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The Practical Guide to Establishing an Eco-Buffer

Introduction

The idea that a forest is more than its trees has long been understood and is increasingly being appreciated. Research continues to re-emphasize the value of "ecosystem services" that emerge from webs of interconnected plants and animals within forest ecosystems. These services provide lasting foundations for prosperous and sustainable livelihoods, and include **soil conservation, water quality protection, groundwater recharge, snow management, nutrient cycling, food, fuel, timber, shelter for yard sites and livestock, and habitat for pollinators, pest suppressing insects, birds, and other wildlife**.

Figure 1. 3-row Eco-Buffer in Francis, SK, 16 years old (AAFC Photo).

The easiest and most effective way to ensure that these services are present on your farm or property is to protect and sustainably manage existing natural forest habitat. However, it can also be beneficial to add forest habitat to areas where certain services are desired. Establishing an "Eco-Buffer" is one way of doing this (Figure 1).

Figure 2. Conventional shelterbelt (AAFC Photo)

Eco-Buffers are plantings of perennial species (i.e. trees, shrubs, and/or herbaceous) designed to mimic natural forest habitat that provides specific ecosystem services. The Eco-Buffer concept was developed by agroforestry researchers at the Agriculture and Agri-Food Canada Agroforestry Development Centre in Indian Head, SK. The researchers found that if designed well, an Eco-Buffer, like the natural forest it mimics, can provide many ecosystem services at once and continue to sustain itself in the long-term with minimal ongoing maintenance (Schroeder, 2012). These are some advantages that Eco-Buffers have over more well-known shelterbelts (Figure 2), which are usually rows of trees and shrubs of a single species designed specifically for the services associated with reduced wind speed (i.e. sheltering, soil conservation, or snow management).

The following factsheet is intended to guide farmers, acreage owners and other land managers through the process of establishing an Eco-Buffer, so that these advantages may be realized. It does so by breaking up this process into six steps: *Goal Definition and Site Assessment, Design, Obtaining Stock, Site Preparation,* and *Maintenance.*

Goal Definition and Site Assessment

The first step is to develop an initial idea of what you'd like your Eco-Buffer to do, and then find a site that will allow you to meet your goal(s). As shown in Table 1 at the end of this factsheet, Eco-Buffers can be designed to provide a variety of services, and location is an important element of design. Eco-Buffers are often planted in

underutilized areas such as field margins, ditches, roadsides, pivot irrigation corners, yard sites, stream banks, or underperforming patches in cropland or pasture (Figure 3). Assess possible sites by asking the following questions:

- **Would an Eco-Buffer survive here?** Sites that have high levels of soil compaction, excessive vegetation competition aboveground or belowground (i.e. a thick sod mat), or regular flooding events may not be able to support any planted species or require additional site preparation (described below).
- **Which species would thrive here?** Make note of your site's moisture regime, soil texture and salinity, light exposure, natural region (e.g. foothills, parkland, prairie, or boreal), and Plant Hardiness Zone. Then, use Table 2 at the end of this factsheet to determine which species are adapted to these conditions.
- **Which services could be provided here?** Use Table 1 to help you make a list of the services that could possibly be provided by an Eco-Buffer planted at the site, taking into account prevailing wind direction, and proximity to existing habitat, water bodies, cropland, livestock areas, farmyards, and roadways. This exercise may highlight additional potential services beyond your initial goal(s).

Figure 3. Potential Eco-Buffer site (AWES Photo).

Design

When you have an idea of your site and what it can offer, the next step is to integrate your desired services into its design. For example, if you want your Eco-Buffer to provide habitat for native pollinators, consider including a diversity of native trees, shrubs, and forbs (i.e. herbaceous wildflowers) with overlapping bloom periods, so that something is in flower throughout the entire growing season. Refer to Table 1 for a more complete list of the design requirements for some of the many possible Eco-Buffer services.

Several principles can help guide this design process and allow your Eco-Buffer to mimic natural forest habitat that provides long-lasting, self-sustaining functionality. These principles have been learned through observations of natural forests and past experience with establishing Eco-Buffers. They include:

- **Species diversity**. Choose species with different characteristics, such as suckering ability, fruiting/flowering periods, growth rate, nitrogen fixation ability, deciduous/evergreen, shade/drought/salt tolerance, presence of thorns, rooting depth, etc. (see Table 2).
- **Structural diversity between AND within rows**. Shelterbelts are typically planted with one species per one row. In contrast, Eco-Buffer rows should be filled with species of different heights and growth rates (e.g. long-lived trees, fast-growing "pioneer" trees, tall shrubs, and short shrubs) to create a layered texture (Figure 4).
- **High density.** Eco-Buffers are planted at a far greater density than shelterbelts, with 1m (3') spacing recommended within rows and 1.5-2.5m (5-8') spacing between rows. This density does not compromise plant growth if the other principles are followed (Schroeder, 2012).
- **Native dominated.** Choose species that are native to your area wherever possible. Non-natives may be added

