Appendix C: Undesirable Species Management Strategies

APPENDIX C: Undesirable Species Management Protocols

There are a range of effective treatment options for invasive species management. Management decisions should consider cost, effectiveness, and collateral impacts. Some treatment options may not be practical due to lack of equipment access, disruption to visitor access, or disturbance to adjacent properties. Mechanical and chemical treatments, prescribed burns, seeding, biological control, and cultural approaches can be considered as management options. A species' flowering period often dictates the timing of management strategies. Properly timed combinations of treatment methods offer the best control of invasive species. Management calendars are shown throughout this appendix for each of the species below, and are combined by management strategy at the end of this appendix. Information about estimated costs can be found in Section IV.C of the report. Descriptions of the management strategies are found in Appendix B. Recommendations for management treatments to control the most common invasive species in the valley are described in this appendix for the following species.

Forbs

- Garlic Mustard
- Common Burdock
- Canada Thistle
- Bull Thistle
- Crown Vetch
- Leafy Spurge
- Motherwort
- Birds-foot Trefoil
- Purple Loosestrife
- Sweet Clover

Grasses

- Smooth Brome
- Reed Canary Grass
- Narrow-leaf and Hybrid Cattail

Woody Species

- Oriental Bittersweet
- Japanese Barberry
- Honeysuckle
- Common and Glossy Buckthorn
- Siberian Elm
- Russian Olive

The Long-term Management strategy is similar for all of the following species. Monitoring and ongoing management is almost always required to maintain control of previously treated locations and to identify and treat new invasive species. Interrupting seed development is the key to controlling most invasive species. If the flowering stage is halted, so too is seed production. Seedlings and saplings should be treated before they are large enough to develop seed. When inflorescences are present, removing them can prevent additional seed inputs to the area. Management procedures must continue long enough to deplete viable seeds remaining in the soil. Generally, control should not begin unless a long-term management plan is in place. Revegetation with desirable species should occur after invasive species have been removed, and typically should not be attempted until the end of the second season of management. Maintaining a vigorous, diverse plant community is the best defense against invasive species.

FORBS

Garlic Mustard (Alliaria petiolata)

Description: Garlic mustard is native to Europe. In Minnesota, it is listed as a restricted noxious weed. Garlic mustard invades woodlands, riparian forests, and disturbed ground along forested roadsides, trails and waterways. Its proliferation in Minnesota native ecosystems has had a significant impact on forest understory habitats. It is able to spread aggressively, create large monocultures, outcompete native forest ground layer species, and displace ecologically important components of the native flora. Habitat suitability for native wildlife is severely reduced where garlic mustard has taken hold.

Garlic mustard is an early season biennial herb with coarsely toothed, alternate, triangular to heart-shaped leaves that release a garlic-like smell when crushed. Evergreen basal rosettes are produced from seeds the first year. In the second year, the rosettes mature and bolt, producing erect, 1- to 3-foot tall stalks. Small 4-petaled white flowers develop into slender 1-2.5 inch long seed capsules, each with a single row of oblong black seeds. Garlic mustard reproduces via the prolific seed it generates. A single garlic mustard plant drops hundreds of seeds that remain viable for up to five years. The seeds are readily dispersed from the tall stiff flowering stems that catapult the seed away from the mother plant, via soil displacement during erosion events, and when soil containing the seed is picked up on the feet of wildlife or humans or on tools and equipment. Eradication of garlic mustard may not be feasible. However, there are areas that are a higher priority for control. Strategies for control include maintaining zero tolerance for seed production in priority areas. Volunteers can help monitor and prevent establishment of new isolated populations.

Mechanical:

- By Hand: If a population of garlic mustard is small enough or found growing among native wildflowers, the best option for control is to manually pull the plants before they develop seed and bag them for removal. Garlic mustard should be bagged in black plastic bags and laid in the sunlight if flowering or in seed.
- Mowing: If the infestation is too large or too dense for hand removal, weed whipping or mowing are viable control options. It is essential to mow before the plant flowers because garlic mustard will continue to develop seeds even after cutting. Mowing with a flail mower is recommended, because it which will shred the plant and prevent seed production.

  If the plant is flowering or past, mowing will spread the seed and increase infestation. Careful attention should ensure that sensitive native plants around the mowed areas are not impacted. Mowed garlic mustard may form new flowers, but the plant will be shorter and will produce fewer seeds. A second mowing is sometimes needed to treat the regrowth.

Natural Disturbances:

- Prescribed burns: In fire dependent ecosystems, prescribed burning is an effective management tool against first year garlic mustard. Second year garlic mustard will potentially sprout following a burn, so follow up treatment is required. Prescribed fire is best used as part of an integrated management approach in which mechanical or chemical control are used as a follow-up treatments. Spot treating small populations with a propane torch is also effective on garlic mustard seedlings.

Chemical (Foliar Herbicide):

- Glyphosate: Garlic mustard can be chemically treated with glyphosate in early spring before flowering or in the late fall when native plants are dormant. Glyphosate is a nonselective herbicide and will kill all plants including forbs, grasses, sedges and woody species.
- Triclopyr: This broadleaf specific herbicide can be used to control garlic mustard when native species are dormant, or when garlic mustard is growing among grasses and sedges. Monitoring and follow-up treatment will be necessary.

Garlic Mustard Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Mow									
Don't mow									
Flowering									

Common Burdock (*Arctium minus*)

Description: Burdock is a biennial native to Europe. In the first year, the plant forms a rosette, similar in appearance to rhubarb. The rosette can reach 3 feet across, with large, heart-shaped leaves. In its second year, the plant develops a branched, 3 to 7-foot tall hollow stem. The grooved stem can be green or reddish-purple in color, with tapered leaves along its length. The leaves are dark green, coarse-textured above and woolly beneath, with wavy margins. The plant arises from a large, fleshy taproot. Flowering occurs from July until frost. The pink to purple flowers of this member of the Aster Family occur in heads that are about ¾ inch wide. The thistle-like flower heads are surrounded by spiny bracts with hooks at the tip. Flowers heads are clustered at the ends of branches and in leaf axils along the stem. The mature flower heads become burs that facilitate seed dispersal by clinging to clothing and hair. A single plant produces an average of 15,000 seeds.

