

Current Issues Resources Biodiversity and Invasive Species

Testing Resources:

- *Biodiversity* (adapted from Illinois Biodiversity Basics: A Biodiversity Education Program of the IL Department of Natural Resources, Chicago Wilderness, and the World Wildlife Fund, 1999)
- “What is in place in PA?”
- “Invasive Species – Villains, Saviors or Something in Between?” (Keystone Wild! Notes, Summer 2010 Edition)
- “Invasive Species Coming to a Town Near You” (Keystone Wild! Notes, Summer 2010 Edition)
- “Invasive Animals Don’t Need Passports to Travel” (Keystone Wild! Notes, Summer 2010 Edition)
- Table: **Invasive Species – Insects** [Hemlock Woolly Adelgid, Emerald Ash Borer, Spotted Lanternfly]
- Table: **Invasive Species – Aquatic** [Rusty Crawfish, Didymo (rock snot), Asian Carp]
- Table: **Invasive Species – Birds and Mammals** [Nutria, Feral Swine, House Sparrow]
- Table: **Invasive Species – Plants** [Garlic Mustard, Multiflora Rose, Purple Loosestrife, Mile-a-minute]
- Vocabulary

Also included as **non-testing** resources: Wild! For Kids Word Search and Color Me Wild! Invasive Animals

Focus:

1. Students should focus on the importance of biodiversity and how non-native species can impact biodiversity.
2. Students are responsible for information on the following invasive species:
 - Hemlock Woolly Adelgid (HWA)
 - Emerald Ash Borer
 - Spotted Lanternfly
 - Rusty Crawfish
 - Didymo (rock snot)
 - Asian Carp
 - Nutria
 - Feral Swine
 - House Sparrow (English Sparrow)
 - Garlic Mustard
 - Multiflora Rose
 - Purple Loosestrife
 - Mile-a-minute

Other species are referenced in the study materials but are not the intended focus for testing.

3. Students may be asked to identify measures to control or eliminate invasive species.
4. Students need to be aware of cause and effect – how the introduction of an invasive species can start a chain of events that can be far-reaching and often harmful to many parts of our environment and way of life.
5. Students will need an understanding of the differences between natives, non-natives and invasives and impacts on and threats to biodiversity.

Sample Questions:

1. An effective method to control aquatic invasive is to _____
 - A. Infrequently decontaminate all fishing and boating equipment that comes in contact with the water
 - B. Not transfer or release bait
 - C. Use a herbicide
 - D. Prohibit fishing and swimming in rivers and lakes
2. All non-native species are invasive species. True or False

Answers: 1. B/ 2. False (not all non-native species are invasive. In order for a species to be invasive, it must harm or have the potential to cause harm to human health, the environment or to the economy.)

Biodiversity



Adapted from Illinois Biodiversity Basics: A Biodiversity Education Program of the IL Department of National Resources, Chicago Wilderness, and the World Wildlife Fund, 1989.

What is Biodiversity?

Biodiversity is the variety of life on earth, reflected in the variety of ecosystems and species, their processes and interactions, and the genetic variation within the species.

Biodiversity includes species diversity, ecosystem diversity and genetic diversity. *Species diversity* includes all living things, from tiny bacteria to raccoons to hemlock trees. It has been estimated that the number of species on earth is somewhere between 10 million and 300 million.

Biodiversity also includes *ecosystem diversity*, the habitats that house all life forms and the interconnections that tie living things together. Ecosystem diversity includes wetlands, woodlands, and all other environments where species live. Biodiversity also includes the variety within a species, which is determined by the genes. *Genetic diversity* is the genetic variation present in a population or species. It is what makes every living thing unique. Genetic diversity is also a safeguard against future problems, such as disease or natural disasters.

Benefits of Biodiversity

- ♦ Helps maintain the atmosphere, keeps the soil fertile, purifies water, and provides other functions that enable life to exist on the planet
- ♦ Provides a wide variety of resources to humans, including food and medicinal products
- ♦ Species variety can help to avert disasters, like a major crop failure due to disease or drought
- ♦ Drives economy as it provides many products
- ♦ Good for the quality of life as the natural world offers a place to reflect and relax

Is our biodiversity being threatened?

All living things have evolved to live in special areas on the planet. Local climate, geology, soils, water and other natural factors have great influence on the species that live in particular ecosystems and habitats.

Unfortunately, our biodiversity is threatened. According to many of the world's leading experts in science, the loss of biodiversity is one of the most urgent environmental problems facing our planet. As human population increases so, too, do pressures on our natural resources. These pressures are altering ecosystems and species around the world.

People make a significant impact on the landscape and its diversity. Clearing forests, draining wetlands, developing urban areas, building roads and conducting other human activities is reducing the diversity of habitats and altering the overall biodiversity.

When people alter habitats, they kill and/or force out the organisms that live in the area, upset ecological relationships and reduce the ecosystems ability to perform necessary functions like flood control, water purification and nutrient recycling.

How do invasive species affect biodiversity?

A key issue threatening biodiversity is invasive species. Invasive species often reproduce quickly and spread over the landscape and waterways. They typically have few, if any, natural controls like herbivores, predators or diseases.

Many times people introduce non-native species to an area either on purpose or by accident. Some species are introduced for landscaping purposes or erosion control while others arrive unknowingly, on various imported products. Many aquatic invasives are introduced by dumping unwanted aquarium plants and other species into waterways. Once established in a new environment, some non-native species proliferate and expand over larger areas, becoming invasive pests.

