NEBRASKA
Invasive Species Program

Invasive Species

EDUCATION CARDS


Insects


Aquatics


Plants


Wildlife


Pathogens

What are Invasive Species?

Invasive species are non-native species that cause harm to the environment, economy or human health. Approximately 42% of threatened and endangered species are at risk primarily due to invasive species. Invasive species compete with native species for habitat and food. They often lack predators, adapt to disturbances and become able to reproduce at a young age. These characteristics give them an upper hand to displace and outcompete native species. Invasive species management and eradication is expensive and in some cases impossible. Taking precautions to prevent the spread of invasive species is key to protecting our native species and natural resources.

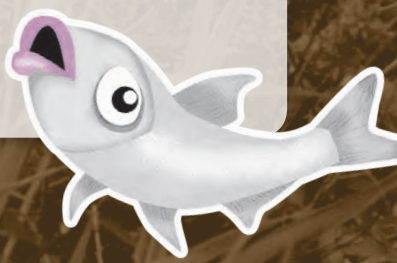
How do I use the Nebraska Invasive Species Education Cards?

These cards are meant to give teachers and outdoor educators information on invasive species of concern in Nebraska. Use these cards to learn about these species then lead students in activities and lesson plans which incorporate these species. Activities, lesson plans and curriculum are available for download at the Nebraska Invasive Species Program website: NEinvasives.com

Teaching Tools are Available:

Invasive species specimen and books for K-12 students and adult learners are available for check out. Contact the Nebraska Invasive Species Coordinator for more information.

Phone: (402) 472-3133
Email: invasives@unl.edu
Website: NEinvasives.com



Emerald Ash Borer

Genus: *Agrilus*
Species: *A. planipennis*
Priority Listing: Federal & State Quarantine
Found in Nebraska
Classification: Wood-Boring Insect

Pupa cut from an infested tree

Tree damage caused by larvae

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Emerald Ash Borer

Species and Origin

The emerald ash borer (EAB), was originally introduced into the U.S. from Asia in infested wood packing material and was first found in Michigan in 2002. EAB are metallic green wood-boring insects with small, bullet shaped bodies, about 13 mm long. EAB larvae are milky white with triangular segments. EAB have a one year lifecycle. EAB are known to infest all ash tree species (Fraxinus spp.) as well as the white fringe tree, Chionanthus virginicus. Nearly 50 million ash trees can be found throughout Nebraska. EAB have the potential to destroy all of these ash trees.

EAB Larva

Impacts

The first indication of EAB infestation is canopy thinning and dieback. Woodpecker damage may also be present. Suckering may also occur at the base of infested trees. EAB adults produce 1/8 inch D-shaped exit holes along the trunk and branches. It may take several years for a tree to die once it is infested. Ash tree mortality impacts other species that rely on these trees as habitat. The loss of ash trees cost cities and homeowners a lot of money. Ash tree lumber is commonly used to make baseball bats. EAB is currently found in 30 states including Nebraska, primarily in the northeast and Midwest. EAB was discovered in Omaha, NE (Douglas County) and in Greenwood, NE (Cass County) in 2016. Five Nebraska counties are under state and federal EAB quarantine as of June 2016 (Cass, Dodge, Douglas, Sarpy and Washington). Visit neinvasives.com for current range information.

D-Shaped exit holes

Means of Spread

EAB spreads through the movement of ash wood products, especially firewood, from infested areas. After mating, female EAB lay eggs on nearby ash trees. Females can move up to three miles but most travel less than one mile. Due to their limited dispersal ability, treatment is not recommended until an EAB infestation has been confirmed within 15 miles of your ash tree(s).

Prevention

Help stop this invader by limiting firewood movement to short distances (less than 50 miles) and reporting any sightings of this metallic emerald green beetle at neinvasives.com. Inspecting your ash trees regularly and spreading the word about EAB are vital steps to help with early detection and preventing new infestations of this invasive species. Visit www.eabne.info for treatment options and current information on this invasive species.

Before and after images of trees killed by the emerald ash borer

References: Emerald Ash Borer. (2014). In *Nebraska Invasive Insects Field Guide* (p. 10). Lincoln, Nebraska: Nebraska Invasive Species Program; *Emerald ash borer the green menace.* (2009). Washington D.C.: USDA; *Emerald ash borer.* (2015). Montana: Montana Department of Agriculture.

Asian Longhorned Beetle

Genus: *Anoplophora*
Species: *A. glabripennis*
Priority Listing: Federal Quarantine
Not Found in Nebraska
Classification: Wood-Boring Insect

Larvae

Adult near exit hole

Tree damage caused by larvae

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Asian Longhorned Beetle

Species and Origin

The Asian longhorned beetle, also known as ALB, was introduced to the U.S. from Asia in infested wood packing material. The first reproducing population was found in New York in 1996. The long black and white antennae give the Asian longhorned beetle its name. Adult beetles are large, about 1-1.5 inches long, with shiny black with white spots and bluish legs. In China they are called "starry sky beetle". Its color pattern is opposite of the native cottonwood borer, which is white with black spots. ALB larvae are white and may grow up to 2 inches long. This beetle has a one year lifecycle in most places. ALB prefers maple, willow, elm, horse chestnut and birch, but feeds on several different genera of hardwoods. The Nebraska state tree, the eastern cottonwood, is susceptible to ALB infestation.

Impacts

Symptoms of ALB infestation include top dieback of the tree and "out-of-season" yellowing of leaves. Larvae create tunnels under the bark and deep into the wood. Adult ALB chew large round exit holes (up to the size of a dime) when they emerge from the tree. The holes cause the tree to ooze frass and sap, which can cause the tree to die. ALB have the potential to destroy shade trees, which provide habitat for other species and are important to property owners. Maple trees, which are highly susceptible to ALB, are particularly valuable. Maple trees are used to make furniture and to produce maple syrup. They also have beautiful orange, yellow and red leaves in autumn. ALB is not known to occur in Nebraska. The only known infestations in the U.S. are in Ohio, New York and Massachusetts. Populations have been eradicated in Illinois and New Jersey.

Means of Spread

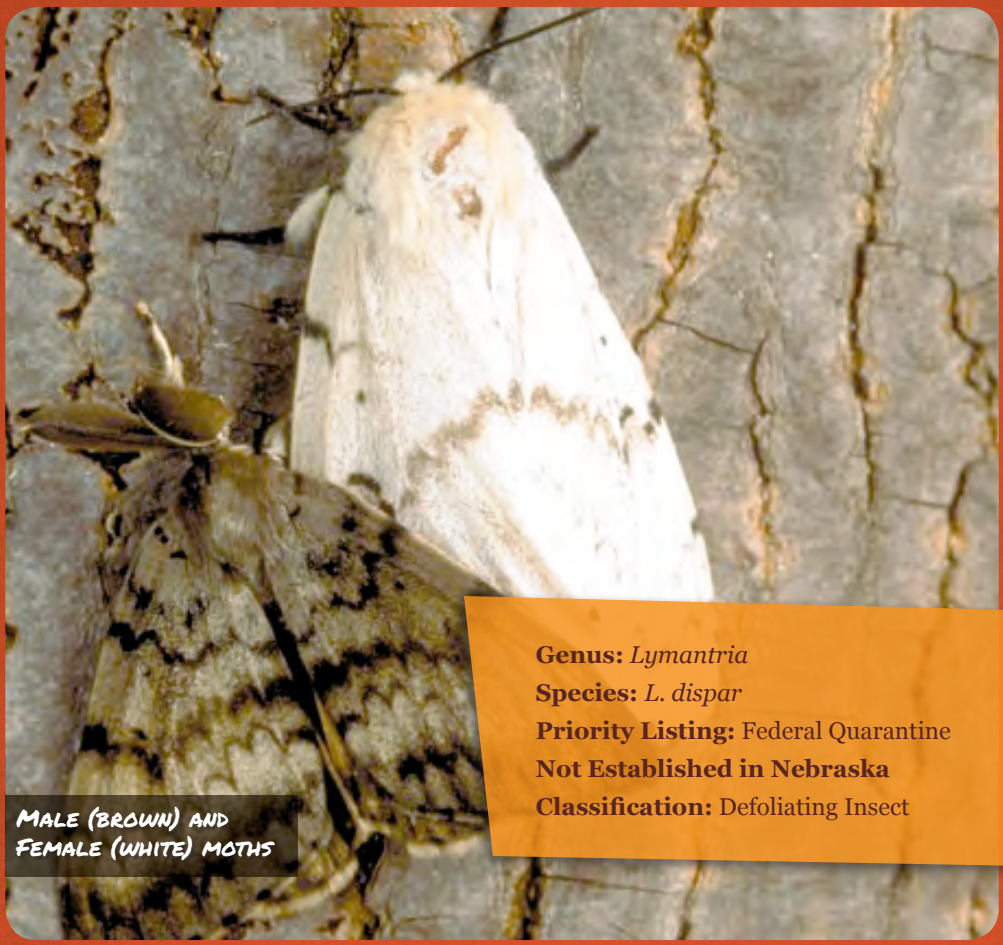
ALB is spread from place to place in firewood and other wood products. The adult beetles can also fly up to a mile.

