



First Detector's Handbook

A guide to being a citizen scientist and
defending Washington from invasive species

The Washington Pest Watch Citizen Science Handbook is a product of the Washington Invasive Species Council, housed within the Recreation and Conservation Office. Initial funding for the Washington Pest Watch curriculum and handbook provided by U.S. Department of Agriculture Animal and Plant Health Inspection Service Plant Protection and Quarantine.

The council wishes to express its appreciation to the many individuals who contributed time and expertise to the development of this handbook. Please note that while the council has endeavored to be thorough and complete in this list, we apologize in advance for any unintended omissions.

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Washington Pest Watch

Washington Pest Watch (WAPW) is a citizen science initiative dedicated to protecting Washington from new invasive species. Invasive species harm the environment, industry, and people. Washington has many invasive species already and there are more threatening to invade. Many species of concern exist in other parts of the United States and are creeping closer all the time, while others run the risk of being introduced from overseas. Some species have reached Washington, but were successfully eradicated—thanks to everyday people noticing and reporting them.



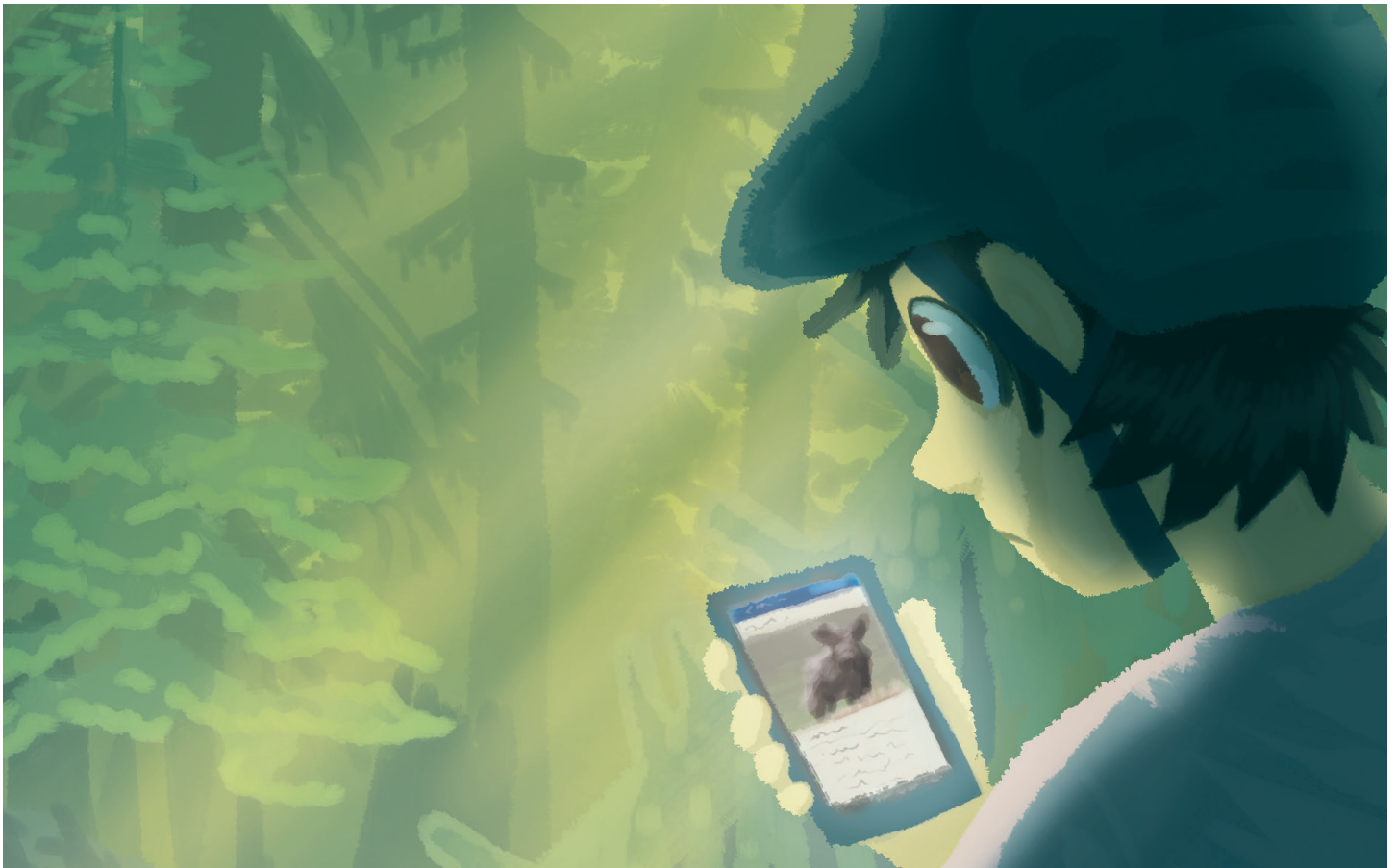
But for every invasive species stopped, more will arrive and that's where you come in. As a Washington Pest Watcher, you might be the first detector of a new invasive species, alerting the experts so they can act quickly and stop it from taking over Washington.

Anyone can participate in Washington Pest Watch—you don't need to be an expert. Everybody has the power to protect Washington from new invasive species. Being a Washington Pest Watcher is simple, just learn about which

species are invasive, keep an eye out for them, and report what you see. You don't even need to actively search for them; invasive species can be as close as your own backyard.

To protect Washington from invasive species, we need as many eyes on the ground as possible. The more alert and knowledgeable citizen scientists like you there are, the better the chances of stopping a new invasive species from making Washington its new permanent home.

Washington Pest Watch exists to recruit and train citizen scientists like you to start watching for new invasions. Washington Pest Watch was formed by a partnership of the Washington Invasive Species Council and Washington State University Extension, with other agencies and organizations serving as network partners.



Being a First Detector

What does it mean to be a Washington Pest Watch first detector? First detectors keep an eye out for new invasive species, and report anything they see that they think might be a problem. These reports give invasive species managers the alert they need to respond to new invasions and stop them before they take over Washington.

It's that simple. There's no commitment. You don't have to pass any tests, go out searching for invasive species, attend any trainings, or meet any minimum requirements. Washington Pest Watch first detectors are just everyday people keeping an eye out for new invasive species in their daily lives.



Trainings

While formal training is not required to be a Washington Pest Watcher, training may help you learn more about invasive species of concern and what to look out for. If you want to attend an invasive species training, you can see a calendar of upcoming opportunities by visiting the Washington Pest Watch Web page at:

invasivespecies.wa.gov/council_projects/wapestwatch.shtml

In-person trainings are offered periodically across the state with different themes. Most trainings will focus on a limited range of invasive species of concern, so you may want to attend multiple trainings if you wish to learn about more species. Most trainings are free, but many require registration to reserve a spot, so sign up early if you want to attend. There are also free periodic

Webinars that you can register for and participate in online. Some previous Webinars have been recorded and are accessible at any time on the Washington Pest Watch Web page linked on the previous page. Scroll down to “Trainer Resources” and look for the “Webinar Trainings Recordings” section for links to the recordings of past Webinars.