Common burdock occurs along roadsides and ditch banks, as well as in pastures and other disturbed areas, where the plant effectively outcompetes desirable species by shading them out with its large basal leaves. Burdock generally prefers moist, nitrogen-rich soils, but will grow in a variety of soils.

Mechanical

- By Hand: Cultivation can be used to control small plants. For larger plants, the entire plant needs to be removed which can be challenging because of the long taproot. Severing the tap root as deep as possible with a shovel or parsnip predator can knock the plant back, if not kill it completely.
- Mowing: The rosette should be mowed or the flowering portion should be cut off when it is in bud or has recently flowered. This will prevent the plant from seeding or, at the very least, will significantly reduce the amount of seed the plant produces. Mowing the plant when it begins to bolt (produce a flower stalk) will allow time for a second mow later in the year to control any resprouts. If burdock has already gone to seed, clip and bag the seed heads to prevent seed dispersal.

Natural Disturbances

- **Prescribed burns** can kill young burdock and kill the tops of older plants if there is sufficient fuel to carry a burn. Fire will also accelerate removal of nutrients, such as nitrogen, which favor burdock. If performed long-term, prescribed burns can alter the conditions in fire adapted plant communities to favor the establishment of native species that can compete with burdock.

Chemical:

- Foliar Herbicide: Apply 2,4-D, glyphosate, or triclopyr as a foliar application to the first year rosette. Foliar herbicide treatment may only kill the tops of plants. Follow-up treatment may be required.
- Cut Stem Herbicide: Cut the plant below the basal leaves and stump treat the tap root with glyphosate before the bud stage.

Common Burdock Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Cut Stem Herbicide									
Mow									
Flowering									

Canada Thistle (*Cirsium arvense*)

Description: This Eurasian member of the Aster Family was introduced to North America in the early 1600s, and is now one of the most tenacious and economically important agricultural weeds. It is listed as a noxious weed in 43 states. This perennial has an extensive root system with horizontal roots extending 15 feet or more and vertical roots which may grow up to 15 feet deep. Its extensive rhizomatous growth allows it to form large clones. Canada thistle's ability to rapidly spread by both rhizomes and seed make it particularly difficult to manage.

Canada thistle emerges as a small rosette in late-April to early-May, but new shoots can emerge during most of the growing season. Leaves are irregularly lobed with small spines along the margins. The upper surface of mature leaves is dark green, with a paler underside. Mature plants reach 2 to 5 feet in height, and begin flowering in June. The numerous magenta florets are arranged in ¾"-1" diameter heads. By July, the seeds are windborne on their delicate pappus, and can be found throughout the landscape. Canada thistle may produce 1,000 to 1,500 seeds per flowering stalk and seeds can remain viable in the seed bank for up to twenty years. Canada thistle grows in meadows, prairies, fields, pastures and waste areas with a variety of site conditions including full sun or part-shade exposure, and wet or dry soils.

Mechanical:

- Mowing or cutting Canada thistle may be effective if repeated on a regular basis until the plant's root reserves are depleted. The optimal time to mow Canada thistle is when the buds are formed or early flowering stage. Mowing should be avoided after seeds have developed, as it may disperse the seed.
- By Hand: Clipping and bagging seed heads can be done in smaller populations.

Natural Disturbances:

- Prescribed burns: Fire can have mixed results for Canada thistle control and is best used as part of an integrated management program. Using prescribed burns to increase the health and diversity of fire dependent native plant communities is a recommended tactic.

Chemical:

- Foliar Herbicide: Treat Canada thistle with clopyralid, glyphosate, or triclopyr. Glyphosate can be used for careful spot treatment or when broadcast treating in areas with no desirable species. Clopyralid, a broadleaf herbicide for use particularly on members of the Aster and Legume family, is useful for control of Canada thistle where cover of native species is high. Herbicide should be applied during the rosette stage for best results, but can be applied up until flower buds are formed and again in the fall. Repeat treatments are required.
- Cut Stem Herbicide: Herbicide can also be applied to cut stems for treatment of small areas. It is essential to apply herbicide to each stem that may be connected by rhizomes. Any stems that are not treated will allow the clone to survive. Continued follow-up treatments will be needed.

Biological:

There are biological control agents available for thistle control. However, caution is warranted as the available weevils have been observed feeding on native thistles.

Canada Thistle Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn									
Foliar Herbicide									
Cut Stem Herbicide									
Mow									
Don't mow									
Flowering									

Bull Thistle (*Cirsium vulgare*)

Description: Bull thistle is a biennial herbaceous plant which develops a rosette in the first year, then sends up a 3 to 6 foot flowering stalk the second season. The plant is prickly, with spine-tipped lobes on the leaves and stems with prominent ridges armed with spines. The upper surface of the leaves is rough to the touch. Bull thistle is in the composite or Aster Family, so the purple florets are arranged in dense flower-heads. Seeds with their attached plumes are dispersed by wind and may persist in the seed bank for 10 years or longer. Bull thistle readily invades disturbed prairies, as well as low quality pastures, fallow fields, and roadsides. It is readily identifiable in over-stocked pastures where the livestock have grazed around it. It is not a significant problem in high quality natural areas where it cannot easily become established.

Mechanical:

- Mowing: Bull thistles can be cut or mowed prior to developing seed. If seeds have formed, the plant material should be removed from the site. Severing the tap root as deep as possible with a shovel or parsnip predator can kill the plant. This method can be used for rosettes or flowering plants.

Chemical:

- Foliar Herbicide: Bull thistles can be spot treated with glyphosate, clopyralid, triclopyr, or metsulfuron while they are in the rosette stage.

Biological:

There are biological control agents available for thistle control. However, caution is warranted as the available weevils have been observed feeding on native thistles.

