Space Invaders!

THE BIG PICTURE

To understand what we call an invasive species, their impact on our ecosystems, and how humans impact their survival and spread.

Activity Overview

This activity will split between two groups, with 1 or more leaders per group. Both groups will begin with the Background Exploration in different locations.

Background Exploration -- *20 minutes*

- Introductory Roleplay -- *10 minutes*
- What is an invasive species? -- *10 minutes*

Backyard Adventure -- *45 minutes for each period,* including transition -- Two periods

First period:

Group 1:

- Tree Doctor - *20 minutes before switching*
- Transplanting Native Plants

Group 2:

- Bat Conservation

Second period:

Group 1:

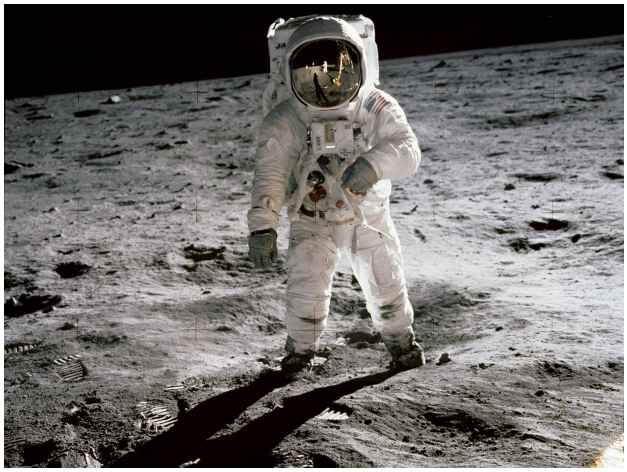
- Bat Conservation

Group 2:

- Tree Doctor - *20 minutes before switching*
- Transplanting Native Plants

Reflection -- *10 minutes*

- How does this relate to us?



Astronaut John Glenn on the surface of the moon.

Background Exploration -- *20 minutes*

Introductory Roleplay -- *10 minutes*

Imagine you step off a spaceship onto a new planet. You are wearing a spacesuit to protect yourself and to give you oxygen to breathe. You see plant life, so you decide to take a big risk, and remove your helmet....*to find you can actually breathe!* In the distance you see a pond, and it appears full of fish. There are trees with fruit that can also be used to make shelter. No other creatures like you appear to be around. It's yours for the taking.

What do you do first?

What might you do to survive?

What kind of impact might you have on this ecosystem?

How would you feel if a creature from another planet released new animals around you -- that transformed your environment and how you survived?

What Are Invasive Species? -- *10 minutes*

Optional: Intro video from TED-Ed (5 minutes)

Many species that live around us -- up to 30% of vascular plants in West Virginia, for example -- have been introduced into our state's diverse ecosystems. Kind of like humans would be an introduced creature to another planet!

Species are introduced to new ecosystems every day on planet Earth. No matter how this happens -- accidentally, like a fungus on the soles of our shoes, or on purpose, like an ornamental plant we like -- that species is called "non-native," or "introduced" in its new ecosystem. *(Generally, experts consider native species of West Virginia those that existed here before Europeans arrived in North America.)* Humans have vastly accelerated the movement of plants and pathogens, carrying thousands of species that could not have crossed natural barriers like oceans, mountain ranges and deserts, to new areas.

Some introduced species successfully reproduce and become a dynamic part of the surrounding environment over a long period of time, without a large negative impact. We call these wildlife "domesticated" or "naturalized." Some examples in West Virginia are the European honey bee, most of our food crops, and most livestock. They are desirable to us, and provide products and services we have come to depend on.

Some introduced species, on the other hand, negatively impact the ecosystems they are introduced to. Sometimes they are parasites that have found a new host -- like white-nose syndrome affecting North Americans bats, or emerald ash borer affecting ash trees -- and cause a dramatic reduction in their hosts' survival. Sometimes these introduced species simply reproduce and spread faster than native species, like autumn olive, moving into areas disturbed by human activities like road and trail building, urban development, timbering and mining. **Experts often call these species "invasive" because of how quickly and permanently they can make an impact.** (source: WV DNR)

Optional brainstorm: What do you think some of the impacts of an invasive species can be?

