## **Glossary of Relevant Terms:**

- **Browse:** Parts of woody plants that are eaten by animals.
- Ecologic Succession: The dynamic process of where a habitat changes over time. A common example is of how a grassland (with grassland-friendly plants and animals), eventually becomes a woodland (with different plants and animals).
- **Edge:** Break in habitat continuity. Edges can welcome both native and non-native species to an altered habitat.
- Lichen: A symbiotic organism that is actually composed of two organisms, a fungi and an algae (or bacteria, in the case of cyanobacteria). Lichens are commonly found on rocks and trees.
- Trophic level: An organism's position on the food chain.



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# 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 quide 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**

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**Orange: Ecology and Species Habitat** 

## What can you see or hear?

Watch for these things while on your adventure! Please don't pick up or disturb any items on your hunt. Want another challenge? Take a picture of all the items you find so you can look for them at home too!





## **Information Referenced:**

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- Smith, Sanford S, and Tracey Coulter. "From the Woods: American Chestnut." *Penn* State College of Agricultural Sciences Cooperative Extension. 2004. http:// pubs.cas.psu.edu/FreePubs/pdfs/uh167.pdf (accessed March 1, 2013).
- United States Department of Agriculture: Animal and Plant Health Inspection Service. *Hungry Pests: Frequently Asked Questions.* http://www.hungrypests.com/ faqs/ (accessed March 1, 2013).
- United States Forest Service: Fire & Aviation Management. *Managing Wildland Fires: Prescribed Fire.* http://www.fs.fed.us/fire/management/rx.html (accessed March 7, 2013).

## **Species Habitat 101**

#### Who lives in this forest?

While the school property has not been examined scientifically for specific species, other sites in Pike County were assessed recently (2009-2011) as part of a study to examine the conservation status of certain plant and animal species. This study, known as a natural heritage inventory, assessed over one hundred sites throughout the County to examine resident species and their habitats. The study looked at not only the flora and fauna but also the level of disturbance, approximate age of the forest community, as well as local threats to the natural community. Taken together, these studies examine the biodiversity of natural communities within Pike County. In the Natural Heritage Inventory for Pike County, ecologists found 555 extant occurrences of endangered, threatened, and rare species and natural communities, ranking Pike County third in natural diversity out of Pennsylvania's 67 counties (Pike County 2011). Given the fact that forest covers 80% of Pike County, and the North Campus property is surrounded completely by state forest, it is likely that many of the species found in similar habitats along this forested corridor reside for some period of time each year near the North Campus Trail. These species may include many of those described in the Interpretive Trail Guide, such as the pileated woodpecker, black bear, red-tailed hawk, fisher, ruffed grouse, eastern screech owl, white-tailed deer,

porcupine, grey squirrel, and the eastern coyote. Insects either seen along the trail. or that would reside in a similar habitat include species dragonfly, of firefly, and the gypsy moth. Notable plants in the area include the pitch pine, several species oak of and



Above: Western Pennsylvania Conservancy ecologist collecting insects for examination, as part of the Pike County Natural Heritage Inventory. (PCCP Photo)



maple, and the sassafras. Invasive, non-native species such as the multiflora rose have been seen along the trail, along with hay-scented fern, a native plant that can exhibit invasive characteristics. Other organisms, such as fungi and **lichens** have been found along the trail.

#### What types of habitats exist in this area ?

Several habitats exist in and around the North Campus Trail. Most of the trail passes through oak forest, but other habitats can be seen from the trail. The northwest section of the trail passes near a large wetland in the adjacent State Forest. Other wetlands have been identified on or near the trail, as seen in the map on pages 8-9. Depending upon the time of year and the weather, these areas may or may not appear to contain water.

The entire property has experienced change to its habitats over the last one hundred years. Similar to most of Pike County, this area likely had chestnut trees in addition to the oak and maples found here. Prior to construction of the North Campus School, this property was previously owned by a hunting club. Some of the older trees present may have been chosen to provide food or shelter for wildlife game species. Following the development of the property by the school, clearings were made to the forested areas in the construction of roads and buildings. These clearings created "edges" to the forest and new habitats species which prefer edge habitats. While some of these areas are now seeded for lawns, covered in blacktop or are the site of school buildings, some of these clearings "restart" the growth process, known as ecological succession. Recently cleared areas will eventually populate with smaller plants that would not normally exist under a tree canopy. This is known as early successional habitat. In addition to different plants occupying the site, different animals will find this habitat suitable for food, for breeding, or for shelter. As the site matures, larger plants will begin to grow on the site, ultimately resulting in a forest. Likewise, animals that use the site will also change with the habitats.