If you wish to become a certified first detector, you’ll need to attend a training that offers that option. While all Washington Pest Watch trainings will teach you a lot, not all can offer the option of first detector certification. Certification is not required for participation in Washington Pest Watch. You can make a difference, certified or not!

To request a training for an interested group or on a specific topic, contact the Washington State University Plant Pest Diagnostic Clinic:

plant.clinic@wsu.edu

(509) 335-3292

www.plantpath.wsu.edu/diagnostics



Intro to Invasive Species

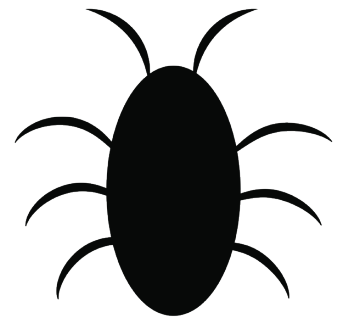
There are many terms you might come across with similar, but slightly different meanings: **invasive species**, **exotic**, **non-native**, **alien**, and **noxious weed** are some of the more common terms.

Exotic, non-native, and alien all mean the same thing—a species that is not native to an ecosystem (a community of living and non-living things that interact with one another). To be invasive, the species must be harmful to ecosystems, people, agriculture, or industry, and capable of spreading outside of human control. Not all exotic species are invasive, but all invasive species are exotic.

A noxious weed is an invasive plant species listed by the Washington State Noxious Weed Control Board. Noxious weeds are all invasive, but not all invasive plants are listed as noxious weeds. Learn more about noxious weeds at:

www.nwcb.wa.gov

Invasive species can cause a range of problems that vary by species. Invasive species are harmful because they threaten native species, important agricultural crops, and natural resources. Invasive species often reproduce quickly, are very hardy, and lack local predators, allowing them to outcompete native species for food and other resources. Invasive species can also prey on native species, spread diseases to them, and sometimes breed with closely related native species—reducing biodiversity.

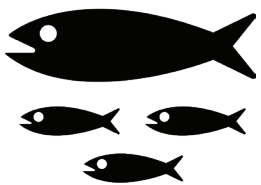


Invasive species can alter natural areas. For example, knotweed increases erosion on river banks, choking the water with sediment. Scotch broom changes soil chemistry to suppress the growth of native plants. Ecosystems may become particularly vulnerable to invasive species after experiencing

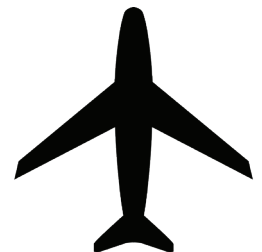
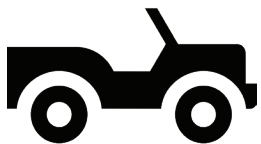
some sort of disturbance, such as wildfire or development. Changes to ecosystems can create opportunities for invasive species to get a foothold, at which point they may prevent the native ecosystem from returning.

Species have some ability to move into new area on their own, and this is a natural process. But in the modern era of globalization, invasive species are spreading faster, farther, and more frequently than ever before. Often people introduce invasive species by transporting them from place to place, knowingly or not.

Sometimes non-native plants that are introduced to yards, ponds, or aquariums eventually escape into the wild and become invasive. Some people bring invasive fish into Washington's waters for sport fishing, or release a pet that they can no longer care for into the wild, not realizing it could become an invasive species.



Invasive species can be introduced without anyone noticing—insects and plant seeds can travel via cars, trains, boats, cargo, planes, and anything moved across the country or the world.



Stopping the spread

Invasive species are not always possible to remove once they become established. Preventing invasive species from spreading is much easier than eradicating them after they arrive. The best way you can help stop invasive species is simply make sure you're not unintentionally helping them move to new places! Remember these steps:

PLAY CLEAN GO: When recreating outdoors, clean your boots and other gear before coming home to make sure you're not spreading invasive plant seeds and invertebrates. www.playcleango.org



BUY IT WHERE YOU BURN IT.

DON'T MOVE FIREWOOD.org

DON'T MOVE FIREWOOD: Buy firewood close to where you're going to burn it to avoid spreading invasive wood-boring pests long distances. www.dontmovefirewood.org

DON'T LET IT LOOSE: Don't release exotic animals into the wild. If they survive, they might become an invasive species or introduce diseases to native species. www.dontletitloose.com



CLEAN DRAIN DRY: When moving boats overland between water bodies, be sure to clean the boat thoroughly, drain all standing water, and allow the inside and outside of the boat to dry completely before putting it in the water. This will remove any plants and animals that might be hitching a ride on your boat. Some aquatic invasive species are microscopic, so a visual inspection is not enough! stopaquatichitchhikers.org

SQUEAL ON PIGS: Feral swine is a highly destructive invasive species that isn't common in Washington yet, though they have taken over in other parts of the United States. To prevent feral swine from moving into Washington, report all sightings of any pig wandering outside of captivity, even farm animals and pet pigs.



DON'T PACK A PEST: Invasive pests and diseases sometimes travel on your luggage. To prevent the spread of these invasive species, certain plant and animal products cannot be brought into the United States.

Always declare any food or agricultural items including dairy, meat, plant products, etc. when coming into the United States.

Visit www.dontpackapest.com to learn more about what items are safe to bring home with you.

How to Report

If you see something you think might be an invasive species but aren't sure, don't worry. Go ahead and snap a photo (or several) to send with your report so it can be verified. Better safe than sorry!

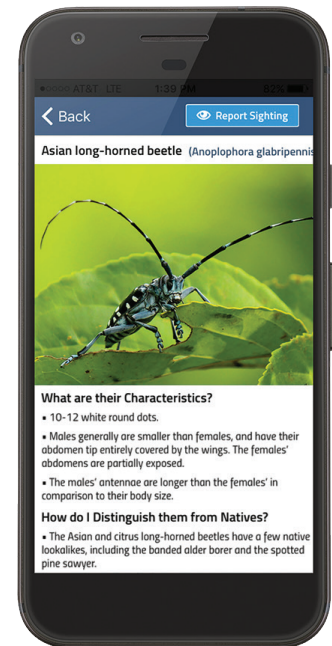
Your invasive species sighting reports are received by the Washington Invasive Species Council. Staff review your reports and confirm the specie's identity. Staff may then forward the report to alert other state or federal agencies responsible for managing that specific invasive species. Early detection and rapid response is the goal.

Reports of invasive species that are well-established in Washington may not warrant eradication, but they still provide valuable location data that can be used for research or management. Reports of established invasive species are very helpful and encouraged.

All invasive species sightings reports go to a database hosted by Early Detection & Distribution Mapping System (EDDMapS), which collects reports from different invasive species monitoring programs from across the country.

www.eddmaps.org

On the EDDMapS Web site, you can view your own and others' reports. In the top bar, click "Distribution Maps," search for a species to view and click it to see the entire United States map. You can view a list of reports by clicking the "List" option in the header under the species' name. Return to map view by clicking "Points."