Invasive species, like invading armies, are taking over and degrading our natural ecosystems. They disrupt the intricate web of life for plants, animals and microorganisms and compete for limited resources. Some invasives spread so rapidly that they stifle other species. An invasive plant, for example, could change a forest, meadow or wetland into a landscape dominated by one species. Such monocultures (stands of a single plant species) have little ecological value and greatly reduce the biodiversity of an area.

How can we protect biodiversity?

The greatest challenge we face to protect biodiversity is how to balance the needs of the present without jeopardizing those of the future. There is no single way to address the loss of biodiversity because there is no single reason why it is being lost. One approach is to maintain a relative state of equilibrium with our environment called sustainability. A society that reaches sustainability is one that can persist for generations without producing significant amounts of pollution, depleting natural resources and causing a decline in biodiversity. To achieve sustainability, the following need to be considered:

- **Land use planning is needed so that space may continue to exist for species and ecosystems.**
- **Habitat restoration is very important. We need research to determine what species exist, how they depend on their habitats and how habitats can be managed to ensure healthy populations.**
- **Legal protections for some species may be necessary.**
- **Stewardship of natural resources should be considered when making land use decisions.**
- **Increased education will lead to a better understanding of the problems and solutions. This can help citizens to take action in their own communities.**
- **Prevent and control the spread of invasive species. Consider removing invasives planted on your property. Be alert when visiting a natural area to avoid “hitchhiking” species; i.e., remove seeds from clothing and shoes and remove plants and other aquatic species from boats. Do not dump fishing bait!**

What is in place to help species at risk?

President Nixon signed the Endangered Species Act of 1973 into law on December 28, 1973. It was designed to protect critically imperiled species from extinction as a "consequence of economic growth and development untempered by adequate concern and conservation."

Endangered

Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania

Threatened

Species that may become endangered within the foreseeable future throughout their range in Pennsylvania

Extirpated

Species that have disappeared from Pennsylvania but still exist elsewhere

Extinct

Species that occurred in Pennsylvania but no longer exist

The Endangered Species Act is administered by two federal agencies, the United States Fish and Wildlife Service (FWS) and the National Oceanic and Atmospheric Administration (NOAA). As of October 17, 2018, there were a total of 1,466 threatened and endangered animals in the United States and 948 threatened and endangered plants nationwide.

What is in place in Pennsylvania?



In PA, the Pennsylvania Natural Heritage Program (PNHP) conducts inventories and collects data regarding PA's native biological diversity. The PNHP is a partnership between the Western Pennsylvania Conservancy, the Department of Conservation and Natural Resources, the PA Fish and Boat Commission, <http://www.pgc.state.pa.us/> and the PA Game Commission. Information is stored in an integrated data management system consisting of map, manual, and computer files.

The PNHP (PA Natural Heritage Program) inventories and maintains a list of all plant and wildlife species, plant communities, and geologic features in PA for which there is a conservation concern. The table below is data from the all-inclusive listing for York County.

PNHP Inventory York County – October 2018	
Reptiles and Amphibians	15
Birds	13
Fish	2
Mammals	3
Insects and Spiders	19
Mussels and Snails	4
Plants	98
Geology	2
Communities	0

The PNHP is continually refined and updated to include recently discovered locations and to describe environmental changes affecting known sites. The goal is to build, maintain, and provide accurate and accessible ecological information needed for conservation, development planning, and natural resource management.



Do something Wild!

Keystone Wild! Notes

Summer 2010 Edition

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Invasive Species –Villains, Saviors or Something in Between?

by Jessica Sprajcar,

Conservation Program Manager for the Pennsylvania Department of Conservation and Natural Resources

Open up the pages of any conservation related publication and you are likely to see an article or two discussing the threats posed by invasive species. There are entire conferences devoted to the subject. The Wild Resource Conservation Program even has a **documentary film** on the topic. Invasives are everywhere, both literally and figuratively. You might think that



Multiflora rose was promoted for agricultural fence rows, but it spread throughout the state. (Photo: James Miller, US Forest Service)

something so ubiquitous would be well understood, but for invasives that isn't always the case. The sheer variety of invasive species makes it a challenge to quantify their impact on the environment and economy. For instance, there is no agreed upon count of how many different species of invasives there are in the United States.

At www.invasivespeciesinfo.gov they list 123 species, but their list does not include species that have already become established, meaning that they are common in the landscape, breeding and self-sustaining. **Multiflora rose** is a well-known example of this; take a walk through any forest in Pennsylvania and you are bound to see these prolific shrubs.

DCNR's list of invasive plants includes more than 60 species, a handful of which are not included on the federal list. Part of the difference in lists stems from the fact that the definition of invasives is value-based; it all depends on what benefits you reap from the environment. For instance, if you are managing your land for timber and an exotic plant hinders the growth of your trees, you might consider that exotic to be

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Administered by the
 PA Department of Conservation & Natural Resources
 in cooperation with the PA Game Commission
 PA Fish & Boat Commission



invasive. Yet someone else who manages their land for ornamental flowers and shrubs might deliberately plant that exotic because it adds to the aesthetics of their landscape. Competing ideas of what the “natural environment” should look like leads to differing opinions on what is considered an invasive.

The mixed messages on invasives that the public is receiving from the media and scientists only help to further blur the issue. A few vocal opponents, or deniers as some media label them, make it seem like there is more controversy than perhaps there really is. Their philosophy is, “they are here to stay, so get used to it.” This article will lay out some of the issues with, and science behind, invasive species and let you make an informed decision about whether or not you think invasive species are the villains that many portray them to be.

