate P, K. and micronutrients; pH 6.7–6.9; full sun	• grows perennially for 3–5 years, then need to reseed; pesticide applications on established stands are minimal
Grasses and Forbs					
prairie grasses mix	seed, mulch, floral arrange-ments	H: 3–8 ft.	all	mainly mesic soil	• keep relatively weed free; mow or control-burn every 3 years or so; organic is more marketable than nonorganic
prairie forbs mix	seed, mulch, floral arrange-ments	H: 3–4 ft.	all	mainly mesic soil	• keep relatively weed free; mow or control-burn every 3 years or so; organic is more marketable than nonorganic
big bluestem *Andropogon gerardii*	seed, mulch, floral arrange-ments	H: 3–8 ft.	all	dry, mesic, wet (not aquatic) soil	• warm season
blue grama grass *Bouteloua gracilis*	seed, mulch, floral arrangements	H: 1–2 ft.	western, central, southern	dry soil	• grows naturally on sandy soils; warm season
buffalo grass *Buchloe dactyloides*	seed, mulch, floral arrange-ments	H: 1–2 ft.	southwest	dry mesic soil	• warm season; rhizomatous
Canadian wild rye *Elymus canadensis*	seed, mulch, floral arrange-ments	H: 3–6 ft.	all	dry, mesic, wet (not aquatic) soil	• grows naturally in flood plains; cool season
Indian grass *Sorghastrum nutans*	seed, mulch, floral arrange-ments	H: 3–6 ft.	all	mesic, wet (not dry or aquatic) soil	• warm season
little bluestem *Schizachyrium scoparium*	seed, mulch, floral arrange-ments	H: 2–3 ft.	all but northeast	dry, mesic (not wet or aquatic) soil	• warm season
prairie cord grass *Spartina pectinata*	seed, mulch, floral arrange-ments	H: 4–8 ft.	all	wet, aquatic (not dry or mesic) soil	• warm season; aggressive; rhizomatous

(Table 1: grasses and forbs, continued)

PLANT	PRODUCT	PLANT CHARACTERISTICS[1]	ECOREGION	OPTIMUM GROWING CONDITIONS	NOTES
side oats grama *Bouteloua curtipendula*	seed, mulch, floral arrangements	H: 2–3 ft.	western, central, southern	dry, mesic (not wet or aquatic) soil	• warm season
switch grass *Panicum virgatum*	seed, mulch, floral arrangements	H: 3–5 ft.	all	mesic, wet (not dry or aquatic)	• warm season
aster, smooth blue *Aster laevis*	seed, mulch, floral arrangements	H: 3–5 ft.		dry, mesic (not wet or aquatic) soil	
bedstraw, northern *Galium boreale*	seed, mulch, floral arrangements	H: 20–30 in.		dry, mesic, wet (not aquatic) soil	
blazing star, meadow *Liatris aspera*	seed, mulch, floral arrangements	H: 2–3 ft.		dry, mesic (not wet or aquatic) soil	
butterfly weed *Asclepias tuberosa*	seed, mulch, floral arrangements	H: 2–3 ft.		dry, mesic (not wet or aquatic) soil	• grows naturally on well-drained soils
Canada anemone *Anemone canadensis*	seed, mulch, floral arrangements	H: 1–2 ft.		wet to mesic (not aquatic or dry)	• grows naturally in sedge meadows
compass plant *Silphium laciniatum*	seed, mulch, floral arrangements		south-central and southwest	wet, mesic, dry (not aquatic)	• southern prairies
coneflower, narrow purple, nonorganic *Echinacea angustifolia*	seed, mulch, floral arrangements, medicine	H: 12–18 in.	southwest; drier parts of other regions	drier, well-drained soil; pH 6.5–8.0; full sun	• not very competitive with weeds (weed early and often); grows naturally on the driest parts of the Great Plains
coneflower, narrow purple, organic *Echinacea angustifolia*	seed, mulch, floral arrangements, medicine	H: 12–18 in.	southwest; drier parts of other regions	drier, well-drained soil; pH 6.5–8.0; full sun	• see above
coneflower species *Echinacea purpurea, E. pallida*	seed, mulch, floral arrangements; medicinal	H: 3–4 ft.	all	fairly fertile soil that is moist and well-drained; pH 6.0–7.0; full sun (*E. purpurea* can tolerate partial shade)	• control weeds first year; cultivate early second year; a field of *E. purpurea* in bloom is spectacular!
coreopsis, prairie *Coreopsis palmata*	seed, mulch, floral arrangements	H: 18–30 in.		mesic to dry (not aquatic or wet) soil	
leadplant *Amorpha canescense*	seed, mulch, floral arrangements	H: 2–3 ft.		dry to mesic soil	
milkweed, whorled *Asclepias verticillata*	seed, mulch, floral arrangements	H: 16–30 in.		dry to mesic soil	