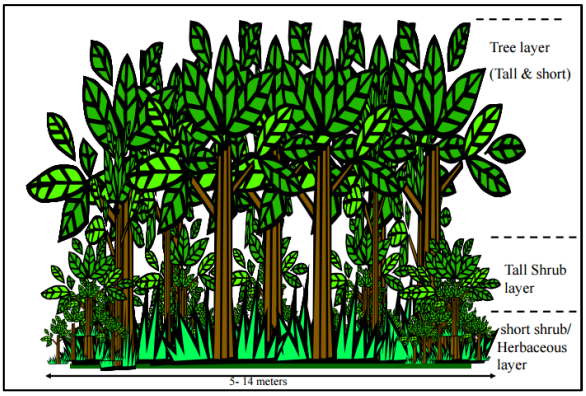

Figure 4. Eco-Buffer rows are structurally complex, providing a "layered" texture (AAFC Illustration).

for functions that cannot be provided by natives (e.g. food-producing cultivars).

- **Connected to existing habitat.** If possible, Eco-Buffers should link up or at least connect to existing forested habitat. This will facilitate the transfer of pollen and seed between Eco-Buffer and existing habitat, improving the genetic diversity and long-term resilience of both.
- **At least 6m (20') between long-lived trees.** Long-lived trees such as spruce, pine, fir, green ash, or Manitoba maple will become part of the climax ecosystem of the Eco-Buffer. It is important to leave enough space in between them, as long-term competition will reduce their lifespan.
- **Mostly smaller shrubs in outside rows.** Favouring smaller shrubs in the outside rows will make for a more gradual transition from Eco-Buffer to cropland/pasture, reducing turbulence from wind and maximizing sun exposure

When you have an idea of what to plant and where to plant it, sketch out your design using a piece of graph paper, or a computer program such as Google Earth Pro or Microsoft Excel. Figure 5 below shows some example designs of 3- and 5-row Eco-Buffers made in Microsoft Excel.