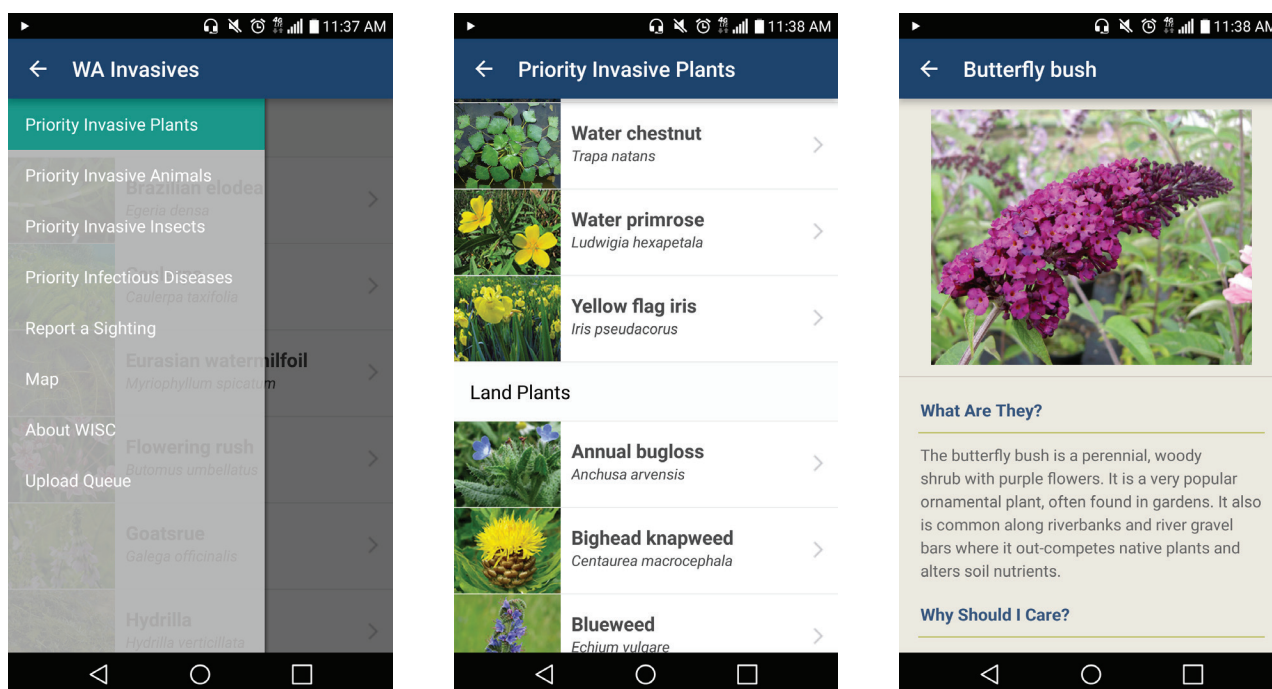


How to report

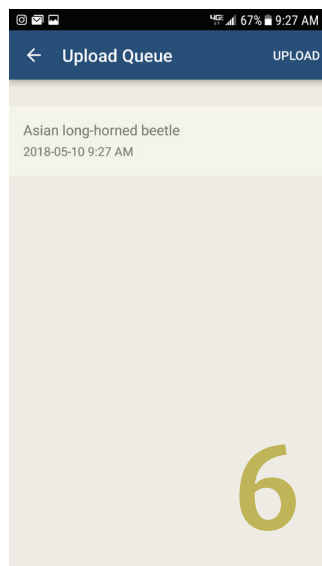
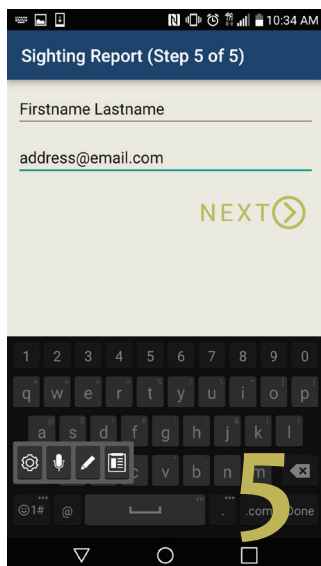
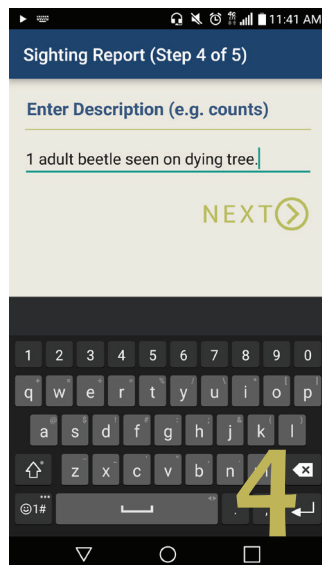
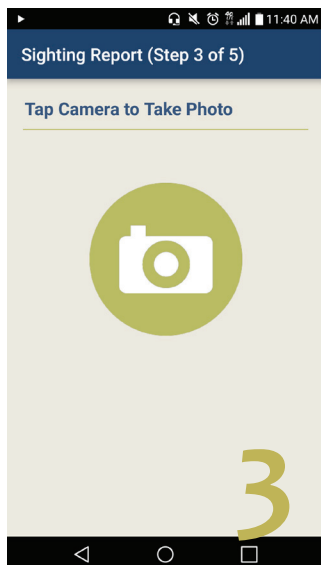
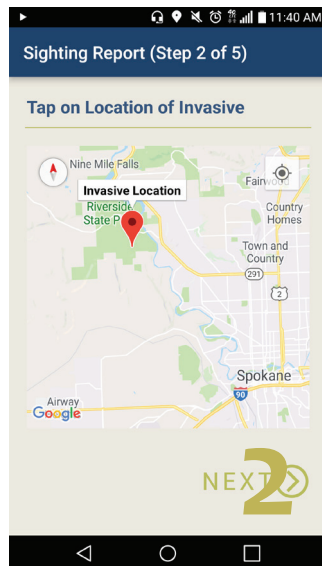
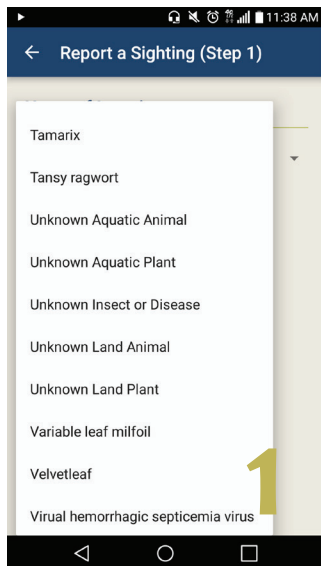
When you're ready to file an invasive species sighting report, you can either use the mobile app "WA Invasives" or the reporting form on the Washington Invasive Species Council's Web site:

invasivespecies.wa.gov/report.shtml

To download the app, search for "WA Invasives" in your device's app store. When you finish downloading the app and open it...