(Table 1: grasses and forbs, continued)

PLANT	PRODUCT	PLANT CHARACTERISTICS[1]	ECOREGION	OPTIMUM GROWING CONDITIONS	NOTES
mountain mint *Pycnanthemum virginianum*	seed, mulch, floral arrangements	H: 20–36 in.		mesic to wet soil	
New Jersey tea *Ceanothus americanus*	seed, mulch, floral arrangements			dry to mesic soil	
onion, prairie *Allium stellatum*	seed, mulch, floral arrangements	H: 10–20 in.		dry soil	• grows naturally on dry hilltops; edible
prairie phlox *Phlox pilosa*	seed, mulch, floral arrangements	H: 1–2 ft.		mesic to wet soil	
Medicinal Plants					
catnip *Nepeta cataria*	soothing tea for colds, etc.	H: 18–24 in.	all	sandy loam/clay loam, moist, well-drained soil; pH 5.8–7.5; partial shade to full sun	• an introduced, hardy perennial in the mint family; propagate by cutting; often cultivated and naturalized; roadsides, fields, waste places; row-seeded; strong weed competitor
dandelion *Taraxacum officinale*	leaves for tonic and eating; roots for diuretic and liver stimulant			well-drained, sandy loam (easier to dig); tolerates broad pH range; sun; rich, wet pastures	• use culinary seeds for cultivation (roots bigger); start in greenhouse; biennial (plant one year in advance)
ginseng, American *Panax quinquefolium*	invigorating, adaptogenic tonic	H: 1–2 ft. hardy perennial	northern, central, north-central, southeast	rich, well-drained soil; partial shade; moist, rich woods on north slopes; grown in the understory of upland, eastern deciduous forests	• "woods-grown" root (fetches highest prices) should be at least 5 years old to sell, with ages of 10–15 years common; unknown if it can be grown under a newly established wooded environment; illegal to harvest the roots before the red berries ripen and set seed in late summer or early autumn; propagated by division
goldenseal *Hydrastais canadensis*	anti-inflammatory for irritated mucous membranes, anticonvulsant and mild sedative	H: 6–12 in.	northern, central, north-central, southeast	rich, well-drained soil; partial shade; moist, rich woods on north slopes	• one of the most widely consumed health and natural foods products; plants grow in colonies; propagated by division; grown in the understory of upland, eastern deciduous forests; hardy perennial; becoming less common in eastern deciduous forests
motherwort *Lionurus cardiaca*	tonic for heart, to regulate menses, to aid in childbirth	H: 40 in. cultivated crop is drought tolerant	all	sandy soils, well-drained soils; semishade; often cultivated and naturalized; roadsides, fields, waste places	• strong weed competitor

(Table 1: medicinal plants, continued)

PLANT	PRODUCT	PLANT CHARACTERISTICS[1]	ECOREGION	OPTIMUM GROWING CONDITIONS	NOTES
nettle *Urtica dioica*	source of iron; tea used for "blood purifier" or "blood builder"	H: 30–60 in.	all	mucky ground, rich, moist soil; semishade; moist meadows, roadsides, old pastures, pond edges	• strong weed competitor; difficult to establish; hardy perennial; naturalized from Europe; soil builder
skullcap *Scutellaria* sp.	sedative, antispasmodic, anti-inflammatory	H: 12–24 in.	all	moist, loamy, well-drained soil; swamp; rich, moist soil; sun/partial shade; rich woods; moist thickets	• don't harvest too young; tedious to weed; start with transplants; biennial; sell root and top; highly valued in traditional Chinese medicine
sweetclover *Melilotis officinalis*	flower tops used for relaxing effects; good soil builder; green manure	H: 18–24 in. (can grow up to 6 ft.); legume	all	well-drained soil (no wet ground); sun	• introduced biennial; common "weed" of roadsides, fields, and lawns; broadcast seeded; strong weed competitor; biennial; seed early fall for blooms the next year
valerian *Valeriana officinalis*	tranquilizer	H: 48–78 in. root smells like wet socks	all	moist, loamy ground; tolerates high pH; sun, partial shade; naturalized to old fields and pastures	• hardy, introduced perennial; often cultivated
witch hazel *Hamamelis virginiana*	leaf tea for colds and sore throats; twig tea used externally for bruises and sore muscles; astringent	H: up to 15 ft. large shrub to small tree; flowers appear after leaves fall	central, north-central, north, southeast	moist soil; sun to part shade; woods	
wormwood *Artemisia absinthum*	tonic for worms and malaria; fragrant dried leaves used in wreaths and arrangements	H: 22–36 in.	all	sandy soil; tolerates drier conditions; sun, part shade; waste ground	• weak weed competitor; strong smell; escapee from herb gardens