An invasive species, according to the federal government, is any species that is not native to the area and causes or may cause harm to human health, to the environment or to the economy. The key terms there are “not native” and “causes harm,” for there are many non-native species that remain neutral or beneficial in the environment (think of the many fruits and vegetables we eat). Some land managers argue that there are native species that can have invasive tendencies in the environment; we will get to that later in the article. For now, let us discuss the role of invasives in our ecosystems.

The small but vocal contingent of biologists and land managers that think that too much fuss is being made over invasive species management even go so far as to say that we may be underestimating the benefits these species may have. Mark A. Davis, a professor and Chair of Biology at Macalester College, has written the book [Invasion Biology](#) to challenge the notion that all exotic species are bad. In the book, Davis asserts that if some invasives are simply changing the ecosystem, not causing extreme harm, then “altering one's perspective is certainly much less costly than any other sort of management program.” The public cost of invasives is estimated at more than \$138 billion a year according to the article, *Environmental and economic costs of nonindigenous species in the United States*, in the journal [Bioscience](#), so you can see where Davis is coming from.

Davis isn't saying that we disregard all invasive species though. For highly destructive species like [kudzu](#),

where the damage is great, he does support control programs, as long as the control methods stand a good chance of success. Unfortunately many times no one can predict the chance of success until large amounts of time and money have been spent.



Kudzu, “the vine that ate the south,” is now in parts of Pennsylvania. (Photo: John Byrd, Mississippi State University)

One of the more controversial assertions that Davis makes is saying that invasives rarely drive native species to extinction. On the contrary, he says that the opposite is true; that exotics increase species richness by adding new species to the native landscape. Yet many other biologists disagree. Dan Simberloff, professor of environmental science at The University of Tennessee - Knoxville, wants us to think of the [Asian chestnut blight](#), an introduced fungus that for all intents and purposes exterminated the native chestnut tree from the United States (some small root sprouts persist but are unable to reproduce). A variety of species that depended on chestnut trees were impacted, including “total global extinction of at least seven species of moth that were host-specific only on American chestnuts.” Research published in [Bioscience](#) by David Wilcove at Princeton University found that invasive species are at least partially responsible for the extinction or threatened status of 49 percent of imperiled species in the U.S. Invasive species have also been shown to homogenize some habitats, leading to a loss of genetic diversity.

Davis' use of the term exotics, rather than “invasives,” could have a part to play in the difference of opinions. Not all exotics are invasive. Confusing the two terms can have negative results. Defining an exotic species as invasive is a value judgment. The federal definition's use of the word “harm” depends on things that the

Invasive Species—Villains, Saviors or Something in Between? continued...

reader holds as important, and this is why no one can agree on a set list of species. For example, **Japanese barberry** is one of the most profitable shrubs in the nursery and landscape trade, but in many states it has been shown to cause significant harm to natural habitats. Conservationists and land managers consider Japanese barberry to be invasive and want it banned from commercial sale, while the nursery trade considers it to be beneficial and a great revenue generator. The ideal solution may be to determine whether this and other species are likely to cause more harm than good to society as a whole and then react accordingly. Massachusetts, for instance, went through this process and determined that Japanese barberry's benefits did not overwhelm its negative impacts on the environment; since 2009 it is illegal to trade or sell it within the state.



Japanese barberry is one of the top selling plants in the trade, but it can have damaging consequences to native ecosystems. (Photo: Jessica Sprajcar, DCNR)

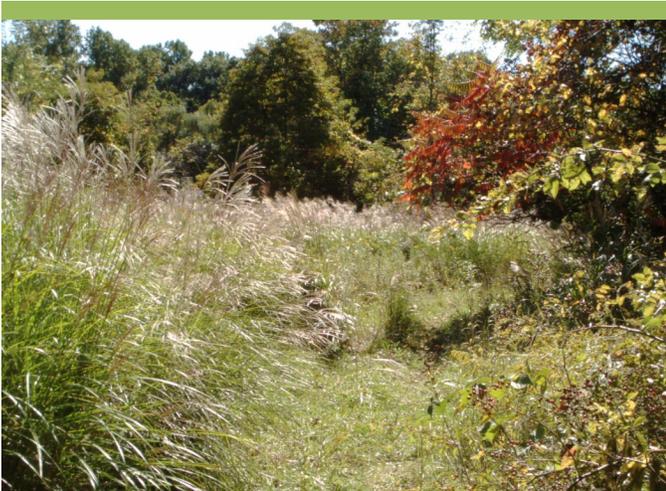
Invasive species reach this country through a variety of means: in ship ballast water, in the cargo holds of planes, in the soil of nursery stock, in the bellies of birds, on the wind or in the water. They arrive both accidentally and intentionally. As global travel and trade expand, so do the ranges of many invasive species. One argument for controlling invasive species is that because so many of them arrived here because of the actions of people, we have a responsibility to take action against them. Others argue, however, that because some species introductions have happened without human intervention, it is a natural process that we should just accept. They would say that we can no easier stop the

fall migration of birds than the influx of invasives. According to David M. Lodge and others, in their paper *Nonindigenous Species: Ecological Explanation, Environmental Ethics, and Public Policy*, "humans are, of course as natural as any other species," but over the last few centuries the human-induced rate of species invasion (and species extinction) has increased exponentially. Their reasoning says that just because something does or does not happen because of human actions, it doesn't mean we can turn a blind eye to it if it is harming our world.

