Glossary of Relevant Terms:

- **Browse:** Parts of woody plants that are eaten by animals.
- **Ecological niche:** The relationship of a certain species with its ecosystem. When two species fight for the same niche, this is called "competitive exclusion," and eventually results in the extinction of one of the two species from the ecosystem.
- **Exotic species:** A plant, animal, or other organism not native to a given area.
- **Extirpation:** Extinction of a species from a local ecosystem.
- **Stand:** A group of trees.
- **Standing dead:** Also known as "snags" these are dead trees that have not fallen to the forest floor. They can provide habitat to other animals and insects.
- **Trophic level:** An organism's position on the food chain.

Development of this guide was the result of a partnership between the East Stroudsburg Area School District, the Pike County Conservation District and the Pike County Office of Community Planning. Support from the Pike County Board of Commissioners and grant funding from the Pennsylvania Department of Environmental Protection's Environmental Education Grants Program contributed to the production of these materials.

Invasive Species

At East Stroudsburg Area School District's North Campus

Outdoor Learning Guide

How to use the Outdoor Education Guide

This Outdoor Education Guide is intended to provide faculty and staff with a background knowledge of what can be found on the North Campus Trail. While the Interpretive Trail Guide provides a brief overview of the natural features found along the North Campus Trail, the Outdoor Education Guides go into greater detail on five of the Trail's most salient features. The five Outdoor Education Guides augment the topics presented in the Interpretive Trail Guide with case studies, discussion questions, and examples found along the North Campus Trail. These guides are not meant to take the place of existing lessons and instruction; instead, this guide should be used to help draw connections between the North Campus Trail and existing classroom instruction.

Access Road to North Campus Trail (PCCP Photo)

Outdoor Education Guide Series:

- **Green: Interpretive Trail Guide**
- **Red: Invasive Species**
- **Blue: Water and Watersheds**
- **Grey: Local Geology and Soils**
- **Brown: Trees**
- **Orange: Ecology and Species Habitat**

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University of Georgia: Warnell School of Forestry and Natural Resources and the College of Agricultural and Environmental Sciences Department of Entomology. *Invasive.org: Center for Invasive Species and Ecosystem Health.* www.invasive.org (accessed March 1, 2013).

grades 5-8) involves the creation of 10'x10' plots to inventory area species, and determine whether they are native or non-native. Accessed January 2013: **http://www.projectwild.org/**

- *Sustaining Penn's Woods:* Produced in 2000 specifically for Pennsylvania educators, *Sustaining Penn's Woods* is a curriculum guide for forest education, grades 5-10. Every school in Pennsylvania received a copy of this program. Activity of interest for grades 7-10 "Saga of the Gypsy Moth." While more of an indoor activity, a visit to the trail beforehand could be a great introduction to the subject. This activity can be found as a pdf (as of December 2012) at: (**http://www.hlma.org/pennswoods/online/activities/Sec2-7.pdf**). Another activity "Who's Invading Pennsylvania's Forests?" for grades 5-10 provides an overview on the American Chestnut Blight and exotic species introduced to Pennsylvania. This activity can be accessed (As of January 2013) at: (**http://paforestproducts.org/pennswoods/online/activities/Sec2-6.pdf**).

- Penn State University's College of Agricultural Sciences has a program on Ecosystem Science and Management. This page includes resources for students and teachers on a wide variety of topics including invasive species. Lesson plans, educational materials, and quizzes are also included. Accessed December 2012: **http://ecosystems.psu.edu/youth/sftrc**

- The American Chestnut Foundation offers educational resources to educate students on the outdoors, the importance of the American Chestnut tree, and general forest ecology. The site includes links to other educational resources as well as forest and chestnut "kits" for purchase. Accessed December 2012: **http://www.acf.org/educational_programs.php**

Invasive Species 101

Who are these invasive species?

Plant, animal, fungus or other living organism, not native to a certain location that when introduced, causes harm to the existing local ecosystem. In Pike County, several invasive species exist, including Japanese Knotweed, *Didymosphenia geminate* (AKA "Rocksnot"), purple loosestrife, house sparrow, European starling, multiflora rose, and the hemlock woolly adelgid. A notable historic example is the American Chestnut blight fungus.

What are the problems associated with invasive species?

