

Most Common Invasive Species of Pictured Rocks National Lakeshore



2014



Beech Bark Scale

(*Cryptococcus fagisuga*)

nymph .03 mm

Uninfected Beech Bark



**Beech
Leaf**



Beech Bark Scale (*Cryptococcus fagisuga*)

Life History: Adult beech scales are small (1/16 inch) insects related to aphids, oval and yellow, but appear white because they are covered with a protective white, waxy “wool.” Adult scales are wingless and parthenogenetic (no males are known – females clone each other). Females lay four to eight oval, yellow eggs underneath their protective wool. The egg stage lasts at least 20 days; then the first instar, or crawler (1/32 inch), which is the only mobile stage of beech scale, emerges. The active crawlers search for suitable feeding sites and settle in cracks and crevices in the bark. Often crawlers are dispersed passively via wind currents, or possibly on animals, and infest other trees. Upon settling, crawlers feed and produce protective wool, underneath which they overwinter (late-season eggs also may overwinter). Short-lived second instars emerge in the spring and soon molt to adults.

The beech scale insect feeds on the tree by inserting its mouthpart through the bark of the beech tree and into the underlying live tissues where it can suck up sugars and other nutrients. These feeding sites create tiny wounds and the *Nectria* fungus can enter the tree through these wounds. Known predators in North America on the scale include the twice-stabbed ladybird beetle and several species of mites, but none have had much impact on reducing populations.

Distribution: Native to Europe where it feeds on European Beech. Accidentally introduced to U.S. in 1890 on an ornamental beech in Nova Scotia. By 1932, it was found in Maine; by the 1960s it had spread to most of New England and New York. By 1975, it was in Pennsylvania, then New Jersey, Tennessee and as far south as North Carolina. Movement has been slow because insects do not fly, but are carried by wind, animals, birds, and by humans on infested firewood. Found in Ohio and West Virginia in the 1980s. In Michigan in 1990, and the UP by 2000. Found at Pictured Rocks in 2001. The native range of beech includes most of the East Coast down through the Carolinas and west to east Texas, and extends into Wisconsin, southern Illinois and eastern Missouri.

Impacts on Environment: Has killed 50% of the beech trees in New England and severely damaged many more. However, it appears that beech is not as important and abundant component of New England forests, so the impact has not been as great. In some environments, such as here in Michigan, beech is the only mast producing tree, so loss of beech will have profound impacts on wildlife.

Beech provide food and habitat for over 40 species of mammals and birds. Future studies will be needed to determine what this impact has. BBD has the potential to alter the species composition of the forests it occupies.

Young trees are generally (but not always) resistant to the disease; they usually become infected after reaching 5 – 8 inches in diameter.

At PIRO: Killing wave has been moving from east to west. Most beech trees in the eastern part of the park are dead. Mortality here is expected to reach 90%. Trees are dying even before the *Nectria* fungus is present. An infected tree may contain a million or more scale insects. Trees here at PIRO have been infected since 2001 – takes about 5 - 7 years for trees to die and then fall. More trees fall down here than other parts of the UP, perhaps because of our wind. 2012 has been a record year for downed trees. The reason our mortality is greater than that of New England beech is not known – perhaps due to density, soil, climate, etc. Park staff are currently identifying and monitoring possible resistant trees.

Control: Pesticides are not useful on BBD, as the insects exude a protective high-wax covering that resists the chemicals. For high value landscape trees, it is recommended that scale insects be physically scrubbed and high pressure washed. Management practices of removing infected beeches in a stand have been effective in preventing spread of the disease. Identifying and propagating resistant trees remains the best chance to preserve the species as a functional component of the forest.

About Beech Trees: American beech grows best in rich, moist soils and is found in bottomlands and upland forests. Co-dominant tree of northern hardwood forests with sugar maple. Grow well under sugar maple; sugar maple grows well under beech. Loss of beech will affect forest structure in unknown ways. Don't produce nuts until at least 40 years old. At least 40 mammals and birds feed on the oil-rich nuts. Long-lived – can live 300 years or more. Highly shade tolerant. A much-revered tree in the British Isles; important in Celtic mythology.



**Common
Burdock**
(*Arctium minus*)



Common Burdock (*Arctium minus*) Composite Family

Life History: A biennial thistle with purple flowers and distinctive prickly seed heads (burs). First year rosette leaves can be quite large, up to 2 ½ feet across. During the second year, burdock flowers July through October. Flowers are clumped on a central stalk, which can be up to 6 feet. Stem leaves are large, heart-shaped and very hairy underneath. At first glance, burdock appears very similar to Cocklebur, but burdock seeds are rounder and softer. Each bur contains about 40 seeds. Once the seed has ripened, the whole plant turns brown and dies. Also known as Lesser Burdock.

Distribution: Common burdock is native to Europe and was introduced to the U.S. in the 1700s, possibly for medicinal purposes. Found now in nearly all 50 states. It is present in grasslands and forests, and along roadsides, ditches, stream banks, pastures, and disturbed habitats. It prefers sunlight and moist, well-drained soils, though it can tolerate most soil conditions.

Uses: The inspiration for Velcro. The taproot and immature flower stalks are edible. It is also used in traditional and herbal medicine for various ailments.

Impact on the Environment: Common burdock can become a problematic invader of pastures, hay fields and open prairie ecosystems. It acts as a secondary host for pathogens, such as powdery mildew and root rot, which affect economically important plants. It moves quickly into disturbed areas and crowds out native species. Burs can cling to the hair of wildlife, interfere with feathers and cause mouth irritation if eaten by animals. The above-ground portions of the plant may cause dermatitis in certain humans.