Bull Thistle Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Foliar Herbicide									
Mow									
Flowering									

Crown Vetch (Coronilla varia)

Description: Crown vetch is a perennial legume native to Eurasia. It reproduces both by seed and vegetatively by rhizomes, forming large patches. Its sprawling growth habit allows it to rapidly cover and shade out native vegetation. A single plant may fully cover 70 to 100 square feet within a four-year period. Leaves are pinnately compound with 15 to 25 pairs of oblong leaflets. The two-toned pink and white flowers are arranged in umbels on long stalks. Slender finger-like seedpods develop after bloom. The mechanism of seed dispersal is not known. Animals likely play a role since some plant populations appear miles from a nearby seed source. Crown vetch blooms from May through August, and is very conspicuous with profuse pink blossoms.

Crown vetch has been used extensively in the northern two-thirds of the United States as a temporary ground cover, for erosion control, and as a green fertilizer crop. It prefers open, sunny areas; typically occurring along roadsides, other rights-of-way, and in open fields and prairies. Where it establishes, it readily displaces native plants and decreases biodiversity.

Mechanical:

- Mowing: Crown vetch can be mowed in June when the plant is flowering. Mowing slows the growth of the plant and removes thatch, making future chemical applications more efficient. Repeated mowing can be used to negatively impact the plant long-term. Plants can be pulled where infestations are small and soil conditions are amenable.

Natural Disturbances:

- **Prescribed burns** can be helpful in removing thatch to facilitate herbicide treatments. Burning can kill some small plants and can impact the growth of larger plants. However, prescribed burning is not enough to control crown vetch and should be integrated with other control methods.

Chemical:

- Foliar Herbicide: Chemical applications are currently the most effective management strategy. Glyphosate, clopyralid, and triclopyr can all be used for foliar treatment. Glyphosate is non-selective and may not be a viable choice for managing small scattered populations in established native plant communities. Clopyralid and triclopyr are both broadleaf specific and can be used where native grasses are established. Follow-up treatments will be required to ensure mature plants are controlled and to manage seedlings that establish from the seed bank.

Crown Vetch Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn/Foliar									
Foliar Herbicide									
Mow									
Flowering									

Leafy Spurge (*Euphorbia esula*)

Description: Leafy spurge is native to Eurasia. Plants are characterized white milky sap and flower parts in three's. Leafy spurge is an erect, branching, perennial herb 2 to 3½ feet tall. The smooth stems may arise in clusters from a vertical root that extends many feet into the ground. The leaves are alternate and lance-shaped on the upper stem and scale-like on the lower stem. The flowers of leafy spurge are inconspicuous and are surrounded by showy yellow-green bracts. The bracts open in late May, while the flowers bloom from June to fall.

Leafy spurge is aggressive and can completely overtake large areas of open land. Leafy spurge tolerates moist to dry soil in sun or part shade, but is most aggressive under dry conditions where competition from native plants is reduced. It is capable of invading disturbed prairies, savannas, pastures, as well as fallow fields and roadsides.

Leafy spurge reproduces readily by seeds that have a high germination rate and may remain viable in the soil for at least seven years. Its seed capsules open explosively, dispersing seed up to 15 feet from the

parent plant and may be carried further by water and wildlife. Leafy spurge also spreads vegetatively at a rate of several feet per year. The root system is complex, reaching 15 or more feet into the ground, but also spreading laterally. Buds at the base of the stem sprout when the plants are grazed or mowed.

Mechanical:

- Mowing: While mowing can deter the plant from spreading, an integrated approach that combines prescribed burning, chemical treatment, and/or biological controls is ideal.
- If biological control agents are introduced, other treatments must be carefully timed so that they don't impact the biological control agents. Spring fires can successfully reduce the number of new seedlings.

Chemical:

- Foliar Herbicide: Treating leafy spurge is tough in any situation, but when it occurs in an established prairie, it is particularly difficult to manage without collateral damage to desirable native species, even when carefully attempting to spot treat it. If the leafy spurge occurs in a discreet area, it may be necessary to sacrifice some forbs to obtain control. A mix of chemicals is most effective for treatment. Glyphosate, quinclorac, and 2,4-D are an effective mix when applied in June at flowering and again in September prior to senescence. Glyphosate is a broad spectrum herbicide and will kill both graminoids and forbs, so must be used with caution or avoided in high quality areas. Leafy spurge can also be treated with broadleaf specific herbicides, but extra care is needed to avoid impacts to native grasses. Chemical treatment will be needed for several years. Efficacy of chemical treatments may be improved when combined with prescribed fire.

Biological:

Biological control agents can be obtained and released to control spurge. The flea beetle, *Aphthona lacertosa*, has been found to be particularly effective against leafy spurge in Minnesota. Adult flea beetles feed on leafy spurge foliage, while the larvae feed on the roots, damaging or killing the plant. Control can take 3-10 years to achieve depending on the size of the site, density of the invasion, and other environmental factors. Chemical treatments can negatively impact the biological control agents, so consideration should be given to these impacts prior to incorporating herbicide treatments.

Leafy Spurge Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Mow									
Don't mow									
Flowering									

Motherwort (Leonurus cardiaca)

Description: Motherwort is a perennial, herbaceous plant in the mint family. Originally from Eurasia, it is widely established around the world due to its use as a medicinal herb. Motherwort is found in both sun and shade, often in highly disturbed sites, and is becoming particularly common and problematic in many woodland sites. Motherwort is 2 to 4 feet tall. As is typical of members of the mint family, the stem is square and the leaves are opposite. The leaves are variable in shape, with 3 or 5 sharply-pointed lobes, and deeply toothed margins. The flowers are arranged in whorls at the nodes where the leaf stalks meet the stem. The small, tubular, lavender flowers are generally hairy or fuzzy and bloom from June through August. The seeds have spiny burs that catch in clothing or animal fur.

Mechanical:

- By Hand: Digging or hand-pulling motherwort can effectively control the plant if all of the root is removed.
- Mowing: Continuous mowing or whipping can reduce the vigor of the plant over time and reduce seed production.

Chemical:

- Foliar Herbicide: Applying glyphosate or triclopyr prior to seed production can effectively control motherwort. Follow-up applications are required for plants that germinate from the seed bank.