Prevention

To prevent the introduction and spread of ALB, use or buy local sources of firewood, rather than moving firewood long distances. Report any sightings at neinvasives.com.

References: Asian Longhorned Beetle. (2014). In *Nebraska Invasive Insects Field Guide* (p. 12). Lincoln, Nebraska: Nebraska Invasive Species Program.
Asian longhorned beetle. (2015). Montana: Montana Department of Agriculture.

European Gypsy Moth



Male (brown) and Female (white) moths

Genus: *Lymantria*
Species: *L. dispar*
Priority Listing: Federal Quarantine
Not Established in Nebraska
Classification: Defoliating Insect

Larvae feeding on oak tree leaves

Larvae hatched in an egg mass

Larva

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European Gypsy Moth

Species and Origin

The European gypsy moth, also known as gypsy moth, was introduced to the U.S. from Europe for silk production, and escaped captivity in Massachusetts in the late 1800's. Males are dark brown with black "chevron" (v shaped) markings. Females are white with black "chevron" markings. Males have large feathery antennae. The female is too heavy to fly and can lay up to 1000 eggs at a time in a sticky egg mass. Larvae (caterpillars) are dark colored and fuzzy with five pairs of blue dots and six pairs of red dots on their back. The gypsy moth has a one year lifecycle. Gypsy moths prefers oak, aspen, willow, apple and crabapple, tamarack, white birch, witch hazel, and mountain ash but are found on over 300 species of trees.


Larva eating an oak leaf

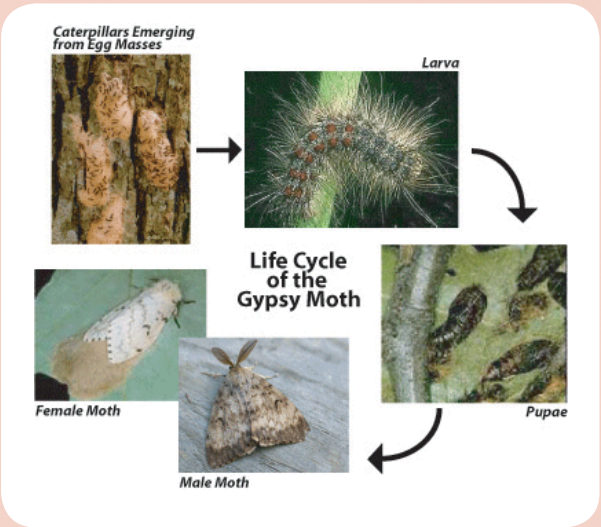

Traps used for sampling

Impacts

Gypsy moth larvae are defoliators, chewing holes in leaves and may completely strip a tree. Trees that are defoliated several years in a row often die. Tree die off can reduce habitat for wildlife and change the understory composition affecting the ecosystem. Many of the trees affected are valuable for lumber, furniture and other wood items. Gypsy moth larvae can be annoying when their droppings fall on picnic tables, benches, decks and sidewalks. Established populations are not known to occur in Nebraska, although individual moths have occasionally been caught in detection traps (which are set throughout the state each year). These "hitchhikers" likely made their way to the state on a vehicle or nursery stock from an infested area. There are infestations in much of the Northeast, west to Wisconsin and south to North Carolina.

Means of Spread

The gypsy moth is spread through the movement of infested nursery stock, timber products, and firewood. Gypsy moths usually lay egg masses on trees, but occasionally they are laid on cars or outdoor furniture. Humans can also unknowingly transport the gypsy moth egg cases on vehicles, camping equipment, and other outdoor household articles.



Prevention

Help stop this invader by limiting firewood movement to short distances (less than 50 miles). Be aware of federal quarantines that impact the movement of firewood, nursery stock, and other regulated articles from infested areas. Survey your trees and vehicles for signs of gypsy moths, larvae and egg masses and report them at neinvasives.com.

References: *Gypsy Moth.* (2014). In Nebraska Invasive Insects Field Guide (p. 10). Lincoln, Nebraska: Nebraska Invasive Species Program. Grafton, E., & Webb, R. (2010). *Homeowner's Guide to Gypsy Moth Management.* Retrieved November 1, 2015. Gypsy moth. (2015). Montana: Montana Department of Agriculture.

Zebra & Quagga Mussel

Genus: *Dreissena*

Species: *polymorpha; rostiformis bugensis*

Priority Listing: Present in Nebraska (Zebra mussels only)

Classification: Aquatic Mollusk

Zebra mussels on a boat propeller

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Zebra + Quagga Mussel


Zebra mussels filter feeding

Species and Origin

Zebra and quagga mussels were introduced into the United States via the ballast water of commercial shipping vessels from lakes in southern Russia. Zebra mussels were found in the Great Lakes in 1988 and quagga mussels in 1989. These small freshwater mussels can grow to be 1.5 inches in size. Zebra mussels are striped with zigzagged yellowish striped patterns, and the shells have a flat side upon which they can stand be stoodup on edge. Quagga mussels are usually pale and may have colored bands or bars, sometimes with a few stripes. Quagga mussels have no flat edge to stand on. Both zebra and quagga mussels are found in freshwater lakes, ponds and slow-moving or sluggish streams/rivers. These two species of mussels attach themselves to hard surfaces such as rocks, docks, cement, wood, debris, and vegetation, and quagga mussels can bury into soft sediments.


Zebra mussels clog a pipe

Impacts

Zebra and quagga mussels form dense colonies and filter out large quantities of plankton from water. This filter feeding results in a decrease in the food supply available for other aquatic organisms including fish, crustaceans, and other fresh water mollusks. The filter feeding by zebra and quagga mussels increases the water clarity, which in turn causes an overabundance of aquatic vegetation. These two species of mussel have sharp shells that can cover swimming areas and beaches which an cut swimmers feet. Both zebra and quagga mussels can clog water intake pipes for power and treatment facilities, irrigation pipes, etc., increasing the cost to operate such facilities.

Means of Spread

Zebra and quagga mussels are moved from waterbody to waterbody in both the larval and adult stage. Larval mussels float in the water column and are undetectable by the naked eye. Both larval and adult mussels can spread between waters when transported in bait buckets, live wells, and bilge water or attached to hull, motors, trailers, and other water equipment. Adult mussels have the ability to survive approximately three weeks out of water with the right conditions. In 2015, an established population of zebra mussels was confirmed in Lewis and Clark Lake, located in northeast Nebraska near Yankton, SD. They were also found in the entire length of the Missouri river in Nebraska. Offutt Air Force Base Lake in Bellevue, NE has an infestation of zebra mussels following re-establishment of the mussels in 2014. Zebra mussel larvae (veligers) were found in Lake Zorinsky in Omaha, NE in 2016. The lake had been drawn in 2010 to freeze and kill zebra mussels. Quagga mussels have not been found in Nebraska. Visit neinvasives.com to see the current zebra and quagga mussel ranges.

Prevention

Educating the public on regulations and status of invasive species in surrounding states, the policies in Nebraska regarding the movement of water from one source to another, and the ways zebra mussel and quagga mussels can attach to watercrafts is crucial to the prevention of zebra and quagga mussels. Boater surveys indicate a positive increase in public knowledge about zebra and quagga mussels, and that most boaters **clean, drain and dry** their watercrafts. Physical control methods of an infestation can include drawing down a waterbody below where zebra and quagga mussels can survive. Biological controls include fish that eat these mussels including: redear sunfish, freshwater drum and blue catfish, however these fish are not a one-and-done solution. There are no viable chemical treatments to eradicate zebra and quagga mussels in an open water setting at this time. Research continues to investigate treatment and management options. Make sure to report any sightings of small striped shelled mollusks at neinvasives.com.

References: Zebra/Quagga Mussels. (2014). In *Nebraska Invasive Aquatics Field Guide* (p. 34). Lincoln, Nebraska: Nebraska Invasive Species Program.

Rusty Crayfish

Genus: *Orconectes*
Species: *rusticus*
Priority Listing: Present in Nebraska
Classification: Crustacean

Rusty crayfish in fishing line

Identifiable rusty patch on side

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Rusty Crayfish

Species and Origin

The rusty crayfish is native to the Ohio River drainage area of the United States. This includes the states of Indiana, Kentucky, and Ohio. They are found in limited locations in eastern Nebraska including: city ponds in Omaha, the Gavin's Point tail water area, and the Missouri River downstream in Nebraska. The rusty crayfish was first discovered outside of its native range in the 1960's. The rusty crayfish is an aggressive crayfish that can grow up to 4 inches in length. Its color may be variable, but it consistently has rust-colored spots on either side of its shell, and black bands on the claw tips. Rusty crayfish prefer deep pools and fast currents with cover such as rocks, logs, and debris in freshwater lakes, rivers and streams.

Impacts

The rusty crayfish eats and damages stands of aquatic plants, reducing food sources and habitat for aquatic invertebrates and fish. Due to its size and aggressiveness, the rusty crayfish often out-competes native crayfish for food and habitat, and negatively impacts fish populations through competition for food and predation on fish eggs.