...you can browse the categories of invasive species and select a species to learn more about it, including how to identify it. This database includes all of the Washington Invasive Species Council's priority invasive species as well as all noxious weeds. To start reporting, choose "Report a Sighting" from the main menu.



1: Select the species you saw or select “Unknown.”

2: Use your phone’s GPS to mark where you saw the invasive species, or pan across the map and tap about where you saw it.

3: Tap the camera icon to take a photo of the invasive species to attach to your report.

4: Enter a brief description (optional).

5: Enter your contact information so someone can follow up with you. Then submit your report.

6: You can create invasive species reports even when your phone isn’t connected to the Internet. When you return to service, be sure to check “Upload Queue” under the main menu and submit any reports that were saved when a connection was unavailable.

Taking good photos

Taking a photo may not always be possible, but it is extremely valuable. If possible, attach at least one photo of the invasive species you saw to your report. Here are some tips for taking good quality photos that will allow the pros to properly identify the species:

Including something for scale helps in the identification of smaller organisms. A ruler, pen, coin, etc. can be included in the photo next to the subject to convey the scale. The back of this handbook has a ruler you can use.

The lighting in the photo makes a tremendous difference about how visible the subject is.

- Light from above or the side is best.

- Indirect sunlight is ideal (direct sunlight is often too strong).

- The flash on your camera might be too strong. If so, a flashlight might provide better lighting.

- You can diffuse light for a better shot by taping a bit of vellum or 1-2 layers of tissue over the light source.



Without light diffuser (left) and with light diffuser (right).

Examples of good and bad photos



- Subject is blurry
- Dimly lit
- Busy background



- Busy background



- Good focus
- Plain background

A background that is plain and contrasts with the subject helps make it stand out. The back of this handbook may make a good background for photographs. Move the camera around to find a better shot, or, if possible, physically move the specimen (insect/twig/leaf etc.) to compose a better photo.



Underexposed



Just Right

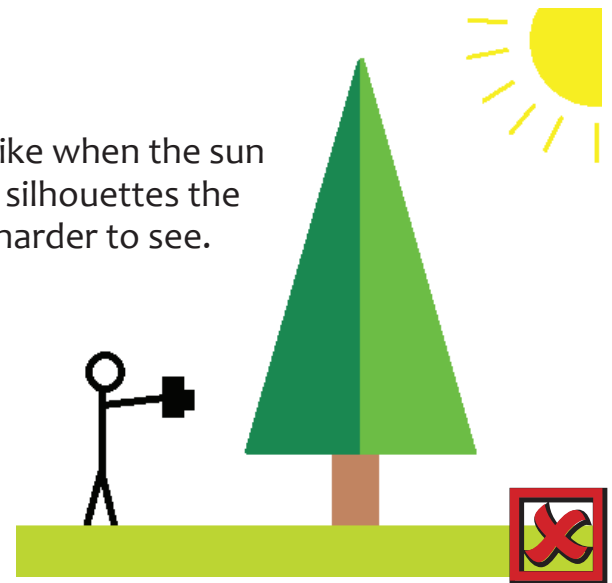


Overexposed

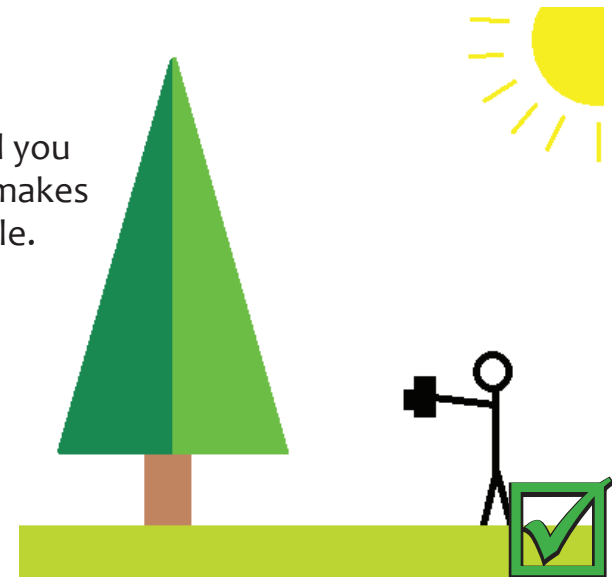
Over- or under-exposure can obscure the details.



Strong backlighting, like when the sun is behind the subject, silhouettes the subject and makes it harder to see.



Having the sun behind you when taking a photo makes the subject more visible.



High-contrast lighting, like direct sunlight, might make it hard to see the subject's details (left).

You might try shading the subject to get softer indirect light (right), but take care not to make it too dark.

Insects

- If possible, placing the insect in front of a background like cardboard or a counter top can help improve the focus.
- Try to take photos of the entire insect from above, below, and any distinctive markings or features.
- Take a few photos, at least one of the entire insect, and send along the best ones.
- Photos of the damage done by the insect (ex: bore holes in trees, chewed-up leaves) also help to identify the species. Including information with the report, like where it was found, what it was doing, and how many you saw can help with identification.

Plants

- There are a few different parts of the plant you may want to capture photos of to include in your report, including: the entire plant, a twig showing the leaf arrangement, a leaf close-up, flowers or fruits if present, and leaf buds if present (helpful during the winter when leaves are absent). When taking photos of different plant parts, it helps to focus on just one part per photo in order to ensure high quality photos of each part of the plant.

- Note other characteristics in your report: is there fuzzy hair or pubescence anywhere on the plant? Was it growing in sun or shade, a wet or dry area? Where was it found? How big was the plant? If possible include something in the photo for scale like a quarter, shovel, baseball bat etc.—something common with a fairly standard size. If this is not possible, try to include in your report estimates of the sizes of the plant, leaf, flower, seed, fruit etc.

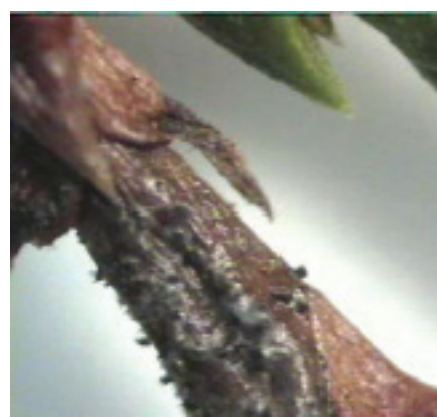


Good photo example: has a quarter for scale, showing leaves and leaf arrangement, fruit inside and out, plain background and diffuse lighting

- Try to avoid photos with other plants in the background. A solid dark background provides best contrast.
- Take pictures with the light source behind the camera to avoid the plant being silhouetted against a brighter background, which would make it more difficult to distinguish.

Plant diseases

- Take a few photos, starting with the big picture (the entire landscape or plant) then move closer with each picture until a close-up of the symptoms of concern, such as leaf blights or visible pathogen structures (such as mushrooms), are obtained.



Good photos example: the entire plant, the twigs, and a close-up of the diseased needles.