Motherwort Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Mow									
Flowering									

Birds-foot Trefoil (*Lotus corniculatus*)

Description: Birds-foot trefoil is a low-growing perennial, native to Eurasia and North Africa. It was introduced into the United States for erosion control and livestock forage and is still sold commercially. Birds-foot trefoil is a member of the Legume Family. Its compound clover-like leaves are alternate with three oval leaflets and a pair of stipules. Bundles of yellow, pea-like flowers develop from May to August. Clusters of brown, cylindrical seed pods that resemble a bird's foot develop after flowering. Birds-foot trefoil produces a long taproot that may extend over three feet. It also has rhizomes that form secondary roots. Stolons, or modified above-ground stems, allow it to form dense mats. The plant reproduces by seeds and spreads laterally by stolons and rhizomes. Birds-foot trefoil tolerates a wide range of soil conditions and is found along roadsides, in fields, prairies, wildlife openings, and other open disturbed areas. Burning increases seed germination, allowing the plant to spread rapidly in areas where it is established.

Mechanical:

- **Mowing** is not an optimal treatment for birds-foot trefoil, which responds quickly to being mowed and will regrow within a couple of weeks. Continuous monitoring and mowing would be required to prevent it from going to seed. Continuously mowing birds-foot trefoil at a 2" height periodically throughout the year for several years may eventually kill the plant. However, doing so will obviously also harm native plants in the mowed area. In some settings, birds-foot trefoil adapts to frequent mowing by growing as a low-profile ground-hugging plant, thereby avoiding the mower blades.
- **By Hand:** Birds-foot trefoil can be hand-pulled in areas where it has only very low cover and the soils are light. Severing the tap root as deep as possible with a shovel or parsnip predator can kill the plant.

Natural Disturbances:

- Prescribed fire is not recommended as the sole management strategy because it increases seed germination. However, burning can be part of an integrated approach to increase effectiveness of other methods. A spring burn will remove thatch, exposing the soil and stimulating germination from the seed bank. This timing will increase the effectiveness of herbicide applications and accelerate the depletion of the seed bank.

Chemical:

- Foliar Herbicide: Triclopyr applied to fast growing plants before flowering, or glyphosate applied in spring before or during flowering will kill birds-foot trefoil. Clopyralid, a broadleaf herbicide selective for members of the aster and legume families, can also be used to control birds-foot trefoil. Follow-up applications will be required over several years to manage new plants establishing from the seed bank.

Birds-foot Trefoil Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Mow									
Don't mow									
Flowering									

Purple Loosestrife (Lythrum salicaria, L. virgatum)

Description: Introduced as an ornamental to North America from Europe and Asia, purple loosestrife is now an invasive species in wetlands, lakeshores, and ditches. It replaces native wetland vegetation in the habitats it invades, forming dense stands with low value for wildlife food or cover. Plants are 2-7 feet tall, with an upright habit. Leaves are slender, oblong-oval and downy, with smooth margins. Leaves are arranged on the stem in opposite pairs or in whorls of 3. Stems are variously 4, 5, or 6-sided and feel grooved to the touch. The reddish-purple, 5-7-petaled flowers are produced in spikes at the top of the plant, with some flowering from lateral stems as well. Flowering occurs in mid-summer, making the plants readily identifiable. Purple loosestrife reproduces prolifically, producing as many as 2 million seeds per plant each year. The seeds are efficiently dispersed by moving water and animals. Its root systems are

extensive, consisting of fibrous roots as well as rhizomes which allow it to spread vegetatively as well as by seed.

Mechanical:

- **Hand-pulling** or digging purple loosestrife is not recommended. Any pieces of the roots that are missed when a plant is removed by pulling or digging can resprout.
- **Mowing** could be used to reduce seed inputs, but is often not practical due to the wet site conditions that loosestrife is typically found in. Follow-up treatments will be needed to control the resprouts.

Chemical:

- Foliar Herbicide: Where purple loosestrife is established in smaller accessible populations, it could be controlled by treating it with herbicides. It may be possible to time the treatment when other herbaceous species, such as reed canary grass, are being controlled. Glyphosate formulated for use over water will likely be needed as purple loosestrife typically grows in wetlands. Herbicide treatment for purple loosestrife should be timed for July through August since the plants are readily identifiable while they are in bloom. Treating while in bloom also preempts additional seed inputs into the seed bank. Small populations can be treated by spot spraying with a glyphosate product formulated for use over water (Rodeo, Aquaneat, etc.). To ensure no seed is produced, small populations can be deadheaded as they are treated. Bag the inflorescences and remove from the site. Permits are required for treating aquatic weeds within the boundaries of state protected waters.

Biological:

Biological control is effective at reducing populations of purple loosestrife in large wetland systems. Four species of insects have been approved as biological control agents, two leaf eating beetles, a root boring beetle, and a flower feeding beetle. Biological controls will reduce the population of purple loosestrife to low levels, but will not likely eliminate it.

Purple Loosestrife Management Schedle

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Foliar Herbicide									
Cut Stem Herbicide									
Flowering									

Sweet Clover (Melilotus officinalis, M. alba)

Description: As biennials, the white and yellow sweet clovers invest in a healthy root system the first year. In the second year, new shoots emerge from the taproot. Second year plants flower from May through September. The small white or yellow pea-like flowers are crowded in narrow spikes at the tips of the flowering stems. Each flower produces one or two seeds. Seeds may remain viable in the soil for up to 30 years or more and are dispersed by runoff and stream flow. The compound leaves of sweet clover are alternate with three finely toothed, longer than broad leaflets. Sweet clover is native to Europe and Asia, but was recorded in North America as early as 1664. Sweet clover is cultivated as a forage crop and soil builder, and is also cultivated as a wildlife cover crop and for the production of honey. It is adapted to a variety of conditions, growing well in full and part sun. It prefers calcareous or loamy soils, and readily invades roadsides, abandoned fields, pastures and open natural communities such as a prairies.

Mechanical:

- Mowing: Sweet clover can be mowed or cut below the lower stems in the early flower stage before seed production has occurred. If cut low enough, the plant will typically not regrow.
- By Hand: Sweet clover can also be hand-pulled when the soils are moist and the taproot can be removed easily. Cutting first year growth in the fall can disturb the plant when it is sending most of its nutrients to its taproot, making the plant weaker the following year.