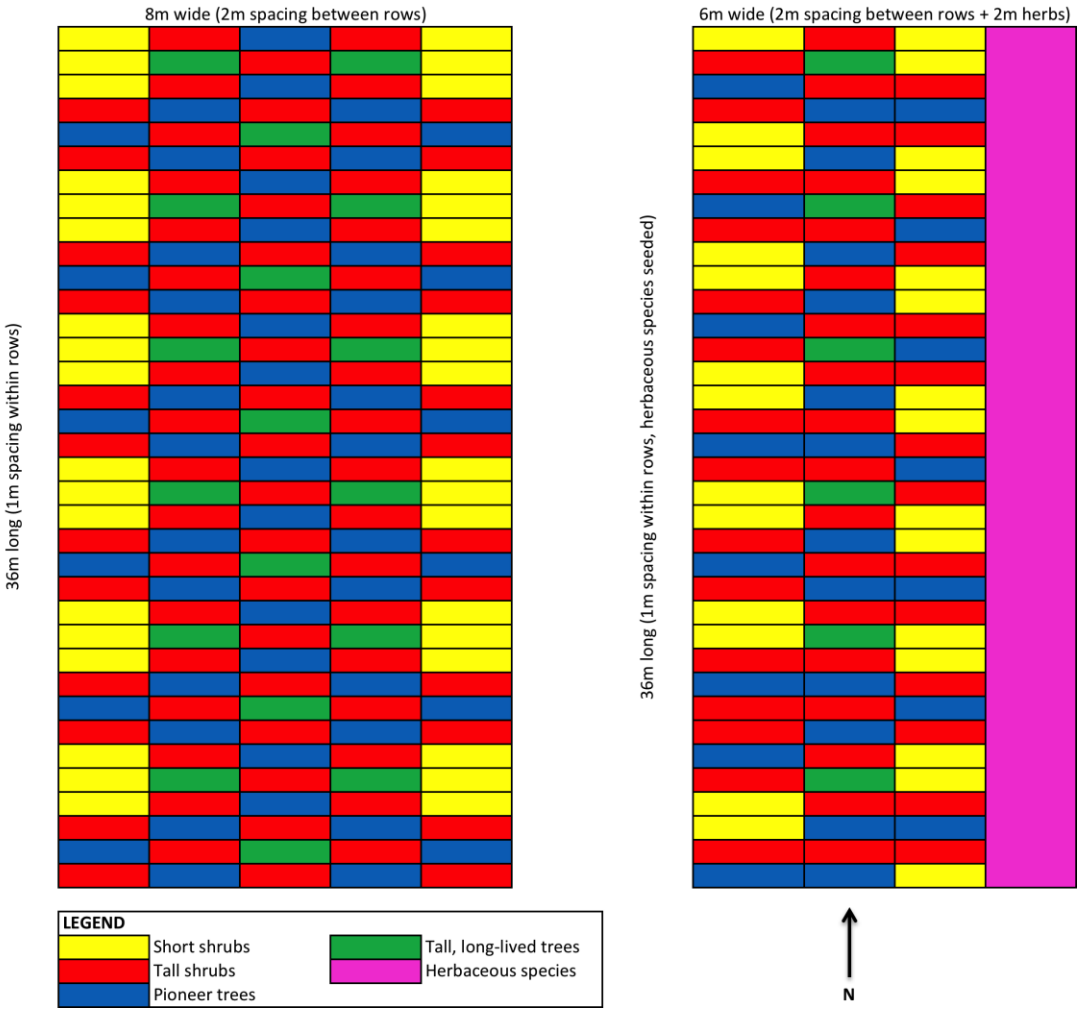

Figure 5. Example designs of a 5-row Eco-Buffer (left) and a 3-row ecobuffer with a 2m strip of herbaceous species (right). Note that that these are only examples, and Eco-Buffers should be customized according to site conditions and desired services (see Table 1) (AWES Illustration).

Obtaining Stock

Typically, Eco-Buffers are planted with small **container plug** or **bare root stock** seedlings. These seedlings are 15-60cm (6-24") tall, usually cost between $1 and $3, and should be ordered in the fall or winter prior to planting to ensure availability. Refer to the Alberta Native Plant Council website (http://anpc.ab.ca/) for an up-to-date list of native plant nurseries.

Other stock types include **stem cuttings** and **seed**. Stem cuttings can be harvested and successfully planted for certain species (i.e. willow, red-osier dogwood, balsam poplar, and plains cottonwood), while seeding is usually recommended if herbaceous species (e.g. native grasses and forbs) are desired. Refer to AWES' *Manual for Riparian Forest Buffer Establishment in Alberta* for more information on these stock types.

Site Preparation

Site preparation is highly recommended to reduce competition from weeds and grasses. If planting into grass, till the future area repeatedly in the fall prior to planting and then again in the spring of planting until sod clumps are removed and the soil is black and crumbly. Herbicides can help with this process.

Note that in contrast to shelterbelt site preparation, plastic mulch application is generally **not** recommended for Eco-Buffers because it can inhibit root suckers from capturing the site. Therefore, sites with high levels of above- or belowground competition from existing vegetation may need to be tilled for an entire growing season before planting, particularly if herbaceous species (e.g. native grasses and forbs) are being seeded.

Planting

Seedlings can be planted either by hand with a planting shovel or with a tree planting tractor attachment (available for rent from many counties in Alberta). With proper organization and direction, teams of hardy volunteers or professional tree planters can be valuable assets particularly for larger scale projects (>500 seedlings). The following steps can help guide the planting process:

1. **Sort your stock.** Prior to the day of planting, sort the stock that you ordered/harvested into bundles according to the species types designated in your planting design (Figure 6). For example, you might want to separate out long-lived trees and shorter shrubs from the rest of the species, as these have particular planting locations according to the principles outlined above.
2. **Stake out the planting area.** Before planting, measure and mark out the locations of the future Eco-Buffer rows using wooden stakes or pin flags.
3. **Plant "location-specific" species (if planting by hand)[1].** Begin by planting species that have a specified place in your design. These will likely include long-lived trees planted every 6 meters along each row, and shorter shrubs planted on the outer rows. Depending on your design, they could also include high-value species (e.g. fruit producers) that require specific microhabitats, or clumps of flowering species planted together to facilitate pollination.

Figure 6. Sorting bare root stock into appropriate species types (AAFC Photo).

[1] If you are planting the majority of species with a mechanical tree planter, then location-specific species should be staked out and planted by hand after the rest of the species are planted to avoid damaging them with the planter.

4. **Plant the rest of the species.** After the "location-specific" species are in place, fill in the gaps in your rows with the remaining species. Although it is possible to prescribe specific locations for every seedling being planted, this is not usually necessary and can bog down the overall process. In particular, avoid becoming too concerned with the placement of fast-growing trees and shrubs, as these species will quickly spread from their original locations anyways.
5. **Water seedlings after planting.** Watering seedlings shortly after planting alleviates transplant stress and settles them into the soil, increasing survival rates. The easiest way to do this is to plant directly before a rain, but mobile irrigation systems such as water trucks, hoses, or sprinklers can be more reliable.