Snails



For snails, a set of three photos from these three angles is important to make identification possible. Also include something for scale.

Asian/citrus longhorned beetles

Anoplophora glabripennis/chinensis



Above: Asian longhorned beetle

Below: Citrus longhorned beetle



The Asian and citrus longhorned beetles are two species of closely related wood-boring beetles that damage and kill hardwood trees. Tree damage is caused by the larvae as they feed underneath the bark. If either of these beetles established in the Northwest, there is potential for great ecological, economic, and visual damage to our deciduous trees.

Identification

The two beetles look similar but have several characteristics that aid in identification. Adult Asian longhorned beetles range in size from 0.75 to 1.25 inches long, citrus longhorned beetles are slightly larger with a length up to 1.5 inches. Both have long antennae with alternating black and white bands. The male and female adults of both species are shiny black with up to 20 irregular white spots on the wing covers. The feet and legs of Asian longhorned beetles can have a bluish tinge.

There are other similar looking longhorn beetles that are native to the Northwest, but none of them regularly attack healthy trees like these two beetles. The Oregon fir sawyer is commonly misidentified as an Asian or citrus longhorned beetle because the females have a black body with mottled white patches and are similar in size. Their antennae are faintly banded with black and grey, as opposed to Asian or

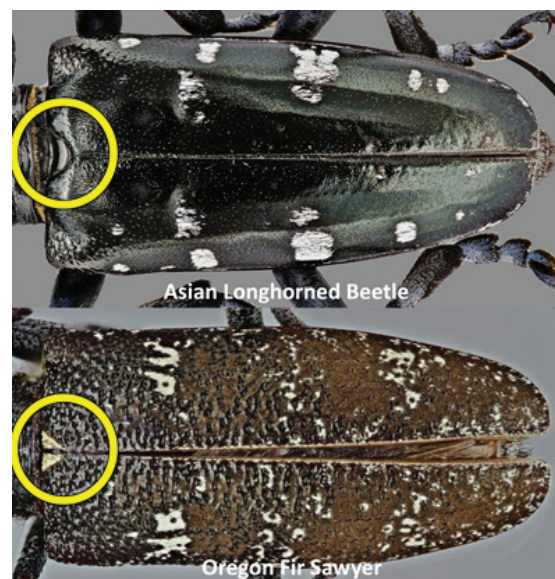
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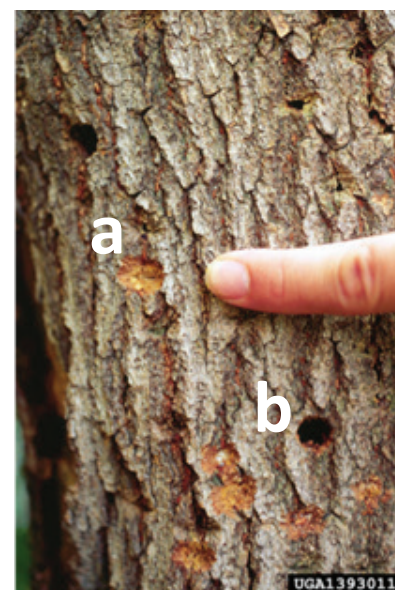


citrus longhorned beetle, which have distinct black and white bands. The Asian longhorned beetles, however, have smooth, glossy wing covers, as opposed to the pitted, rough-textured wing covers of the Oregon fir sawyer. Further, the color of the scutellum (triangular shape between the wing covers) is different. Asian longhorned beetles have a black scutellum while the Oregon fir sawyers have a white scutellum (see right).



There is one other species worth noting that may be mistaken for Asian or citrus longhorned beetles, the native banded alder borer. This banded alder borer has very definitive black and white bands as opposed to the white dots that are characteristic of Asian and citrus longhorned beetles.

Identifying the larvae is more difficult as they are similar in appearance to native species. Mature larvae of both species are whitish in color and about 2 inches long. Like many other wood borers that are hidden underneath tree bark for most of their life, noticing declining tree health, eggs niches, exit holes, and saw dust on the tree trunk are clues of their presence.



a: Saw dust; b: Exit hole

Japanese beetle

Popillia japonica



The Japanese beetle has been a serious pest of lawn and hundreds of other plants for nearly a century in the United States. Natural enemies in its native Japan keep this beetle from becoming a pest; however, North America lacks these population controls. The beetle is established in areas of the Pacific Northwest. Given the widespread distribution of this invasive exotic beetle, it is important for northwestern residents to be on the lookout for potential infestations.

Identification

The adult beetle is about $\frac{1}{2}$ inch long and has a metallic-green body with bronze wing covers. Females are generally slightly larger than males. Adults are most common in the late spring and summer. Both the male and female adults have distinctive white tufts of hair around their body margins.

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Leaves defoliated by adult Japanese beetles



Lawn damaged by Japanese beetle larvae

Asian and European gypsy moth

Lymantria dispar

Asian & European gypsy moths are two subspecies of the gypsy moth. Asian gypsy moths are not known to occur in the United States, whereas the European gypsy moth is a significant nonnative forest pest in the northeastern United States. Both subspecies prefer forest habitats and can cause serious defoliation and deterioration of trees and shrubs as the larvae feed on the leaves. European gypsy moths have more than 300 known host plants, but prefers oak. The Asian gypsy moth has a much broader host range of more than 500 species, including larch, oak, poplar, alder, willow, and some evergreens.

European gypsy moth have been steadily spreading throughout the United States from the Northeast to the Southeast and the Midwest since 1869. It is probable that Asian gypsy moth could quickly spread throughout the United States. Unlike the flightless female European gypsy moth, Asian gypsy moth females are active, long distance fliers (males of both subspecies can fly). Infestations of Asian gypsy moths can lead to the death of large sections of forests, orchards, and landscaping.

Identification

Adult males have grayish-brown wings and a wingspan of 1 ½ inches. Adult female moths are white and larger, with wingspans of 3 ½ inches or more. Gypsy moth caterpillars start out extremely tiny but rapidly grow up to 3 inches long. As they grow, they can be readily identified by their yellow head, hairy body, and distinct five pairs of blue dots followed by six pairs of red dots on their backs.

For more information see: agr.wa.gov/PlantsInsects/InsectPests/GypsyMoth



Gypsy moth caterpillar



Top: Female; Bottom: Male



Female gypsy moth laying an egg mass

Emerald ash borer

Agrilus planipennis



The emerald ash borer is a deceptively beautiful wood-boring beetle that wreaks havoc on ash trees. The larvae feed underneath the bark, disrupting nutrient and water flow and causing tree damage and mortality. Since being introduced to Michigan, it has rapidly spread to at least 22 states; however, it is not currently found in the Pacific Northwest.