Means of Spread

The most likely means of spread of this aquatic invasive is through the dumping of personal bait buckets and illegal importation by bait vendors. Rusty crayfish are also spread from the dumping of aquariums from classrooms and households.

Prevention

The best ways to prevent the spread of the rusty crayfish is to ensure that you dispose of your bait properly. Do not dump your bait in the water. Instead, kill the bait before disposing of it in the garbage. Biological controls such as the introduction of largemouth bass paired with mechanical control of intensive trapping of rusty crayfish has been effective in population control. No chemical treatment exclusively targets rusty crayfish, and should not be used as it is harmful to native crayfish as well. The best control method is prevention through education, so make sure to report any sightings of this large crayfish at neinvasives.com.

Rusty crayfish eggs

References: Rusty Crayfish. (2014). In *Nebraska Invasive Aquatics Field Guide* (p. 28). Lincoln, Nebraska: Nebraska Invasive Species Program.

Asian Carp (Bighead + Silver)

Bighead Carp

Genus: *Hyopophthamichthys*
Species: *molitrix; nobilis*
Priority Listing: Present in Nebraska
Classification: Fish

Silver Carp

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Asian Carp (Bighead + Silver)


Silver Carp (Top)
Bighead Carp (Bottom)

Species and Origin

There are several species of Asian carp, but bighead and silver carp are some of the most destructive to an ecosystem. Silver and bighead carp were introduced to the U.S. in the 1970's to improve water quality in aquaculture due to their tremendous filter feeding ability. Due to flooding in the 1990's these two carp species invaded the river systems in several southern states and established breeding populations. They are making their way up the Mississippi River and its tributaries slowly, but have been found as far north as Minnesota. Both silver and bighead carp have scale-less heads with low-set eyes and an upturned mouth. Adult silver carp can reach weights of 60 pounds and bighead carp can weigh up to 110 pounds. Bighead and silver carp are strong swimmers and often migrate upstream. Silver carp can jump over low-head barriers. These fish prefer quiet waters, usually shallow lakes, ponds, rivers, impoundments, channels, and sand pits.

Impacts

Silver and bighead carp are voracious filter feeders that compete for food with larval fishes, native and game fish and freshwater mollusks. Boaters can be injured by silver carp that leap out of the water, up to 10 feet high, when disturbed. Both silver and bighead carp reproduce rapidly (in larger river systems) and grow quickly, making them vulnerable to predation only for a limited time period. High densities of these fish enable them to take over the habitat of native species and alter the entire aquatic ecosystem. Research is underway to find management and control options for these carp species.

Means of Spread

Silver and bighead carp are introduced to new waterbodies by moving upstream during floods, escaping from aquaculture pens and bait bucket releases. These carp may also be transported in the live wells of personal watercrafts. In Nebraska, silver and bighead carp are found in the Missouri, Platte, Elkhorn and Loup rivers.

Prevention

The best way to prevent the spread of these carp is to dispose of bait properly on land or in the trash. If a silver or bighead carp is caught, do not throw it back into the water, instead prepare and eat it (they are delicious) or kill and dispose of it properly. It is not legal in Nebraska to move these two carp species away from a waterbody alive. Bow fishing is a popular recreational activity and is an effective method to harvest the carp species as they are rarely caught using a conventional fishing pole. Commercial fishing has been used as a management strategy and is allowed in Nebraska for these carp species in the Missouri River with a Commercial Fishing License. Report any sightings of these unique looking large fish, found in any waterbodies not mentioned above, at neinvasives.com.


Bighead Carp

References: Asian Carp. (2014). In *Nebraska Invasive Aquatics Field Guide* (p. 10). Lincoln, Nebraska: Nebraska Invasive Species Program. *Aquatic Invasive Species Bighead Carp.* (2011). Indiana: Indiana Department of Natural Resources.

Feral Hog

Genus: *Sus*
Species: *scrofa*
Priority Listing: Not Found in Nebraska
Classification: Mammal

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Feral Hog

Species and Origin

The first wild pigs in the United States originated solely from domestic stock brought to North America by early European explorers and settlers. In the early 1900's, Eurasian or Russian wild boar were introduced into portions of the United States for hunting purposes. In areas where domestic pigs and Eurasian wild boar were found together in the wild, interbreeding occurred. Today, many hybrid populations exist throughout the wild pig's range. Feral Hogs are domestic hogs that either escape or are released for hunting purposes. Each generation the hog's domestic characteristics diminish, and they develop the traits needed for survival. Feral hogs are capable of breeding at six months of age. These hogs can have litters of 10-12 young, and can produce two litters a year. Feral hogs have a shoulder height up to 36 inches, and weight between 110-300 pounds. Their size greatly varies depending on geography and food supply. Feral hogs are very adaptable, and can thrive in various habitat types. These hogs feed on grasses, forbs, agricultural crops and roots, tubers, and invertebrates. They have also been found to consume the eggs of ground nesting birds.

Impacts

Feral hogs cause destruction of habitat and agriculture commodities. They root and trample to feed which damages agricultural crops and native habitats affecting wildlife. The loss of agricultural crops affects farmers and ranchers as well as the consumers of those crops.

Means of Spread

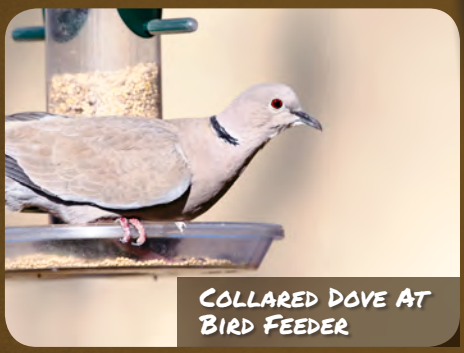
The popularity of wild pigs with hunters as a game species has played a major role in the expansion of the range of feral hogs throughout the United States. The sudden presence of wild pigs in new areas is most often a result of: escapes of stocked animals from privately owned hunting preserves, or illegal translocation by humans. Feral hogs have been known to move on their own, but only after an established population has been created in an area. There are no known populations of feral hogs in Nebraska at this time, but there are large populations in the southern states.

Prevention

States have found that using a public hunting season on feral hogs is not a good way to control populations because it can cause increase in the release of hogs for hunting purposes. Resource agencies commonly use baiting, trapping, and shooting from a helicopter for population control. The hogs are very intelligent, and are difficult to catch and control. If you see any feral hogs, please report it at neinvasives.com so something can be done immediately.

References: *Feral Hogs.* (2014). Lincoln, Nebraska: Nebraska Invasive Species Program. Retrieved November 1, 2015, from neinvasives.com

Eurasian-Collared Dove



Collared Dove at Bird Feeder

Genus: *Streptopelia*
Species: *decaocto*
Priority Listing: Present in Nebraska
Classification: Bird

Collared Marking

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Eurasian-Collared Dove


Collared Dove With Young In Nest

Species and Origin

The Eurasian-collared dove was introduced to the United States from the Bahamas, where several birds escaped form a pet shop during a mid-1970's burglary, after which the shop owner released the rest of the flock of approximately 50 doves. After the initial introduction to Florida from the Bahamas the Eurasian-collared dove rapidly colonized most of North America. The Eurasian-collared dove grows to a length of 29-30 cm and weighs between 140-180 grams. It is larger than the native mourning dove, but smaller than a rock pigeon. It is typically light in color with a distinctive black collar around its neck. The Eurasian-collared dove is found in a variety of habitats ranging from cities to ranches and open woodlands to tall grasslands and is widespread throughout the state of Nebraska.

Impacts


Canker Caused By T. gallinae

Eurasian-collared doves are found in both urban settings as well as rural settings. The Eurasian-collared dove chase off other birds, including the native mourning dove, cardinals, and blue jays from nesting, feeding and bathing spots. The Eurasian-collared dove also carry a disease-causing parasite, *Trichomonas gallinae*, which they may spread to native doves at feeders or bird baths. Eurasian-collared doves can also spread this parasite to the raptors that feed on them. *T. gallinae* has caused major mortality in mourning doves and pigeons. This infection attacks the upper digestive tract of birds and kills the bird if the bird's immune system cannot fight off the parasite.

Means of Spread

The Eurasian-collared dove has been able to rapidly spread across the country, because they can produce multiple nests throughout the spring and summer, and young birds will often travel long distances to nest, allowing them to colonize new areas. Where weather conditions, such as temperature, allow, the Eurasian-collared dove can nest year round.

Prevention

Many states have hunting seasons on this invasive species. In Nebraska, they are protected by state law and can be harvested year round with a valid hunting permit. Make sure to limit the habitat availability and food sources for these invasive species. Clean your barns, sheds and porch stoops to ensure these pest are not nesting in any of the rafters. Clean birdfeeders and bird baths regularly to prevent the conditions favorable to *T. gallinae*. A 10 percent solution of household bleach is recommended to clean feeders and bird baths.