Seeding can also take place at the same time that seedlings are planted. However, note that seeding should be avoided in areas that will be maintained by tilling, such as within or between rows of seedlings (see Maintenance below).

Maintenance

One of the main "selling features" of Eco-Buffers is that over time they become self-sustaining and thus require minimal long-term maintenance. However, **achieving a self-sustaining Eco-Buffer very much requires initial maintenance**, usually over the first two growing seasons after planting. Generally, an Eco-Buffer maintenance plan involves:

- Lightly tilling (no more than 5cm (2") in depth) in between the rows 2-3 times per year for the first couple of years, using a small disker (ideally) or rototiller pulled by a garden tractor. This will provide the majority of required weed control, and stimulate root suckering in certain species (see Table 2 for a list of suckering species) by slightly wounding their roots.
- Controlling weeds *within* rows using a hoe, scythe, or weed eater during the first couple of years after planting. A pre-emergent herbicide such as Linuron may also be spot-applied in the fall when seedlings are dormant.
- Both forms of weed control can usually be stopped after two years to allow root suckers to fill in the spaces between and within the rows (Figure 7). If suckers are not filling in quickly, weed control can continue for an extra season or herbaceous species (e.g. native grasses and forbs) can be seeded to provide cover.

Figure 7. 5 years after planting a shelterbelt (left) and an Eco-Buffer (right). Suckering species have completely filled in Eco-Buffer rows (AAFC Photo)

Note that the Eco-Buffer may also need to be watered in the event of a drought and protected from wildlife and livestock if any are present in your area. In both cases, this management is most important during the first couple of years after planting, although livestock can cause significant damage even to full-grown trees and shrubs if they are able to access them for sustained periods of time.

Finally, maintaining areas seeded with herbaceous species typically involves mowing repeatedly over the first 2-4 growing seasons to prevent fast-growing annual weeds from going to seed. Weeding out perennial weeds by hand or through spot spray may also be required.

Conclusion

Establishing an Eco-Buffer is more complex than establishing a shelterbelt. It is also more expensive, requiring around twice the number of seedlings for a given length. However, the benefits of the initial investment are significant, and will begin to be felt as maintenance is phased out after two years. At this point, the site should increasingly become "captured" by suckering trees and shrubs that shade out weeds and provide shelter for slower growing long-lived trees. As the Eco-Buffer continues to mature, a diversity of birds, small mammals, insects, and soil microbes will take up residence and spread seed, pollinate, and cycle nutrients both within it and in the surrounding landscape. If the Eco-Buffer is well designed, after about ten years it will be difficult to tell that it was in fact a planted Eco-Buffer and not a remnant strip of natural forest running through your land.

Figure 8. It is no longer possible to tell which species were planted and which came in naturally in this 14 year old Eco-Buffer (AWES Photo).

Useful References

Previous Eco-Buffer Research

Schroeder, W. 2012. Eco-Buffers: A high density agroforestry design using native species. In Proceedings: Forest and Conservation Nursery Association, Denver CO, USDA Forest Service RMRS-P-68. p. 72-75.

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AWES, 2018. Recommended Native Pollinator Friendly Plants for The Aspen Parkland Region Of Alberta. https://www.awes-ab.ca/publications/native-pollinator-friendly-plants/

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Agriculture and Agri-Food Canada, 2010. Shelterbelts: Design Guidelines for Farmyard, Field, Roadside, Livestock, Wildlife, and Riparian Buffer Plantings on the Prairies. http://publications.gc.ca/collections/collection_2010/agr/A125-2-2010-eng.pdf

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Water Quality Protection

Wonneck, L., Zeran, S., Renton, J., and Peterson, K. 2017. *Manual for Riparian Forest Buffer Establishment in Alberta*. Agroforestry and Woodlot Extension Society, http://www.awes-ab.ca/

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Food Provisioning

Jacke, D., and Toensmeier, E., 2005. Edible Forest Gardens: 2 Volume Set. Chelsea Green: White River Junction, VT.