At PIRO: Found in large populations in several areas of the park. Has a limited impact on the environment for now, but could become more serious if populations increase. Currently treated intermittently with chemical herbicides.

How to Control: First year plants are easy to pull up. Second year plants are controlled by cutting and bagging the flowering heads before seeds are produced. Common burdock can also be controlled by constant mowing before plants go to seed. Most broadleaf herbicides are also useful for control.



Cypress Spurge
(*Euphorbia cyparissias*)





Leafy Spurge

(Euphorbia esula)

Cypress Spurge (*Euphorbia cyparissias*) Spurge Family

Life History: An herbaceous-to-woody perennial that grows to 12 inches. Greenish-yellow flowers, surrounded by conspicuous flat bracts, cluster in bunches at the end of stems. Linear leaves are ½ to 1 ¼ inches long and 1/8 inch wide. A young plant may resemble a young pine or spruce tree. All parts of the plant emit a milky sap when broken. **Leafy spurge** is similar in appearance, but is much taller and has wider leaves.

Distribution: Native to Europe and introduced to the U.S. as an ornamental plant in the 1860s. Found now in nearly all 50 states. Commonly found in the dry, gravelly soil of roadsides, pastures, and meadows. Cypress Spurge thrives in open, disturbed areas rather than forests or highly cultivated soil.

Uses: Ornamental.

Impact on the Environment: Like most non-native plants, spurge infringes upon the growth of native species. It is known to be harmful to cattle and horses if eaten, but not sheep. Has the ability to form monocultures in highly sensitive areas, such as dunes.

When broken, cypress spurge, like all spurges, emits a milky sap. Other sources allege that the milky juice of the plant is toxic to humans and causes irritations on contact with the skin. The sap may also irritate the eyes, mouth, and gastrointestinal tract.

At PIRO: Both species are here at PIRO, although cypress spurge is causing the most concern at the moment. It is currently located at Grand Sable Lake and it is important it does not spread into the dunes. A small population of leafy spurge is located in the field across from the Grand Sable Visitor Center.

How to Control: Both spurges can be difficult to control; several species of European insects were released in North America in this effort. Certain beetles and fleas have been found to be effective, but those may pose even more risk to native plants than the removal of the spurge itself.



**Eurasian
Watermilfoil**
(Myriophyllum spicatum)



Eurasian Watermilfoil (*Myriophyllum spicatum*) Water Milfoil Family

Life History: A perennial, submersed aquatic plant with feather-like leaves. Eurasian watermilfoil typically has 12 to 21 pairs of leaflets. The native northern watermilfoil, with which it is often confused, usually has 5 to 9 pairs. The mature leaves are typically arranged in whorls of four around the stem. The plant usually grows from 3 – 10 feet, but can grow much longer. Yellow flower spikes often stand above water for pollination, and then re-submerge.

Unlike many other plants, Eurasian watermilfoil does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces vegetatively by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or by boats.

Distribution: Native to Europe and Asia. Introduced accidentally to U.S. around 1900. Found now in nearly all 50 states and most of Canada. Eurasian water milfoil grows best in fertile, fine-textured, inorganic sediments in shallow parts of lakes. In less productive lakes it is restricted to areas of nutrient-rich sediments.

Impact on the Environment: The introduction of milfoil can drastically alter a water body's ecology. Milfoil forms very dense mats of vegetation on the surface of the water. These mats interfere with recreational activities such as swimming, fishing, water skiing, and boating. The sheer mass of plants can cause flooding and the stagnant mats can create good habitat for mosquitoes. Milfoil mats can rob oxygen from the water by preventing the wind from mixing the oxygenated surface waters to deeper water. The dense mats of vegetation can also increase the sedimentation rate by trapping sediments. When milfoil invades new territory, typically the species diversity of aquatic plants declines. While some species of waterfowl will eat milfoil, it is not considered to be a good food source. Milfoil reproduces extremely rapidly and can infest an entire lake within two years of introduction to the system. The plant's floating canopy can also crowd out important native water plants.

Eurasian watermilfoil does not spread rapidly into habitats where native plants are well established and tends to exist in habitats where native species grow

poorly or cannot adapt. Altered waterways have created an unnatural, disturbed environment where milfoil thrives. Although this plant can create short-term habitat improvement in habitat for fish and waterfowl, the long-term effects are considered to be more damaging.

At PIRO: Eurasian watermilfoil has been found along Sand Point, but so far has not spread to the major inland lakes of the park. This plant has already infested many lakes on the Hiawatha National Forest and other locations in Alger County.

How to Control: Once milfoil becomes well-established within a body of water, it is difficult or impossible to remove. In some cases milfoil can be controlled using aquatically approved herbicides or by mechanical means, such as a harvester or cutter. Milfoil is able to reproduce very successfully and rapidly through the formation of plant fragments. In the late summer and fall the plants become brittle and naturally break apart. These fragments will float to other areas, sink, and start new plants. Milfoil will also grow from fragments created by boaters or other disturbances during any time of year. A new plant can start from a tiny piece of a milfoil plant. This is why milfoil can so easily be transported from lake to lake on boat trailers or fishing gear. Once established in its new home, water currents may carry milfoil fragments and start new colonies within the same waterbody.

Prevent Spread: The best way to prevent the spread is to thoroughly clean all parts of boats, trailers, car wheels, watercraft apparatus or sports equipment that come in contact with lake water. Fragmented plant pieces can easily get transported accidentally from lake to lake through human actions.