Identification

The emerald ash borer has a brilliant emerald, metallic color. Underneath their wing covers is a coppery red abdomen. Note that the emerald ash borer's metallic sheen can vary depending on light conditions, and there are some very rare color varieties of the emerald ash borer that range from bluish green to coppery red. Despite their flamboyant coloring, the emerald ash borer is still difficult to identify, because there are several species that look very similar. In general, emerald ash borers are slightly larger than most native lookalikes, measuring $\frac{2}{5}$ – $\frac{1}{2}$ inches long. Send specimens to: Washington State Department of Agriculture Pest Program, 1111 Washington Street, Olympia WA 98504.



The larvae and the serpentine tunnels (galleries) they excavate under the bark are fairly distinguishable. The mature larvae are 1 to 1.25 inches long and have ten sharply defined segments.

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(pubs.wsu.edu)

Usually, the damage the emerald ash borer causes will be the first sign of an infestation. Some signs of infestations are: crown dieback (occurs after multiple years of feeding); serpentine galleries under the bark (below left), D-shaped exit-holes, and epicormic sprouting (new shoots that grow after a tree experiences great stress; below right).



Sudden oak death

Phytophthora ramorum



Sudden oak death is an invasive disease that attacks multiple species of trees and shrubs. This disease is caused by *Phytophthora ramorum*, a type of fungus-like organisms commonly known as water molds. Sudden oak death causes different symptoms depending on which species of plant is infected.

The name sudden oak death is fitting because in a matter of months, very susceptible trees (oaks, pine, beech, etc.) can die. The pathogen damages vascular tissues of very susceptible trees, and they start to wilt and eventually develop cankers (areas of dead tissue) at the bases of their trunks.

A foliar blight (browning and eventual death of leaves) occurs most often on common understory woody ornamental trees like rhododendrons, kalmia, and viburnum. Plants with foliar blight do not die suddenly, but do have reduced growth and may lose leaves and shoots and can spread the pathogen to susceptible trees.

There is no treatment for this disease; our only hope is to prevent the spread of the pathogen. Examine plants before purchasing at nurseries or garden stores to avoid planting infected nursery stock.

Identification

On oaks, firs, redwoods, beeches, and other trees,

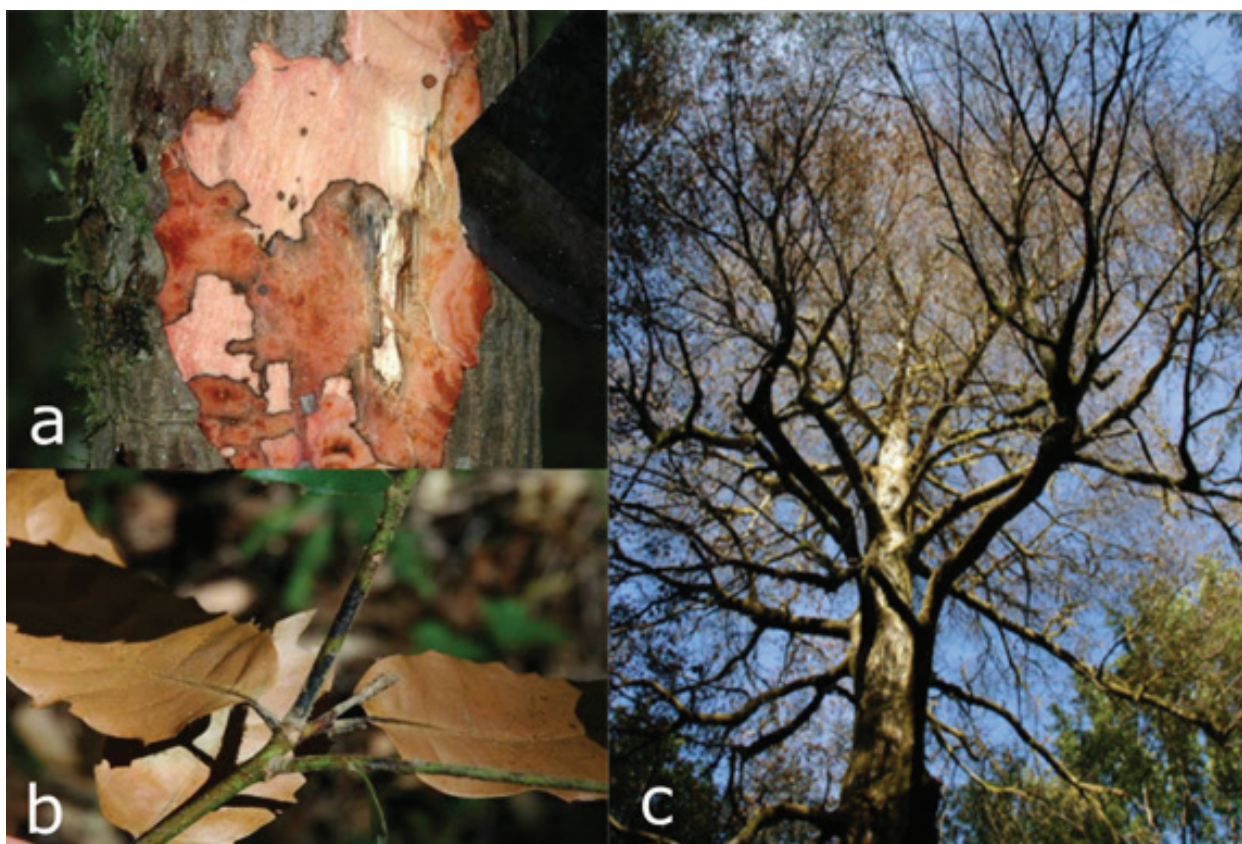


United States Department of Agriculture



For more information, see: www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/pests-and-diseases/phytophthora-ramorum

look for reduced growth, wilting, and dieback. These symptoms may be more obvious during hot, dry weather as there is more water stress. A dramatic symptom is the appearance of a bleeding canker on the stem or trunk of the tree. These cankers can cause a rusty appearance on the outside of the bark and may even leak red-brown ooze. For woody ornamentals, leaf spots may develop at the tips or the leaf margins, and more severely affected plants may have defoliation and shoot dieback. Monitor the health of susceptible trees. Many plant pathogens display similar symptoms, so if you see symptoms, contact your local Washington State University extension agent or National Forest Service diagnostic clinic to have a sample checked out to confirm the disease.



a: Damaged vascular tissue; b: Discoloration of leaves; c: Dieback

Thousand cankers disease

Pityophthorus juglandis
Geosmithia morbida



Thousand cankers disease causes the decline and eventually the death of walnut trees. In Washington State, walnuts such as the black walnut and English walnut are susceptible to thousand cankers disease and die rapidly after the initial infestation. The disease is caused by the walnut twig beetle, which carries the fungus *Geosmithia morbida*. The walnut twig beetle is a small beetle (0.15-0.2 cm long) native to the Southwest. The beetle larva feed on the tree and the fungus creates a canker in the tree; both disrupt the flow of nutrients through the tree, resulting in the decline in the tree's health. When the walnut twig beetle enters a walnut tree it releases a chemical signal that attracts other walnut twig beetles, amplifying the damage and creating more fungal cankers, hence the name thousand canker disease.