Natural Disturbances:

- Prescribed burns: Well-timed prescribed burns are a recommended control method for sweet clover. As it is a biennial, performing burns in consecutive years is optimal. An early spring season burn in April will increase germination rates of sweet clover. The following year, a late spring burn in May will kill the germinated sweet clover before it flowers and seeds. Doing this every two years can successfully control sweet clover. If the burn is not complete and thorough, spot treatment with another control method will be necessary.

Chemical:

- Foliar Herbicide: Glyphosate or triclopyr can be used to spot treat sweet clover; however, follow-up treatments might be necessary. A surfactant is also recommended. A good time to spray is before the early flower stage or in the fall when other native plants are dormant. Sweet clover can grow quite tall and foliage may be sparse, so spray drift and overspray should be noted and avoided.

Sweet Clover Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Mow									
Don't mow									
Flowering									

GRASSES

Smooth Brome (*Bromus inermis*)

Description: Smooth brome is a perennial cool season grass introduced to North American from Eurasia as a forage crop. It is able to persist through drought and occasional flooding. It grows from 2-4 feet tall with an upright habit. The ¼" wide leaf blades have a prominent W- or M-shaped construction across the blade. In the fall, the persistent leaves brown and curl on the stems. The inflorescence is an open panicle with flowers occurring on 4-10 erect branches from a main axis. Flowering occurs in June and July. When the achenes ripen, the lateral branches of the seedhead relax from their upright posture and nod sideways. Smooth brome reproduces from seed as well as by rhizomes which spread laterally through the soil. Smooth brome often occurs in native grassland habits intermixed with warm season grasses.

Mechanical:

- Mowing: Repeated mowing can be used to deter smooth brome. However, repeated mowing can have adverse effects on populations of native species as well. A more effective approach is to mow in conjunction with herbicide treatments. Mow, then allow brome to regrow before applying herbicide.

Natural Disturbances:

- Prescribed burns: Since smooth brome is a cool season grass, it may be best controlled with well-timed prescribed burns. Burns timed for late spring when smooth brome is beginning to green, but before the native grasses are actively growing, will hinder the cool season grasses. Though, burning will not kill the rhizomes. This timing is advantageous to warm season native grasses, which are slower to green-up in the spring.

Chemical:

- Foliar Herbicide: Non-selective systemic herbicides (glyphosate) or grass specific herbicides (fluazifop-p-butyl) can be used to control smooth brome, particularly where it grows in monotypic stands. Where smooth brome is mixed with native grasses and forbs, treatment is best in early spring or late fall when native species are more likely to be dormant and less susceptible to the herbicides. Fall treatments favor the transfer of the chemical to the roots, which results in better control. Another strategy is to apply a dormant overspray in areas where smooth brome provides a dense cover. A grass specific herbicide can be applied in late fall if treatment is carefully timed when cool season grasses are still actively growing and warm season grasses are dormant.

Smooth Brome Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Mow									
Flowering									

Reed Canary Grass (*Phalaris arundinacea*)

Description: Reed canary grass is a robust cool season grass that is likely circumboreal in origin. Ecotypes and/or cultivars of Eurasian origin were widely planted for use as a forage, conservation plantings, and erosion control. This species often invades and dominates native wetlands and other moist soil habitats throughout Minnesota. Reed canary grass can reach 6 feet in height, but typically lays over, forming a dense mat that smothers native vegetation. The plant is hairless. Leaf blades are ½ to ¾ inches wide, flat, rough to the touch and blue-green in color. The ligule, found at the base of the leaf blade where it joins the sheath, is long and membranous. Flowering occurs from May to mid-June. The inflorescences are 3-16 inches long and initially purple tinged, with lax branches. As the seeds ripen, the inflorescences turn a tawny beige color and the branches close up against the main axis. The shiny seeds rain out of the inflorescences when disturbed. Seeds disperse on water, and are moved by humans and animals as well. The plants are clonal, spreading aggressively by rhizomes. Reed canary grass is adaptable, growing in dry upland soils and part shade as well as moist to wet soils and full sun where it is most aggressive. Reed canary grass management should only be tackled if there are adequate resources for both initial treatment and ongoing follow-up treatment. It is not reasonable to attempt to control a discrete area of reed canary grass within a larger system invaded by the grass, as there will continue to be inputs of seed and perhaps even invasion by rhizomes.

Chemical:

- Foliar Herbicide: The preferred method to control dense stands of reed canary grass is to broadcast treat it with glyphosate in early to mid-fall while the cool season plants are still actively growing and the chemical will be transferred to the roots and rhizomes. Glyphosate formulated for use over water should be used for reed canary grass control where it occurs in wetlands. In upland areas, glyphosate or a grass specific herbicide such as fluazifop-p-butyl can be used. When treating dense clones of reed canary grass, there is little chance of overspray onto desirable species. However, care should be taken to avoid overspray when treating smaller patches of reed canary grass that occurs within a remnant or restored native plant community. Where feasible, mowing prior to herbicide treatment can facilitate application. Mow prior to seed production or in late summer for a fall foliar herbicide treatment. If the population is especially dense, one herbicide treatment is not likely to be enough for complete control.

Mechanical:

- Mowing: In theory, intensive mowing, grazing, or haying could diminish the resources of this robust perennial grass, but in practice this is difficult to achieve. Reed canary grass is typically found in environments that are too wet to mow. In addition, this method will not eliminate reed canary grass. Typically, it will only set reed canary grass back temporarily allowing some other species to occupy the space. If ongoing maintenance does not occur, reed canary grass will recover and dominate the plant community again. Mowing can be used to facilitate herbicide treatment on invaded areas that are accessible by equipment. Mow in advance of herbicide treatment, allowing adequate time for reed canary grass to grow back.

Natural Disturbances:

- **Prescribed burns** can be used to remove thatch and prepare a previously treated area for follow-up treatment. Mowing can be used in lieu of a prescribed fire to remove the dead canopy of previously treated reed canary grass. Though, mowing may be limited by access on wet sites, whereas prescribed burns are not.