As the threat of climate change looms ever closer, more people are looking toward alternative energy sources to halt the emission of carbon dioxide (a greenhouse gas) into the atmosphere. One such alternative energy is biofuel. Biofuel is a gas that can be used to run vehicles and heat homes. The fuel is created by the conversion of plant material—such as corn—into a fuel. In order for the United States and other countries to create enough biofuel to replace petroleum-based fuels, non-food crops must be identified. Switchgrass and *Miscanthus* hybrids are just two of the many plants being considered, but there is some concern over their potential invasiveness or the possibility they could escape from cultivation.

Switchgrass is native to Pennsylvania and much of the eastern United States. When planted in its native range it does not out compete other species, however it could become invasive in regions of the U.S. that are not part of its native range. There are several species of *Miscanthus*, and a hybrid of two, called *Miscanthus giganteus* (Giant *Miscanthus*), is currently being used for biofuel in the Midwest. Research is being conducted by Penn State University to discern the possibility of its use as a biofuel in Pennsylvania. Yet one of the parent species of this cross is *Miscanthus sinensis*, a common ornamental plant that is occasionally found as an escapee from cultivation.

Research done by the University of Illinois has found that using a sterile version of *Miscanthus giganteus* has proven successful and is capable of offsetting 20 percent of the country's gasoline usage and would require just 9 percent of current food crop acreage as opposed to 25 percent of the food crop acreage for corn-based ethanol production. *Miscanthus giganteus* also requires fewer chemical inputs than corn, thus its use is more environmentally-friendly. To promote these benefits while minimizing the risks of invasiveness, the **U.S. Invasive Species Advisory Council** has outlined a series of steps that federal



Miscanthus sinensis has the ability to escape from cultivation. (Photo: Pat Pingel, DCNR)

agencies (and others) can take to minimize the risks of a biofuel crop becoming invasive, in the publication, [Cultivating Energy, Not Invasive Species](#). These steps include researching traits that make plants less likely to become invasive, determining the areas best suited for cultivation of biofuel crops, preventing the spread of these plants by creating sterile hybrids and developing a rapid response plan should a plant escape into the surrounding ecosystem.

The very definition of invasive includes that the species is not native to the area in question, but what about the possibility of natives being invasive? As was stated earlier, some land managers contend that there are invasive natives. Mark Sagoff, senior public policy researcher at the [University of Maryland](#), wrote in

“Why exotic species are not as bad as we fear,” that some “native cousins [of exotics]... are as bad or worse.” Many foresters in the state would agree with that statement. They spend time battling striped maple and mountain laurel that interfere with their timber management. Some homeowners can attest to the aggressive tendencies of native vines like poison ivy and wild grape. Sagoff uses these occurrences to conclude that it is acceptable to allow invasive species to add to the destructive effects already caused by a few natives. Lodge takes the opposite view; that the acceptable solution is to manage both native and exotic species so that they do not harm the environment, the economy and human health.

Love them or hate them, invasive species are here to stay. There is little chance of eradicating most, so our options are to manage them so that they do not harm special habitats or threatened species, leave them alone to colonize areas at-will or use them to our advantage as much as possible. There is no one best management option and people will continue to argue over what is and isn't invasive for years to come, particularly as our climate changes in strange and unpredictable ways. Perhaps some invasive species will fill in niches vacated by our natives as our climate changes? Perhaps species that are now invasive will lose their aggressiveness as temperatures and weather patterns shift? Whatever the future holds for our ecosystems, invasive species will be sure to hold a place in them. Is that a good thing, a bad thing, or in between? I will let you make your own decision on that. ✓

Thanks to Melissa Bravo and Ashley Walter, [PA Department of Agriculture](#), for their assistance in developing this article.



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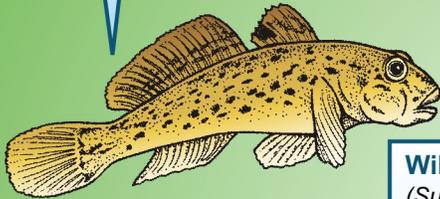


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Invasive Species Coming to a Town Near You

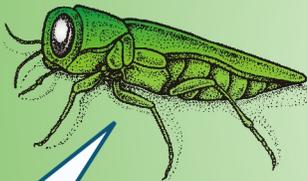
Round Goby (*Neogobius melanostomus*)

These small bottom-dwelling fish from Eastern Europe now inhabit the Great Lakes, including Lake Erie. They are voracious feeders and prolific breeders that can out-compete our native fish. There is an upside to these invaders though; up to 70 percent of their diet consists of invasive zebra mussels!



Wild Boar and Feral Swine (*Sus scrofa*)

Several counties in Pa. are now home to these wild pigs. These invaders can grow up to 400 pounds in size, wreaking havoc on crop lands and natural habitats as they root and dig through the soil for food (nuts, amphibians, bird eggs).



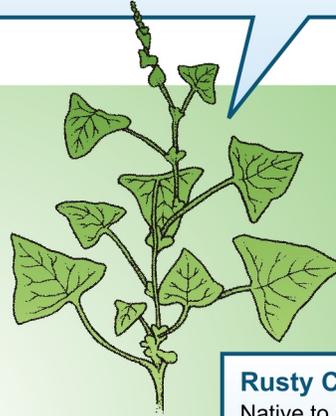
Emerald Ash Borer (*Agrilus planipennis*)

This metallic green beetle was first found in Pennsylvania in 2007, although it was probably here for many years prior, and has now spread to at least 12 counties in the state. EAB feeds on all ash trees and can kill them within 4 years of infestation. Tens of millions of ash trees have been destroyed in the U.S. so far, with no sign of an end in sight.