Unfortunately there are no ways to cure a tree once the beetles and the fungus have infested it. Trees that are confirmed to have thousand cankers disease should be destroyed. One of the major ways the beetle can move to new locations is the movement of wood such as firewood. If you see a walnut that you are concerned may have thousand cankers disease, contact a local Washington State University extension agent or a diagnostic clinic (NPDN.org).

Identification

Walnut trees with wilting and yellowing of leaves, branch dieback, or sap

For more information see
thousandcankers.com



staining on the trunk or large branches can be suspect for thousand cankers disease. Check the trunks and large limbs (> 1.5 cm diameter) for tiny holes the size of a mechanical pencil tip bored by the beetles. The serpentine galleries tunneled by the beetle larvae and the cankers from the fungus can be seen, if present, by removing a thin layer of bark and looking in the tissue called the cork cambium.



Cankers (dark spots) visible just under the bark



Walnut twig beetles laying on a penny



The tiny exit holes bored by the beetles

Feral swine

Sus scrofa

Feral swine are the same species as pigs that are found on farms. Feral swine are descendants of escaped or released pigs. Feral swine are called by many names including; wild boar, wild hog, razorback, piney woods rooter, and Russian or Eurasian boar. No matter the name, they are a dangerous, destructive, invasive species.

Feral swine were first brought to the United States in the 1500s by early explorers and settlers for food. Repeated introductions occurred thereafter. The geographic range of this destructive species is rapidly expanding and its numbers are increasing across the nation.





United States Department of Agriculture



adapted from USDA fact sheet

www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/operational-activities/feral-swine/feral-swine-identification

Identification

Feral swine often look very similar to domestic hogs, but are generally thinner with thicker hides of coarse bristly hair and longer tusks. Because of their extensive crossbreeding, feral swine vary in color and coat pattern, including combinations of white, black, brown, and red. Piglets are often striped or spotted, but lose this coloration as they mature. Some look like pure Russian or Eurasian wild boars, while others look more like domestic pigs.



Quagga and zebra mussels

Dreissena spp.

Quagga and zebra mussels are filter feeders capable of filtering about one liter of water per day while feeding primarily on algae. They will attach to any stable substrate - rock, artificial surfaces (cement, steel, rope, boats, etc.), crayfish, clams, and each other - forming dense colonies. These mussels were first sighted in the Great Lakes in the 1980s.

They are notorious for colonizing water supply pipes of hydroelectric and nuclear power plants, public water supply plants, and industrial facilities. Continued attachment of these mussels can cause corrosion of steel and concrete, affecting its structural integrity. These mussels can have profound effects on the habitats they invade.

Identification

Quagga mussel

Compared to zebra mussels, overall quaggas are rounder in shape. Color patterns vary widely with black, cream, or white bands. They usually have dark concentric rings on the shell and are paler in color near the hinge. They reach sizes up to 4 cm.

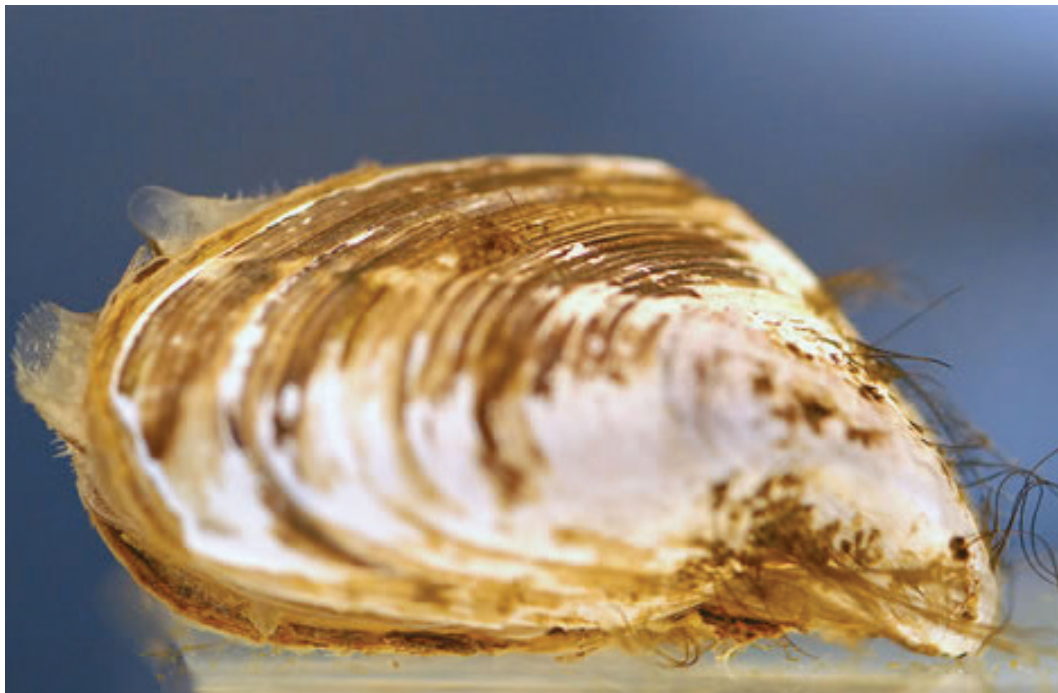
Zebra mussel

Color patterns can vary to the point of having only dark or light colored shells and no stripes. It is typically found attached to objects, surfaces, or other mussels by threads extending from underneath the shells. Although similar in appearance to the quagga mussel, the two species can be easily distinguished. When placed on a surface zebra mussels are stable on their flattened underside while quagga mussels, lacking a flat underside, will fall over.

adapted from USGS fact sheets:
nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=95
nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=5



Zebra mussels - note the color variation



Quagga mussel

Invasive frogs

American bullfrog - *Lithobates catesbeianus*

African clawed frog - *Xenopus laevis*

Bullfrogs

Bullfrogs are found in lakes, ponds, cattle tanks, bogs, and sluggish portions of streams and rivers. Adults consume birds, rodents, frogs, snakes, turtles, lizards, and bats. They are voracious eaters who also prey on their own young.

Egg masses are black on top and white underneath. They start as a round, basketball-size mass that flattens over time.

Tadpoles are dark green with black dots, orange or bronze eyes, opaque yellow underbellies, and are up to 6 inches long.

Juveniles are green to brown with small black spots, orange or bronze eyes, and a fold of skin from the eye around the eardrum.

Adults are 7-8 inches, with large, exposed eardrums behind their eyes, and are green, tan, or dark brown with dark spots and gold eyes.



adapted from USGS fact sheets:
nas.er.usgs.gov/queries/factsheet.aspx?speciesid=71
nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=67



African Clawed Frog

African clawed frogs (are a primarily aquatic, highly adaptable frog that can inhabit almost any body of water, natural or human-made, and tolerates sewage and relatively saline waters. These carnivores mostly consume aquatic invertebrates (worms, crayfish, snails, etc.), but also include small vertebrates (fish, tadpoles, etc.), including other African clawed frogs, and sometimes land animals, in their diet. African clawed frogs have long been used in laboratory research and are popular aquarium pets. Because these frogs live relatively long lives they are often dumped into nearby waters when owners lose interest or the experiment ends.