Forget-Me-Not

(Myosotis sylvatica)



Garden Forget-me-not (*Myosotis sylvatica*) Borage Family

Life History: A perennial (and sometimes biennial) plant with 5-petaled flowers. Grows to 1 foot tall. The most common color is blue, but it may range from blue to pink to white. It produces seeds readily and spreads quickly. Blooms in spring to early summer. Also called woodland forget-me-not. A similar species, *Myosotis scorpioides* (also called common or true forget-me-not) grows in wetter areas.

Distribution: Native to Eurasia. Brought to the US for ornamental purposes, where it is a common garden flower. Currently found in the Northeast, upper Midwest and Pacific Northwest. Invasive patches are likely from plants that have escaped from gardens and other areas of human habitation.

Uses: Forget-me-nots were used as remembrance flowers for war dead. Also used by Freemasons in Germany as a message not to forget the poor and desperate.

Impact on the Environment: It can dominate forest understories, especially in openings and along edges. Invades in dense patches and crowds out native flora, particularly spring wildflowers. The velcro-like seeds are easily dispersed by people or animals.

At PIRO: Considered highly invasive as it is one of the few non-native plants to infest the deep forest. Particularly bad at Miners Castle area. Control methods are aimed at keeping it out of more pristine backcountry areas, and do not target developed areas as much. Both species are here at the park – *M. scorpioides* is noticeable in the wet ditch areas along Sand Point Road.

How to Control: Since the seeds are easily tracked to new sites by people, it is important to clean off boots and laces while hiking. Seeds in the soil can persist for years. Plants are easy to pull before seed is set. Herbicide use is more effective on larger areas.



Garlic Mustard
(*Alliaria petiolata*)





Garlic Mustard (*Alliaria petiolata*) Mustard Family

Life History: Biennial plant that grows up to 4 feet tall in second year (or as short as 4 inches tall), and leaves give off a garlic odor as crushed. Flowers are small white, and in the cruciform (cross-shaped) pattern of members of this plant family. Flowers form at the terminal of a single stalk. First year is a rosette of kidney-shaped leaves with scalloped toothing. Rosettes stay green throughout the winter. Mature second-year leaves are triangular and sharply toothed. Flowers April through June. The fruit is an erect, slender, four-sided pod called a *siliqua*, containing two rows of small shiny black seeds that are released when the pod splits open. A single plant can produce hundreds of seeds, which scatter as much as several meters from the parent plant.

In Europe as many as 69 species of insects and 7 species of fungi utilize Garlic Mustard as a plant food.

Distribution: Native to Europe, western Asia and northern Africa. In the U.S. it's found in all but the southernmost states, usually in moist, shaded areas, woodlands, open areas, on floodplains and along trails. There are 80 known sites in the UP, impacting 450 acres. In 11 of the 15 UP counties. Found in lots of state parks. One of the biggest sites is AuTrain River Basin (100 acres).

Uses: Originally brought to the U.S. for culinary purposes. An edible herb. Chopped leaves are used for salads and seeds are used for seasoning.

Impacts on the Environment: Aggressive invasive, moving into healthy woodlands and displacing understory plants. Keeps native plants from getting the light, moisture and nutrients they need, ultimately crowding them out completely. Inhibits mycorrhizal fungi needed by trees. Changes soil nutrients – increases N, P, Ca, Mg. Reduced food and cover for some native animals. Dominates forest floor, replaces all native shrubs, tree seedlings and wildflowers. Deer do not eat it, so it thrives and spreads while native plants are consumed by herbivores.

At PIRO: One of the invasives staff targets with herbicides. Staff also pulls plants in the spring. Not widespread in the park – yet. There are hopes that this plant might possibly be eradicated completely from the park. This plant is of concern as it is one of the few invasives that does well in the shade.

How to Control: Pull with the root before seeding. Plant pulls up easily. Remove all flowering heads. Put plant in bags and place in landfill. Needs to be bagged – one of the few invasives that can still produce seeds even after the plant is pulled out of the ground.

Prevent Spread: Use boot brushes, check cuffs, check pets for tiny seeds.



Goutweed
(*Aegopodium podagraria*)



Variegated form

Goutweed (*Aegopodium podagraria*) Carrot/Parsley Family

Life History: Perennial with small, white, five-petaled flowers that are produced in mid-summer. Flowers are arranged in flat-topped clusters on a leafy stem up to about 3 feet tall. The seeds are small and elongate, similar in size and shape to carrot seeds, and ripen in late summer. In contrast to the dense foliage cover produced by goutweed, flowering shoots are uncommon in densely shaded areas. Also called Bishop's Weed and Snow-on-the-Mountain (variegated form). Can grow from seed or from rhizomes.

Distribution: Native to Europe and northern Asia and now has spread around the world. Introduced to U.S. as an ornamental, it is currently found in 29 states and is considered an aggressive invader in Upper Great Lakes states and the Northeast. Goutweed appears to do best on moist soil and in light to moderate shade, but is highly shade-tolerant and capable of invading closed-canopy forests.

Uses: Ornamental. Also, young leaves have been used as a salad green, much like spinach.

Impact on the Environment: Spreads quickly over large areas by underground rhizomes. Once established, goutweed is highly competitive, even in shady areas, with a high potential to crowd out native plants, thus reducing the diversity of ground cover and preventing the establishment of trees and shrubs. It has limited seed dispersal and a short-lived seed bank so most of its spread to new areas is due to humans planting it in gardens and from rhizome growth in disposed garden waste.

At PIRO: Park has the all green, non-variegated form at this time.

How to Control: The all green form appears to be more persistent and spread more quickly than the variegated form. Once established, goutweed is very hard to eradicate as the smallest piece of rhizome can develop into a new plant. Hand pulling is effective only if all pieces are removed.