But is being introduced the only way a species can become invasive? Human activities make a big impact on our ecosystems, and can make even native species have a larger impact, almost like an invasive species. Think about white-tailed deer. They are native to West Virginia, but are much more abundant now than when West Virginia became a state because of the targeted removal of their natural predators and a reduction in hunting. Scientists have also discovered that pathogens that are already in our ecosystems can reproduce much more rapidly in a changing climate -- like the fungus that causes snake fungal disease.

Some characteristics of invasive species:

Invasives outcompete other species for resources, and can threaten their survival.

Invasives are opportunists. Invasive species are able to take advantage of a change in habitat, or a new host, that helps them reproduce and spread, at the expense of other species or their new host.

Some of the impacts of invasive species can include loss of habitat, loss of species, and loss of ecosystem services (such as water and carbon cycle).

Invasive species can be any species, given the right environmental conditions and human impacts. They are part of our environment, like us. We all make a difference in how many introduced species become invasive here, and how much of an impact they will have.

Let's look at three examples that are affecting the survival of West Virginia organisms today.

1) **White-Nose Syndrome** in Bats

White-nose syndrome (WNS) is a fungus that weakens and kills bats, caused by an introduced European fungus. Scientists believe that white-nose syndrome was brought over from Europe on humans or human cargo accidentally. European and Asian bats do not seem to suffer the dramatic die-offs that North American bats do.

Battle for the Bats - background video *(13 minutes)*

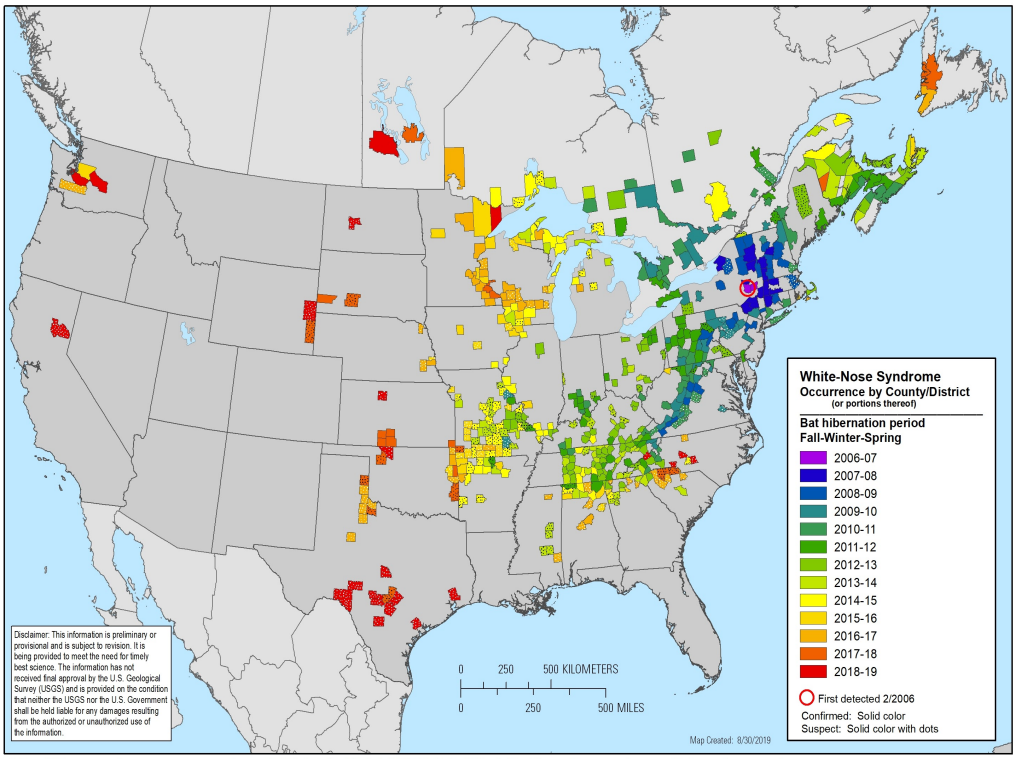
White-nose syndrome on a little brown bat.