Table 1. Examples of Eco-Buffer functions and their corresponding design recommendation

Function	Recommended Location	Recommended Composition	Recommended Layout
Shelter for livestock or yard sites	Main zone of shelter will be 10-15X the height downwind. Main zone of snow trapping will be 2X the height downwind – do not locate important infrastructure (e.g. roads, buildings) in this zone if the windspeed is high prior to hitting the buffer.	Deciduous and coniferous trees and shrubs.	Plant species to achieve 40-60% porosity evenly distributed throughout height (typically 3-5 rows). Plant smaller shrubs on windward side. Orient perpendicular to prevailing winds.
Soil conservation and snow distribution on downwind fields	Main zone of shelter will be 10-20X the height downwind. Main zone of snow trapping will be 2X the height downwind.	Deciduous and coniferous trees and shrubs.	Plant species to achieve 40% porosity evenly distributed throughout height (typically 2-3 rows). Orient perpendicular to prevailing winds. Plant smaller shrubs on windward side.
Water quality protection	Downslope of land-use activities with potential to contribute pollutants/nutrients	Plants with deep binding roots (e.g. trees, shrubs, as well as sedges, cattails, and bulrushes if area is riparian). Include salt tolerant species if pollutants have a high salt content (e.g. road salts).	Orient perpendicular to the slope. Recommended buffer widths from activities with high potential to contribute nutrients are 20m (65') for permanent water bodies with glacial till substrate, 50m (165') for permanent water bodies with alluvial substrate, and 6m (20') for ephemeral water bodies.
Flood risk reduction and groundwater recharge	Within riparian areas, or in areas of spring runoff.	Riparian plants with deep binding roots (e.g. trees, shrubs, sedges, cattails, and bulrushes).	Buffer should ideally be as wide as the 100-year floodplain.
Beneficial insect habitat	Connect to or locate near existing habitat. Locate near benefitting crops (<150m).	Native flowering species with high pollen/nectar resources and diverse shapes, sizes, colours, and bloom periods. Hollow-stemmed plants, decadent trees and shrubs, and bunch grasses for nesting and overwintering sites.	If possible, plant individuals of the same species together in small clumps (3-8 individuals per clump). Orient to maximize morning sun exposure – i.e. taller species on north or west side.
Wildlife habitat	Connect to or locate near existing natural habitat	A variety of native tree, shrub and herbaceous species that are diverse in terms of size, shape, age, coniferous/deciduous, and blooming/fruiting period.	Create structural diversity by interspersing species of different shapes and sizes together in different ways.
Nutrient cycling	Locate near benefiting crops (<20m).	Diverse native trees and shrubs. Favour those that associate with mycorrhizal fungi, and/or fix nitrogen.	Plant so that nitrogen fixing species are nearest to the benefitting crop.
Food, forage and fuel provision	Select a location where provisioning species can be easily accessed for harvest or forage.	Species with desired provisioning value. Nitrogen fixing species. Fast-growing species to provide wind shelter.	Plant provisioning species in a way that they can easily be harvested or foraged (e.g. rows are often used). Plant nitrogen fixing species near to provisioning species (<20m). Place sheltering species on windward side of provisioning species.

Table 2. Characteristics and tolerances of common native trees and shrubs of the boreal forest, foothills, grassland, and parkland eco-regions of Alberta.

* Note that forage value may vary significantly for different species of livestock and wildlife