Reed Canary Grass Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Mow									
Flowering									

Narrow-leaf and Hybrid Cattail (*T. angustifolia, Typha* x *glauca*)

Description: The cylindrical velvet brown flower heads of cattails are readily identifiable, but distinguishing the native broad-leaf cattail from the invasive narrow-leaf cattail and hybrid cattail requires closer study. The narrow-leaf and hybrid cattail tend to grow in deeper water and form denser clones. The hybrid grows taller, 6-9 feet compared to 3-9 feet for broad-leaf and narrow-leaf cattail. The narrow-leaf cattail has narrower leaves, less than ½ inch wide compared to ½ - 1 inch for broad-leaf cattail. The leaves of the hybrid are variable, but range between those of the broad-leaf and narrow-leaf cattail. In cattail flower spikes, the female flowers form the brown club. The male flowers, which occur above the female flowers, are yellow when loaded with pollen, but soon wither after the pollen is shed. In narrow-leaf and hybrid cattail, the male flowers are separated from the female flowers by a gap of 1-1.5 inches. In broad-leaf cattail spikes, the male flowers are contiguous with the female flowers.

The thick starchy rhizomes of narrow-leaf cattail intertwine to form a dense mat. In some wetlands, the mat may be floating. Cattails reproduce by wind-borne seeds and rhizomes. The altered hydrology of urban wetlands favors the establishment and growth of narrow-leaf cattails, allowing them to dominate the wetland flora.

Chemical:

- Foliar Herbicide: Narrow-leaf cattails growing in wet pockets along pathways and boardwalks are easy candidates for control. Application of glyphosate in late-summer to fall when the herbicide will be transferred to the rhizomes increases the efficacy of the treatment. Glyphosate products formulated for use over water should be used. **Wick application, spot treatment, or broadcast** may be appropriate techniques. Treatment of other invasive species such as reed canary grass and purple loosestrife may occur at the same time.

Mechanical:

- **Mowing** should be performed after an initial herbicide treatment to remove thatch and facilitate follow-up herbicide treatments. Though, mowing is typically difficult to implement due to the wet habitat preferred by narrow-leaf cattails.

Natural Disturbances:

- **Prescribed burns** offer an alternative to mowing, and should be performed in conjunction with herbicide treatments.

Narrow-leaf and Hybrid Cattail Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Mow									
Flowering									

WOODY SPECIES

Oriental Bittersweet (*Celastrus orbiculatus*)

Description: Oriental bittersweet is a recent threat to Minnesota native habitats, having escaped from cultivation. It is a robust vine that climbs by twining around a support. The vine can grow up to 60 feet or more. The vines have been reported to be so vigorous that they can overwhelm and kill a tree either by blocking light to the canopy or by causing it to be more susceptible to windthrow and breakage when loaded with ice or snow. The vines may also girdle trees as they twine around the trunk. Stems are gray-brown with raised lenticels and may grow as big as 4 inches around. Vegetatively, it is very similar to and difficult to distinguish from the native American bittersweet. The leaves of both species are alternate, simple, and range from oblong to nearly round in shape with rounded teeth on the margins.

Male and female flowers occur on separate plants, so only the female plants will have the showy fruit for identification. American bittersweet flowers and fruits occur on the terminal ends of the stems, while those of oriental bittersweet occur in the leaf axils along the stem. The fruits of American bittersweet are red with an orange capsule, while those of oriental bittersweet are red with a yellow capsule. The two species are known to hybridize, and the hybrids should be controlled as well. Oriental bittersweet, like its native counterpart, spreads by suckering as well as by seed.

Mechanical:

- By Hand: Small populations can be controlled by digging in locations where that treatment is feasible.
- Mowing is not recommended and may stimulate additional suckering from the root system.

Chemical:

- Cut Stem Herbicide: Cutting and treating the stumps will likely be the most effective control method. Cut stems may be treated with glyphosate or triclopyr. Cut stump treatment can occur from mid-summer through winter.
- Foliar Herbicide: In areas with extensive establishment of seedlings and young plants, a foliar herbicide treatment can be used.

Oriental Bittersweet Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Foliar Herbicide									
Cut Stem Herbicide									
~~Mow~~									
Flowering									

Japanese Barberry (*Berberis thunbergii*)

Description: Barberry is a small spiny shrub, growing 3-5 feet tall. It may be spindly in habit when growing in deep shade, or more compact when growing in part-shade and sun. The small, rounded leaves taper to the stem and occur in small clusters associated with one of the spines along the stems. Insignificant yellow flowers open in May. They occur singly or in groups of 2-4, hanging beneath the branches. Fruits are bright red oblong berries which may persist into winter if they aren't eaten by birds. Barberry has the ability to spread by layering, when its lower branches root into the ground.

Japanese barberry, along with many of its horticultural cultivars are sold as ornamentals in Minnesota and other states. Japanese barberry was recently added to the Minnesota Department of Restricted Noxious Weeds list, which means that the species type and several cultivars of *Berberis thunbergii* are no longer sold legally in the state.

Mechanical:

- By Hand: Small populations of individual plants can be removed with a shovel, mattock, or weed wrench. Because the lower stems may have rooted down, care must be taken to uproot all stems for complete control.
- Mowing: Forestry mowing in winter may control barberry if the shredded stems are exposed to dessicating conditions. However, follow-up foliar herbicide treatment is often necessary. Cut stems should be treated with herbicide to prevent the shrub from resprouting.

Chemical:

- Cut Stem Herbicide: Cut-stump treatment with glyphosate or triclopyr is effective at controlling barberry. The herbicide should be applied to the stump without delay for optimal effectiveness. Barberry may be difficult to control due to its ability to layer. If all of the rooted stems are not cut and treated, barberry may survive cut stump treatment.
- Foliar Herbicide: Foliar herbicide treatments using glyphosate or triclopyr can also be effective, but care needs to be taken to avoid collateral damage to native species. Timing foliar treatments while native species are dormant is necessary to minimize damage to desirable species.