#### Where will I find resident species in this area?

Besides the trees, fungi, and other more sessile organisms, you will not likely see many animal species on your visit to the North Campus Trail. Different species will reside in the area during different times of year, based upon factors such as climate and availability of food source. Some resident animal species are nocturnal, and are not active during the day. Diurnal animal species, animals who are active during the understand that animals come in many colors for survival (Pages 2-3). "Classroom Carrying Capacity" (Grades K-4) is an indoor and outdoor activity that demonstrates to younger students the concept of carrying capacity (Pages 9-11). "How Many Bears Can Live in This Forest" (Grades 5-8) explores limiting factors and how they affect animal populations (Pages 23-27). "Carrying Capacity" introduces students (Grades 9-12) to the topic through an indoor activity (Pages 46-48). 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
- The Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry provides a conservation education page with links to publications, plant identification guides, and activities for younger students. Accessed March 2013 : http://www.dcnr.state.pa.us/forestry/education/index.htm
- Nature has a resource website, as part of their "Knowledge Project" that offers educational articles and resources for high school students. Many topics are covered, including one on ecology. Accessed February 2013: http:// www.nature.com/scitable/knowledge/ecology-102



## Activities and Resources:

- The United States Forest Service has a number of resources for students and educators, as part of its "Conservation Education" program. The Educator Toolbox provides background information on several education topics, including climate change, water resources, forests, forest fires, and a history of the Forest Service (and related programs). Links to resources for elementary, middle school, and high school educators are also available. The site includes curriculums developed by the National Forest Service and partnering agencies. Accessed February 2013: http://www.fs.usda.gov/main/ conservationeducation/home
- The United States Department of the Interior's Bureau of Land Management's Learning Landscapes program includes information and resources on topics that include energy, riparian areas, public lands, invasive species and wildland fire. The page also includes a link to articles authored by the Bureau of Land Management for Science & Children, a publication produced by the National Science Teachers Association (elementary and intermediate grades). The resources on this page include activities and information for educators grades K-12. Accessed February 2013: http://www.blm.gov/wo/st/en/res/ Education\_in\_BLM/Learning\_Landscapes/For\_Teachers/ teaching\_resources.html
- The Natural Enguirer, a middle school science journal from the United States Department of Agriculture has several issues that deal with topics covered in this guide, including "Ecosystem Services" and "Wildland Fire." These publications include stories, reference information, and activities for students. Journal issues can be downloaded for free from the website, click "View & Order Journals." . Accessed February 2013: http://www.naturalinquirer.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 "Color Crazy" (Grades K-4) for students to

day, will likely leave the area or stay well hidden within their nest at the sound of human activity, especially with 100+ students walking along the trail. You may encounter animals that are more adapted to human presence, such as birds, squirrels or chipmunks. If you are lucky, you may



Above: Red-spotted newt. (PCCP Photo)

encounter one of Pike County's many amphibians, such as the red-spotted newt (Notophthalmus viridescens viridescens), as seen in the picture to your right. You should be able to find evidence from other creatures that use the area, such as woodpecker holes, or animal droppings. Take caution when handling rocks, however, as Pike County has known populations of timber rattlesnakes (Crotalus horridus). These rattlesnakes will live near rocky areas in the woods to absorb heat.

### **Deer and Deer Exclosures**

While man-made construction of houses and commercial areas has had a noticeable impact on the landscape in areas such as East Stroudsburg, the largest visible impact to areas such as the North Campus Trail has come as a result of the white-tailed deer (Odocioleus virginianus). Without a natural predator to act as a limiting factor to the deer population, the deer population has increased, to the detriment of other local plants and animals. Deer normally browse smaller shrubs, plants, and trees in the forest. Additional deer means an increased need for food, which results in the "overbrowse" of these smaller plants. Damage from deer over-browse can reduce the biodiversity of a forest. Without these smaller plants in the forest habitat, other animal



Left: Deer Exclosure Sign in Delaware State Forest. Right: Deer exclosure at Promised Land State Park. (PCCP Photo)





species may not be able to meet their needs for food and shelter. It also means that young trees will not be able to eventually replace older trees. Over time, this will reduce overall forest biodiversity. To promote healthy forest habitat, foresters will sometimes install "deer exclosure" areas, by fencing off areas from deer intrusion. In the picture on the preceding page, a deer exclosure in Promised Land State Park shows two very different forest scenes. Both sides of the fence have larger trees, but the area on the right side of the fence has smaller trees and more plants on the forest floor. These exclosures will serve several purposes: maintain habitat for other animals, allow younger trees to grow, and increase forest biodiversity.