Scientific name	Common name	Natural region (B boreal forest, F foothills, G grassland, P parkland)	Plant type (LT long-lived tree, PT pioneer tree, TS tall shrub, SS small shrub, V vine)	Height (m)	Width (m)	Growth rate (F fast M medium S slow)	Flower period (Ap April M May Jn June Jl July Au August)	Fruit/seeds available (type) (Sp spring, Su summer, F fall, W winter)	Forage value* (G good, F fair, P poor, T toxic)	Traits (N nitrogen fixer, Sp spreads fast, St salt tolerant, Su suckering)	Soil texture (C clay, L loam, S sand)	Moisture tolerance (D dry, A average, M moist, W wet)	Exposure (F full sun, P partial shade, S shade)
Abies balsamea	Balsam fir	B, F	LT	15-25	6-8	S	n/a	(cone) F, W, Sp	P		C, L, S	M	F, P, S
Acer negundo	Manitoba maple	G, P (eastern)	LT/PT	12-20	10-15	F	M	(samara) F, W	P	Sp, St	C, L, S	D, A, M	F, P
Alnus incana ssp. Tenuifolia	River alder	B, C, F, P	PT/TS	2-8	2-4	F	Ap, M	(nutlet) F, W	P	N	C, L	M, W	F, P
Alnus viridis ssp. Crispa	Green alder	B, F, P	TS	2-5	2-5	F	Ap, M, Jn	(nutlet) F, W	P	N	C, L	M, W	F, P
Amelanchier alnifolia	Saskatoon	B, F, G, P	TS	2-5	2-4	M	M, Jn	(pome) Su	G	Su	C, L, S	A, M	F, P
Andromeda polifolia	Bog rosemary	B, F	SS	0.1-0.4	0.1-0.4	S	M, Jn	(capsule) Su, F, W	T	Su	L, S	M, W	F, P
Arctostaphylos uva-ursi	Common bearberry	B, F, P	SS	0.1-0.2	0.8-1.5	M	M	(drupe) Su, F, W	P	St	L, S	D, A	F, P
Artemisia cana	Sagebush	G, P	SS	0.4-1	0.4-1	F	Jl, Au	(achene) F, W	F	Su	L, S	D, A, M	F
Betula occidentalis	Water birch	B, F	PT/TS	3-9	2-4	F	Ap, M	(nutlet) F	F		C, L, S	M, W	F, P
Betula papyrifera	White birch	B, F, P	PT	10-15	5-8	F	Ap, M	(nutlet) F	F		C, L, S	D, A, M	F, P
Betula pumila	Dwarf birch	B, F, P, R	TS	2-3	2-3	M	M, Jn	(nutlet) S, F	F		C, L, S	M, W	F
Chamaedaphne calyculata	Leatherleaf	B	SS	0.2-1	0.2-1	M	M, Jn	(capsule) Su, F, W	P		C, L, S	M, W	F, P
Clematis ligusticifolia	Western clematis	F, G	V	3-6	N/A	M	Jl, Au	(achene) F	P/T		L, S	D, A, M	F, P
Clematis occidentalis	Purple clematis	F	V	1-3	N/A	S	M, Jn, Jl	(achene) Su, F	P/T		C, L, S	D, A, M	F, P
Cornus sericea	Red osier dogwood	B, F, P	SS	1-3	1-3	F	Jn, Jl	(drupe) Su, F	G	Su	C, L, S	A, M	F, P, S
Corylus cornuta	Beaked hazelnut	B, F, P	SS	2-3	1-3	S	Ap, M	(nut) Su, F	F	Su	C, L, S	A, M	F, P
Crataegus chrysocarpa	Round-leaved hawthorn	G	TS	3-6	3-6	M	M, Jn	(pome) F, W		St, Su	C, L, S	D, A, M	F
Dasiphora fruticosa	Shrubby cinquefoil	B, F, G, P	SS	0.6-1.5	1.5	M	Jn, Jl, Au	(achene) F, W	P		C, L, S	D, A, M	F, P
Elaeagnus commutata	Wolf willow	B, F, G, P	SS	0.5-4	0.5	M	Jn, Jl	(drupe) Su, F, W	F	N, St, Su	C, L, S	D, A, M	F
Empetrum nigrum	Crowberry	B, F	SS	0.1-0.4	0.1-0.4	M	M, Jn, Jl	(drupe) Su, F, W	P		C, L, S	D, A, M	F, P