Since the species is not native to a certain location, it may not have any natural predators or other environmental factors, such as the local climate, to keep it in check. Without these controls, invasive species can replace the **ecological niche** of other species and outcompete them for resources. This can result in local decline or even **extirpation** of the native species. The loss or reduction of this native species may have ripple effects on the local environment. For example, a local species may have fed upon an insect that could pose a health risk to humans. Without the local species acting as a predator, the insect population could dramatically rise and result in the spread of disease. Invasive species can create their own ecological niche by feeding upon crops, or plants or animals that did not previously have a natural predator.

Where do they come from?

A certain species may be fine in its native area because the ecosystem has adapted to it. When this species is introduced somewhere else, it may cause problems when the new ecosystem is not able to adapt. Invasive species can come from another country, another state, or even from one lake in Pike County to another nearby lake. Invasive species make their way to an area either intentionally or unintentionally through human movement. People may intentionally introduce a plant or animal to a new area for purposes such as pest control, landscaping, fruits or vegetables from another country or location, or as a pet. Invasive species may be introduced unintentionally when they "hitch" a ride off of a boat, vehicle, train, or in the case of the Asian Longhorn Beetle, inside packaging materials. In another example, the Zebra Mussel was introduced to the Great Lakes after getting caught in ship ballast water from Russia. Other factors, indirectly related to human activity may play a role in

invasive species introduction, such as through climate change. Altered weather patterns, extreme weather, and different growing seasons may encourage the introduction and spread of invasive species.

When do they cause problems?

Invasive species cause problems when they outcompete a native species and disrupt the local ecosystem, and have no natural predators or forms of resistance that can slow their spread. Sometimes an organism can be introduced to an area and their spread is limited due to environmental factors, such as cold or warm weather, or a rainy or dry season.

Rock Snot, image New Zealand Fish and Game, courtesy Missouri Department of Conservation and Wildlife

How can you restrict their spread?

Avoid transporting plants, animals, or other products that may act as a "vehicle" for any potential exotic species. While your pet animal may not directly be an invasive threat, traveling with them overseas could theoretically introduce something that may have hitched a ride on the animal, such as a mold spore or an insect. Other "vehicles" include firewood and other wood products. If you take your boat out onto a river, lake, stream, or other body of water, make sure to wash the boat thoroughly before you bring it to another body of water. If you wear waders or felt-soled shoes for fishing, make sure to clean them as well. Some areas have actually placed restrictions on the use of felt-soled shoes to avoid the spread of certain invasive species that can "hide" inside the felt, and escape once it reenters the water. The state of Missouri has banned the use of felt to curb the spread of the invasive Didymosphenia geminate, commonly known as "rock snot." This algae, originally from northern north America and Europe has even made its way into the Delaware River, so it is important to make sure to prevent its spread.

Activities and Resources:

- The United States Department of Agriculture's National Invasive Species Information Center contains a resource library on invasive species. The library includes an invasive species database, photographs, a frequently asked questions (FAQ) page, identification resources, as well as activities and resources for students K-12. Under "Browse By Subject," select "Resource Library." Accessed December 2012: **http://www.invasivespeciesinfo.gov**

- The United States Department of the Interior's Bureau of Land Management's Learning Landscapes program includes information and resources on invasive species. Accessed December 2012: **http://www.blm.gov/wo/st/en/res/Education_in_BLM/Learning_Landscapes/For_Kids/homework_helpers/invasive_species.html**

- The *Natural Enquirer*, a middle school science journal from the United States Department of Agriculture has an Invasive Species issue that includes information and activities for students. Journal issues can be downloaded for free from the website, click "View & Order Journals." Accessed December 2012: **http://www.naturalinquirer.org/**

- Invasive.org, a website from the Center for Invasive Species and Ecosystem Health, is a joint project of the Center for Invasive Species and Ecosystem Health and the US Department of Agriculture's Animal and Plant Health Inspection Service offers resources for teachers and students, including photographs, videos, publications, maps, and methods related to species control. Accessed January 2013: **www.invasive.org**

- *Project Wild:* Project WILD is an interdisciplinary conservation and environmental education program emphasizing wildlife. This program periodically publishes a Curriculum and Activity guide for Grades K-12. To receive further information and materials from this program, the contact for Pennsylvania is Theresa Alberici with the Pennsylvania Game Commission. She can be reached at: (717) 787-1434 (talberici@pa.gov). While activity and curriculum information can be accessed through this contact, the Pike County Conservation District has a copy of the guide that may be accessed for reference. Relevant activities in the 2000 Edition of Project WILD include "Seed Need" (Page 98-99), how animals carry seeds (recommended for grades 5-8), which can be used to see how humans can unwittingly carry seeds. Another activity, "World Travlelers" (Page 334-338 for

Discussion Questions

These questions are suggested starting points to help spur discussion and critical thinking about invasive species and their impact on a local ecosystem.