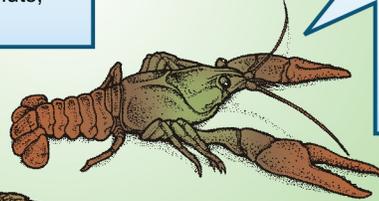
Mile-a-Minute (*Persicaria perfoliata*)

First introduced into the U.S. in the 1930's at a plant nursery in York County, this fast-growing vine can now be found in parts of northern Pa. and New York. Also known as "Devil's tearthumb" because of the many sharp spines along the stem and leaves, this invader drapes over native plants, blocking sunlight from them.



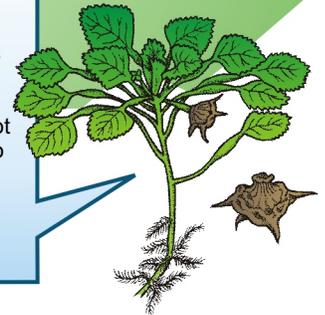
Rusty Crayfish (*Orconectes rusticus*)

Native to Ohio, these fast-growing crayfish have arrived in many streams and rivers in Pennsylvania. They can eat twice as much as our native crayfish, making it difficult for other species to find food. You will know these invaders by the rusty-red patches on their carapace (mid-section of body) and large size.



European Water Chestnut (*Trapa natans*)

No, this isn't the kind of water chestnut in your chop suey. It is a dangerous plant to swimmers as the spiky seed pods can puncture shoe leather. While not common throughout the state so far, this plant is spreading through the Delaware River watershed in the eastern part of the state.



Pennsylvania is home to numerous invasive plants, insects, birds, mammals and fish. Some, like multiflora rose, can be found statewide while others, like round goby and wild boar, have limited ranges (at least for now). These invaders entered Pa. by many means—in boat ballast water, as fishing bait, in the soil of nursery plants, in firewood, and on the soles of hikers' shoes. Their impact on the state's wildlife and habitats varies but one thing is the same for all invasive species; by definition they have the ability to cause harm to the environment, to the economy or to human health. Learn to identify a few key invaders in your area, find out how to prevent their spread and do your part to protect our native plants and animals.

Some Other Invasive Species in Pennsylvania

- European starling** (*Sturnus vulgaris*)
- Giant hogweed** (*Heracleum mantegazzianum*)
- Hemlock woolly adelgid** (*Adelges tsugae*)
- Japanese knotweed** (*Fallopia japonica* or *Polygonum cuspidatum*)
- Kudzu** (*Pueraria lobata*)
- Rock snot** (*Didymosphenia geminata*)
- Snakehead** (*Channidae* spp.)
- West Nile virus** (*Flavivirus*)
- Zebra mussels** (*Dreissena polymorpha*)

Invasive Animals Don't Need Passports to Travel



by **Jessica Sprajcar**

DCNR
Office of Conservation Science
Conservation Program Manager



Invasive animals know no boundaries; they don't get stopped for a Passport check at the border. Therefore, they are a global problem. Not only do numerous species from countries across the oceans end up here in Pennsylvania, but species native to our country end up causing trouble overseas. We hear a lot about the foreign species that make life difficult for us here, but what is it like for those living with our "exotic" species?

It may come as a big surprise to hear that the same grey squirrels that inhabit Pennsylvania parks, casually munching on acorns, are wreaking havoc in Great Britain. Grey squirrels (*Sciurus carolinensis*) were deliberately imported into Great Britain in 1876 and there are now an estimated 2 million of them living in the British Isles. By some accounts they are one of the most commonly seen mammals in Great Britain. The Isles are not devoid of their own native squirrels; the red squirrel (*Sciurus vulgaris*), a smaller species roughly half as large as the greys, makes its home there. Once the larger grey squirrels established themselves, however, the red squirrels started to decline. One estimate puts the red squirrel's population at just under 120,000 in some isolated pockets to the north in the U.K.

Grey squirrels out compete their red cousins for food and habitat and transmit the "Squirrel Pox" disease (a parapoxvirus). Grey squirrels are not killed by the pox, but for some reason the reds are. Already losing their homes and food to the grey squirrels, perhaps the pox is what puts them over the edge? All the negative impacts of grey squirrels combined have placed them on the [International Union for Conservation of Nature's](#) (IUCN) list of [100 of the world's worst invasive alien species](#).



Red squirrels, native to Great Britain, are being negatively impacted by invasive grey squirrels from the U.S. (Photo: Wikimedia)

Another mammal from the U.S. that is considered invasive in the U.K. (as well as other European countries, Russia, parts of South America and Japan) is the American mink (*Mustela vison*). These animals were introduced into Great Britain in 1929 for fur farms but many either escaped on their own or were deliberately released after the decline of the fur industry. They have been able to colonize most of the U.K. waterways, threatening native species like the endangered water vole. Mink are predators that eat the eggs and chicks of native waterfowl, fish and small mammals. Some of these animals had no natural predators before the arrival of mink, so they have not adapted to dealing with such attacks. The American mink is also in direct competition for food and territory with the European mink (*Mustela lutreola*), which is now limited to a few fragmented populations.

Water voles, an endangered species in the U.K., is being threatened by non-native American mink. (Photo: Wikimedia)



“Invasive Animals Don’t Need Passports to Travel” continued...