Japanese Knotweed
(*Fallopia japonica*)

Japanese Knotweed (*Fallopia japonica*) Buckwheat Family

Life History: An upright, shrublike perennial that can grow up to 10 feet. Stems of Japanese knotweed are smooth, stout and swollen at joints where the leaf meets the stem. The minute greenish-white flowers occur in attractive, branched sprays in summer and are followed soon after by small winged fruits. Seeds are triangular, shiny, and very small, about 1/10 inch long. Can also reproduce and spread vegetatively.

Distribution: Native to eastern Asia. Introduced to the U.S. in the 1800s and is now scattered throughout the states, more prevalent in the upper Midwest and Northeast. Japanese knotweed can tolerate a variety of adverse conditions including full shade, high temperatures, high salinity, and drought. It is found near water sources, such as along streams and rivers, in low-lying areas, waste places, utility rights-of-way, and around old homesites. It can quickly become an invasive pest in natural areas after escaping from cultivated gardens.

Impact on the Environment: Japanese knotweed spreads quickly to form dense thickets that exclude native vegetation and greatly alter natural ecosystems. It poses a significant threat to riparian areas, where it can survive severe floods and is able to rapidly colonize scoured shores and islands. Once established, populations are extremely persistent.

At PIRO: An aggressive invasive with the potential to impact large areas. It is already found in large populations in several park areas. Currently controlled by annual herbicide treatment.

How to Control: Juvenile plants can be hand pulled depending on soil conditions and root development. Any portions of the root system not removed will potentially resprout. All plant parts (including mature fruit) should be bagged and disposed of in a trash dumpster to prevent reestablishment.

Prevent Spread: It is often transported to new sites as a contaminant in fill/dirt seeds, sometimes distributed by water, and carried to a lesser extent by the wind. Take care while gardening as escapees from neglected gardens, and discarded cuttings are common routes of dispersal from urban areas.



Purple Loosestrife

(Lythrum salicaria)



Purple Loosestrife (*Lythrum salicaria*) Loosestrife Family

Life History: Loosestrife plants grow from four to ten feet high, depending upon conditions, and produce a showy display of magenta-colored flower spikes throughout much of the summer. Flowers have five to seven petals. Mature plants can have from 30 to 50 stems arising from a single rootstock. Flowering lasts throughout the summer. When the seeds are mature, the leaves often turn bright red through dehydration in early autumn; the red color may last for almost two weeks. A single plant can have dozens of flowering spikes and produce up to 2 million seeds a year. Seeds are easily dispersed by wind and water. The plant also can sprout from pieces of roots and underground stems left in the soil or water.

Distribution: Native to Europe, Asia, northwest Africa and southeastern Australia. It was introduced to the northeastern U.S. and Canada in the late 1800s, for medicinal and ornamental reasons, and now is found in every state. Purple loosestrife is capable of invading many wetland types, including freshwater wet meadows, tidal and non-tidal marshes, river and stream banks, pond edges, reservoirs, and ditches.

Uses: It has been used as an astringent medicinal herb to treat diarrhea and dysentery; it is considered safe to use for all ages, including babies. It is also cultivated as an ornamental plant in gardens. It has also been introduced in many areas of North America by bee keepers, due to its abundance of flowers which provide a large source of nectar.

Impacts on the Environment: Infestations result in dramatic disruption in water flow in rivers and canals, and a sharp decline in biological diversity as native food and cover plant species, notably cattails, are completely crowded out, and the life cycles of organisms from waterfowl to amphibians to algae are affected. As it establishes and expands, it outcompetes and replaces native grasses, sedges, and other flowering plants that provide a higher quality source of nutrition for wildlife. The highly invasive nature of purple loosestrife allows it to form dense, homogeneous stands that restrict native wetland plant species, including some federally endangered orchids, and reduce habitat for waterfowl.

At PIRO: A few plants were discovered at PIRO in the last decade – these were removed and to date, there are no new plants in the park. One of the success

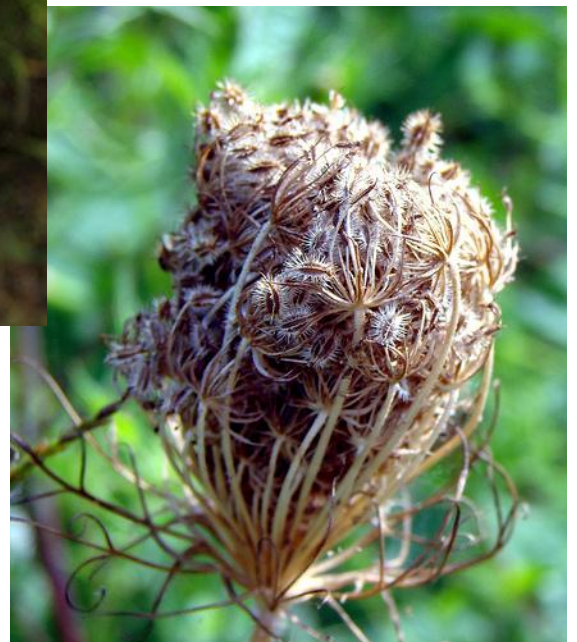
stories involving a highly invasive species that was removed before it could be established.

How to Control: Young plants are easy to pull out of the ground. If plants are flowering, cut flowering spike. If plants have already gone to seed, carefully cut seed head and bag it. Make sure not to transport the tiny seeds on clothes or equipment. Dispose of all plant parts at the landfill in sealed bags. Herbicide can also be used in small areas. There has been success controlling purple loosestrife by biological means. Five species of European beetles have been introduced to feed on the plant (two species of leaf beetles and three species of weevils.)



