McKeesport Area School District
Flexible Instruction Days – High School Lesson Plan

SUBJECT: 10th Grade Biology		LESSON TITLE: Managing Invasive Species in Pennsylvania		
☐LESSON 1: 1st or 2nd 9-Weeks	☐ LESSON 2: 2nd or 3rd 9-Weeks	☐ LESSON 3: 2nd or 3rd 9-Weeks	☐ LESSON 4: 2nd or 3rd 9-Weeks	☒ LESSON 6: 3rd or 4th 9-Weeks

STANDARD(S):
BIO.B.4.2.4 Describe how ecosystems change in response to natural and human disturbances (e.g., climate changes, introduction of nonnative species, pollution, fires).

INSTRUCTIONAL OUTCOMES:
Students will be able to:
- Identify species native and invasive to Pennsylvania
- Describe the characteristics of an invasive species
- Develop a management plan for an invasive species

STUDENT PARTICIPATION *(Lesson steps):*
Students will:
1. Read the attached handout "Managing Invasive Species in Pennsylvania" and answer the questions which accompany the reading in Part 1.
2. Develop and budget a plan to manage the spotted lanternfly in Part 2.
3. HONORS: expand the management plan to include the spotted lanternfly's preferred host plant, the tree-of-heaven.

ACCOMMODATIONS:
- I recommend that students underline their answers in the reading before writing them down.
- Adapted lessons include cloze statements. Students complete the statements with information from the reading.
- This video describes invasive species and may augment the reading: https://www.youtube.com/watch?v=spTWwqVP_2s.

HANDOUTS *(exact names of ALL accompanying handouts)* **& RESOURCES** *(materials, websites, books, etc.)*
- Writing utensil
- Handout: "Managing Invasive Species in Pennsylvania"
- Internet access (optional)

EVIDENCE OF LEARNING
Students will demonstrate:
- Understanding of how to distinguish and manage invasive species by reading and responding to comprehension questions.
- Management and budgeting skills by completing a plan to manage the spotted lanternfly.

Adapted from: https://www.dcnr.pa.gov/Conservation/WildPlants/InvasivePlants/Pages/default.aspx
https://www.nrcs.usda.gov/wps/portal/nrcs/main/pa/technical/ecoscience/invasive/
https://dnr.wi.gov/topic/Invasives/control.html
https://extension.psu.edu/spotted-lanternfly
https://extension.psu.edu/tree-of-heaven

Managing Invasive Species in Pennsylvania

Part 1: What is an invasive species?

Invasive species are species that:

- Are not native to an area
- Spread quickly
- Cause economic or environmental harm, or harm to human health

Many invasive species have appeared in Pennsylvania over the years, primarily by human travel or commerce that displaces them from their native ecosystem. The transport of an invasive species can happen accidentally or on purpose. If enough individuals of a non-native species are present to form a breeding population, they can become an invasive species.

1. What kinds of harm do invasive species cause?

2. What is the primary method by which invasive species arrive in a new ecosystem?

When invasive species are mentioned, often invasive animals come to mind first. One of the most notable invasive animals in Pennsylvania, and the entire United States, is the feral hog. In the early 1900s, European boars were introduced to the United States for hunting sport. These wild hogs bred with escaped domestic pigs to make a smaller, and very aggressive, feral hog.

However, invasive plants pose a more common and varied problem than invasive animals. Invasive plants out-compete natives and "take over" native plants' habitats. They often emerge earlier in the spring and reproduce rapidly. Rapid reproduction limits habitat available for native wildlife and disrupts the food chain. Garlic mustard is an example of an invasive plant in Pennsylvania. Native butterflies lay eggs on garlic mustard, and they either die or the caterpillars don't grow properly.

3. Why were European boars introduced into the United States?

4. How do invasive plants limit habitat available for native species?

Invasive species also cost money. According to the U.S. Fish and Wildlife Service, the United States spends more than $120 billion to control invasive species each year. Farmers spend money to protect their crops from invasive insects and plants such as Japanese beetles and bindweed. Waterfront property loses value when Eurasian watermilfoil occupies lakes.

5. How much money does the United States spend each year to control invasive species?

6. Name one invasive species in Pennsylvania and describe what kind of harm it causes.

Strategies to manage invasive species generally fall into two broad categories: proactive, which limit the spread of invasive species, and reactive, which control existing invasive species.

Proactive management:

- research the risks posed by various species
- inspect human travel and commerce between regions
- quarantine regions already exposed to an invasive species.