Common Barberry Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Basal Bark Herbicide									
Cut Stem Herbicide									
Flowering									

Honeysuckle (Lonicera tartarica, L. morrowii, L. x bella)

Description: Honeysuckle species are most often found on forest edges and in forest interiors, but are also found in lakeside and riparian habitats and in a variety of waste places such as abandoned agricultural land and road and railroad rights-of-way. They grow in poorly drained to well-drained soils, and tolerate low nutrient availability. Exotic honeysuckle species, with their invasive nature and early leaf-out, often replace native forest shrubs and herbaceous plants. They shade out herbaceous ground cover and deplete soil moisture. Some research suggests that honeysuckles inhibit the growth of other plants in their vicinity through allelopathy. Honeysuckle reproduces primarily through seeds which are dispersed by birds that eat the fruits. Honeysuckle is one of the first plants to leaf out in the spring and one of the last species to retain its leaves in the fall.

It can be challenging to correctly identify *L. tatarica*, *L. morrowii*, or the hybrid of the two species, *L.* x *bella*. Since they are managed the same way, it is not necessary to make a positive identification to species. *Lonicera tatarica* (native to central Russia) has 1-2.5 inch long, glabrous, ovate to oblong leaves. Its white-pink flowers are glabrous. The fruits are red or rarely yellow. Height can reach 9 feet. The gray-green leaves of *Lonicera morrowii* (native to Japan) are soft-pubescent beneath. Its flowers are pubescent, white fading to yellow on densely hairy peduncles. Its fruits are red, and its height can reach 6 feet. The

hybrid *L*. x *bella* has intermediate characteristics. The leaves are slightly hairy beneath. Its flowers are pink fading to yellow, on sparsely hairy peduncles. Its fruits are red or rarely yellow, and its height can reach 15 feet.

Mechanical:

- Mowing: Brush mowing or cutting honeysuckle without herbicide treatment is ineffective unless done continuously for several years. The lower branches tend to grow horizontally along the ground, making it challenging for mowers to effectively cut the plant. Combining mowing with a fall herbicide application is very effective.

Natural Disturbances:

- Prescribed burns: Repeated prescribed burns will kill young honeysuckles and potentially girdle and top kill larger plants. However, carrying fire through areas of high infestation is often a challenge due to insufficient fuel. Combining prescribed fire with other control methods is preferable.

Chemical:

- Cut Stem Herbicide: Cut-stump treatment with glyphosate or triclopyr is effective at controlling honeysuckle. The herbicide should be applied to the stump without delay for optimal effectiveness. Honeysuckle can be difficult to control due to its ability to layer. Layering occurs when plant stems lay on moist ground and root from adventitious buds. If all of the rooted stems are not cut and treated, honeysuckle may survive cut stump treatment.
- **Foliar herbicide** treatments can also be effective, but care needs to be taken to avoid collateral damage to native species. Timing foliar treatments using glyphosate or triclopyr while native species are dormant is necessary to minimize damage to desirable species.

Honeysuckle Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Basal Bark Herbicide									
Cut Stem Herbicide									
Flowering									

Common Buckthorn (*Rhamnus cathartica*), Glossy Buckthorn (*Frangula alnus*)

Description: Both common buckthorn and glossy buckthorn were introduced to North America as ornamental shrubs for use in fence rows and as wildlife habitat. Both buckthorn species were valued for their hardiness and ability to thrive in a variety of soil and light conditions. They also have a dense habit making them ideal for use as privacy hedges in densely populated urban areas. As an invasive in native habitats, common buckthorn tends to form dense, even-aged thickets, crowding and shading out native shrubs and herbs. Dense buckthorn invasions also prevent native tree and shrub regeneration.

Common buckthorn is a shrub or small tree that can grow up to 22 feet in height and up to a 10" diameter trunk. Though, stems are typically in the range of 2"-5" diameter. The crown of mature plants is spreading and irregular. The bark is gray to brown, rough textured when mature and may be confused with that of plum trees in the genus *Prunus*. When cut, the inner bark is yellow. Twigs are often tipped with a spine. In spring, dense clusters of 2 to 6 inconspicuous yellow-green, 4-petaled flowers emerge near the bases of the leaf stalks. Male and female flowers are borne on separate plants. Small black fruits, about 1/4 inch in cross-section and containing 3-4 seeds, develop after blooming. Leaves are broadly oval, with toothed margins, rounded or pointed at the tip, with 3-4 pairs of up-curved veins. The upper and lower leaf surfaces are hairless. Leaves appear dark, glossy green on the upper surface and stay green late into fall, even after the leaves of most other deciduous species have fallen. Glossy buckthorn does not have a spine at its twig tips. Its leaves are not toothed, and the undersides of the leaves are hairy. The trunks and stems have lighter colored lenticels. It also produces dark fruits on the female plants. The fruits of both species, if not eaten by birds, typically fall directly beneath the shrubs, creating a dense understory of seedlings characteristic of common buckthorn stands. The fruit is eaten by birds and mice, and is known to cause a severe laxative effect that helps distribute the seeds far from the parent plant.

Buckthorn seeds can stay viable in the soil for up to 5-7 years. Dispersal of buckthorn seeds from adjacent properties also makes long-term monitoring and management essential in all formerly invaded ecosystems.

Common buckthorn is primarily an invasive species of upland habitats, but it also occurs within wetlands. It prefers lightly shaded conditions, invading open oak woods, and wood edges; it may also be found in prairies, open fields, and wetlands. It is tolerant of many soil types: well drained sand, clay, poorly drained calcareous, neutral or alkaline, wet or dry. Management strategies vary depending on the terrain and timing of control. Glossy buckthorn prefers wetland habitats, but will grow in upland conditions as well. Initial control of glossy buckthorn typically occurs occur in winter when the ground is frozen, allowing access to all areas.

Mechanical:

- Mowing: On level upland areas, **forestry mowing** is an efficient method to remove the standing buckthorn species. If the stems are shattered close to the base and conditions after forestry mowing are very cold and dry, the wood is prone to drying out and may not be capable of resprouting. On steep slopes and wetlands, **brush saws** can be used to cut the stems. Areas cut by either method will require a follow-up foliar herbicide treatment, as it is likely that a percentage of the stems will resprout. Mowing repeatedly for several years, often multiple times per year, will eventually kill buckthorn. Smaller buckthorn and seedlings will require fewer mowings.