References: *Eurasian-Collared Dove.* (2014). Lincoln, Nebraska: Nebraska Invasive Species Program. Retrieved November 1, 2015, from neinvasives.com
Eurasian-Collared Dove. (2015). Cornell University. Retrieved November 9, 2015, from http://www.allaboutbirds.org/guide/Eurasian_Collared-Dove/lifehistory

House Mouse

Genus: *Mus*
Species: *musculus*
Priority Listing: Present in Nebraska
Classification: Mammal

SIZE COMPARED TO A DIME

DAMAGE TO A CEREAL BOX

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House Mouse

Species and Origin

The house mouse is native to northern Europe and Madeira. It is thought to have entered the United States during the period of European exploration and colonization. Its introduction it is thought to have spread rapidly because the house mouse requires the settlement of humans to thrive. Due to their close proximity to humans, house mice are thought to be the primary reason for the taming of the domestic cat. The house mouse grows to a length of about 2 inches long, is light brown or black in color, and often has a lighter colored underbelly. House mice prefer to live in structures but can also live outdoors. House mice are commonly found in prairies and grasslands, and in neighboring structures.

Impacts

The house mouse can spread disease through a bite, or by contaminating food and water with urine and feces. House mouse waste is a major concern, as they can eat up to 15-20 times a day. This waste will be visible in a household, and should be taken care of right away to prevent the spread of disease. The house mouse can also carry parasites such as ticks, mites, and fleas that may spread disease to humans.

Mouse Droppings

Means of Spread

The house mouse is attracted to places with a food source. Leaving food out, not cleaning up crumbs, or cleaning infrequently can attract a house mouse to your home. The house mouse needs a place to create a nest which includes grasslands, and structures, particularly attics or sheds. The house mouse is attracted to humans, and will be present where humans have settled. As a result, the house mouse is wide spread and found throughout the state of Nebraska.

Mouse Colony

Prevention

The house mouse can be easily managed by simply cleaning your attics, sheds and crawlspaces to ensure these storage areas are clean and dry. Cleaning your outdoor garbage cans is also helpful in preventing the spread of the house mouse. Eliminating any holes, or places of entry in structures can be effective in eliminating the house mouse. Several traps are available ranging from the wood snap traps, to the sticky pad traps. Mouse poison is available but use care to avoid non-target animals from consuming it. Cats and dogs are also helpful in managing house mouse populations.

References: *House Mouse.* (2014). Lincoln, Nebraska: Nebraska Invasive Species Program. Retrieved November 1, 2015, from neinvasives.com. *Pest World For Kids.* (2014). National Pest Control Association. Retrieved November 8, 2015, from http://www.pestworldforkids.org/pest-guide/mice/

European Starling

Genus: *Sternus*
Species: *vulgaris*
Priority Listing: Present in Nebraska
Classification: Bird

Juvenile with an Adult

Starlings at a Bird Feeder

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European Starling

Species and Origin

European starling were introduced in New York in 1890 by a Shakespeare enthusiast. Since its introduction, European starling populations have grown to over 200 million birds, and they can be found coast to coast, even in Alaska. The European starling grows to be 6", and is dark brown or black and iridescent with light spectacles on its feathers. European starlings tend to build their nests in trees or in any opening greater than 1" in a human structure. The European starling is found in a variety of habitats ranging from cities to ranches, and open woodlands to tall grasslands.

Impacts

European starlings form huge congregations that occur and roost at livestock facilities and feed on livestock rations. They are competitive with other birds, specifically native cavity nesters, such as bluebirds, which have negatively affected those species' populations. European starlings have also been known to damage ripening corn. They have been known to selectively eat high-protein supplements that are added to livestock rations. Their droppings may weaken the steel and lead of buildings that they build their nest in, causing structural damage. When their droppings collect on the ground fungus grows underneath of the droppings, and can lead to the spread of various diseases. Starlings have been known for flying into airplanes causing damage to the airplane, and even occasionally causing them to crash.

Means of Spread

The European starling is spread primary through its reproduction during the spring and summer. These birds may produce two groups of offspring per year, laying four to seven eggs each time. Make sure not to allow starling nests to develop during the spring and summer months. The European starling is widespread and found throughout the state of Nebraska.

Prevention

Starlings at a livestock yard

Make sure to clean your barns, sheds and porch stoops to ensure these pests are not nesting in any of the rafters. Limit food sources in both urban and rural areas to keep the European starling numbers down. Close all openings larger than 1" to exclude starlings from buildings and other structures. Soft, sticky repellents such as Roost-No-More and 4-The-Birds are useful in discouraging starlings from roosting on ledges and roof beams. There are poisons available but advised against as they can effect other species. Regularly clean bird baths and feeders to prevent the spread of diseases.

References: *European Starling.* (2014). Lincoln, Nebraska: Nebraska Invasive Species Program. Retrieved November 1, 2015, from neinvasives.com. *Educational Resources Starlings.* (2012). Wildbirds Unlimited Inc. Retrieved November 8, 2015, from http://www.wbu.com/education/starlings.html. *Pest World For Kids.* (2014). National Pest Control Association. Retrieved November 8, 2015, from http://www.pestworldforkids.org/pest-guide/birds/ *European Starlings and their control.* (2005). Retrieved November 7, 2015, from Internet Center for Wildlife Damage Management.

Canada Thistle

Genus: *Cirsium*
Species: *arvense*
Priority Listing: State Noxious Weed
Growth: Perennial
Type of Plant: Forb

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Invasive Species Program

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Canada Thistle

Species and Origin

Canada thistle is originally from Eurasia and North Africa. This plant was designated a Nebraska State Noxious Weed in 1873. It is the most widespread of all the thistle species in the United States and many land mangers consider it the most difficult to control. It is widely dispersed across Nebraska with an estimated 375,000 acres infested. It grows to a height of 4 feet. Its foliage is irregularly and sharply lobed with margins with short spines. This species has compound pink to purple flowers in clusters that are smaller than other thistles and flowers June to August.

Impacts

Canada thistle creates multi-million dollar losses in crop production due to competition. This species also releases toxic substances into the soil which inhibits growth of some plants. It competes with native vegetation, often resulting in monocultures and less plant diversity.

Means of Spread

Canada thistle can be spread up to a half a mile by wind, water, and wildlife. It has been both introduced and spread as a seed contaminant. It reproduces from seed and by its extensive horizontal roots.

Prevention

Canada thistle can be managed through prevention and various control methods. Prevention includes planting crops free of Canada thistle seeds, preventing the movement of infested hay, and cleaning equipment being used in multiple sites. The best mechanical method is cultivation of new shoots, beginning in May. Biological controls include the use of the Canada thistle bud weevil and the Canada thistle stem mining weevil. Consult your local County Weed Control Authority for chemical control recommendations.

References: Canada Thistle. (2014). In *Nebraska Invasive Plants Field Guide* (p. 12). Lincoln, Nebraska: Nebraska Invasive Species Program. Wilson, R. (2009). Canada Thistle. *Noxious Weeds of Nebraska.*

Leafy Spurge

Genus: *Euphorbia*
Species: *esula*
Priority Listing: State Noxious Weed
Growth: Perennial
Type of Plant: Herb

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Leafy Spurge

Species and Origin

Leafy spurge is originally from Eurasia and is speculated to have arrived in Newbury, Massachusetts in 1827 through the ballast water of ships from Europe. It was designated a Nebraska State Noxious Weed in 1962 and is found in most counties in the state. It has also been identified in 35 states and 20 Canadian provinces. It infests over three million acres in the northern Great Plains. It can grow to a height of 3 feet but typically stand between 1-2 feet tall. The plant has green to yellow bracts surrounding non-showy umbel flowers, which appear from May to September and are followed by a three-lobed capsule fruit. The stems contain a white, milky substance that can cause dermatitis when handled. The leaves are oblong with one noteworthy vein. Leafy spurge is most commonly found in cropland, woodlands, shelter belts, rangeland, roadsides and disturbed sites.

Impacts

Leafy spurge infestations reduce areas available for range and crop lands with a direct annual loss in forage value of more than $2 million. It establishes quickly through high seed viability and rapid seedling development, forming prolific populations. This allows leafy spurge to easily out-compete native vegetation. Leafy spurge is considered toxic to cattle.

Means of Spread

Leafy spurge spreads by seed and shoot buds which catapult seeds some distance from the parent plant. Wildlife and humans contribute to the spread and introduction of leafy spurge.

Prevention

Leafy spurge can be managed through prevention and various control methods. Prevention includes planting crops free of leafy spurge seeds, preventing the movement of infested hay, and cleaning equipment being used in multiple sites. Mechanical management includes removing the aerial portion of the plant by mowing or shredding. Biological management methods include the use of several different insects and sheep grazing. Consult the local County Weed Control Authority for chemical control recommendations.