Reactive management:

- manual (uprooting plants, trapping animals, etc.)
- chemical (pesticides, herbicides, etc.)
- biological (grazing animals, supporting native competitors, introducing a predator, etc.)

Biological and manual strategies are generally less harmful to native ecosystems than chemical strategies but are often more expensive and less effective.

7. What is an example of proactive control for invasive species?

8. Compare the use of biological versus chemical control on invasive species.

Part 2: Managing the spotted lanternfly

The spotted lanternfly is a new and serious invasive pest in Pennsylvania. It has a strong preference for feeding on economically important plants including grapevines, apple trees, black walnut, birch, willow, and other trees. The feeding damage significantly stresses the plants which can lead to decreased health and potentially death. If not contained, spotted lanternfly could potentially drain Pennsylvania's economy of at least $324 million annually, according to a study carried out by economists at Penn State.
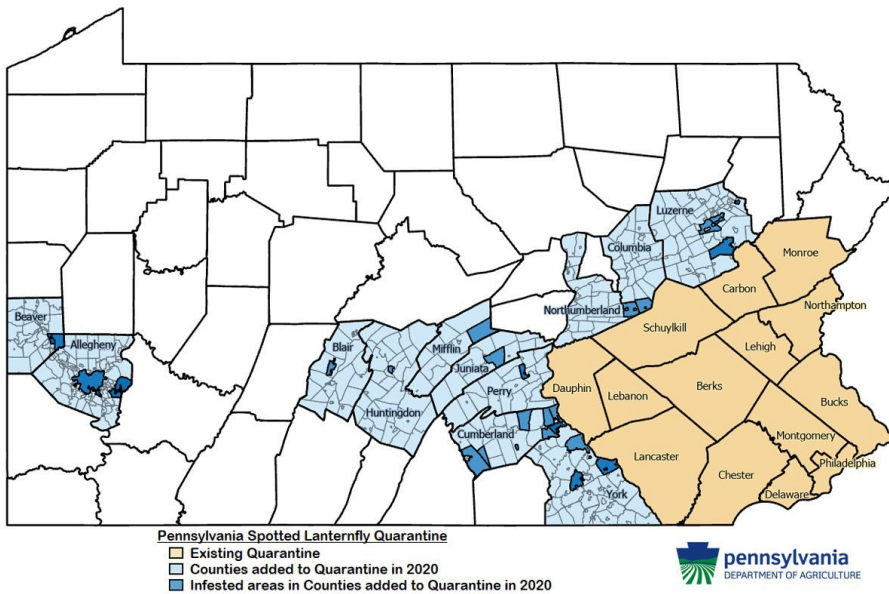
According to this map, the spotted lanternfly was recently identified in Allegheny County. Spotted lanternfly often spreads by laying eggs on trains or trucks.

The Pennsylvania Department of Agriculture has selected YOU to develop a management plan for the spotted lanternfly in Allegheny County. You will have a budget of $10,000. In the table on the next page, list at least three strategies, activities, or methods to limit the spread of spotted lanternfly or control its abundance in Allegheny County. Budget your $10,000 between these strategies and describe HOW each strategy will manage the spotted lanternfly.

You can use the control strategies on the previous page for inspiration. Other strategies to consider include: a public awareness campaign, inspections of trains and trucks, inspections of trees, insect traps, insect poisons, support a native predator to the spotted lanternfly, introduce a non-native predator, restrict travel between states/counties, or invest in agricultural plants resistant to spotted lanternfly.

Example:

Strategy/Activity/Method	Budget	Description
0. Spotted lanternfly traps	$2,000	These traps will catch the spotted lanternfly before it damages any trees.

Strategy/Activity/Method	Budget	Describe HOW this strategy will manage the spotted lanternfly
1.		
2.		
3.		
	TOTAL: $10,000	

HONORS (optional for other students):
The tree-of-heaven is a plant species native to China and Taiwan and invasive to Pennsylvania. Spotted lanternfly prefers to lay eggs on tree-of-heaven, which supports the spread of the insect. The tree produces a lot of pollen. In addition, a few cases of skin irritation have been reported from contact with tree-of-heaven. Besides urban areas, tree-of-heaven is found growing along roadsides, railways, and in forest openings. Many sensitive native plants live in the same habitat.

The Pennsylvania Department of Agriculture is planning a large project to control tree-of-heaven. They are deciding between two strategies: manual removal or herbicide application. Considering the characteristics of tree-of-heaven, which strategy would you recommend? Why?