[1] H = height; W = width

Table 2. Per-Acre Establishment Costs for Selected LSF Species

PLANT	PRICE ($/UNIT)[1]	UNIT SIZE	LABOR ($/UNIT)	UNITS/ ACRE	VEGETATION COST ($/ACRE)	LABOR ($/ACRE)	WEED CONTROL FABRIC ($/ACRE)	TOTAL ESTAB. COST ($/ACRE)	TYPE[2]	SOURCE[3]
Shrubs										
blueberry	6.50	7–12 in.	0.45	2,178	14,157.00	980.10	1,500.00	16,637.10	S	6
buffaloberry	0.47	2–3 ft.	0.45	2,178	1,023.66	980.10	1,500.00	3,503.76	S	1
cherry, Nanking	0.44	2–3 ft.	0.45	2,178	958.32	980.10	1,500.00	3,438.42	S	1
cherry, pin	0.50	2–3 ft.	0.45	2,178	1,089.00	980.10	1,500.00	3,569.10	S	1
chokecherry	0.49	3–4 ft.	0.45	2,178	1,067.22	980.10	1,500.00	3,547.32	S	1
dogwood, red-osier (bare-root seedling)	0.46	3–4 ft.	0.45	2,178	1,001.88	980.10	1,500.00	3,481.98	S	1
dogwood, red-osier (transplant)	0.70	3–4 ft.	0.45	2,178	1,524.60	980.10	1,500.00	4,004.70	TR	1
elderberry	0.65	18–24 in.	0.45	2,178	1,415.70	980.10	1,500.00	3,895.80	S	1
grape, wild	0.36	18–24 in.	0.45	2,178	784.08	980.10	1,500.00	3,264.18	S	1
hazelnut	0.55	18–24 in.	0.45	2,178	1,197.90	980.10	1,500.00	3,678.00	S	1
hazelnut, hybrid	3.28	8–18 in.	0.45	2,178	7,143.84	980.10	1,500.00	9,623.94	Tu	3
high-bush cranberry (seedling)	1.05	2–3 ft.	0.45	2,178	2,286.90	980.10	1,500.00	4,767.00	S	1
high-bush cranberry (transplant)	1.30	2–3 ft.	0.45	2,178	2,831.40	980.10	1,500.00	5,311.50	TR	1
nannyberry	1.00	18–24 in.	0.45	2,178	2,178.00	980.10	1,500.00	4,658.10	S	1
nannyberry	1.10	2–3 ft.	0.45	2,178	2,395.80	980.10	1,500.00	4,875.90	S	1
plum, wild (American)	0.54	3–4 ft.	0.45	2,178	1,176.12	980.10	1,500.00	3,656.22	S	1
pussy willow	2.80	10 in.	0.45	2,178	6,098.40	980.10	1,500.00	8,578.50	S	8
raspberry	2.50	N/A	0.45	2,178	5,445.00	980.10	1,500.00	7,925.10	S	6
rose, rugosa and woods	0.35	2–3 ft.	0.45	290	101.50	130.50	1,500.00	1,732.00	S	1
saskatoon	2.00	10 in.	0.45	2,178	4,356.00	980.10	1,500.00	6,836.10	S	4
serviceberry	0.50	2–3 ft.	0.45	2,178	1,089.00	980.10	1,500.00	3,569.10	S	1
strawberry	0.30	N/A	0.45	2,178	653.40	980.10	1,500.00	3,133.50	S	6
sumac	0.38	18–24 in.	0.45	2,178	827.64	980.10	1,500.00	3,307.74	S	1
Trees										
birch, paper	0.66	18–24 in.	0.45	290	191.40	130.50	1,500.00	1,821.90	S	1
birch, river	0.66	2–3 ft.	0.45	290	191.40	130.50	1,500.00	1,821.90	S	1
crabapple, Manchurian	0.43	2–3 ft.	0.45	290	124.70	130.50	1,500.00	1,755.20	S	1
hawthorn	0.43	2–3 ft.	0.45	290	124.70	130.50	1,500.00	1,755.20	S	1
maple, sugar	0.57	18–24 in.	0.45	290	165.30	130.50	1,500.00	1,795.80	S	1
pine, ponderosa	0.40	8–15 in.	0.45	210	84.00	94.50	1,500.00	1,678.50	S	1
pine, red	0.60	7–15 in.	0.45	210	126.00	94.50	1,500.00	1,720.50	TR	1
pine, Scotch	0.65	12–18 in.	0.45	210	136.50	94.50	1,500.00	1,731.00	TR	1
pine, white	0.60	8–12 in.	0.45	210	126.00	94.50	1,500.00	1,720.50	TR	1
poplar, hybrid	0.15		0.45	290	43.50	130.50	1,500.00	1,674.00	S	1