References: Leafy Spurge. (2014). In *Nebraska Invasive Plants Field Guide* (p. 38). Lincoln, Nebraska: Nebraska Invasive Species Program. Sandell, L., & Knezevic, S. (2009). Leafy Spurge. *Noxious Weeds of Nebraska.*

Musk Thistle

Genus: *Carduus*
Species: *nutans*
Priority Listing: State Noxious Weed
Growth: Biennial
Type of Plant: Forb

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Musk Thistle

Species and Origin

The musk thistle, also called nodding thistle, is originally from Eurasia and North Africa. It was first recorded in the U.S. in 1852 and was designated a Nebraska State Noxious Weed in 1962. This plant will invade a wide range of habitats, primarily rangelands and open woodlands. Musk thistle is the most widespread thistle species in Nebraska. Musk thistle can grow to a height of 10 feet tall. It has a rosette the first year that has terminal compound pink-purple flowers. Musk thistle blooms from May to August. This plant has lobed, serrate leaves with a serration shallower than plumeless thistle. There are spines at the end of each lobe, and the tip spine is white. Musk thistle produces yellow to brown achene fruits with one edge curved.

Impacts

Musk thistle has prolific seed production, and forms dense colonies that reduce yield in forage crops. Cattle will not graze forage plants with heavy infestations of this spiny thistle. Dense infestations of musk thistle compete with native vegetation for water, light and nutrients. Musk thistle also results in lower quality hay due to contamination. All of the above impacts create a loss of income for farmers and municipalities alike.

Means of Spread

Musk thistle is spread through its seeds. Musk thistle seeds can be spread by wind, water, and wildlife. Seven to 10 days after the head begins to bloom the seed dispersal of this invasive plant begins. Musk thistle is widespread and found in most counties in Nebraska. On average 11.3 seeds are produced per plant with 4,850 seeds capable of germination.

Musk thistle head weevil

Prevention

Musk thistle can be managed through mechanical, biological, and chemical control methods. The first step in any of these management methods is prevention. This includes planting crops free of musk thistle seeds, preventing the movement of infested hay, and cleaning farm equipment being used in multiple locations. Mechanical management methods of musk thistle include mowing, particularly during full bloom. Biological management methods include proper grazing habits, the use of fire, and native insects such as the musk thistle head weevil. Consult your local County Weed Control Authority for chemical control recommendations.

References: Musk Thistle. (2014). In *Nebraska Invasive Plants Field Guide* (p. 42). Lincoln, Nebraska: Nebraska Invasive Species Program. Fick, W., & Peterson, D. (1995). Musk Thistle Identification and Control.

Plumeless Thistle

Genus: *Carduus*
Species: *acanthoides*
Priority Listing: State Noxious Weed
Growth: Biennial
Type of Plant: Forb

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Plumeless Thistle

Species and Origin

Plumeless thistle is a forb native to Eurasia. It was designated a Nebraska State Noxious Weed in 1975. It is widespread, particularly in the northeast, currently infesting approximately 51,000 acres. It can grow to a height of 4 feet. This plant will form a rosette in its first year. It has purple clustered or solitary compound flowers that bloom June to August on a spiny winged stem. It has elliptical and spiny leaves. The fruits are almost square, with hairs forming a ring at the tip. Seeds can germinate through the early fall, based on conditions. It is typically found in pastures, rangeland, non-crop areas, and roadsides.

Impacts

Plumeless thistle reduces the economic viability of pastures and rangeland by competing with and suppressing the growth of desirable, native species, reducing the overall productivity of the land.

Means of Spread

Plumeless thistle spreads primarily by wind-driven seed distribution. There are approximately 50-80 seeds per head and a single plant possesses 35-60 heads. Even though most seeds germinate the next year, the seeds can remain viable in the soil for up to 10 years.

Prevention

Plumeless thistle can be managed through prevention and a variety of control methods. Prevention includes planting crops free of plumeless thistle seeds, preventing the movement of infested hay, and cleaning equipment being used in multiple sites. Mechanical management includes removing the plant through digging, cutting, or late bloom stage mowing. Biological management methods include the use of insects such as the head weevil or the introduction of fungi. Consult your local County Weed Control Authority for chemical control recommendations.

THISTLE CROWN WEEVIL

References: Plumeless Thistle. (2014). In *Nebraska Invasive Plants Field Guide* (p. 50). Lincoln, Nebraska: Nebraska Invasive Species Program.
Hilgenfield, K., Martin, A., & Bernards, M. (2010). Plumeless Thistle. Noxious Weeds of Nebraska.

Purple Loosestrife

Genus: *Lythrum*
Species: *salicaria*
Priority Listing: State Noxious Weed
Growth: Perennial
Type of Plant: Forb

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Purple Loosestrife

Species and Origin

Purple loosestrife is a forb native to Europe. It was introduced in the United States as an ornamental plant and sold in nurseries, retail stores and online. It was designated a Nebraska State Noxious Weed in 2001. It is found throughout Nebraska, especially in the east, along the Platte and Niobrara Rivers. It has pink to purple flowers that bloom from July to September. It has heart-shaped leaves and can grow to a height of 8 feet tall. It is typically found in marshes, river and creek banks, ditches and wet meadows. It is capable of withstanding flooding up to 18 inches deep.

Impacts

Purple loosestrife forms dense stands over very large areas, restricting water movement, trapping sediment and causing changes in water quality. It adapts to many different environments and competes with native vegetation and reduces habitat for wildlife. Severe infestations will dominate wetlands in a single monoculture. These infestations interfere with various levels of the ecosystem and recreational activities such as fishing, boating, and hunting, diminishing revenue from such activities in the area and statewide. Ornamental cultivars and hybrids used in the landscape have been known to cross-pollinate, causing the species to spread in urban areas.

Means of Spread

Purple loosestrife seeds are long-lived and can disperse by wind, water, and by adhering to wildlife, livestock, people, and vehicles. A single plant can produce up to 2,000,000 seeds per season. Plants can spread by re-sprouting from stem cuttings and from regeneration of pieces of roots.

Black-margined loosestrife beetle

Prevention

Purple loosestrife can be managed through prevention and a variety of control methods. Prevention includes planting crops free of purple loosestrife seeds, preventing the movement of infested hay, and cleaning equipment being used in multiple sites. Mechanical management includes digging the plant up, mowing, burning and flooding. Biological management methods include the use of two weevils, a root weevil and flower-feeding weevil both of which defoliate only purple loosestrife. Consult your local County Weed Control Authority for chemical control recommendations.

References: Purple Loosestrife. (2014). In *Nebraska Invasive Plants Field Guide* (p. 52). Lincoln, Nebraska: Nebraska Invasive Species Program. Knezevic, Stevan Z., "EC03-177 Noxious Weeds of Nebraska: Purple Loosestrife" (2003). *Historical Materials from University of Nebraska-Lincoln Extension.* Paper 1707.

Spotted & Diffuse Knapweed

Spotted Knapweed

Diffuse Knapweed

Genus: *Centaurea*
Species: *C. biebersteinii, C. diffusa*
Priority Listing: State Noxious Weed
Growth: Perennial
Type of Plant: Forb

Spotted Knapweed

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Spotted & Diffuse Knapweed

Species and Origin

Spotted and diffuse knapweed are two species of forbs native to southeastern Europe and Asia. These two species arrived in the United States from Eurasia in contaminated alfalfa and ship ballast water. They were both designated Nebraska State Noxious Weeds in 1992. They are also listed as noxious weeds in seventeen other states. They are fairly widespread in Nebraska, with approximately 7,000 infested acres, particularly in the northern counties. Both species form rosettes the first year, and they can grow to a height of 4 feet. Spotted knapweed has pink to purple finely dissected compound daisy like flowers with black fringe. Diffuse knapweed has finely dissected compound white flowers that can be pink to purple. Both species bloom from June to September. The leaves of these species are small and elliptical with yellow to brown bracts that surround the flowers. These knapweeds occur in rangeland, meadows, and roadsides. They prefer well-drained, open and sandy soils and thrive in dry environments.

Impacts

These two knapweeds displace native vegetation and change the plant community structure. They have become major weeds of range and pasture land, as they easily become widespread and are particularly damaging to livestock production throughout the state of Nebraska.

Means of Spread

These knapweeds spread by movement of seeds on equipment, wildlife, clothing and pets and in water. They are quick to establish on disturbed ground and produce allelochemicals that inhibit the establishment of other plants, which allows the knapweeds to develop monocultures.

Prevention

Spotted and diffuse knapweeds can be managed through prevention and various control methods. Prevention includes planting crops free of knapweed seeds, preventing the movement of infested hay, and cleaning equipment being used in multiple locations. Mechanical management includes persistent and diligent pulling of the plant, ensuring the removal of the entire crown root. Biological management methods include the use of eight insects (both root and flower-feeding insects), fungus introduction and livestock grazing at the seedling stage. Consult your local County Weed Control Authority for chemical control recommendations.