Fraxinus pennsylvanica	Green ash	G, P (eastern)	LT	12-20	10	F	M	(samara) F, W	P	St	C, L, S	D, A, M	F
Juniperus communis	Ground juniper	B, F, P	SS	0.3-1.5	1.3	S	n/a	(cone) Sp, Su, F, W	P	St	C, L, S	D, A	F
Juniperus horizontalis	Creeping juniper	B, G, P	SS	0.1-0.3	5	M	n/a	(cone) Sp, Su, F, W	P	St	C, L, S	D, A	F
Larix laricina	Tamarack	B, F	LT	6-20	6-10	M	n/a	(cone) F, W	P		L, S	M, W	F
Lonicera dioica	Twining honeysuckle	B, F, P	V	1-3	N/A	M	M, Jn	(berry) Su	P		C, L, S	D, A, M	F, P
Lonicera involucrata	Bracted honeysuckle	B, F, P	SS	1-2	1	M	M, Jn, Jl	(berry) Su, F	P		C, L, S	M, W	P
Picea glauca	White spruce	B, F, P	LT	15-25	4-7	M	n/a	(cone) F, W, Sp	P		C, L, S	A, M	F, P, S
Picea mariana	Black spruce	B, F	LT	7-20	3-4	S	n/a	(cone) Sp, Su, F, W	P		C, L, S	M, W	F, P
Pinus banksiana	Jack pine	B, F	LT/PT	9-22	3-7	F	n/a	(cone) Sp, Su, F, W	P		L, S	D, A	F
Pinus contorta	Lodgepole pine	B, F, P	LT/PT	12-25	3-7	F	n/a	(cone) Sp, Su, F, W	P		L, S	D, A	F
Populus balsamifera	Balsam poplar	B, F, G, P	PT	15-25	8-12	F	Ap	(capsule) Su	F	St, Su	C, L, S	M, W	F
Populus deltoides	Plains cottonwood	G	PT	20-25	12-16	F	Ap, M	(capsule) Sp, Su	F	Su	C, L, S	M, W	F
Populus tremuloides	Trembling aspen	B, F, G, P	PT	15-25	6-9	F	Ap	(capsule) Sp, Su	G	Sp, Su	C, L, S	A, M	F, P
Prunus pensylvanica	Pin cherry	B, F, G, P	PT/TS	2-7	1-5	F	M, Jn	(drupe) Su, F	F	Sp, Su	C, L, S	D, A, M	F
Prunus virginiana	Chokecherry	B, F, G, P	TS	2-7	1-5	F	M, Jn	(drupe) Su, F	F/T	Sp, Su	C, L, S	D, A, M	F, P
Rhamnus alnifolia	Alder-leaved buckthorn	B	SS	0.5-2	0.5-2.5	M	M, Jn	(drupe) Su, F			C, L, S	M, W	P, S
Rhododendron groenlandicum	Common labrador tea	B, F	SS	0.4-1.5	0.4-1.5	M	Jn, Jl	(capsule) Su, F	P		C, L, S	M, W	F, P, S
Rhus trilobata	Skunkbush	G	SS	1.5-2	1.5-2	M	M	(drupe) Su, F, W	P	Sp, St, Su	C, L, S	D, A, M	F
Ribes americanum	Wild black currant	B, F, P	SS	0.9-1.2	1.5-2.5	M	M, Jn	(berry) Su	P		C, L, S	M, W	F, P, S
Ribes aureum	Golden currant	G	SS	1-2.5	1-2	M	M, Jn, Jl	(berry) Su	P		C, L, S	D, A, M	F, P
Ribes glandulosum	Skunk currant	B, F, P	SS	1	1.5-2.5	M	M, Jn	(berry) Su	P		C, L, S	M	F, P
Ribes hirtellum	Smooth gooseberry	B, F, P	SS	0.9	1.5-2.5	M	M, Jn	(berry) Su	P		C, L, S	M	F, P
Ribes hudsonianum	Northern black currant	B, F, P	SS	0.5-1	1.5-2.5	M	M, Jn	(berry) Su	P		C, L, S	M, W	F, P
Ribes oxyacanthoides	Wild gooseberry	B, F, G, P	SS	0.3-1.5	1.5-2.5	M	M, Jn	(berry) Su	P		C, L, S	M	F, P
Ribes lacustre	Bristly black currant	B, F, P	SS	0.5-1	1.5-2.5	M	M, Jn	(berry) Su	P		C, L, S	M, W	F, P
Ribes triste	Wild red currant	B, F, P	SS	1	1.5-2.5	M	M, Jn	(berry) Su	P		C, L, S	M, W	F, P