Queen Anne's Lace

(*Daucus carota*)



Queen Anne's Lace (*Daucus carota*) Carrot/Parsley Family

Life History: Biennial plant that grows up to 3 feet. The basal, pinnately divided leaves emit a carrot-like odor when crushed. Appears as a rosette the first year. The tiny, lacy flowers bloom May through October, creating a white, rounded umbel. The flowers contract as they turn to seed, then become concave and resemble a bird's nest. The dried umbels detach from the plant in the fall, creating tumbleweeds that disperse small barbed seeds. Seeds are also spread by animals and people. One plant can produce up to 40,000 seeds, which can stay viable in the soil for several years. A single red/purple flower in the middle of the umbel is thought to attract pollinators. This plant is also called Wild Carrot or Bird's Nest.

Distribution: Native to Europe and southwest Asia. Introduced to the U.S. by European settlers and is now widespread throughout almost all 50 states. It prefers sunny, disturbed areas and grows in dry grasslands, fields, meadows, pastures, ditches, and railroad and highway rights-of-way.

Uses: The taproot is edible, much like a cultivated carrot. This plant has long been used for medicinal purposes. The seeds have been used for treating cystitis and prostatitis and the root juice is being studied for anti-cancer properties.

Impact on the Environment: Queen Anne's Lace invades disturbed dry prairies, abandoned fields, waste places and road sides. It matures quickly and outcompetes native species. It is a threat to recovering grasslands and can be persistent on clay soils. However, it tends to decline once native grasses and herbaceous plants become established. The sap can cause phytophotodermatitis in humans.

At PIRO: Found throughout the park in sunny areas, roadsides, meadows and fields. At this time it poses limited negative impact on native species or environments. It is currently treated intermittently with herbicides.

How to Control: Control by hand-pulling or mowing in mid to late summer before seed set. Burning is not recommended, as it may induce seeds to sprout.

Prevent Spread: Check clothing and pets for seeds.



Red Clover
(*Trifolium pratense*)

Red Clover (*Trifolium pratense*) Pea Family

Life History: An herbaceous, short-lived perennial, growing 6 to 36 inches. The leaves are alternate, trifoliate (with three leaflets), with a characteristic pale crescent (or “V” pattern) in the outer half of the leaf. Flowers are dark pink with a pale base, produced in a dense inflorescence. Red clover can spread vegetatively or by reseeding itself.

Distribution: Native to Europe, western Asia and northwest Africa. Likely introduced deliberately as an agricultural forage crop. Now found in all 50 states and most of Canada. Prefers full sun and mesic conditions, and is generally found in meadows, fields and along roads.

Uses: Red clover is widely grown as a forage crop for animals and as a cover crop to improve agricultural soils by fixing nitrogen. It has been used medicinally to treat menopause, burns, bronchitis, cancer and asthma. Some studies suggest it has an estrogen-like effect in women. Red clover is an ingredient in some teas, and an important component in some commercial honey production. A widely naturalized plant that has been welcomed due to its economic importance. It’s also the state flower of Vermont.

Impact on the Environment: Like all invasives, it has the potential to crowd out native species. Red clover invades meadows, but generally is considered to be one of the lesser invasives.

At PIRO: Red clover is found throughout the park in developed and disturbed areas with high human traffic, open areas, fields and meadows. There are large populations in several areas, but its ability to cause negative impact is limited. Periodic chemical control is conducted when necessary.

How to Control: Red Clover can be controlled by mowing, hand pulling before seeds appear and spot spraying with herbicide.



Sea Lamprey
(*Petromyzon marinus*)



Sea Lamprey (*Petromyzon marinus*)

Life History: Jawless, finless primitive fish with cartilage instead of bony skeleton, similar to a shark. An ancient fish, been around 300 million years. They can grow to 20 inches long and weigh up to .75 pounds. Spawn in streams, using their sucker mouths to move about rocks and stones to create nests. Females can lay between 25,000 to 100,000 eggs. Of these, about 6,000 survive to larval stage. After spawning, the adults die. The blind larvae burrow into stream bottoms and spend the next 3 – 5 years there, filter feeding. At that time, when they are about 5-6 inches long, they undergo a metamorphosis to the predatory stage, develop teeth and eyes, and move out into open water where they are parasitic feeders on native fish. After 12-18 months, they enter the mating phase, stop eating and return to streams and rivers for spawning. Sea Lamprey generally live about 6 years but can live as long as 20.

Distribution: Native to the Atlantic Ocean where they feed on large fish such as sharks, tuna and swordfish, which can withstand predation better than the smaller Great Lakes fish. Entered Lake Ontario in 1835 but were blocked from proceeding by Niagara Falls until the Welland Canal was built and modified in 1919. Found in Lake Erie in 1921, Lakes Huron and Michigan by 1937 and Lake Superior in 1939. By the late 1940s, the population had exploded in all the great lakes.

Uses: Lamprey are edible and considered a delicacy, especially in the British Islands. Lamprey from North America were sent to make a pie for Queen Elizabeth's 60th jubilee.

Impacts on the Environment: Sea lamprey decimated the commercial and sport fishing industries of the Great Lakes almost to the point of collapse in the 1940s and 1950s. Between 40-60% of fish attacked die from loss of blood and infection. Each sea lamprey can destroy 40 pounds of fish in its lifetime. An anticoagulant in lamprey saliva keeps the wound open for days. With loss of lake trout and other top predators, the alewife population exploded, with the result of fouled beaches into the 1960s. About 100,000 tourist related jobs were in trouble, along with the entire Great Lakes fishing industry.

There are no known reports of sea lampreys attacking humans. Lampreys appear to be programmed to go after cold-blooded fish, not warm-blooded humans.