# Fire in the Forest

Many of us grew up with the understanding that forest and grassland fires (collectively referred to as wildland fires) were considered to be bad for plants, animals, people, and the environment. While wildfires can put some plants and animals, as well as human life and property at risk, scientists and foresters have learned that controlled, or prescribed burning can benefit the natural community. Preventing fire in a natural community can cause biomass (leaves, dead trees and branches, grasses, and other plants) to accumulate and increase the amount of "fire fuel" available. If left unaddressed, this could lead to more dangerous and powerful fires. While this does not mean that you should build a campfire in the woods during drought conditions, it means that professionally planned burning can reduce this problem. Prescribed burning, a management tool only to be used by experts, involves a planning process to make sure the fire can be controlled by humans to avoid damage to life and property. Fire can help to control invasive species, encourage the growth of some plants that respond only to fire conditions (like the pitch pine along the North Campus Trail), welcome animals and other organisms that rely upon fire disturbance, and return nutrients to the soil (US Forest Service). While debate still exists on how much fire is needed to benefit a natural community (NY Times), take into consideration that natural communities experienced episodic fires before human fire prevention practices began.

# **Discussion Questions**

These questions are suggested starting points to help spur discussion and critical thinking about forest ecology and species habitat.

- What is the role of humans in the forest ecosystem? Describe their ecological niche.
- How can fire be considered both detrimental and beneficial to a forest? In what ways does fire benefit the forest? In what ways does it harm the forest?
- Speculate why fire prevention practices could harm an ecosystem, and what those effects might be.
- How can a forest disturbance (such as the removal of trees during a cutting) be considered detrimental and beneficial to an ecosystem? In which ways does the disturbance benefit the area, and in which ways is it detrimental?
- What is the carrying capacity of your classroom?
- What would be some limiting factors to the school population on a given day?
- Can any creature be both a producer and consumer? What about a producer and a decomposer? Evaluate all of the possible pairings and describe how organisms can exhibit multiple characteristics.





## **Carrying Capacity & Limiting Factors**

Carrying capacity is defined as how many plants, animals or other organisms that can exist in a certain area based upon the available resources necessary for survival. If a forest plot can sustain a population of 10 deer, what happens when 11 deer fill the space? The carrying capacity principle suggests that the 11 deer would have less food, water, and/or shelter, resulting in a diminished quality of life. If the number of deer to the area continued to increase, this quality of life would continue to decrease until outmigration, disease, or famine would reduce the population to a sustainable level (the carrying capacity). Carrying capacity applies to any living species.

Related but not identical to carrying capacity is something called limiting factors. Limiting factors are events or actions that inhibit the growth or success of another organism. On the North Campus Trail, one example of a limiting factor for animals in the forest is the amount of acorns available for food. If an increase in gypsy moth activity limits oak tree production of acorns, then this action will be a limiting factor to not only the acorns, but also the animal populations that depend upon the acorns for food. This limiting factor may then reduce the carrying capacity of resident species, as the forest is only able to provide enough acorns for a smaller population.

References to activities based upon carrying capacity and limiting factors to help explain this topic to students are included in the "Activities and Resources" section of this guide.

# Forest Residents: PRODUCERS, DECOMPOSERS, CONSUMERS

Living creatures along the North Campus Trail and beyond can be classified into three different categories: producers, consumers, and decomposers. Producers, such as photosynthetic plants and bacteria, use energy from the sun to grow. Consumers are organisms that consume producers, such as animals that eat plants, or higher **trophic level** species eating a lower **trophic level** species (such as an herbivore animal being consumed by a carnivore animal). Finally, decomposers are those organisms that consume waste products, and/or dead producers/consumers and return those nutrients to the soil for other organisms to consume.

## Adaptation

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Adaptation is a broad term that refers to biologic or behavior-based changes that a species has made to help it survive in a given environment. This can include how some species will use color to blend in with their surroundings to hide or warn a potential predator. Species may ward off predators with bright colors to signify that they are poisonous. Others have adapted to mimicking their poisonous cousins, while not being poisonous themselves. These creatures rely on a color pattern that suggests danger. Even others have chosen camouflage patterns that allow them to blend in with their surroundings.

On the North Campus Trail, one example of adaptation is seen in the Pitch Pine. The pitch pine has adapted to survive forest fire, and to flourish following a fire disturbance. Pitch pines can resprout from the trunk following a fire, and their seed pods (pinecones) will only open following a fire disturbance. Seeds will then have an advantage over other plants unable to survive the fire and will be able to grow with available nutrients (created from the fire) and sunlight. Unfortunately for the pitch pine, if fire disturbance does not take place in an area, the pitch pine population may be reduced as other trees occupy the forest canopy.



Above: Pitch Pine Trees near the North Campus Trail Pavilion (PCCP Photo)