(Table 2: trees, continued)

PLANT	PRICE ($/UNIT)[1]	UNIT SIZE	LABOR ($/UNIT)	UNITS/ ACRE	VEGETATION COST ($/ACRE)	LABOR ($/ACRE)	WEED CONTROL FABRIC ($/ACRE)	TOTAL ESTAB. COST ($/ACRE)	TYPE[2]	SOURCE[3]
spruce, white or Black Hills	0.60	8–12 in.	0.45	210	126.00	94.50	1,500.00	1,720.50	TR	1
walnut, black	0.58	2–3 ft.	0.45	290	168.20	130.50	1,500.00	1,798.70	S	1
willow, hybrid	0.58	2–3 ft.	0.45	290	168.20	130.50	1,500.00	1,798.70	S	1
Forage										
alfalfa	1.90	seed		15	28.50	20.00		48.50	seed	7
Prairie Grasses and Forbs										
prairie grasses mix	16.00	seed		30	480.00	120.00		600.00	seed	2
prairie forbs mix	100.00	seed		30	3,000.00	120.00		3,120.00	seed	2
big bluestem	16.00	seed		30	480.00	120.00		600.00	seed	2
blue grama grass	16.00	seed		30	480.00	120.00		600.00	seed	2
buffalo grass	12.00	seed		30	360.00	120.00		480.00	seed	2
Canadian wild rye	16.00	seed		30	480.00	120.00		600.00	seed	2
Indian grass	16.00	seed		30	480.00	120.00		600.00	seed	2
little bluestem	16.00	seed		30	480.00	120.00		600.00	seed	2
prairie cord grass	100.00	seed		30	3,000.00	120.00		3,120.00	seed	2
side oats grama	16.00	seed		30	480.00	120.00		600.00	seed	2
switch grass	6.00	seed		30	180.00	120.00		300.00	seed	2
aster, smooth blue	225.00	seed		30	6,750.00	120.00		6,870.00	seed	2
bedstraw, northern	225.00	seed		30	6,750.00	120.00		6,870.00	seed	2
blazing star, meadow	225.00	seed		30	6,750.00	120.00		6,870.00	seed	2
butterfly weed	240.00	seed		30	7,200.00	120.00		7,320.00	seed	2
Canada anemone	320.00	seed		30	9,600.00	120.00		9,720.00	seed	2
compass plant	240.00	seed		30	7,200.00	120.00		7,320.00	seed	2
coneflower, narrow purple, nonorganic	225.00	seed		30	6,750.00	120.00		6,870.00	seed	2
coneflower, narrow purple, organic	530.00	seed		30	15,900.00	120.00		16,020.00	seed	5
coreopsis, prairie	225.00	seed		30	6,750.00	120.00		6,870.00	seed	2
leadplant	240.00	seed		30	7,200.00	120.00		7,320.00	seed	2
milkweed, whorled	240.00	seed		30	7,200.00	120.00		7,320.00	seed	2
mountain mint	480.00	seed		30	14,400.00	120.00		14,520.00	seed	2
New Jersey tea	640.00	seed		30	19,200.00	120.00		19,320.00	seed	2
onion, prairie	480.00	seed		30	14,400.00	120.00		14,520.00	seed	2
phlox, prairie	1120.00	seed		30	33,600.00	120.00		33,720.00	seed	2

(Table 2: medicinal herbs, continued)

PLANT	PRICE ($/UNIT)[1]	UNIT SIZE	LABOR ($/UNIT)	UNITS/ ACRE	VEGETATION COST ($/ACRE)	LABOR ($/ACRE)	WEED CONTROL FABRIC ($/ACRE)	TOTAL ESTAB. COST ($/ACRE)	TYPE[2]	SOURCE[3]
Medicinal Herbs										
catnip	36.50	seed		30	1,095.00	120.00		1,215.00	seed	5
clover, red	50.00	seed		30	1,500.00	120.00		1,620.00	seed	5
dandelion	418.00	seed		30	12,540.00	120.00		12,660.00	seed	5
ginseng, American roots (2 yr. old)	0.93	root		1,000	930.00	120.00		1,050.00	root	5
ginseng, American seed	135.00	seed		30	4,050.00	120.00		4,170.00	seed	5
goldenseal, roots (1 yr. old)	1.00–3.00	root		1,000	2,500.00	120.00		2,620.00	root	5
licorice	132.00	seed		30	3,960.00	120.00		4,080.00	seed	5
motherwort	231.00	seed		30	6,930.00	120.00		7,050.00	seed	5
nettle	109.00	seed		30	3,270.00	120.00		3,390.00	seed	5
pennyroyal	240.00	seed		30	7,200.00	120.00		7,320.00	seed	5
skullcap	490.00	seed		30	14,700.00	120.00		14,820.00	seed	5
valerian	212.00	seed		30	6,360.00	120.00		6,480.00	seed	5
wormwood	181.00	seed		30	5,430.00	120.00		5,550.00	seed	5

[1] Unit for shrubs and trees is the individual plant. Forages, prairie grasses, forbs, and medicinal herbs are measured in other vegetative units. Contact your grower for more information.