At PIRO: U.S. Fish and Wildlife staff currently treat several PIRO streams with lampricides to kill the larvae and also use pheromone traps on the adults.

Control Methods: The sea lamprey is an example of a 50-year success story of control, via various methods. It began with targeting the larval stage, and chemicals (lampricides) were developed that targeted sea lamprey larvae but not other fish. Chemicals were TFM and Balicide. Of the 5,747 streams in the Great Lakes, 433 are known to produce sea lamprey, and about 250 of these are treated on a regular basis by various agencies. These chemicals rapidly degrade after use. Also, low physical and mechanical barriers prevent lampreys from moving into spawning streams, since lampreys cannot jump. Sterile males were also released – since they don't feed at this time, released males did not attack fish. In addition, researchers use pheromones to trap adults in streams. Between all these methods, about 90% of sea lamprey populations have been slashed in many areas of the Great Lakes. So for now, sea lamprey are under control.



Spiny Water Flea
(*Bythotrephes longimanus*)

Spiny Water Flea (*Bythotrephes longimanus*)

Life History: The spiny water flea is a tiny crustacean with a long, barbed tail spine (total length with tail approx. 4 inches). It is much larger than most zooplankton species native to the Great Lakes. These predators catch their smaller zooplankton prey with their long antennae and hold them in place with their legs. During warm summer conditions, each female can produce up to 10 offspring every two weeks. The species can reproduce sexually or asexually. As temperatures drop in the fall, eggs are produced with a thick protective coating that allows them to lie dormant all winter. Adults die after reproduction.

Distribution: Native to freshwater areas of Great Britain and northern Europe, east to the Caspian Sea. Arrived in the U.S. accidentally through ballast water of ocean going ships. First discovered in Lake Huron in 1984, and then present in all the Great Lakes by 1987. They prefer deep lakes but have also invaded smaller and shallower inland lakes and rivers of Great Lakes states and Canada.

Impact on the Environment: Spiny water fleas have a great potential for disrupting the aquatic food web as they compete with fish for zooplankton prey. Because of their barbed tails, spiny water fleas are not preyed upon by small fish. This allows them to proliferate in number, and they feed upon smaller native zooplankton that many small native fish rely on for food. Native water fleas do not have barbs, and therefore they are consumed in greater numbers by hungry fish, which reduces their population. Overall, this reduces the amount of food available to small fish and this could have an impact on large fish populations as well.

Spiny water fleas are eaten by larger Great Lakes fish, although apparently not enough to impact their population. The eggs are eaten by fish of any size, but the eggs are often still viable and intact when they pass through the digestive tract.

Impacts to humans include fouling of fishing line and gear, and the potential for reduced recreational and commercial fish catches. Clumps look and feel like gelatin or cotton batting with tiny black spots.

At PIRO: Currently found in Beaver Lake and Grand Sable Lake. Most likely introduced by contaminated boats. Monitoring of inland lakes continues but at

present there are no control measures in place beyond working to prevent further spread.

How to Control: Legislation regarding the dumping of ballast water remains the only way to control spiny water flea. There is discussion of using chlorine toxins as a means of chemical control, but this would also be toxic of other aquatic life, and is currently prohibited.

Prevent Spread: Decontaminate all watercraft before launching. Boats and all associated equipment should be cleaned and dried so they are free of vegetation, animals, and mud and that the bilges, live wells and other compartments are also clean, dry and free of all organic materials. It is also important that fish from one lake not be released into another body of water as they may be carrying spiny water flea eggs. Eggs can also survive out of water for a certain period of time under some conditions.



Spotted Knapweed

(Centaurea maculosa)



Spotted Knapweed (*Centaurea stoebe*) Composite Family

Life History: Much-branched wiry stems with pinkish-purple, thistle-like flowers, and leaves that are covered with down grayish hairs. “Spots” are on the bracts on the base of the flower. Biennial. Can produce 40,000 seeds per plant. Seeds in the soil can last up to 8 years.

Distribution: Native to Eastern Europe. Introduced in the late 1800s. In the U.S. it's found in almost all 50 states – also found in much of Canada. There are 6.9 million acres infested across the entire U.S. Common along roadsides throughout the UP. Likes open, sunny areas. It is also a pioneer plant, found in recently disturbed areas.

Impact on the Environment: An aggressive invader, it takes over large areas and produces a monoculture, outcompeting and forcing out native plants. Crowds out forage for livestock. It has a tap root that sucks up water faster than its neighbors. It spreads quickly through large seed production. It is less palatable to herbivores, which gives it an advantage over edible plants. And it produces chemicals that inhibit the root growth of other plants, so it effectively wipes out its competition with its own herbicide. Sap can sometimes irritate human skin.

At PIRO: Spotted knapweed threatens rare dune plants, threatens piping plover beach nesting habitat due to encroachment. The main focus at PIRO is keeping it out of the dune area. One of the top 5 plants PIRO is targeting.

How to Control: Pull before it goes to seed. Once plant blooms, herbicides are rather ineffective. In other places they are trying biological control, by releasing weevils that are host specific just for spotted knapweed. Results are still out for how effective this is going to be.

Prevent Spread: use boot brushes, check cuffs, check pets for tiny seeds. Plant can even be spread by boating. Check all equipment for seeds and plant parts.



St. John's Wort
(*Hypericum perforatum*)



St. John's Wort *Hypericum perforatum* Mangosteen Family

Life History: Perennial herb with extensive creeping rhizomes. Can grow to 3 feet. Five-petaled flowers are yellow with conspicuous black dots, and develop in May through September. Leaves exhibit obvious translucent dots when held up to the light, appearing “perforated,” hence the Latin name. One plant can produce up to 100,000 seeds a year, which can persist for 10 years in the soil. Seeds are dispersed by wind and animals. It reproduces by seed and also vegetatively, and so can quickly invade a disturbed patch of ground. The common name comes from its traditional flowering and harvesting on St John's day, 24 June. Also known goatweed and Klamath weed.