On the other side of the globe, over 30 non-native species of mammals now call Japan home, including the raccoon (*Procyon lotor*). According to an article in the journal, [Global Environmental Research](#), as early as 1962, populations of raccoons started to naturalize throughout the country. Raccoons were common pets in the late 70s and 80s, due to a popular cartoon show, but some either accidentally escaped or were intentionally released as they got larger and less “tame.”

Raccoons are well-adapted to a wide variety of living conditions and forage in both natural habitats and agricultural areas, affecting farm crops and native vegetation. They are also known to prey on native fish, Japanese crayfish and Ezo salamanders. A lack of natural predators, combined with high reproductive rates, make raccoons a prolific invasive species in Japan. Raccoons are also considered invasive by conservationists throughout Europe, where they were introduced in the late 1920s for fur farming and as pets. They are known affectionately as “wash bears” in Germany (due to the misguided belief that raccoons wash their food before eating it), where they make up the largest population of raccoons outside of the United States.



Germany is home to the largest raccoon population outside the U.S. (Photo: National Park Service)

There is a whole host of Pennsylvania species that are considered invasive in other countries, according to sources like the [DAISIE](#) (Delivering Alien Invasive Species Inventories in Europe) website and the [Japanese Invasive Alien Species Act – List of Regulated Living Organisms](#). These species include mammals like muskrat; reptiles like the snapping turtle; amphibians like the American bullfrog; fish, such as muskellunge, bluegill, small and largemouth bass, striped bass and brook trout; and birds, such as the ruddy duck and Canada goose.

Nearly every continent has contributed some of its species to other continents, whether through global trade, strong storm winds, or lazy pet owners. Some native plants and insects from North America traverse the globe and make foreign countries their home, sometimes with invasive results. So the next time you look at those invasive starlings and curse the British for bringing those birds to the U.S. just remember, they might also curse us for our pesky grey squirrels. ✓

Calling all creative people. We need your ideas!



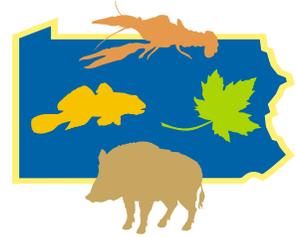
In future issues of *Wild! Notes*, we would like to include stories, photos, drawings, and other creative pieces from our readers. This is your chance to get published and help us make *Wild! Notes* more dynamic and exciting. Content should focus on non-game animal and plant species or habitats within Pennsylvania. Stories must be no longer than 1,000 words in length. Photographs should be at least 300 dpi resolution (jpeg files preferred). The editor reserves the right to condense stories to fit in space allowed and cannot guarantee publication. Send your submissions to *Wild! Notes* Editor, P.O. Box 8764, Harrisburg, PA 17105 or email it to jsprajcar@state.pa.us (file size under 3 MB only, please). Materials will not be returned to sender.

Pennsylvania's Invasive Animals and Insects



Wild! For Kids

Word Search



Asian longhorned beetle
flathead catfish
house sparrow
round goby
snakehead

emerald ash borer
gypsy moth
mute swan
rusty crayfish
wild boar

European starling
hemlock woolly adelgid
nutria
silver carp
zebra mussel

Answer key located on page 18.