No other frog in North America looks like African clawed frogs. They are flattened in shape, with a relatively small head. The small, lidless eyes are on top of their heads and turned upward. There is no visible eardrum behind their eyes, unlike bullfrogs. The forefeet have slender, unwebbed fingers, which are generally held pointed in a forward direction. In mature adults, the hindfeet are large, fully webbed, and have sharp black claws on the three innermost toes.



The skin is very smooth except where the lateral line sensory system gives it a “stitched” appearance. It's usually olive to brown in color, often with blotches, spots, or mottling.

Purple loosestrife

Lythrum salicaria

Purple loosestrife occurs in freshwater and brackish wetlands as well as streams, marshes, and other habitats with moist ground or standing water. Purple loosestrife is a vigorous competitor and can crowd out other vegetation. It can quickly dominate a site and adapt to environmental changes. Loosestrife stands provide poor cover for waterfowl.

Identification

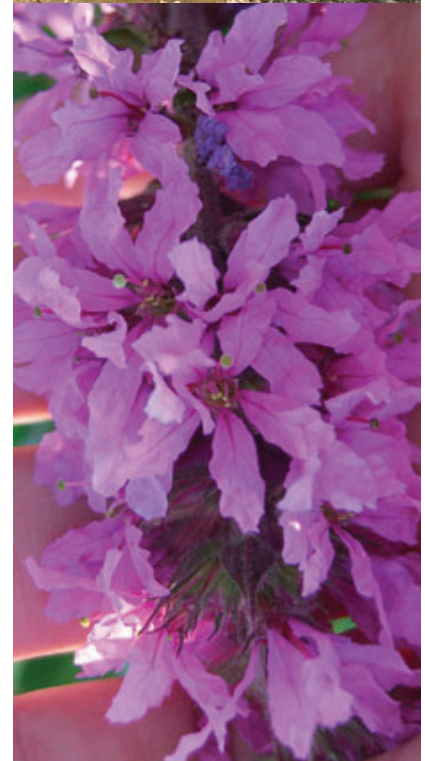
It can reach up to 10 feet tall and 5 feet wide and has a persistent, perennial tap root and spreading rootstock.

Flowers are densely clustered on a 4 - 16 inch flowering spike. Flowers are showy and magenta with five to seven petals.

Leaves are 1.5-4 inches long, lance-shaped to narrowly oblong, and sometimes covered with fine hairs.

Stems are herbaceous and upright, branched or unbranched and somewhat square with four to six sides. Each plant may have 30 to 50 stems with flowers that form at the ends.

Native spirea (*Spirea douglasii*) and fireweed (*Chamerion angustifolium*, syn. *Epilobium angustifolium*) look similar to purple loosestrife. If you need help with plant identification, please contact your county noxious weed coordinator.



adapted from NWCB fact sheet
www.nwcb.wa.gov/weeds/purple-loosestrife



Purple Loosestrife

Fireweed (native)

Loosestrife: Flower cluster consistent width, flowers close to stem

Fireweed: Flowers on long stems, flower cluster wider at base

Spirea: Flower clusters appear fuzzy



Spirea (native)



Loosestrife: 'ridges' on stem, stem squarish in cross-section. Leaves narrow, long, pointed

Spirea: leaves oval-shaped, serrated tips



Invasive knotweeds

Polygonum spp.

Invasive knotweeds are perennials found especially on roadways and riverbanks. These plants are highly aggressive, clogging waterways, eroding banks, displacing streamside vegetation, lowering the quality of shoreline habitat for wildlife, and even growing through building foundations. These tall, bamboo-like plants were introduced from Asia as ornamentals beginning in the early 1800s in England and in the United States by 1890.

Due to their widespread use, the lack of natural predators, and their ability to spread by root and stem fragments, invasive knotweed species have spread and become widely established throughout North America and Europe.

Identification

Growing in large, dense thickets, they reach 4-13 feet tall, with hollow, bamboo-like, green-reddish canes and branched clusters of small white flowers. In the Pacific Northwest, there are four similar species of invasive knotweed that are difficult to tell apart and share similar habitat, impacts, and control methods.



Stems are stout, cane-like, and reddish-brown. The plants die back at the end of the growing season but their old reddish-brown canes often persist. The stem nodes are swollen and surrounded by thin papery sheaths. Leaves are either heart-shaped or spade-shaped or somewhere in between. The flowers are small, creamy white to greenish white, and grow in showy plume-like, branched clusters from leaf axils near the ends of the stems. The fruit is three-sided, black, and shiny.



Bohemian knotweed is the most common invasive knotweed in western Washington. It is a hybrid between giant and Japanese knotweed and shares characters of both parent species. It is often confused with Japanese knotweed. **Japanese knotweed** is the most ornamental of the knotweeds and is shorter than Bohemian or giant knotweed. **Giant knotweed** is the largest knotweed, growing up to 16 feet tall or more. It is also known as elephant ear bamboo because of its very large leaves. **Himalayan knotweed** is the most distinctive of these species. It tends to be shorter, denser and more clump-forming, and has pinker flowers and stems that are not hollow.



Garlic mustard

Alliaria petiolata

In Washington State, garlic mustard is found in forested understory areas including urban parks, roadsides, trails, railroad tracks, streambanks, fields, slopes, and floodplains. Garlic mustard's growth starts early in the spring, outcompeting native and beneficial species that are still dormant. Its ability to reproduce high quantities of seed from a single plant can make it difficult to eradicate once it is well-established. Seeds can survive a number of years in the seedbank, prolonging its ability to dominate a site. Garlic mustard also changes the composition of a plant community by exuding chemicals that disrupt plant growth and certain plant-mycorrhizal fungi connections, which are important for tree seedling health.

Identification

Garlic mustard is a biennial to short-lived perennial plant that is garlic scented and can grow to a height of around 3 feet.

Flowers have four petals, four sepals (green leaflike part under the flower) and six stamens. Petals are white, about 1/4 inch long and are twice as long as the sepals.

Leaves lower on the plant are broad with rounded tips and rounded bases (kidney shaped). Upper stem leaves are alternate and triangular. Both leaf types have petioles (leaf stems). Leaf edges are coarsely toothed. New leaves have a strong garlic odor.

In general, stems are upright and one to many can grow from a rosette (cluster of radiating leaves at base of plant). They may be branched or unbranched.



adapted from NWCB fact sheet
www.nwcb.wa.gov/weeds/garlic-mustard



Seed pods are long and slender, curving upward, up to 2.4 inches long. Seeds are dark brown to black, grooved and oblong in shape. Plants can produce up to 8,000 seeds.



Pointier, more triangular leaves higher on the plant



Rounder leaves lower on the plant

1"

2"

3"

4"

5"

6"

7"

8"

9"

10"

1cm

3

5

7

9

11

13

15

17

19

21

23

25

27

Use this page as a tool for taking
better photos of invasive species!
This page makes a good plain
background too.