- What can humans do to reduce the spread of invasive species?
- When does an exotic species become an invasive species problem?
- Are all invasive species bad? Are there any "good" invasive species? Explain why.
- Select an invasive species. Discuss how it has caused problems to a local ecosystem. How did this particular species affect native species?
- What would cause people to willingly introduce an exotic species to an area? Despite all that we know today about the problems that invasive species can cause, what are some reasons why invasive species introduction continues to be a problem?
- Are humans the only living creatures capable of introducing an exotic species to an area? Why or why not?
- Select a native plant, animal or other organism. If you introduced it somewhere else, how would it impact the local ecosystem? Speculate the impacts that this organism would have and why.
- How can a non-living object assist in the spread of invasive species? How can this be avoided?
- Think about your own daily habits. What are some things you have done that could help spread or introduce an exotic species to a new area? What can you do to make sure you do not contribute to the spread of an invasive species?

Historical Impact of Invasive Species in Pennsylvania: The American Chestnut blight

American Chestnut trees impacted by the American Chestnut blight in Virginia. Photograph courtesy of the Library of Congress, author and date unknown.

While a visually noticeable impact of an invasive creature along the North Campus Trail is the gypsy moth, this impact is limited compared to the destruction caused by the American Chestnut blight in the early part of the twentieth century. The gypsy moth damage seen today in Pike County, including along the North Campus Trail is noticeable of its effect on certain oak tree stands in the forest. The oaks located along the North Campus Trail exhibit the worst possible impact of the gypsy moth, where defoliation of oak leaves has resulted in tree death. While gypsy moth infestation can result in this worst case scenario, control of the gypsy moth, as well as boom-bust cycles of the gypsy moth population, has allowed many oak trees to survive.

On the other hand, the American Chestnut blight drastically altered the forests of Pike County and the greater Pocono region with the near-extinction of the American Chestnut.

While Oak trees characterize the forests of Pike County today, this was not always the case. Prior to the twentieth century, these forests contained a mix of oak and chestnut trees. The American Chestnut blight fungus was inadvertently introduced to America from Chestnut trees imported from Japan and China. Since American Chestnut trees had not developed a natural resistance to the blight like the trees from Japan and China, the blight quickly inflicted severe damage to American forests. Despite efforts to control the spread of the blight, American Chestnut trees across the eastern United States were largely eliminated from the landscape in less than half a century.

Above: American Chestnut tree. Image courtesy of the American Chestnut Foundation.

The blight infects a Chestnut tree by causing cankers on the bark that eventually kill the branches and trunk. While the roots are not affected by the blight and can send up new sprouts, these sprouts have not developed a resistance to the blight and will die as well. Efforts have been made to combat the fungus through genetic engineering. Researchers have been crossbreeding American and Chinese Chestnut trees in order to select the genetic traits in Chinese Chestnut trees that may offer resistance to the blight. Some of these crossbred chestnut trees have been planted in Milford Township, Pike County to reintroduce the Chestnut to its former habitat. It will take time to see if these new Chestnut trees will be able to survive, and perhaps flourish, in the area where they once had a dominant presence.

Invasive Insects

Gypsy Moth

Despite the gypsy moth's small size, this insect probably has the most noticeable impact on the forest along the North Campus Trail. Most of the standing dead trees you see were a result of a gypsy moth infestation. These infestations happen in cycles. An increase in the gypsy moth population feeding on tree leaves causes them to reach their carrying capacity (especially when they run out of living trees to eat) and their populations decline. One way the gypsy moth travels is when it lays its eggs on tree bark. When a tree is cut to make firewood, the spread of these eggs can cause problems in new locations.

Caterpillar image courtesy of PA Bureau of Forestry; Moth image courtesy of USDA

Asian Longhorn Beetle

While this insect has just recently become a resident in parts of Pennsylvania, the Asian Longhorn Beetle was previously discovered in neighboring New York, New Jersey, and Ohio. This troublesome insect only measures 1/2 to 1 inch in length, but can do some serious damage to trees. The Asian longhorn beetle is known to eat ash, birch, elm, maple, poplar, willow and other trees to the point where the tree can no longer survive. While the insect is harmless to humans, this is one insect you do not want to find while outside in Pennsylvania. If you find a beetle that looks like the Asian longhorn beetle, take a picture of it and call the Pennsylvania Department of Agriculture, or the Department of Conservation and Natural Resources. Similar to gypsy moth precautions, avoid transporting campfire/fireplace wood to prevent the spread of this pest.