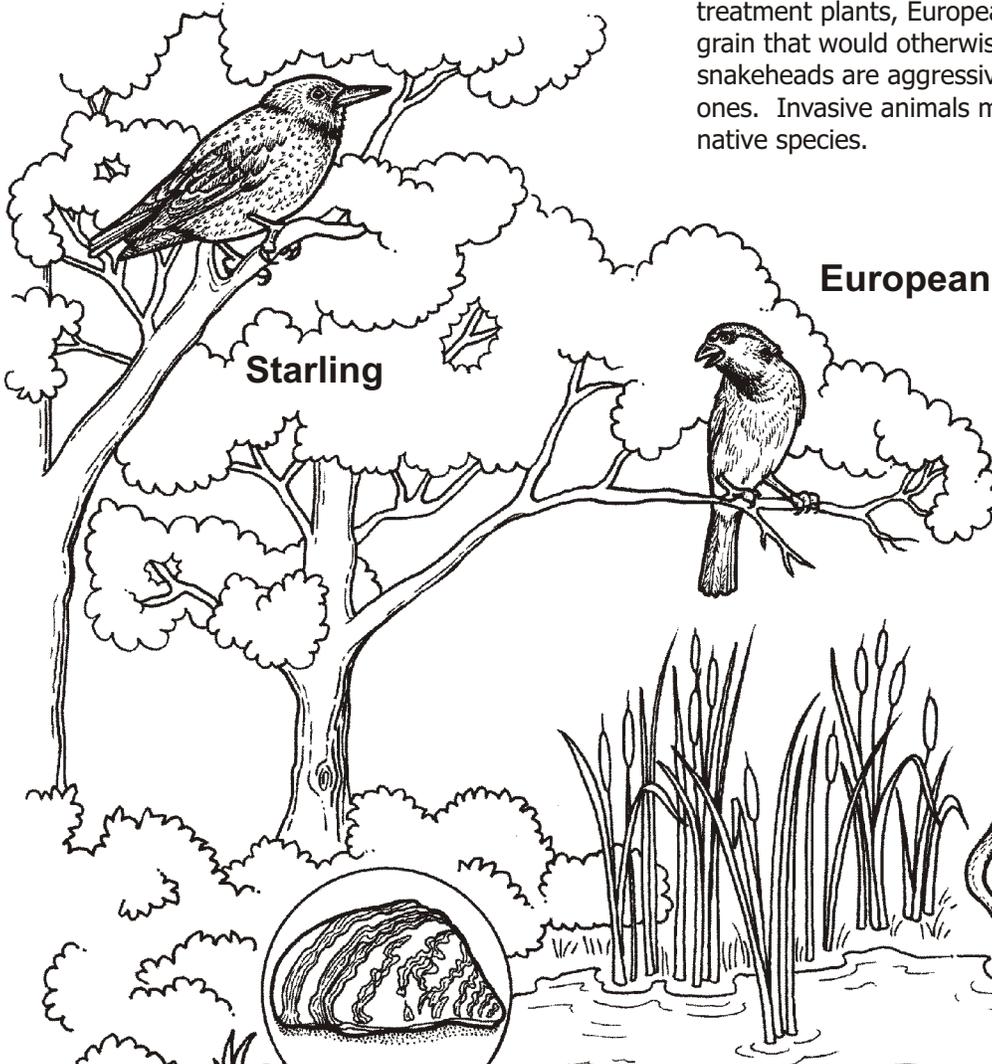
Invasive Animals

Color
Me



Wild!

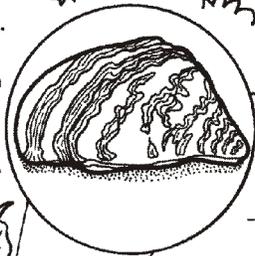
There aren't as many invasive animals as there are invasive plants, but that doesn't mean that they are any less destructive. Mute swans eat large quantities of aquatic plants that would otherwise feed native birds and fish, zebra mussels clog intake pipes at water treatment plants, European starlings eat agricultural grain that would otherwise be sold at market, and snakeheads are aggressive fish that eat our native ones. Invasive animals make life difficult for our native species.



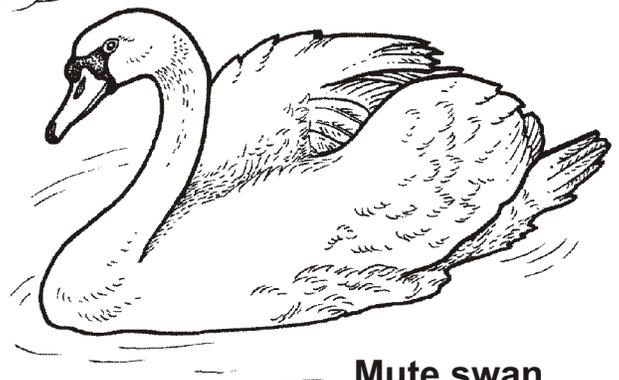
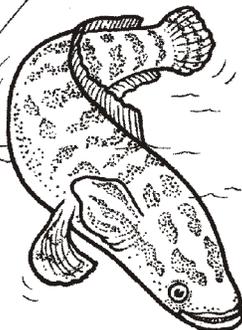
Starling

European house sparrow

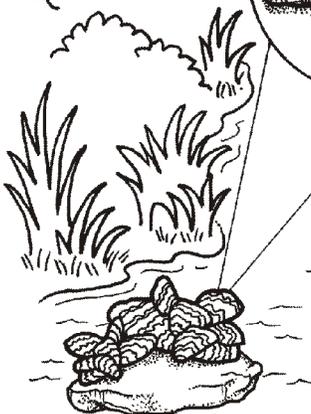
Nutria



Snakehead



Mute swan



Zebra mussels

INVASIVE SPECIES: INSECTS

COMMON NAME	PICTURE	NOTES/DESCRIPTION	CONTROL METHODS
<p style="text-align: center;">HEMLOCK WOOLLY ADELGID (HWA)</p>		<ul style="list-style-type: none"> • Adult HWA are soft-bodied insects too small to see with the naked eye • You can see the eggs, they look like white cottony egg sacs at the base of the needles • Feeds at the bases of hemlock needles • The needles die and drop off first. Then, major limbs of the hemlock die starting from the bottom. Eventually, especially if there is a drought, the tree will die within 4-6 years 	<ul style="list-style-type: none"> • Water hemlocks during drought • Remove dead and dying branches • Apply insecticidal soap • Looking at introducing a beetle that feeds on HWA • Do not transport firewood
<p style="text-align: center;">EMERALD ASH BORER</p>		<ul style="list-style-type: none"> • Adults are wood-boring beetles that are bright metallic green with two pairs of wings • Adults are bullet-shaped and 1/3 of an inch long • The larvae are white with 10 abdominal segments and a pair of pinchers at the end • The larvae are 1 to 1 ¼ inch long • 1 year life cycle • Affects green, white, and black ash trees by creating S-shaped galleries, D-shaped exit holes, and killing the tree within 4 years 	<ul style="list-style-type: none"> • Removal of affected trees • Annual chemical treatment by soil drenches, soil injection, or stem injections • Treat large trees before they become infected • Do not transport firewood
<p style="text-align: center;">SPOTTED LANTERNFLY</p>		<ul style="list-style-type: none"> • 1-1.5 inch wingspan • Newly-laid egg masses have grey, mud-like covering • Greatest impact to grape, hops, and logging industries • Particularly damaging to stone fruit trees • Infected trees develop wounds of sap near the trunk • Evidence of spotted lanternfly in several PA Counties 	<ul style="list-style-type: none"> • Scrape egg masses off, place in double bag and dispose • Kill eggs October – May • Trees can be treated with insecticide June-August • Preferred host is Tree of Heaven (another PA invasive) • Protect trees by wrapping trunks in sticky tape