References: Spotted & Diffuse Knapweed. (2014). In *Nebraska Invasive Plants Field Guide* (p. 66). Lincoln, Nebraska: Nebraska Invasive Species Program. Heckman, Neil L.; Goss, Ryan M.; Gaussoin, Roch E.; Knezevic, Stevan Z.; and Lindquist, John L., "EC02-173 Spotted and Diffuse Knapweed" (2002). *Historical Materials from University of Nebraska-Lincoln Extension.*

Saltcedar

Genus: *Tamarix*
Species: *ramosissima*
Priority Listing: State Noxious Weed
Growth: Perennial
Type of Plant: Deciduous Shrub

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Saltcedar

Species and Origin

Saltcedar was introduced to the United State from Europe and Asia in the mid 1800's to use in landscape plantings, windbreaks, and erosion control along stream banks. It was designated a Nebraska State Noxious Weed in 2005 and is also designated a Noxious weed in 9 other states. Saltcedar can grow up to 20 feet tall. This plant has white to pink flowers that are in bloom from April to September. The leaves of saltcedar are green scales, similar to a juniper. Saltcedar prefers to live in salt marches, floodplains, and shore lines of lakes, ponds, rivers, and streams as it needs plenty of water to survive.

Impacts

Saltcedar pulls heavy amounts of water from the soil with a long taproot. The excessive standing vegetation can increase the risk of fire. It competes with native vegetation in various ways including pulling salt from the water and depositing it on the soil around the plant, preventing native vegetation from growing. The dense roots and rhizomes of saltcedar spread out and slow river flows, which increases sediment deposits.

Means of Spread

Saltcedar spreads by rhizome roots, and seed dispersal via wind and water. The seeds of saltcedar are viable for a year. Seedlings of saltcedar can grow up to 12 inches per month, and will flower during the first growing season. Saltcedar is found in various locations in Nebraska, including along the Platte River, and in the southern and western parts of the state where it has had a chance to establish in the wake of flooding and drought.

Saltcedar Beetle

Prevention

Saltcedar can be managed through cultural, mechanical, biological, and chemical control methods. The first step in any of these management methods is prevention. This includes planting crops free of saltcedar seeds, preventing the movement of infested hay, and cleaning equipment being used in multiple locations. Mechanical management includes both the use of fire and flooding to remove the above ground portion of the plant. Neither of these methods will affect the plant's root structure. Pulling of saltcedar at the seedling stage, or bulldozing followed by root plowing of larger plants, are effective management techniques. Biological management includes grazing using cattle or goats. Chemical control methods are limited due to the wetland preference of saltcedar, and are most effective when applied in August or September rather than May or June. Contact your local County Weed Control Authority for chemical control recommendations.

References: Saltcedar. (2014). In *Nebraska Invasive Plants Field Guide* (p. 56). Lincoln, Nebraska: Nebraska Invasive Species Program.Wilson, R., & Knezevic, S. (2009). Saltcedar. *Noxious Weeds of Nebraska.*

Phragmites

Genus: *Phragmites*
Species: *P.australis*
Priority Listing: State Noxious Weed
Growth: Perennial
Type of Plant: Grass

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Phragmites


Dense stands

Species and Origin

Phragmites, also known as common reed, was introduced from Europe to the United States in the late 1800's for erosion control. It was designated a Nebraska State Noxious Weed in 2008 and is found throughout the state, particularly along the Platte River. It often forms dense stands, and can grow up to 20 feet tall. It has yellow-green leaves which contrast with the gray-green foliage of many native grasses. The seed heads appear from July through September. It prefers wet areas such as marshes, floodplains, ditches, ponds, and waterways. There is a native phragmites in Nebraska but it has loosely attached leaf sheaths while the non-native species has tightly adhered leaf sheaths.

Impacts

Phragmites form dense stands over very large areas, restricting water movement which can cause flooding, trapping sediment and causing changes in water quality. Severe infestations will dominate waters in a single monoculture. It adapts to many different environments and competes with native vegetation by blocking the light that other plants need and by occupying most of the growing space above and below the ground. This loss of native habitat interferes with wildlife, water levels, and biodiversity.

Means of Spread

Phragmites spreads by extensive rhizomes that can have more than 200 nodes. It is also known to spread by the fragmentation of these rhizomes. Seed dispersal also occurs through water, wind and wildlife. It can be transported by boats and other recreational equipment, such as duck blinds and decoys.


Seed Head


Rhizomes

Prevention

Phragmites can be managed through prevention and various control methods. Prevention includes removing mud and vegetation from watercrafts, trailers, decoys and other equipment that comes in contact with water prior to leaving a waterbody. Clean these items prior to relaunching into a waterbody. Mechanical management includes burning, cutting, dredging, draining, mowing, disking and pulling when the plant does not have a seed head. Grazing with cattle or goats can be effective. Contact your local County Weed Control Authority for chemical control recommendations.

References: Phragmites. (2014). In *Nebraska Invasive Plants Field Guide* (p. 48). Lincoln, Nebraska: Nebraska Invasive Species Program. Knezevic, S., Datta, A., & Rapp, R. (2008). Common Reed. *Noxious Weeds of Nebraska.*

Sericea Lespedeza

Genus: *Lespedeza*
Species: *L.cuneata*
Priority Listing: State Noxious Weed
Growth: Perennial
Type of Plant: Forb

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Sericea Lespedeza

Species and Origin

Sericea lespedeza was introduced to the United States from Asia in 1896. It was brought over from Asia for the purpose of soil stabilization and forage for livestock and wildlife. It was designated a Nebraska State Noxious Weed in 2013 and is found in several southeastern counties. It is considered an invasive in 31 other states and is listed as a noxious weed in Kansas and Colorado. It can grow to a height of 5 feet. Sericea lespedeza has white to yellow five-petaled pea-like flowers with purple or pink veins. The flowers are in groups of two to four, arranged in spikes. It flowers from July to October, making it identifiable in the late fall. Its compound leaves are in sets of 3 oblong leaflets with pointed tips. Fruits are in single-seeded pods. It is typically found in grasslands and roadsides, along shore lines and streams, and in thickets.

Impacts

Sericea lespedeza aggressively competes with native vegetation, and its seeds contain dyes that reduce forage value. Its tall, upright growth with multiple branches and dense foliage produces heavy shading. This restricts the amount of light that reaches other plants, creating dense monocultures. It is not palatable to most livestock, allowing it to quickly take over grasslands it has been seeded in as a foraging plant.

Means of Spread

Sericea lespedeza is moved primarily through seed distribution. A single sericea lespedeza stem can have 1,500 seeds and seeds remain viable for up to 20 years. Seeds are moved by wildlife, on equipment, on clothing and by pets.

Prevention

Sericea lespedeza can be managed through prevention and a variety of control methods. Prevention includes planting crops free of sericea lespedeza seeds, preventing the movement of infested hay, and cleaning farm, recreation and personal wear equipment being used in multiple sites. Mechanical management includes mowing every time the plant reaches 12 to 18 inches and burning in the early spring. Biological management methods includes grazing the plant at 3 to 4 inches using goats and cattle. Contact your local County Weed Control Authority for chemical control recommendations.

References: Sericea Lespedeza. (2014). In *Nebraska Invasive Plants Field Guide* (p. 62). Lincoln, Nebraska: Nebraska Invasive Species Program. Ohlenbusch, P., & Bidwell, T. (2007). Sericea Lespedeza: History, Characteristics, and Identification. Sericea Lespedeza Fact Sheet. (2013). Nebraska Weed Control Association.

Japanese & Giant Knotweed


Japanese Knotweed


Japanese Knotweed Leaves

Genus: *Fallopia*
Species: *F. japonica & F. sachalienensis*
Priority Listing: State Noxious Weed
Growth: Perennial
Type of Plant: Forb-shrub


Giant Knotweed


Giant Knotweed

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Japanese + Giant Knotweed

Species and Origin


Giant Knotweed leaves compared to sunglasses

Japanese and giant knotweeds were introduced to the United States from England in the 1800's to be used as ornamental plants. These species and their hybrids were designated Nebraska State Noxious Weeds in 2011. These species are often found in disturbed areas, neglected gardens, and along roadsides, riverbanks and stream-banks and other moist areas in fields. Japanese knotweed is found in a few counties in southeast Nebraska, while giant knotweed is not widespread in the state. Both species may grow to be over 10 feet tall. Both species have stems that are reddish-brown, stout, cane-like and hollow between the nodes and have spade (or heart-shaped) leaves. The alternately attached leaves of Japanese knotweed are approximately 6 inches long and 4 inches wide on a zigzag branch. Giant knotweed have leaves that are 6 to 12 inches long and two-thirds as wide.


Japanese Knotweed Stem

Impacts

Both species spread rapidly and form dense, near monoculture stands. These stands reduce species diversity which alters habitat for wildlife and increases the risk of flooding and river bank erosion.

Means of Spread

These species are spread in multiple ways. Small root or stem segments of these species are able to regenerate into new plants. They are commonly transported by water and easily established on the banks of streams and rivers. Plant segments can also be spread by foot traffic, equipment, mowing and improper disposal of vegetation. They are also spread by seed and easily escape landscapes.


