



Monitoring and Managing Invasive Species Middle School Science

Unit Summary:

Students will be introduced to invasive species and how they cause both economic and ecological harm. They will learn monitoring techniques and create a management plan for managing spotted knapweed.

Next Generation Science Standards:

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Learning Objectives:

Students will be able to:

- Define invasive species.
- Describe how invasive species cause economic and/or ecological harm using relevant examples.
- Explain what characteristics make a plant invasive and what function of each characteristic serves.
- Identify locally important invasive species.
- Describe why ecological monitoring is an important part of effective land management.
- Create hypothetical management actions to effectively combat an invasive species.

Table of Lessons:

(See following page)

Lesson Title	Learning Objectives	NGSS Addressed (codes)	Materials
<p>Introduction to Invasive Species: Students will learn what invasive species are and discover what species are invasive within their state.</p>	<ol style="list-style-type: none"> 1. Define: <ol style="list-style-type: none"> a. Invasive species b. Competition c. Dispersal 2. Explain how invasive species ability to disperse affects their ability to spread so widely 3. Explain how competition affects invasive species colonization of new habitats 4. Describe why Emerald Ash Borer has an economic impact. 5. Give examples of invasive species found within the state. 6. Give examples of how an invasive species could cause economic harm. 7. Give examples of how an invasive species could cause ecologic harm. 	<p>MS-ESS3-3</p>	<ul style="list-style-type: none"> • Access to the internet and projector for teacher • Access to internet for each student or group of students • Invasive Species PowerPoint • Invasive Species Handout
<p>Identifying Spotted Knapweed: Students will learn how to identify spotted knapweed in the field</p>	<ol style="list-style-type: none"> 1. Identify and draw the following components of flowering plant; lobed leaf, dissected leaf, flower petal and bract. 2. List identifying characteristics of spotted knapweed 3. Diagram morphological changes in spotted knapweed as it completes its life history. 4. Identify spotted knapweed in natural settings 5. Identify spotted knapweed in classroom settings 	<p>MS-ESS3-3</p>	<ul style="list-style-type: none"> • Access to the internet and projector for teacher • Recommended: Samples of rosette and adult spotted knapweed • (Optional) Access to internet for each student • (Optional) Plant field guides containing spotted knapweed • (Optional) Spotted knapweed fact sheets I like: • http://www.pestid.msu.edu/weeds-and-plant-identification/spotted-knapweed-centaurea-stoebe/ • Colored Pencils or Crayons or Markers • Invasive Species.Knapweed PowerPoint • Invasive Species Handout

Lesson Title	Learning Objectives	NGSS Addressed (codes)	Materials
<p>Mapping Distribution of Spotted Knapweed: Students will create a map showing the distribution of spotted knapweed in a local study area</p>	<ol style="list-style-type: none"> 1. Define: <ol style="list-style-type: none"> a. Incidence b. Distribution c. Abundance d. Transect e. Sample 2. Explain why environmental monitoring is important to effective management of an ecosystem. 3. Describe the benefits and difficulties of using incidence and abundance in an environmental monitoring program. 4. Explain why sampling is often necessary during environmental monitoring. 5. Calculate and map percent incidence when given appropriate data. 	<p>MS-ESS3-3</p>	<ul style="list-style-type: none"> • 2- 50m measuring tapes • Apx. 100 ft of rope (Diameter is not important as long as it is thick enough so as to not tangle easily) • Clipboard and pen • PowerPoint (Mapping Spotted Knapweed Distribution.pptx) • Datasheet (Distribution Datasheet.xlsx) • Schematic map of study area (see appendix) • Colored Pencils or Crayons or Markers
<p>Spotted Knapweed Management Plan: Students will create a management plan to address spotted knapweed within their study site.</p>	<ol style="list-style-type: none"> 1. Propose appropriate solutions (e.g. management activities) to ecological problems 2. Identify the likely consequences of a management activity 3. Identify advantages and disadvantages of a management action 4. Apply an advantage-disadvantage decision making tool to a problem 5. Explain why a management activity may not be feasible 	<p>MS-ESS3-3</p>	<ul style="list-style-type: none"> • Spotted Knapweed Management Handout.docx

Safety Considerations: Students will be outside for part of this unit take precautions for severe weather, and student allergies.

Evaluation Plan:

- Introduction to invasive species
 - Formative Assessment
 - Students research a local invasive species and identify the traits that make it invasive
 - Summative Assessment
 - Students complete a writing activity using their knowledge of invasive species to create the 'perfect' invasive species
- Identifying Spotted Knapweed
 - Formative Assessment
 - Students draw the various stages of spotted knapweed's life history and identify the key characteristics for identification
 - Summative Assessment
 - Students take a quiz on their ability to identify spotted knapweed
- Mapping spotted knapweed distribution
 - Formative Assessment
 - Asking students questions during each step of the activity
 - Summative Assessment
 - Students create a map of the distribution of spotted knapweed in the study site
- Spotted Knapweed Management Plan
 - Formative Assessment
 - Students document their thought process using the supplied worksheet
 - Summative Assessment:
 - Students detail their management plan in a letter to a decision maker.

Resources (websites):

- Introduction to Invasive Species:
 - Little Things Big Problems: Emerald Ash Borer:
 - <https://www.youtube.com/watch?v=-ASgieVs8Kc>
- Identifying Spotted Knapweed:
 - Little things Big Problems: Spotted Knapweed:
 - <https://www.youtube.com/watch?v=RZj5cSbNFIQ>
 - Spotted Knapweed Fact Sheet:
 - <http://www.pestid.msu.edu/weeds-and-plant-identification/spotted-knapweed-centaurea-stoebe/>

How this unit relates to my research:

My research is focused on a population of fish called coaster brook trout. These fish have a unique migratory life history and were once found in tributaries all over Lake Superior, but their populations have declined dramatically over the past 100 years. There were likely many reasons for the decline in coaster brook trout, and one of those reasons was probably nonnative and invasive species. Coasters must compete for food and refuge with nonnative pacific salmon, and endure parasitism by the invasive sea lamprey. One of the major goals of my research is to identify ways we can custom tailor stream restorations to help coaster brook trout and other native species, but not their nonnative competitors. I would like stream improvements and restorations to give native species a competitive advantage over other invasive and/or nonnative species. This unit draws on my experiences with aquatic nonnative and invasive species and applies it to a more easily studied and overserved system: Spotted Knapweed.

Invasive species are a major yet often overlooked threat to in various ecosystems across the globe. I designed this unit to try and raise awareness of what a pervasive problem invasive species are and how the management of ecosystems can prevent the spread of these invaders. Spotted knapweed is found across the United States and it is remarkably capable invaders. My hope is that this lesson will raise awareness of the widespread and pernicious problem of invasive species.