INVASIVE SPECIES: AQUATIC

COMMON NAME	PICTURE	NOTES/DESCRIPTION	CONTROL METHODS
<p>RUSTY CRAYFISH</p>		<ul style="list-style-type: none"> • Bodies are 3-5" long with large claws which have black banded tips • May have a set of dark rusty orange spots on each side of the carapace (the protective outer covering on mid section of the body) • Very aggressive crayfish with huge appetite • Grows rapidly and become too big to eat for it's predators • Destroys aquatic plant beds that are the food, shelter, and spawning sites for other organisms. • Mates with native crayfish producing sterile offspring, therefore reducing the native population 	<ul style="list-style-type: none"> • Do not release bait • Never transport any crayfish from one water body to another
<p>DIDYMO (ROCK SNOT)</p>		<ul style="list-style-type: none"> • Forms thick mats of grey, white, or brown cottony material on the bottom of rivers and streams • Smothers aquatic plants, insects and mollusks which reduces fish habitat and food • Negatively affects fisheries, tourism, and hydropower. • Odorless and does not appear to be a threat to human health • Often mistaken for raw sewage 	<ul style="list-style-type: none"> • Decontaminate all equipment that comes in contact with the water including waders, boats, paddles, etc. • Do not wash algae down drains • Wash in hot water and either bleach, salt, antiseptic hand cleaner or dish washing detergent
<p>ASIAN CARP</p>		<ul style="list-style-type: none"> • "Asian Carp" refers to 4 different species: Bighead, Silver, Black, and Grass Carp • Can grow to weigh over 100 lbs and 4-5' in length! • Threat because of their large size, reproductive success and the large amount of food they eat • Asian Carp are hazardous to boaters because they can jump 6-10' feet out of the water. • There are no North American fish large enough to eat an adult Asian Carp 	<ul style="list-style-type: none"> • Electric dispersal barriers • Do not release bait • Drain water from boats and live wells before leaving any water access • Learn to identify Asian Carp

INVASIVE SPECIES: BIRDS & MAMMALS

COMMON NAME	PICTURE	NOTES/DESCRIPTION	CONTROL METHODS
NUTRIA		<ul style="list-style-type: none"> • Furry swimming rodents that have long, scaly tails and webbed feet • They weigh 15-20 lbs, resemble beavers and muskrats • In the early 1900's, they were brought to America for fur ranching • Compete with and displace native muskrats • Convert wetlands into open water reducing flood control and wetland filtering capacity • Erosion of marshes destroys fish, crab and shrimp spawning areas 	<ul style="list-style-type: none"> • Trapping or hunting
FERAL SWINE		<ul style="list-style-type: none"> • Feral swine look similar to domestic pigs, but they are much more destructive • Weigh between 130-400 lbs • Males have 4 tusks that grow continually and can be extremely sharp • They are aggressive and can transmit diseases and parasites to livestock and people • Extremely destructive to fields, and fences. They can strip a field of crops in one night • Their wallows destroy aquatic vegetation in ponds and wetlands 	<ul style="list-style-type: none"> • Trapping or hunting
HOUSE SPARROW (ENGLISH SPARROW)		<ul style="list-style-type: none"> • Males have black throat and chest patch, light cheeks and a brown nape • Nests are built in enclosed places such as house shutters, drainage piping, and building rafters. • They are aggressive birds and will force out other birds from their territories and nests • They are a nuisance due to their nesting, eating and living habits; nests clog gutters and drainage pipes and feces buildup can cause structural damage as well as pose a health risk. 	<ul style="list-style-type: none"> • Eliminate present and potential nesting spots • Eliminate food and water sources

Vocabulary

Current Issues: Biodiversity and Invasive Species

biodiversity	The variety of life on earth, reflected in the variety of ecosystems and species, their processes and interactions, and the genetic variation in and among species.
Conservation	The wise use of resources
decontaminate	To neutralize, destroy, or remove any harmful substance by checking, cleaning, and drying equipment and clothing
ecosystem	A community of organisms that are linked by energy and nutrient flows and that interact with each other and the physical environment
endangered species	Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania
extinct species	Species that occurred in Pennsylvania but longer exist
extirpated species	Species that have disappeared in Pennsylvania but still exist elsewhere
fragmentation	The breaking up of large habitats into smaller, isolated chunks
genetic diversity	The genetic variation present in a population or species
habitat	The area where an organism lives and find the nutrients, water, sunlight, shelter, living space, and other essentials to survive
invasive species	An organism not native to an area that has been brought in or spread into an area where it does not naturally occur and causes harm to human health, the environment, or the economy
native species	A species that naturally occurs in an area
non-native species	A species that has been introduced to an area by people from other continents, states, ecosystems, and habitats that remain neutral or beneficial to the environment

over-consumption

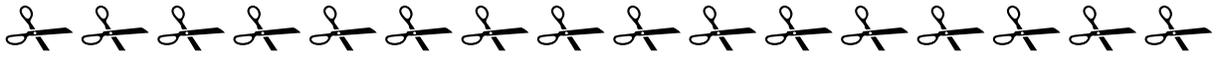
The use of resources at a rate that exceeds the ability of natural processes to replace them

sustainability

State of relative equilibrium with our environment; a society that reaches sustainability is one that is able to persist for generations without producing significant amounts of pollution, depleting natural resources, and causing a decline in biodiversity

threatened species

Species that may become endangered within the foreseeable future throughout their range in Pennsylvania



Cut on solid lines and fold on dotted to make flash cards

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