Scientific name	**Common name**	**Natural region** (B boreal forest, F foothills, G grassland, P parkland)	**Plant type** (LT long-lived tree, PT pioneer tree, TS tall shrub, SS small shrub, V vine)	**Height** (m)	**Width** (m)	**Growth rate** (F fast M medium S slow)	**Flower period** (Ap April M May Jn June Jl July Au August)	**Fruit/seeds available (type)** (Sp spring, Su summer, F fall, W winter)	**Forage value*** (G good, F fair, P poor, T toxic)	**Traits** (N nitrogen fixer, Sp spreads fast, St salt tolerant, Su suckering)	**Soil texture** (C clay, L loam, S sand)	**Moisture tolerance** (D dry, A average, M moist, W wet)	**Exposure** (F full sun, P partial shade, S shade)
Rosa acicularis	Prickly rose	B, F, G, P	SS	0.5-2	0.5-2	M	M, Jn	(hip) Su, F, W	P	Sp, Su	C, L, S	D, A, M	F, P
Rosa arkansana	Prairie rose	G, P	SS	0.3	0.3	M	Jn, Jl, Au	(hip) Su, F, W	P	Sp, Su	C, L, S	D, A, M	F
Rosa woodsii	Wood's rose	B, F, G, P	SS	0.5-2	0.5-2	M	Jn	(hip) Su, F, W	F	Sp, Su	C, L, S	A, M	F, P
Rubus idaeus	Wild raspberry	B, F, G, P	SS	1-2	1-2	M	Jn, Jl	(berry) Su	P	Sp, Su	C, L, S	A, M	F
Salix athabascensis	Athabasca willow	B, F	SS	0.6-1.3		M	M, Jn	(capsule) Su	G		C, L, S	M, W	F
Salix bebbiana	Beaked willow	B, F, G, P	SS/TS	0.5-10		F	Ap, M	(capsule) Sp, Su	G		C, L, S	A, M, W	F, P
Salix candida	Hoary willow	B, F, P	SS	0.3-1		M	M, Jn	(capsule) Su	G		C, L, S	M, W	F
Salix discolor	Pussy willow	B, F, P	TS	2-6		F	Ap, M	(capsule) Sp, Su	G		C, L, S	M, W	F
Salix exigua	Sandbar willow	B, F, G, P	TS	4-6		F	M, Jn	(capsule) Su	G	Sp, Su	C, L, S	M, W	F, P
Salix lasiandra	Shining willow	B, F	TS	4-11		F	M	(capsule) Su	G		C, L, S	M, W	F
Salix maccalliana	Velvet fruited willow	B, F, R	SS/TS	1-5		F	M, Jn	(capsule) Su	G		C, L, S	M, W	F
Salix myrtillifolia	Myrtle leaved willow	B, F, R	SS	0.1-0.6		M	M, Jn	(capsule) Su	G	Sp, Su	C, L, S	M, W	F
Salix pedicellaris	Bog willow	B, F, R	SS	0.2-1.5		M	M, Jn	(capsule) Su	G	Sp, Su	C, L, S	M, W	F
Salix petiolaris	Meadow willow	B, F, G, P	SS/TS	1-6		F	M, Jn	(capsule) Su	G		C, L, S	M, W	F
Salix planifolia	Flat leaved willow	B, F, P	SS/TS	0.2-4		F	M, Jn	(capsule) Su	G		C, L, S	M, W	F
Salix pseudomonticola	False mountain willow	B, F, P	SS/TS	1-6		F	M, Jn	(capsule) Su	G		C, L, S	A, M	F
Salix pseudomyrsinites	Firmleaf willow	B, F, P	SS/TS	1-7			M, Jn	(capsule) Su	G		C, L, S	M, W	F
Salix pyrifolia	Balsam willow	B, F, P	SS/TS	0.4-4			M, Jn	(capsule) Su	G		C, L, S	M, W	F
Salix scouleriana	Scouler's willow	B, F	TS	3-20		F	M, Jn	(capsule) Su	G		C, L, S	D, A, M	F
Salix serissima	Autumn willow	B, F	SS/TS	1-5			M, Jn	(capsule) Su	G		C, L, S	M, W	F
Sambucus racemosa	Red elderberry	F	TS	3-4	2-4	M	M, Jn	(drupe) Su, F	F		C, L, S	A, M	F, P
Sarcobatus vermiculatus	Greasewood	G	SS	0.5-2	0.5-2	M	Jn, Jl	(achene) F, W	T	St	C, L, S	D, A, M	F
Shepherdia argentea	Silver buffaloberry	G	TS	3-5	2-4	M	M, Jn	(berry) Su, F	P	N, Sp, St, Su	C, L, S	D, A	F
Shepherdia canadensis	Canada buffaloberry	B, F, G, P	SS/TS	1-3	1-2	M	Ap, M, Jn	(berry) Su, F, W	P	N	C, L, S	D, A, M	F, P
Sorbus scopulina	Western mountain-ash	B, F	SS/TS	1-4	1-4	M	Jl	(berry) F, W	F	St	C, L, S	A, M	F, P
Spiraea alba	Narrow-leaved meadowsweet	B, F, G, P	SS	1	1	M	Jn, Jl, Au	(follicle) Su, F, W	P	Su	C, L, S	A, M	F, P
Spiraea lucida	White meadowsweet	B, F, P	SS	0.2-0.8	0.2-0.8	M	Jn, Jl	(follicle) Su, F, W	P	Su	C, L, S	D, A, M	F, P
Symphoricarpos albus	Snowberry	B, F, P	SS	0.5-1	1-1.3	M	Jn, Jl	(drupe) Su, F, W	P	Sp, St, Su	C, L, S	D, A, M	F, P
Symphoricarpos occidentalis	Buckbrush	B, F, G, P	SS	1	1	M	M, Jn	(drupe) Su, F, W	P	Sp, St, Su	C, L, S	D, A	F, P
Vaccinium myrtilloides	Velvetleaf blueberry	B, F	SS	0.1-0.6	0.1-0.6	M	Jn, Jl	(berry) Su, F	P	Su	L, S	M	F, P, S
Vaccinium vitis-idaea	Bog cranberry	B, F	SS	0.3	1	M	Jn, Jl	(berry) Su, F, W	P	Su	L, S	M	F, P
Viburnum edule	Low-bush cranberry	B, F, P	SS	0.5-2	0.5-2	M	M, Jn	(drupe) Su, F, W	P		C, L, S	M, W	F, P, S
Viburnum opulus	High-bush cranberry	B, F, P	SS/TS	2-4	2-4	M	M, Jn	(drupe) Su, F, W	P		C, L, S	A, M	F, P, S