Japanese Knotweed leaves

Prevention


Japanese Knotweed Flowers

These species can be managed through prevention and various control methods. Prevention includes planting crops free of seeds from these knotweeds, preventing the movement of infested hay, and cleaning farm, recreation and personal equipment being used in multiple sites. Mechanical management includes pulling the entire root system or cutting the stems about 2 inches above ground level in the early spring. Chemical control methods are effective when applied in early spring to stunt the plant. Multiple applications may be necessary for complete control. Contact your local County Weed Control Authority for chemical control recommendations.

References: Japanese Knotweed. (2014). In *Nebraska Invasive Plants Field Guide* (p. 34). Lincoln, Nebraska: Nebraska Invasive Species Program. Knotweed Fact Sheet. (2012). Nebraska Weed Control Association.

Eastern Redcedar

Genus: *Juniperus*
Species: *virginiana*
Priority Listing: Present in Nebraska
Growth: Perennial
Type of Plant: Native Evergreen Tree

Female Cones

Male Conelets

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Eastern Redcedar

Species and Origin


Eastern redcedar invasion

Eastern redcedar, also called ERC or red juniper, is a common coniferous species growing on a variety of sites throughout the eastern half of the United States. ERC is the most widely distributed conifer of tree size in the eastern United States, and is found in every state east of the 100th meridian. The number of trees and volume of ERC are increasing throughout most of its range. ERC is a dioecious species, and trees reach sexual maturity at around 10 years. Conelets begin to develop on male trees at the tips of axillary branches of new scale-leaves. Pollen grains are formed by late September in conelets which turn yellowish brown when they reach maturity during winter, and thus male trees are readily distinguished from female trees. Small green conelets begin to develop by early fall or late summer on female trees, but grow very little during the winter. They are borne terminally on axillary branches of the new scale-leaves, but do not become conspicuous until late February to early spring. Fertilization occurs in June, and the mature embryo is full grown in about 2 months, anytime from late July to mid-November, depending on location. As the ovulate cone develops, greenish fruit-scales form the outer fleshy protective coat of the berry-like cone. Cones change color from green to greenish white to whitish blue and finally to bluish as the season progresses. Each cone, or fruit, contains one to four rounded or angled brownish seeds that are 2 to 4 mm long, often with longitudinal pits with a thick and bony outer layer. Mature ERC trees produce some seeds nearly every year, but good crops occur only every 2 or 3 years.


Cedar-Apple Rust

Impacts

In 2014, the Conservation Roundtable listed ERC as one of the biggest threats to conservation in Nebraska. ERC is among the first to invade abandoned fields and areas cleared for pasture. ERC severely impacts grassland, forest, water, and wildlife resources on a large scale. ERC increases wildfire danger and has been shown to reduce stream flows. ERC serves as a host for cedar-apple rust which is a fungus that effects apple and crabapple trees. The fungus produces reddish-brown galls from 1/4 to 1 inch in diameter. The spore-bearing galls swell during rainy periods in April and May. The wind carries the microscopic spores to infect apple tree leaves, fruit and young twigs on apple and crabapple trees within a radius of several miles of the ERC with cedar-apple rust.

Benefits when ERC are Rare

ERC was the most suitable species among five combinations tested for single-row field windbreaks. It provides cedarwood oil for fragrance compounds, food and shelter for wildlife, and protective vegetation for fragile soils. ERC is among the best trees for protecting soils from wind erosion.

Means of Spread

The range of ERC has been considerably extended, especially in the Great Plains, by natural regeneration from planted trees. Fruits are eaten by birds and other animals. Seeds then pass through animal digestive tracts, and those that remain on the ground beneath the trees may germinate the first or second spring. ERC may also be established by hand direct-seeding or machine-sowing. ERC does not reproduce naturally by sprouting or suckering, but the species may be propagated by grafting, by air-layering, or from cuttings.


Prescribed burn of ERC

Prevention

ERC can be managed through mechanical, chemical, and cultural methods. The first step in any of these management methods is prevention. Fire is the worst enemy of ERC. The thin bark and roots near the ground surface are easily injured by fires, however extreme care must be taken when using fire, particularly with mature trees. ERC can be managed using chemicals at the appropriate rate, and on trees that are no taller than four feet. The chemicals that are effective include Hexazinone, Picloram, and Tebuthiuron. ERC, especially when weakened by stress or insects, is very susceptible to damage by the root-rot fungus, Heterobasidion annosum. This disease is thought to cause the greatest damage over much of its range. Mature fruits are usually collected in the fall by hand-stripping or shaking onto canvas. Seeds may be stored as dried fruits or cleaned seeds, reducing the overall number of ERC trees present.

References: Juniperus virginiana L. (2013). Retrieved December 15, 2015, from http://www.na.fs.fed.us/pubs/silvics_manual/Volume_1/juniperus/virginiana.htm Smith, S. (2011). Eastern Red-cedar: Positives, Negatives and Management. Retrieved December 15, 2015. Smith, S., & Stubbendieck, J. (2004). Chemical Control of Eastern Redcedar in Mixed Prairie. *Proceedings of the Eleventh North American Prairie Conference*, 147-150. Allen, C. (2014). *Eastern Red Cedar Conservation Roundtable Initiative*. Lincoln, Nebraska: University of Nebraska–Lincoln.

Curly-leaf Pondweed

Genus: *Potamogeton*
Species: *crispus*
Priority Listing: Present in Nebraska
Growth: Perennial
Type of Plant: Aquatic

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Curly-Leaf Pondweed

Species and Origin

Curly-leaf pondweed is an aquatic plant native to Eurasia, Africa, and Australia. It was introduced to the United Sates intentionally in the early 1900's for waterfowl and wildlife habitat. By the 1930s it was established in the Midwest and is now present in all of the continental United States except for Maine and South Carolina. In Nebraska it is most concentrated in the eastern portion of the state but is widely scattered.

Curly-leaf pondweed is a submerged, rooted aquatic plant that is green to red brown in color and has leaves with wavy edges. The plant begins to grow in late winter under the ice, blooms between May and June and dies in mid-summer. Curly-leaf pondweed prefers freshwater lakes, rivers, streams, ponds, ditches, and canals, but also tolerates brackish waters. It is often rooted in silt or clay and sometimes sand and gravel.

Impacts

Curly-leaf pondweed forms dense stands over very large areas, crowding out other species, restricting water movement, and altering oxygen levels which impact the fish. When curly-leaf pondweed dies it accumulates on shorelines impacting: water recreational activities, access to docks and fishing areas. After it dies off it can cause periods of low dissolved oxygen while decomposing and can promote algal blooms.

Means of Spread

Curly-leaf pondweed can spread between waters via plant material such as plant fragments or fruit that are transported on boats, trailers or other aquatic equipment.

Prevention

Curly-leaf pondweed can be managed through prevention and with mechanical and chemical control methods. The public can prevent the spread of this plant by cleaning, draining and drying watercrafts, recreational gear and trailers. Mechanical management includes pulling plants by hand or using large floating cutting blades, or motorized trimmers to remove the plants. Chemical control of curly-leaf pondweed is done using an endothall herbicide in the early spring when the water temperatures are between 50 and 60 degrees. Prior to any chemical treatment select the correct herbicide, follow the label instructions and restrictions and obtain any applicator licenses or permits required.

References: Curly Leaf Pondweed. (2014). In *Nebraska Invasive Aquatics Field Guide* (p. 44). Lincoln, Nebraska: Nebraska Invasive Species Program.
Curly Leaf Pondweed. (2015). Minnesota: Minnesota Department of Natural Resources.

HYDRILLA

Genus: *Hydrilla*
Species: *verticillata*
Priority Listing: Federal Noxious Weed
Growth: Perennial
Type of Plant: Aquatic

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HYDRILLA

Species and Origin

Hydrilla is an aquatic plant native to Asia, Europe, Africa and Australia. It was introduced to the United States from aquarium dumping into waterways in the mid-1900's. It is now established the southeast from Connecticut to Texas and is also in California. It is not known to exist in Nebraska but has been found in Iowa. By the 1990s control and management were costing millions of dollars each year. It is a fully submerged, rooted aquatic plant that has green leaves with serrated edges that grow in a circular pattern. It flowers during summer and fall and has flowers that are either whitish to reddish in color or light green with red streaks. This aquatic plant prefers freshwater rivers, lakes, ponds, streams, and wet ditches in shallow waters, but can also be found at depths greater than 23 feet deep. It can tolerate brackish water environments as well.

Impacts

Hydrilla is listed as a Federal Noxious Weed. It forms tall and dense stands in the water column, blocking sunlight penetration. It is capable of potentially displacing other aquatic organisms such as native vegetation and fish that require different vegetation and cover to survive. It can also impede water flow. Heavy growth obstructs boating, swimming, fishing and other activities. It also blocks withdrawal of water used for power generation and irrigations, which can be very costly.

Means of Spread

Hydrilla can be spread between waters via plant material such as plant fragments or buds that are transported on boats, trailers and other aquatic equipment.