Distribution: Native to Europe, western Asia and north Africa. Introduced to US in the 1700s, likely as an ornamental. Found now in almost all 50 states. St. John's wort prefers poor, sandy dry soils and can be found primarily in waste areas, railroad right-of-ways, sidewalk cracks, roadsides, meadows, dry pastures, rangelands, fields, open woods, dunes, and disturbed ground. However, it has the capability to invade healthy rangelands. It may grow in dense patches or mixed among other plants.

Uses: Widely used as a natural treatment for depression; also as an antibacterial medicine, treatment for wounds, burns, inflammatory skin infections, etc. Currently being studied for use in Parkinson's disease, alcoholism, ADHD, premenstrual syndrome and irritable bowel syndrome. It has also been used as an herbal tea and a flavoring for Japanese udon noodles.

Impact on the Environment: In pastures, St John's wort acts as both a toxic and invasive weed. It replaces native plant communities and forage vegetation to the dominating extent of making productive land nonviable or becoming an invasive species in natural habitats and ecosystems. Animals that eat St. John's wort and then are exposed to direct sunshine develop severe sunburns that are seen as skin irritations in non-haired or white areas. Blistering can also occur in the non-pigmented skin of the mouth, nose and ears. Symptoms do not result from casual contact; the plant must be eaten. Ingestion by livestock can also cause central nervous system depression, spontaneous abortion, and can lead to death. In western North America three beetles *Chrysolina quadrigemina*, *Chrysolina hyperici* and *Agilus hyperici* have been introduced as biocontrol agents.

At PIRO: Widespread in sunny, open areas and along roadsides. Quite abundant in lands adjacent to the park. Park staff do attempt to control this plant in areas where it is likely to have a negative impact.

How to Control: Difficult to control because of extensive rhizome system and long-lived seeds. Hand pulling and mowing can be used to control St. John's wort, but plants will probably resprout and vegetative reproduction may be stimulated. Pulling should only be considered an option on new or small infestation sites and repeated pulls will be necessary to ensure removal of the whole plant and any lateral roots. Do not leave hand-pulled plants at the site, since vegetative growth will occur, and the seed source will remain.

Wear gloves and avoid touching your eyes. There have been reports of blistering and photosensitivity in humans around the eyes and forehead.



White-Nose Syndrome

(Non-native fungus affecting U.S. bats)

White-Nose Syndrome

Description: White-Nose Syndrome (WNS) is a serious, often fatal condition currently affecting 11 species of bats in the U.S. The syndrome is spread by a non-native fungus that originated in Europe. Infected bats usually (but not always) display white fungal blotches and spots on their nose and muzzle, ears, legs, wing membranes or other areas of naked skin. WNS spreads quickly through hibernacula where colonial bats overwinter and appears to kill bats while they are hibernating.

History: WNS was first discovered in New York in the winter of 2006/7 by recreational cavers. It had probably arrived in the U.S. through recreational cavers in Europe who accidentally brought the fungus back with them to the states. By the next winter 10,000 bats were dead in four caves in New York. By 2014 it had spread to 27 states and five Canadian provinces, killing more than 6.5 million bats. It was found in Michigan in early 2014 and is expected to continue spreading through the state, and in general continue to move west. This epidemic is spread via bat to bat and also by humans, who accidentally pick up fungal spores on their clothes and equipment.

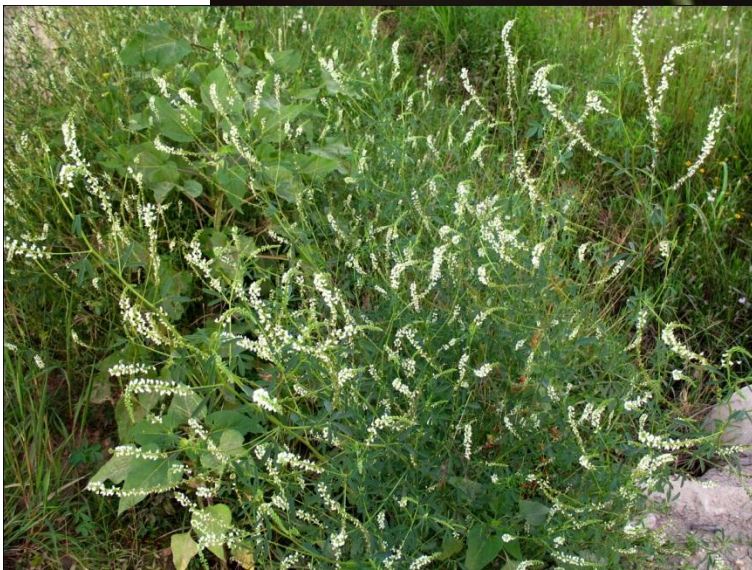
Distribution: In Michigan, WNS has been confirmed in three counties as of early 2014: Alpena in lower MI, and Dickinson and Mackinaw in the UP. More confirmations throughout the UP are likely. No incidents of WNS have been found at Pictured Rocks National Lakeshore, although three of the six species found at the park (Big Brown Bat, Little Brown Bat, and Northern Long-Eared Bat) are among those affected. Other Michigan species at risk include Indiana Bat and TriColor Bat.

