

Unit	Human Impacts
Lesson	4.2 Understanding invasive species
Essential question	How does the introduction of an invasive species affect an ecosystem?
Objective	Students will be able to identify the common characteristics of an invasive species and predict the effects on their introduction into an ecosystem.
Key words	Invasive species, mitigation strategies
Related Standards	
NGSS standard	HS-LS2-7
AP Env Sci topic	9.8
IB Biology topic	
IB ESS topic	3.2
Suggested sequence of learning activities	<ol style="list-style-type: none"> <li>1. Starter quiz/prior knowledge check</li> <li>2. Direct instruction (if traditional) or classroom discussion (if flipped). Slides <a href="#">here</a>.</li> <li>3. Students identify presentation topics (individual or pairs)</li> <li>4. Students research and create presentations (continued as homework?). Instructions <a href="#">here</a>.</li> <li>5. Students present to class</li> </ol>
Assessment	Exit ticket/comprehension check
Possible modifications	<ul style="list-style-type: none"> <li>● Give a keyword list (with or without definitions already included) to students before or during class</li> <li>● Be intentional about student pairings (eg. heterogeneous skill levels)</li> <li>● Provide list of invasive species to choose from rather than have students identify their own</li> </ul>
Resources required	Digital distribution or showing of <a href="#">student presentation instructions and model presentation</a>
Starter questions	<ol style="list-style-type: none"> <li>1. What is a way that an invasive species might be introduced to an ecosystem?</li> <li>2. What is a problem that an invasive species might cause in an ecosystem?</li> </ol>

<p>Concepts covered in lesson</p>	<p>An <b>invasive species</b> is a species that is introduced to an ecosystem outside its natural range that becomes established and outcompetes native species. Invasive species might be introduced on purpose, like brook trout introduced into streams in the western United States for sport fishing. Invasive species might be introduced by accident, like the algae didymo which spread on the wet felt soles of waders of anglers travelling from one river system to another.</p> <p>Invasive species can outcompete native species in a new ecosystem for a number of different reasons, including:</p> <ul style="list-style-type: none"> <li>● Free from natural predators or diseases that control their population in their original range</li> <li>● Rapid reproduction and growth</li> <li>● Can access new types of food sources (often because they eat a wider range of foods than native species)</li> <li>● Can introduce new pathogens/diseases that can harm native species</li> </ul> <p>Invasive species can cause many harmful effects in a new ecosystem, including:</p> <ul style="list-style-type: none"> <li>● Outcompeting and reducing the populations of native species through competition or predation</li> <li>● Can lead to loss of biodiversity</li> <li>● Can alter the habitat</li> <li>● If closely related to native species, can change the genetic diversity by hybridizing with native species</li> </ul> <p>Changes in ecosystems due to invasive species can have negative economic effects if populations of native species with economic value are reduced.</p> <p>Some methods of control of invasive species include:</p> <ul style="list-style-type: none"> <li>● Direct trapping or removal</li> <li>● Poisoning or sterilizing with chemicals</li> <li>● Biological control by introducing a predator or parasite specific to the species from its native habitat</li> </ul> <p>All these control methods have potential disadvantages including cost, possible ineffectiveness, and the chance of affecting other species in unforeseen ways.</p>
<p>Slide presentation</p>	<p>Link <a href="#">here</a></p>
<p>Activity</p>	<p>Presentation instructions and example <a href="#">here</a></p>
<p>Exit ticket</p>	<p>I. What are two common characteristics of an introduced</p>

questions	<p>species?</p> <p>2. What is one common effect of an introduced species on an ecosystem?</p> <p><u>Answers:</u></p> <ol style="list-style-type: none"><li><i>1. Fast growth/reproduction; lack of predators; can access a wide range of food</i></li><li><i>2. Outcompete native species resulting in a decrease in their population; alter habitat; can hybridize</i></li></ol>
Extension questions/activities/resources	<p>Good videos <a href="#">here</a> (Colorado aquatic invasive species spread prevention, 5 minutes) and <a href="#">here</a> (PBS documentary, 26 minutes, not aquatic).</p> <p>Have students research and make an argument for or against the use of rotenone (a chemical piscicide) as a tool for protecting endangered species.</p>