- By Hand: Small saplings can often be hand-pulled if the soil conditions are right. Manually pulling smaller buckthorn with weed-wrenches or levering it out with a shovel is a useful method in smaller populations or when volunteers are involved. Though, weed-wrenches and shovels create disturbance in the soil which can expose new weed seed. It is possible in some settings that disturbance may facilitate establishment of suppressed native species as well.

Natural Disturbances

- **Prescribed burns** can be a useful tool as part of an integrated buckthorn management approach in fire dependent plant communities. Burning provides a means to kill buckthorn seedlings and set back mature plants. However, it can be difficult to continue a fire because there is not enough ground cover beneath the buckthorn to provide fuel.

Chemical:

- Cut Stem Herbicide: There are several strategies to chemically treat buckthorn. Applying triclopyr or glyphosate to the cut stump of buckthorn is highly effective. Frill cutting and spraying larger buckthorn is also effective
- Foliar Herbicide: Triclopyr can also be applied as a foliar spray in late summer, or in fall when other desirable woody species have dropped their leaves. Cutting buckthorn in June and returning to foliar spray in the fall when the stumps have resprouted is an effective way to kill it.
- Basal Bark Herbicide: Buckthorn can also be treated by spraying around the base of the trunk with triclopyr.

Common Buckthorn Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Basal Bark Herbicide									
Cut Stem Herbicide									
Flowering									

Glossy buckthorn

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Basal Bark Herbicide									
Cut Stem Herbicide									
Flowering									

Siberian Elm (*Ulmus pumila*)

Description: Siberian Elm is a small or medium-sized tree with spreading branches. Its bark is gray-brown with shallow furrows. Its twigs and buds are nearly hairless. The leaves are elliptical, prominently veined and single-toothed. When young, the leaves are softly pubescent and arranged alternately. The leaves are rarely more than 2 inches long, distinguishing it from native elms that typically have greater than 3 inch long leaves. Siberian elm is tolerant of dry, nutrient poor soil. The winged seeds are wind-dispersed in spring, soon after flowering. Seedlings grow rapidly and may form thickets in disturbed areas.

Mechanical:

- Thinning: Trees may be girdled with a chainsaw and allowed to die over time. Girdle in late-spring to mid-summer while the sap is flowing and the bark peels away from the sapwood. Use caution that the girdling cut is not made too deep, as this will cause the tree to resprout from the base. If the tree resprouts, the sprouts can be cut and stump treated.
- By Hand: Seedlings can be hand-pulled and saplings can be removed with a weed wrench or shovel. A regime of periodic prescribed fire will control seedlings in fire dependent plant communities.

Chemical:

- Cut Stem Herbicide: Trees may be cut stump treated in fall and winter. Cut stems may be treated with glyphosate or triclopyr.
- **Basal Bark Herbicide** treatment with triclopyr is also effective.

Siberian Elm Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Girdle									
Foliar Herbicide									
Basal Bark Herbicide									
Cut Stem Herbicide									

Russian Olive (Elaeagnus angustifolia)

Description: Russian olive is a deciduous, nitrogen fixing small tree/large shrub. It grows up to 25 feet tall. Its crown is generally rounded, but often unruly in appearance. Twigs have a terminal spine. Leaves are alternate, lance-shaped and silvery-white in color. Fragrant yellow flowers bloom in late spring and produce a hard, olive-like fruit. The trees are tap-rooted. Russian olive was introduced to North America for use in shelterbelt plantings and highway right-of-ways. It is hardy, tolerant of a range of soil conditions and capable of sprouting from adventitious buds on the crown and root suckers.

Mechanical:

- By Hand: Seedlings can be hand-pulled and saplings can be removed with a weed wrench or shovel. To be effective, all roots must be removed.
- Mowing: Repeated mowing of small plants initiated in summer can be an effective control.

Natural Disturbances:

- Prescribed burns: A regime of periodic prescribed burns controls seedlings in communities that are managed with fire.

Chemical:

- Cut Stem Herbicide: Trees may be cut stump treated in fall and winter. Cut stems may be treated with glyphosate or triclopyr.
- **Basal bark Herbicide** spray around the lower stem with triclopyr when dormant.

Russian Olive Management Schedule

	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Burn*									
Foliar Herbicide									
Basal Bark Herbicide									
Cut Stem Herbicide									

CALENDARS BY MANAGEMENT STRATEGY

Burn	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Garlic mustard									
Burdock									
Canada thistle									
Crown vetch									
Leafy spurge									
Motherwort									
Birds-foot trefoil									
Sweet clover									
Smooth brome									
Reed canary grass									
Narrow-leaf cattail									
Honeysuckle									
Buckthorn									
Siberian elm									
Russian olive									

Foliar Herbicide	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Garlic mustard									
Burdock									
Canada thistle									
Bull thistle									
Crown vetch									
Leafy spurge									

Foliar Herbicide	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Motherwort									
Birds-foot trefoil									
Purple loosestrife									
Sweet clover									
Smooth brome									
Reed canary grass									
Narrow-leaf cattail									
Oriental bittersweet									
Honeysuckle									
Buckthorn									
Siberian elm									
Russian olive									

Basal Bark Herbicide	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Buckthorn									
Siberian elm									
Russian olive									

Cut Stem Herbicide	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Canada thistle									
Oriental bittersweet									
Japanese barberry									
Honeysuckle									
Buckthorn									

Cut Stem Herbicide	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Siberian elm									
Russian olive									

Mow	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Garlic mustard									
Burdock									
Canada thistle									
Bull thistle									
Crown vetch									
Leafy spurge									
Motherwort									
Birds-foot trefoil									
Sweet clover									
Smooth brome									
Reed canary grass									
Narrow-leaf cattail									
Oriental bittersweet									

Don't Mow	April	May	June	July	Aug	Sept	Oct	Nov	Dec-Mar
Garlic mustard									
Canada thistle									
Leafy spurge									
Birds-foot trefoil									
Sweet clover									

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