Impacts on Bats: WNS kills bats by disrupting their hibernation cycle. It causes bats to awaken frequently, thus using up their precious stored fat supply needed to last through winter hibernation. Infected bats usually starve to death. WNS also causes bats to display dysfunctional behavior such as flying outside in winter, where they either freeze or starve. Dead bats are often found outside near the hibernaculum entrance. Since thousands of bats crowd into just a handful of caves and abandoned mines to hibernate, the presence of WNS in just one small area can kill entire regional colonies. In some hibernacula, 90% of bats die.

Impacts to Humans: WNS does not appear to affect humans, pets or other animal species. However, indirect impacts, such as economic losses, may be considerable. Bats eat huge quantities of agricultural pests, and loss of bats may cost as much as 1 billion dollars to state agriculture. Loss of bats may also cause an increase in disease-carrying insects, such as mosquitoes that carry West Nile Virus.

Impacts to Environment: The loss of high numbers of bats in a particular region has unknown consequences. Increased non-native forest beetles and pests that would have otherwise been eaten by bats may cause significant damage to trees. Increased insect populations may result in increased spread of diseases to wildlife. Bats are preyed upon by owls and other predators – their loss might upset predator-prey balance in some areas.

How to Control: There is currently no known treatment or cure for WNS. Most efforts are concentrated upon keeping the disease from spreading to new areas and protecting habitat for bats that survive. Researchers are continuing to study how the WNS fungus affects bats in hopes of discovering effective treatments.



**White Sweet
Clover**
(Melilotus alba)

White Sweet Clover (*Melilotus albus*) Pea Family

Life History: Biennial legume that can grow up to 6 feet in the second year. The flowers are packed densely on the top four inches of an elongated stem. Very similar in appearance to yellow sweet clover. Sweet clovers bloom May through September, set seed and then die. Both species can produce seeds that can remain viable in the soil for up to 30 years.

Distribution: Native to Europe and Asia. Introduced to the U.S. in the 17th century for cattle forage purposes and now is widespread throughout the U.S. and Canada. Sweet clovers grow well in direct sunlight or in partial shade. Neither species can tolerate complete shade. Sweet clovers seem to prefer calcareous or loamy soils, and are most frequently found in open, disturbed, upland habitats such as prairies, savannas, and dunes.

Uses: Cattle forage. Also widely used as a nectar source for commercial honeybees. Used in agriculture to fix nitrogen on croplands.

Impact on the Environment: Sweet clovers are fire-influenced, aggressive, weedy plants that produce populations with high rates of fluctuation. Both species degrade native grasslands by overtopping and shading native sun-loving species.

At PIRO: Found nearly throughout the park, but considered only to have a medium potential to negatively impact park environments. Currently treated intermittently with herbicide. Yellow sweet clover is also found throughout the park.

How to Control: Cutting, hand-pulling and burning are most effective. Early season burning helps stimulate germination; later burning kills sprouted plants. In areas where burning is not feasible, herbicide use on large areas is most effective.

Prevent Spread: Adjacent lands near infested areas should be inspected periodically for new plants. Due to the long viability of seeds, sweet clovers need to be managed almost continually.



Wild Parsnip
(*Pastinaca sativa*)



Wild Parsnip (*Pastinaca sativa*) Carrot/Parsnip family

Life History: Biennial/perennial herbaceous plant (plant spends one or more years in rosette stage, blooms under favorable conditions, and then dies); 6" high in the rosette stage and often over 4 feet high on stout, grooved stems in the flowering stage. Looks like a large Queen-Anne's Lace, but the broad-topped flower clusters are yellow. Large, pinnately compound leaves resemble celery leaves. Similar in size to native Cow Parsnip, which has white flowers. Seeds can stay viable in the soil for up to 4 years.

Distribution: A native of Europe and Asia, this plant has escaped from cultivation in the U.S. where it is grown as root vegetable. It is now common throughout almost all 50 states, especially along roadsides. It readily moves into disturbed habitats, along edges and or in disturbed patches. It invades slowly, but once population builds it spreads rapidly and can severely modify open dry, moist, and wet-moist habitats. Prefers sunny locations.

Uses: Ornamental, and has been grown as a cultivated food plant. The long tap root is edible.

Impacts on the Environment: Wild parsnip slowly invades an area in waves following initial infestation. Once the population builds, it spreads rapidly. This species is an aggressive, Eurasian weed that frequently invades and modifies a variety of open habitats.

Impacts to Humans: Causes phyto-photo-dermatitis: chemical burns on the skin in the presence of sunlight (ultraviolet), even on cloudy days. Casual touching of the plant will not affect people – the sap from the plant needs to come into contact with skin; hence the need for caution when pulling up this plant. It can cause burns all year, yet its juices are most potent while the plant is flowering. It may take 24-48 hours for symptoms to appear. Marks from the chemical burning may still be visible after several months or even years. Animals with light-colored skin and very little hair can also be susceptible to the plant's oils.

Other members of this plant family may cause phyto-photo-dermatitis, including giant hogweed, wild parsley, celery, cow parsnip and queen anne's lace. Also some citrus fruit may cause symptoms.

Treatment: Treat as you would any burn. Apply cool wet dressings, and keep blisters from breaking. Topical steroids, anti-itch creams, antihistamines and anti-inflammatory drugs may be necessary.

At PIRO: Found along some roadways and in the Miners Castle area. Possibly arrived here in a match of contaminated gravel.

How to Control: The best way to get rid of wild parsnip is by finding it early in its invasion when there aren't many plants. Cutting the root of each plant just below ground level can help stop the spread. This can be done with a dandelion-digging fork, a sharp shovel or spade. If the population is large, a power brush-cutter is sometimes used. Regular mowing, or grazing by cows, prevents wild parsnip from flowering and making seeds.