[2] Type: S = bare-root seedling, TR = transplant, Tu = tubling.

[3] Source: 1 = Schumacher's, 2 = Fedder's, 3 = Badgersett, 4 = Prairie Plant Systems, 5 = Johnny's Selected Seeds, 6 = Northwind Nursery, 7 = Albert Lea Seed House, 8 = Prairie Moon Nursery

Table 3. Costs, Yields, and Prices for Selected LSF Species

PLANT	ESTABLISHMENT COSTS ($/ACRE)	ANNUAL MAINTENANCE COSTS ($/ACRE) YEAR 2	YEAR 3	YEARS 4 –20	HARVEST COSTS[1] ($/ACRE)	YIELD [2] (LB./ACRE)	SALE OF PRODUCT ($/VOLUME OR WEIGHT)
Shrubs							
blueberry	16,637.10	600	600	600	1,000.00	3,500	1.50/pint
buffaloberry	3,503.76	200	150	20	No info yet	No info yet	No info yet
cherry, Nanking	3,438.42	200	150	20	No info yet	No info yet	No info yet
cherry, pin	3,569.10	200	150	20	850.78	3,267	15.00/gal.
chokecherry (best case)	3,547.32	200	150	20	900.00	10,000	1.00/lb.
chokecherry (worst case)	3,547.32	200	150	20	854.12	6,970	0.75/lb.
dogwood, red-osier (bare-root seedling)	3,481.98	200	150	20	400.00	3,000	0.60/lb.
dogwood, red-osier (transplant)	4,004.70	200	150	20	400.00	3,000	0.60/lb.
elderberry (fruit)	3,895.80	200	150	20	1,633.50	19,602	0.90/lb.
elderberry (flower)	3,895.80	200	150	20	1,600.00		10.00/lb.
grape, wild	3,264.18	200	150	20	1,742.40	10,454	
hazelnut	3,678.00	200	150	20	1,000.00		
hazelnut, hybrid	9,623.94	200	150	20	1,500.00	5,445	0.50/lb.
high-bush cranberry (bare-root seedling)	4,767.00	200	150	20	1,134.38	6,534	0.90/lb.
high-bush cranberry (transplant)	5,311.50	200	150	20	1,200.00	9,000	0.90/lb.
nannyberry (18–24 in.)	4,658.10	200	150	20	No info yet	No info yet	No info yet
nannyberry (2–3 ft.)	4,875.90	200	150	20	No info yet	No info yet	No info yet
plum, wild (American)	3,656.22	200	150	20	1,003.03	15,246	0.35/lb.
pussy willow	8,578.50	200	150	20	500.00	3,000	
blackberry	6,000.00	300	200	200	950.00	2,000	1.65/lb.
raspberry	7,925.10	300	200	200	3,750.00	4,000	1.50/lb.
rose, rugosa or woods	1,732.00	200	150	20	1,000.00	8,000	1.00/lb.
saskatoon	6,836.10	300	200	20	833.00	1,500	1.00/lb.
strawberry, conventional	3,133.50	300	300	200	1,040.00	5,250	1.75/qt.
sumac	3,307.74	200	150	20	No info yet	No info yet	No info yet
Trees							
birch, paper	1,821.90	200	150	20	Variable	Variable	0.60/lb.
birch, river	1,821.90	200	150	20	Variable	Variable	0.60/lb.
crabapple	1,755.20	200	150	20	90.00	400	1.00/lb.
hawthorn	1,755.20	200	150	20	87.00	348	1.00/lb.
pine, ponderosa	1,678.50	200	150	20		290 trees/acre	40.00/foot of tree

(Table 3: trees, continued)