Prevention

Hydrilla can be managed through prevention and with mechanical and chemical control methods. The public can prevent the spread of this plant by cleaning, draining and drying watercrafts, recreational gear and trailers. Mechanical management includes pulling plants by hand using a dive team to get the plant at the base. Chemical controls are limited and should be used with extreme care to minimize the impact upon native plants and aquatic ecosystem. Prior to any application select the correct herbicide, follow the label instructions and restrictions and obtain any applicator licenses or permits required.

References: Hydrilla. (2014). In N*ebraska Invasive Aquatics Field Guide* (p. 54). Lincoln, Nebraska: Nebraska Invasive Species Program. *Heading Off Hydrilla.* (1994). Michigan: Michigan Department of Environmental Quality.

Eurasian Watermilfoil

Genus: *Myriophyllum*
Species: *spicatum*
Priority Listing: Present in Nebraska
Growth: Perennial
Type of Plant: Aquatic

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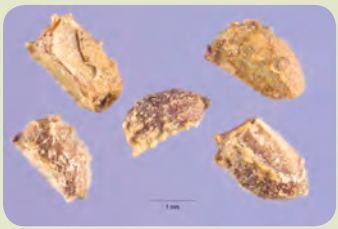
Eurasian Watermilfoil

Species and Origin

Eurasian watermilfoil is an aquatic plant native to Europe and Asia. It was introduced to the United States through the dumping of aquarium contents. It is present in Nebraska and was first collected in Hall and Lancaster counties in 1980, and has since been found in Merrick, Fillmore, Dakota, Greeley, Wheeler and likely occurs in other counties. It is a fully submerged, aquatic plant with green, feather-like leaves with at least 14 leaf segments on each side of the brownish-red to light green stem. Eurasian watermilfoil flowers between late July and August with pink petals. There is a native milfoil also in Nebraska that has fewer than 12 leaf segments on each side. Native milfoil also has toothed leaves and the plant feels rough. Eurasian watermilfoil prefers freshwater lakes, ponds, and slow moving areas of rivers and streams. It is capable of tolerating brackish waters as well.

Impacts



Eurasian watermilfoil competes with native aquatic plants displacing them and reducing the diversity of native aquatic plants. It begins growing in spring, earlier than other plants, and quickly grows to the surface forming dense canopies that overtop and shade out surrounding plants. This shading prevents light penetration that other plants and aquatic species rely on to survive. The dense beds of Eurasian watermilfoil restrict swimming, fishing, boating and clog water intake pipes of industries and irrigators greatly impacting both the economy and recreational activities.

Means of Spread

Eurasian watermilfoil is primarily moved by attaching to boats, trailers and other aquatic equipment. Motorboat traffic contributes to fragmentation of the plant which can be spread to other waterbodies and form new infestations.

Prevention

Eurasian watermilfoil can be managed through prevention and with mechanical and chemical control methods. The public can prevent the spread of this plant by cleaning, draining and drying watercrafts, recreational gear and trailers. Mechanical management includes pulling plants by hand, raking or cutting the plants. Biological controls include lowering the water level and several aquatic insects are currently being tested on their effectiveness in controlling Eurasian watermilfoil. The use of selected herbicides has been proven to be an effective control method, especially when using pre-emergent chemicals. Prior to any application select the correct herbicide, follow the label instructions and restrictions and obtain any applicator licenses or permits required.

Eurasian Watermilfoil. (2014). In *Nebraska Invasive Aquatics Field Guide* (p. 48). Lincoln, Nebraska: Nebraska Invasive Species Program. *Eurasian Watermilfoil Fact Sheet.* (n.d.). Washington: Jefferson County Noxious Weed Control Board.

Thousand Cankers Disease of Walnut Trees

Genus: *Geosmithia* (fungus) &
Pityophthorous (beetle)
Species: *morbida* (fungus) &
juglandis (beetle)
Priority Listing: State Quarantine
Not found in Nebraska
Classification: Insect/Fungal pest complex

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Thousand Cankers Disease of Walnut Trees

Species and Origin

Thousand cankers disease, also known as TCD, was identified in 2008 as the pest complex responsible for the death of black walnut trees in the Boulder, Colorado area. TCD is caused by a fungus *(Geosmithia morbida)* that is vectored into the tree by the native walnut twig beetle *(Pityophthorous juglandis)*. This fungus affects primarily black walnut, but Arizona walnut, English walnut, and California walnut have all shown varying degrees of susceptibility to this fungus. The fungus causes a canker (sore), killing a localized area of a tree's phloem just under the bark.

Impacts

TCD attacks the phloem of a tree impairing its ability to transport nutrients. This creates dead areas that often overlap or coalesce from numerous cankers (35 insects per square inch of wood), causing nutrient disruption to foliage thus leading to branch dieback. Symptoms include yellowing of leaves and foliage, thinning of the upper crown of the tree, and eventually tree death. TCD can kill trees within 3 years of symptoms emerging. Walnut trees are highly valued for lumber, nut industries in some states, and provide wildlife food and habitat. Walnut trees are commonly used in landscaping and can grow to be large shade trees increasing biodiversity in the landscape.

Means of Spread

The most likely pathway for artificial movement is raw wood (logs, stumps, firewood, wood packaging material, and nursery stock). Humans play a large role in the distribution of this pest complex, when they move infested wood from one location to another. There are no known infestations in Nebraska, but this fungus has been confirmed in most states west of Nebraska, including Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Utah and Washington. It is also found in a few eastern states, including Indiana, Maryland, North Carolina, Ohio, Pennsylvania, Tennessee and Virginia.

Prevention

Help stop this invader by limiting the movement of firewood to short distances (less than 50 miles) and reporting any signs of this disease at neinvasives.com. Be aware of state quarantines that regulate the movement of firewood and other walnut products between states. Inspecting your walnut trees regularly and spreading the word about TCD are vital steps to help with early detection and preventing new infestations of this disease.

References: Thousand Cankers Disease. (2014). Lincoln, Nebraska: Nebraska Invasive Species Program. Retrieved November 17, 2015, from neinvasives.com.

White Nose Syndrome

Genus: *Pseudogymnoascus*
Species: *destructans*
Priority Listing: Present in Nebraska
Classification: Fungus

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White Nose Syndrome

Species and Origin

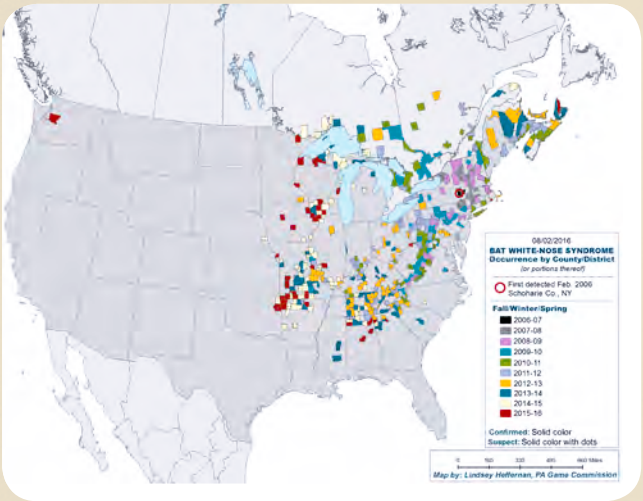
White nose syndrome was first found near Albany, New York in the winter of 2006. This disease was confirmed in Cass County, Nebraska in an abandoned mine in 2015. The first case of this disease in the western U.S. was found in Washington state in 2016. The disease is expected to have come to the United States from Europe. This is a disease of hibernating bats caused by the fungus *Pseudogymnoascus destructans*. The disease gets its name from the white fungal growth that appears on the muzzle and other body parts of infected bats. The disease causes bat mortality through abnormal behavior during winter hibernation months including flying outside during the day, and clustering near the entrances of caves. These behaviors deplete the bat's fat stores causing starvation. The disease is only known to affect winter-hibernating bats. White nose syndrome is known to affect many bat species including: big brown bat, eastern small-footed bat, Indiana bat (endangered), little brown bat, northern long-eared bat (threatened), gray bat and tricolored bat. Bat winter hibernation roosts include caves and mines.

Impacts

White nose syndrome causes 90-100% mortality in caves once infected. It has killed more than 6 billion bats in the eastern U.S. since 2006. Bats are vital for a healthy environment eating tons of insects each night benefitting us and our crops. Each bat can eat up to half its body weight in insects each night, and some bats pollinate plants. Bat species affected by the disease are unlikely to recover quickly due to long life spans and only birthing one pup per year. At this time there is no cure for this disease.

Means of Spread

The disease is spread by bat to bat contact. This means only one bat within the wintering cave needs to come in contact with an infected bat to infect the entire bat population of the wintering cave.



Prevention

Public education about the fungus, what to look for, and not moving bats from one place to another is vital in the prevention of white nose syndrome spread. Recreationists, natural resource workers, and biologists must be vigilant in decontamination of gear, shoes and clothing when moving from one site to another to prevent moving white nose syndrome. Several studies are being conducted on this disease in hopes of finding a cure or treatment.

White Nose Syndrome. (2014). Lincoln, Nebraska: Nebraska Invasive Species Program. Retrieved November 17, 2015, from neinvasives.com.