White-Nose Syndrome (WNS) is an emerging wildlife disease that is causing unprecedented declines in hibernating North American bats. More than half of the bats that live in the United States hibernate in caves and mines to survive the winter. Four of these bats are federally endangered (Indiana, gray, Virginia and Ozark big-eared bats) and live within WNS-affected areas.

First detected in New York in the winter of 2006-2007, WNS has quickly spread south through the Appalachian Mountains and into the Southeast, north through New England and into Eastern Canada, and west into the Great Lakes region and the Midwest. There is great

concern that WNS will continue to spread across North America. In the northeastern United States and Canada, WNS has killed more than *six million bats* and has caused population declines greater than 90% in some populations, including in West Virginia

The effects of WNS on North American bat populations has led the U.S. Fish & Wildlife Service to consider listing several of the most affected species for either threatened or endangered species status under the Endangered Species Act. (*Endangered species are those animals and plants that are in danger of becoming extinct throughout all or a significant portion of their range. Threatened species are those that are likely to become an endangered species within the foreseeable future throughout all or a significant portion of their range.)*



Citation: White-nose syndrome occurrence map - by year (2019). Data Last Updated: 8/30/2019. Available at: https://www.whitenosesyndrome.org/static-page/wns-spread-maps.

Another example of an invasive fungus that is spreading rapidly in West Virginia is snake fungal disease. Snake fungal disease is a fungus that naturally lives in our soil, unlike the introduced WNS fungus that is affecting bats. Scientists believe that warmer winters are making this fungus much more virulent.

How is the fungus in WNS similar to human diseases?

2) Emerald Ash Borer

Emerald ash borer (*Agrilus planipennis*), or EAB, is an invasive Asian beetle that was discovered in southeastern Michigan in the summer of 2002. The adult beetles nibble on ash foliage but cause little damage. The larvae, however, feed on the inner bark of ash trees, disrupting the tree's ability to transport water and nutrients. To our knowledge, they depend only on ash trees to reproduce. We call parasites that depend on one host an *obligate parasite.*

Emerald ash borer probably arrived in the United States on solid wood packing material carried in cargo ships or airplanes originating in Asia. As of October 2018, it is now found in 35 states, including throughout West Virginia.

What do we use ash trees for?

Since its discovery, EAB has:

- Killed hundreds of millions of ash trees in North America.
- Caused regulatory agencies and the USDA to enforce quarantines and fines to prevent potentially infested ash trees, logs or hardwood firewood from moving out of areas where EAB occurs.
- Cost municipalities, property owners, nursery operators and forest products industries hundreds of millions of dollars.
- Caused declines in other species that depend on ash trees for their survival.

Adult emerald ash borer beetle.

Larva trails under the bark of an infested ash tree.

Damaged bark from emerged beetles (notice D-shaped exit holes).

Have you seen trees that look like this?

3) Autumn Olive

Not all invasive species are as small as WNS fungus and EAB. Sometimes invasive species end up taking advantage of space we create for them.

One common example in West Virginia is autumn olive.

Autumn olive (*Elaeagnus umbellata Thunb*.) is a large deciduous shrub capable of forming dense thickets in West Virginia pastures. It was introduced to North America in the 1800s and is native to eastern Asia. Individual plants may reach heights of 20 ft, and can be easily distinguished by their leaves, which have a lustrous silvery appearance on their lower surface, and are arranged alternately to the stem. Autumn olive displays a white bloom in early spring, and its growth habit may provide refuge for certain wildlife, as well as nectar for honey bees.

Autumn olive is one of the most common invasive brush species in the state. If left uncontrolled, it is capable of significantly affecting pasture productivity and taking over roadsides. It may reduce the water, nutrients and sunlight available for desirable plant species. Dense thickets of autumn olive can be an eyesore and may serve as a source of undesirable weed seeds to nearby pastures and farms. (source: WVU Extension Service)

Autumn olive thrives in clearings, usually created by humans.