PLANT	ESTABLISHMENT COSTS ($/ACRE)	ANNUAL MAINTENANCE COSTS ($/ACRE) YEAR 2	YEAR 3	YEARS 4 –20	HARVEST COSTS[1] ($/ACRE)	YIELD [2] (LB./ACRE)	SALE OF PRODUCT ($/VOLUME OR WEIGHT)
pine, red	1,720.50	200	150	20		290 trees/acre	40.00/foot of tree
pine, Scotch	1,731.00	200	150	20		290 trees/acre	40.00/foot of tree
pine, white	1,720.50	200	150	20		290 trees/acre	40.00/foot of tree
poplar, hybrid	1,674.00	200	150	20	982.00	3.0 cords/ac/year	
spruce, Black Hills or white	1,720.50	200	150	20		290 trees/acre	60.00/foot of tree
walnut, black	1,798.70	200	150	20	Variable	Variable: 50–100 lb. is good	10.00/cwt., after hulled
Forage							
alfalfa (hay)	48.50	60	60	60	60	3.5 ton/acre	4/bale
Prairie Grasses and Forbs [3]							
prairie grasses mix (seed)	600.00	200	200	200	100.00	66	16.00/lb. (seed)
prairie grasses mix (native straw mulch)	600.00	200	200	200	100.00	No info yet	No info yet
prairie forbs mix (seed)	3,120.00	200	200	200	100.00	66	
big bluestem	600.00	200	200	200	100.00	66	16.00/lb. (seed)
blue grama grass	600.00	200	200	200	100.00	66	16.00/lb. (seed)
buffalo grass	480.00	200	200	200	100.00	66	12.00/lb. (seed)
Canadian wild rye	600.00	200	200	200	100.00	66	16.00/lb. (seed)
Indian grass	600.00	200	200	200	100.00	66	16.00/lb. (seed)
little bluestem	600.00	200	200	200	100.00	66	16.00/lb. (seed)
prairie cord grass	3,120.00	200	200	200	100.00	66	100.00/lb. (seed)
side oats grama	600.00	200	200	200	100.00	66	16.00/lb. (seed)
switch grass	300.00	200	200	200	100.00	66	6.00/lb. (seed)
aster, smooth blue	6,870.00	200	200	200	Variable	NA	15.00/oz. (seed)
bedstraw, northern	6,870.00	200	200	200	Variable	NA	15.00/oz. (seed)
blazing star, meadow	6,870.00	200	200	200	Variable	NA	15.00/oz. (seed)
butterfly weed	7,320.00	200	200	200	Variable	NA	15.00/oz. (seed)
Canada anemone	9,720.00	200	200	200	Variable	NA	20.00/oz. (seed)
compass plant	7,320.00	200	200	200	Variable	NA	15.00/oz. (seed)
coneflower, narrow purple, nonorganic (seeds)	6,870.00	200	200	200	Variable	NA	5.10/oz. (seed)
coneflower, narrow purple, organic (seeds)	16,020.00	200	200	200	Variable	NA	15.50/oz. (seed)
coneflower, organic (root)	16,020.00	200	200	200		9,000	8.00/lb. (fresh root) 25.00/lb. (dry root)
coreopsis, prairie	6,870.00	200	200	200	Variable	NA	20.00/oz. (seed)
leadplant	7,320.00	200	200	200	Variable	NA	15.00/oz. (seed)

(Table 3: prairie grasses and forbs, continued)

PLANT	ESTABLISHMENT COSTS ($/ACRE)	ANNUAL MAINTENANCE COSTS ($/ACRE) YEAR 2	YEAR 3	YEARS 4 –20	HARVEST COSTS[1] ($/ACRE)	YIELD [2] (LB./ACRE)	SALE OF PRODUCT ($/VOLUME OR WEIGHT)
milkweed, whorled	7,320.00	200	200	200	Variable	NA	15.00/oz. (seed)
mountain mint	14,520.00	200	200	200	Variable	NA	30.00/oz. (seed)
New Jersey tea	19,320.00	200	200	200	Variable	NA	40.00/oz. (seed)
onion, prairie	14,520.00	200	200	200	Variable	NA	30.00/oz. (seed)
phlox, prairie	33,720.00	200	200	200	Variable	NA	70.00/oz. (seed)
Medicinal Herbs [4]							
catnip	1,215.00					3,500 fresh	5.00/lb. (dry) 40.00/bale (dry)
clover, red	1,620.00					3 T. dry matter/acre	20.00/lb. (dry flowers) 6.00/lb. (whole plant)
ginseng, American, roots (2 yr. old)	1,050.00						cultivated: 20.00-60.00/lb. woods-grown: up to 200.00/lb
ginseng, American, seed	4,170.00						cultivated: 20.00-60.00/lb. woods-grown: up to 200.00/lb.
goldenseal, roots (1 yr. old)	2,620.00					2,000 lb. dry root/acre	wildcrafted: 35.00/lb. organic: nearly 50.00/lb.
licorice	4,080.00						
motherwort (above-ground part)	7,050.00					1,850 lb. dry matter/acre	10.00/lb. (dry)
nettle (organic)	3,390.00					3,500	9.00/lb. (dry, organic leaf)
pennyroyal	7,320.00						
skullcap (above-ground parts)	14,820.00					2,000 lb. dry matter/acre	13.00/lb. (dry) 8.00/lb. (fresh)
valerian (root)	6,480.00					2,000 lb. dry matter/acre	11.00/lb. (organic, dry root) 4.00/lb. (commercial, dry root) 7.00/lb. (organic, fresh root)
wormwood (above-ground part)	5,550.00					2,000 lb. dry matter/acre	11.00/lb. (organic) 6.00/lb. (commercial)

[1] One person harvesting for one entire season. (Estimate uses a $15 per hour labor rate, but this will obviously vary.)