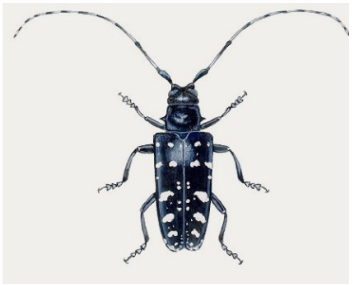


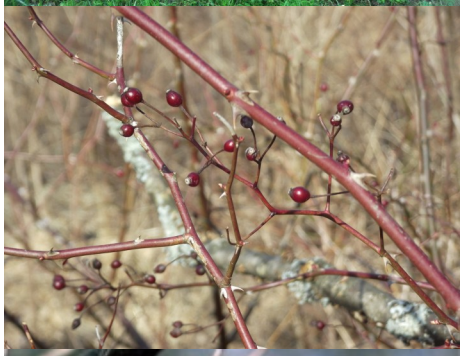
Image and data courtesy of the USDA's Animal and Plant Inspection Service

"Resident" Invasives

Not all of the creatures you find on the trail are necessarily welcome additions to the local forest community. As you can see below, some species have been here for some time and may appear to be part of the native landscape.

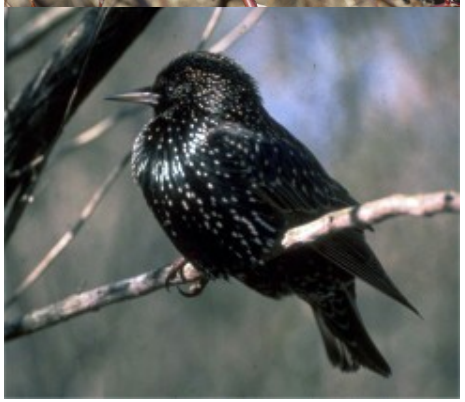
Multiflora Rose

An example of multiflora rose can be found along the entrance road to the trail, near the pond area. To the right are pictures of this plant in the spring (Above) and Winter (Below). Multiflora rose is considered an invasive plant in Pennsylvania due to the fact that its aggressive growth will hinder the growth of native plants. This plant was originally brought to the United States from Japan to serve as a rootstock for ornamental roses, and later as a form of erosion control, a "living fence," habitat for game species, and as a planting along highways.



European Starling

The European Starling was intentionally introduced to North America in the nineteenth century from Europe as part of a project to bring the birds mentioned in the works of Shakespeare to New York City's Central Park. While the bird may appear harmless, the starling is blamed for displacing native species from the Pike County area, as well as causing damage to farm crops.



Above: Multiflora Rose found along North Campus Trail. Top image shows entire plant in summer months. Second image shows branches and rose hips in winter. (PCCP Photos)

Below: Starling image courtesy of Colorado State University Wildlife Damage Management

Other "Problem" Species

Just because a certain species creates a "problem" in a given environment, does not necessarily mean it is an invasive species. Sometimes the problem is subjective, such as a rancher's objection to a wolf reintroduction program in the Rockies, or when native plants try to grow on someone's lawn. At other times, the problem may be a result of a disruption to the local environment. In an area where a natural predator has been removed, a lower **trophic level** species can reproduce without something to keep their population in check.

Opportunistic Species:

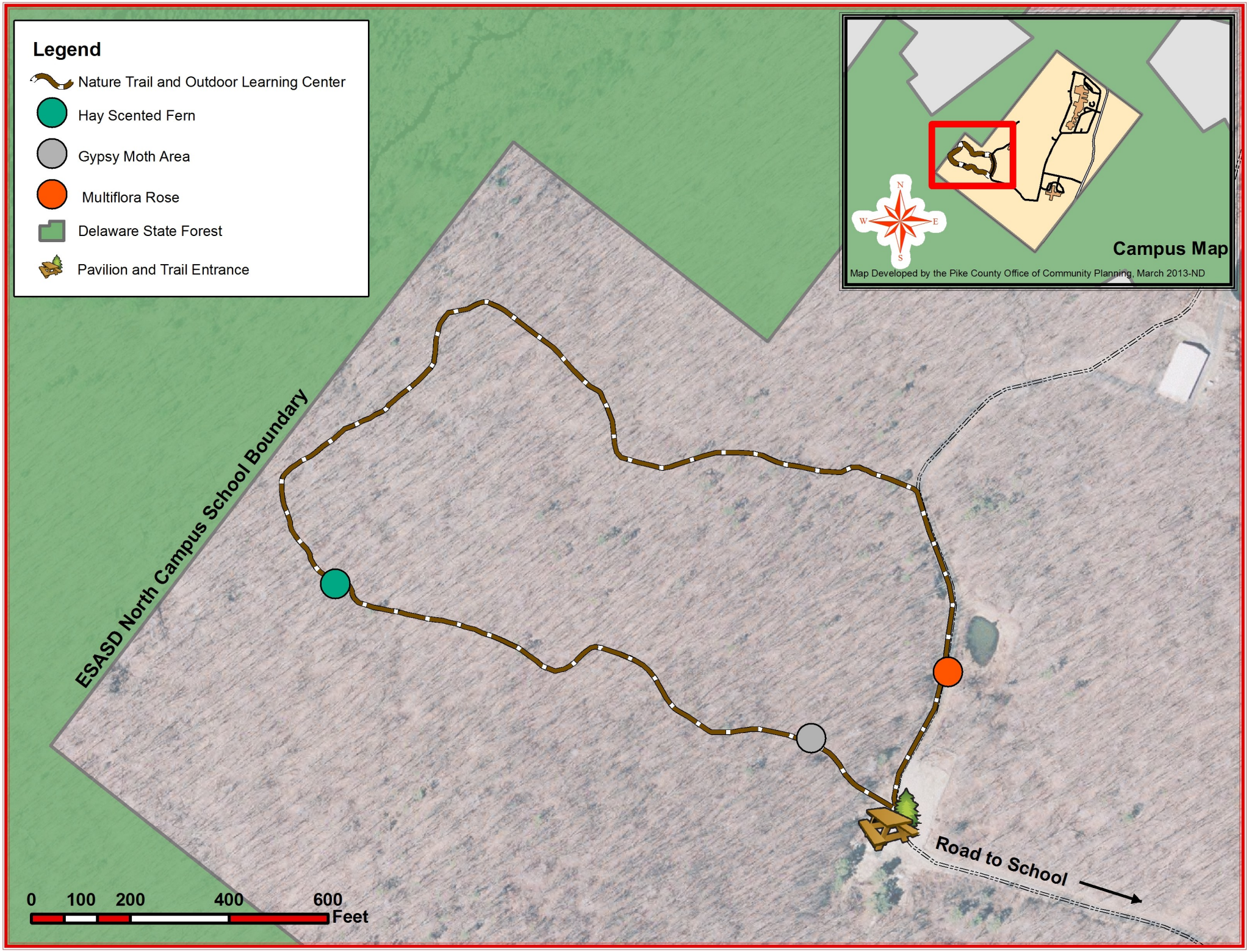
Species that will take advantage of a disruption to a local ecosystem are opportunistic species. Two visible examples in Pike County include the white-tailed deer and the hay-scented fern. These two species are native to the area, but as a result of a disruption to the local ecosystem, exhibit characteristics of invasive species.

Above: Hay-scented fern along the North Campus Trail (PCCP Photo)

The native hay-scented fern can begin to grow out of control, similar to an invasive when other factors impact the local ecosystem. Cretaz and Kelty (1999) found that this extreme growth took place when forest canopy thinned AND deer browse (feeding) of seedlings and smaller forest plants increased. This was likely the result of several factors, including the invasive gypsy moth damage to many trees near the North Campus Trail that resulted in a thinned forest canopy. In addition, hay-scented fern is alleopathic, meaning that it produces chemicals that can inhibit growth of other neighboring plant species. Increased deer **browse**, as a result of a larger deer population from the removal of natural predators (wolves, cougars, bobcats) has also played a role in thinning the forest canopy and forest plant diversity.

Pest Species:

A pest species is a subjective human construct that can refer to a species that is unwanted in a certain area. This could refer to local coyotes, because they have been known to go after farm animals, into trash, and even attack pet cats and dogs. Simply because an animal is considered a pest does not always make it invasive.


Legend
Nature Trail and Outdoor Learning Center
Hay Scented Fern
Gypsy Moth Area
Multiflora Rose
Delaware State Forest
Pavilion and Trail Entrance
Campus Map
Map Developed by the Pike County Office of Community Planning, March 2013-ND
N
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E
S
ESASD North Campus School Boundary
Road to School
0 100 200 400 600
Feet