Have you seen autumn olive before?

Backyard Adventure -- *30 minutes per activity*

1) **Tree Doctor** -- *optional opportunity for guest arborist*

In this activity, we will be taking a look at our trees and checking for signs of environmental stressors, including the impact of invasive pests.

Arborists are like tree doctors. They take a look at individual trees and assess their health, diagnose problems and come up with solutions. *How do you think they do this?*

Start with the Tree Cookie Activity from Project Learning Tree. Divide the participants into groups of 2 to 4 and provide each with a tree cookie from a healthy and a diseased/infested tree.

How are they different? How can you tell?

Ash trees (*Fraxinus* spp.) aren't the first type of tree that has disappeared from West Virginia's canopy. An invasive fungus called chestnut blight devastated the American Chestnut (*Castanea dentata)* after it was accidentally introduced in 1904. By the 1950s, the American Chestnut was functionally extinct in West Virginia. However, many chestnut trees continue to sprout from their stumps, and a wide effort to revive the chestnut is underway.

If time allows, have participants inventory ash trees in a specified area, and report back their findings. *Is there evidence of new growth?*

2) **Transplanting Native Species** -- *led by Headwaters native plant staff or visiting specialist*

Participants will learn about specific native plants with important wildlife and ecosystem value, how and where to transplant them. Staff can show examples of non-natives and natives that are growing in the restoration area.

This is a hands-on stewardship activity. Every participant should have the opportunity to help plant one native plant, working in pairs or a small group.

3) **Bat Conservation** -- *optional opportunity for guest speaker*

West Virginia has 14 species of bats. They perform essential ecosystem services throughout West Virginia -- eating millions of pounds of mosquitoes per bat! Not only does this make summer evenings more pleasant for all of us, it also reduces disease transmission and crop damage.

More information on West Virginia's bats, and White-Nose Syndrome.

Lead Neighborhood Bats activity from EduBat.

Additional bat conservation activities are available here.

Stewardship in Action -- *additional options to discuss and pursue*

- **Seed saving.** Seed repositories help conserve the genetic diversity of threatened and endangered plants.
- **Build bat boxes.** One example here.
- **Spread awareness** about human impacts on invasives.

  Examples: Don't move firewood campaign
  Respecting cave closures
  Invasive species awareness

Reflection -- *10 minutes*

What are other ways our changing climate might affect how invasive species impact West Virginia's ecosystems?

Brainstorm: What can you do to reduce the impact of invasive species?

If time allows, make an action plan around one of these ideas as one group, or in several smaller groups.

Additional Activity Ideas

1) **Make a surprise garden** -- participants will scrape the dirt and debris off their shoes, and see what grows! *How many are native species, non-native species?*
2) **Evergreen Detectives** -- Surveying for invasive hemlock woolly adelgid (HWA) on area hemlocks.
3) **Champion Tree challenge** -- Work in groups to identify the largest examples of each species in your area. *How do these compare to West Virginia's champion trees? How many of these species are considered non-native?*
4) **Show-and-tell with a local woodworker**. Have a local woodworker share about how protecting native trees is important to the craft.
5) **Make a tree cookie "badge."** Have each participant identify and age the tree cookie, and personalize it.
6) **Evening Ecology:** Bat mist-netting survey. Permission required from the Fish and Wildlife Service.

7) **Field Trip: Cave Visit!** Some local cave preserves are listed on the WV Cave Conservancy website. Alternatively, several abandoned mine entrances are accessible to the public at Southern District of the New River Gorge.

Resources

Invasive Plants in West Virginia - WV Department of Natural Resources
Emerald Ash Borer Information Network
Research: Emerald Ash Borer Biocontrols and Climate Change
Snake Fungal Disease in WV Snakes -- press release
Project EduBat -- educational resources
Spotted Lanternfly Information -- Penn State Extension Service
National Invasive Species Information Center: West Virginia - USDA