[2] Most yields are variable. These figures represent an average of a range.

[3] Yields for native grasses are quite variable. Yields for prairie forbs are extremely variable, depending upon the weather, seed cycles, competition, browsing, etc. Forb seed is usually counted by the ounce, because of low volumes. Harvesting can be very labor intensive because 1) plants can be hard to find; 2) some plants are browsed heavily; 3) typically seeds pop out of little shells; 4) seeds often need to be checked (some are empty); 5) seed heads don't always ripen evenly; and 6) timing is crucial—often you need to be there to harvest the seed precisely when the seed is ripe or it will scatter and be lost.

[4] Planting, maintenance, and harvesting of medicinal herbs can take up to 500 hours per acre plus an additional $200 to $300 per acre "out of pocket" expenses.

Appendix B: Resources

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Appendix C: LSFs and CRP Eligibility

This section summarizes information and regulations regarding LSFs and the Conservation Reserve Continuous Signup Program (CRP). Perhaps the point that has the most effect on potentially product-producing LSFs is the agreement not to harvest trees and shrubs on CRP land (see "Agreements Pertinent to LSFs" below). It is clear that LSFs are eligible for CRP unless harvested, in which case they are not eligible. However, even though harvested LSFs are ineligible under the current regulations, these types of LSFs may become eligible in the future. Also, it is possible that reduced payments may become an option for harvested LSFs.

Summary of CRP Regulations on LSFs

Responsible Agencies

CRP is administered by the U.S. Department of Agriculture Farm Service Agency in cooperation with the Natural Resources Conservation Service (NRCS); Cooperative State Research, Education, and Extension Service; state forestry agencies; and local Soil and Water Conservation Districts (SWCDs). The Commodity Credit Corporation (CCC) makes all payments for CRP acreage; NRCS has technical responsibility for CRP.

Rental Rates

Rental rates are based on the average value of dryland cash rent for the past three years (adjusted to reflect the relative productivity of soils). A $5/acre payment rate will also be added for maintenance of eligible practices.

Cost Share (C/S) Payments

The CCC will pay up to 50 percent of the cost of establishing permanent vegetative cover. (Participants may also receive C/S assistance from nonfederal sources; however, the total C/S amount received may never exceed 100 percent of the cost of the practice.)

Length of Contract

For LSFs, Conservation Practice CP17A, the length of contract is 10 years.

Purpose

LSFs are designed to:

- manage snow;
- provide living screen; and
- enhance the wildlife habitat on the designated area.

Policy

Protect against drifting snow on lanes, roads, railroads, and public facilities.

Size Requirements

In accordance with the design standard for snow management (see NRCS and MN/DOT requirements).

Cost Share

Eligibility

In order to be eligible for cost share (C/S) the practice shall:

- improve environmental benefits to an acceptable level;
- prevent degradation of environmental benefits from recurring after establishment;
- be maintained for the period of 10 years (not to exceed 15 years); and
- be included in the conservation plan.

Cost share components

Components that are authorized for C/S include:

- trees and shrubs planted as LSFs to improve environmental benefits to farm or ranch;
- certain temporary vegetative cover; and
- plastic mulch or supplemental drip irrigation.

Components that are not authorized for C/S include:

- planting orchard trees;
- ornamental planting; and
- Christmas tree production.

Authorized limited use of CRP areas

Limited use of field margins and areas within a field enrolled in CRP is authorized during the primary nesting season only if this activity is conducted as part of the planting, cultivating, or harvesting of a crop in an adjoining field. Use of this acreage shall be:

- limited to turning of crossing areas; and
- minimal.

CRP acreage shall not be used as a lane or road under any circumstances.

Public use of CRP areas
Land being used by public utilities for installing gas lines, pipes, cable, telephone poles, etc., or by the state for road building is allowed if:

- Commodity Credit Corporation (CCC) authorizes the use; and
- NRCS certifies that the usage will have a minimal effect on:
  —erosion;
  —wildlife and wildlife habitat;
  —water quality; and
  —air quality.

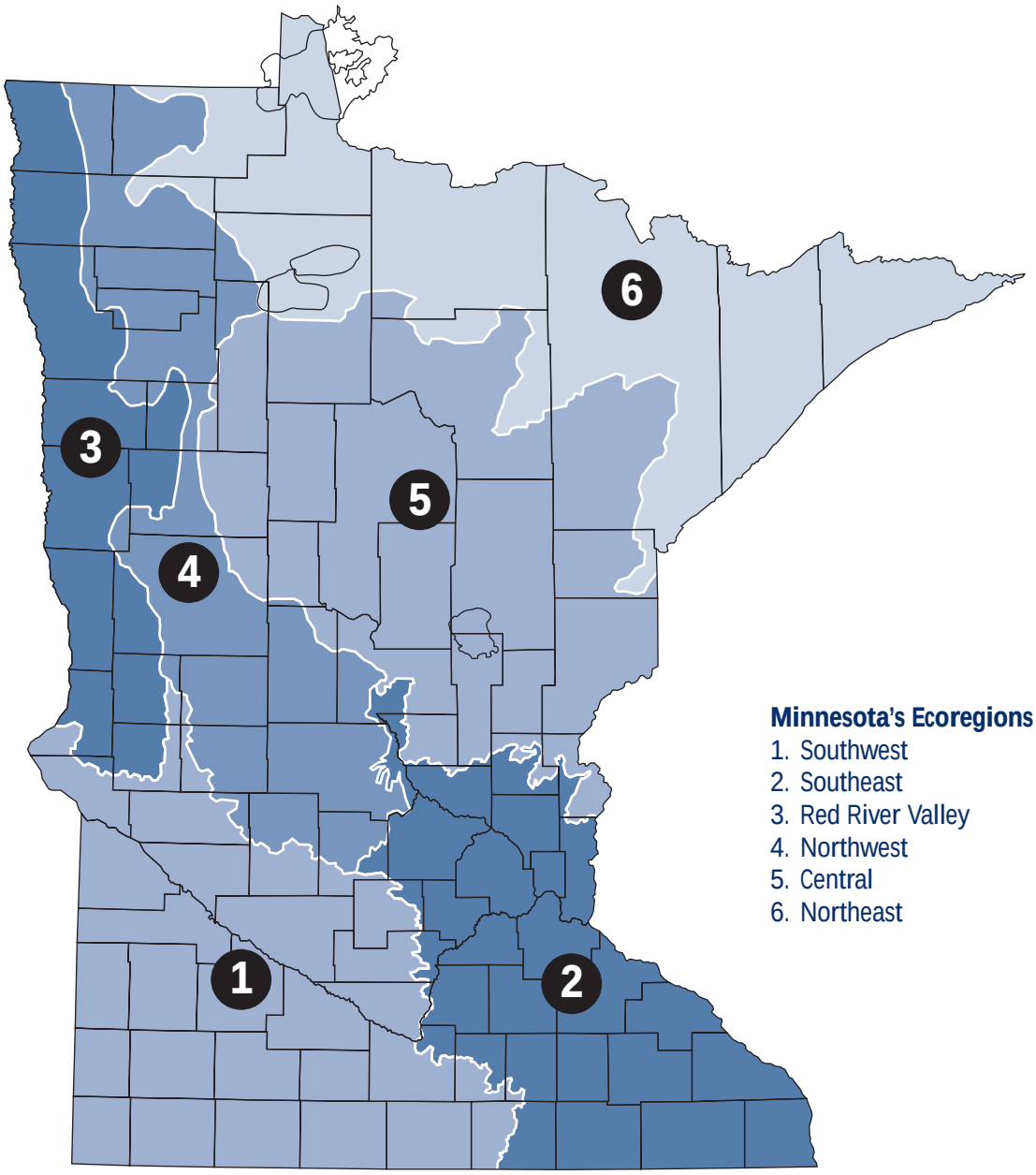
Agreements Pertinent to LSFs

- To establish, maintain, and replace, as specified in the CRP contract, the practices agreed to in the Conservation Plan.

- Not to harvest or sell, nor otherwise make commercial use of trees or forage or other cover on the CRP land including the shearing or shaping of trees for future use as Christmas trees (the participants may conduct pruning, thinning, stand improvement, or other activities consistent with customary forestry practices on land that is planted to trees); provided further, however, that CCC may in its discretion and only in writing or by publication intended for a general allowance for CRP lands in particular states or regions, permit, in certain emergencies, certain commercial uses, as specified by CCC, which may be conditioned on a reduction in CRP payments otherwise payable under this contract.

- To control all weeds, insects, pests and other undesirable species to the extent necessary to ensure that the establishment and maintenance of the approved cover is adequately protected and to provide such maintenance as necessary to avoid an adverse impact on surrounding land taking into consideration water quality, wildlife, and other factors.

- Not to disturb the acreage under contract during primary nesting season for wildlife, except as approved by CCC.



Minnesota's Ecoregions

1. Southwest
2. Southeast
3. Red River Valley
4. Northwest
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