Unit 6.6
"The Tangled Web We Weave":
Interactions Within Ecosystems
Public Preview

Unit Summary

In this unit, students confront the problem of invasive species by learning about various Michigan ecosystems, making predictions about how an invasive species may affect organisms and ecosystems within Michigan, and identifying appropriate management strategies for the invasive species.

To help students predict the impact of the invasive species, students first learn about a single organism and its place in the environment. Students learn about the resources the organism requires, and how access to resources limits individual and population growth (MS-LS2-1). They identify and describe patterns of interactions across ecosystems like predation, competition and mutualism (MS-LS2-2). Students learn about abiotic disruptions to ecosystems like weather and climate, as well as biotic disruptions like invasive species (MS-LS2-4). Finally students choose among competing management strategies and prioritize management of a particular invasive using a decision matrix (MS-ETS1-2).

Unit Challenge Questions

- What can cause the number of organisms in an ecosystem to increase, decrease, or disappear over time?
- How and why do ecosystems change, and why is it important to us?

Unit Big Ideas

- Organisms interact with one another (both within and between species) and the environment in consistent patterns across different ecosystems.
- Seemingly small changes to the environment and/or the species found in an ecosystem can cause drastic changes.

Connection to 21st Century Issues

Modern technology allows people and goods to move quickly across the globe. The ease of transportation that makes wintertime tropical vacations possible also increases the probability, frequency, number, and speed with which living things can be relocated. When a species establishes a population outside of the area where it evolved, it is referred to as a nonnative species. When an organism spreads to the point in which it causes economic or ecological harm, it is referred to as an *invasive species*. Species typically become invasive when they are freed from the competition, parasitism, and predation that previously limited their populations. Invasive species can grow and outcompete native species for ecosystem resources, causing significant changes to the ecosystem. Most nonnative species do not spread fast enough or far enough to be invasive. In fact, many nonnative species are beneficial to people, such as wheat, cattle, and chickens, which are major sources of food.

The increased spread of invasive species has harmed many native species. Scientists have even found that some ecosystems across the globe are becoming more and more similar, in essence, regions are losing their individuality. This loss of regional uniqueness is a major concern for many ecologists.

Unit Challenge

Unit Challenge Summary

Students work to advise their local state legislator about how invasive species affect a population of native species in various Michigan ecosystems. Student teams are assigned to one of six Michigan ecosystems. Within each team, individual students first create a model to describe how a single species interacts with their group's ecosystem. Once the individual species models have been completed, teams use these models to predict how the ecosystem may change when disrupted by an invasive species. Student teams use a decision matrix to identify the best management strategy for the invasive species in their ecosystem. Finally, each team creates a presentation which outlines how the invasive species may change their ecosystem and provides a recommended management strategy. The goal of the presentation is to provide information to fellow classmates, so the class can recommend a single ecosystem they think should be managed, to the state legislator.

Unit Challenge Scenario

Your local representative in the Michigan Legislature would like your help. The legislator recently attended a presentation by the Michigan Department of Natural Resources (DNR) that described how many ecosystems across Michigan may change due to the arrival of new species. Somehow these new species cause the numbers of some organisms to disappear while others stay the same or even increase! The DNR said these changes were due to a changing ecosystem, but the legislators do not really understand what that means. The legislator has asked you to explain to the other legislators on the Natural Resources Committee how different organisms fit into the ecosystem and how a changing ecosystem could cause the numbers of some organisms to decrease while some stay the same.

The DNR presentation also inspired the legislator to draft a bill to protect Michigan's ecosystems. There is not enough money to manage all of the ecosystems the DNR talked about. The legislator would like your class to recommend an ecosystem in which managing new species should be a high priority, and the proposed management solution, with evidence and reasoning to support your argument.

Unit Challenge Student Products & Teacher Resources

Exemplary Student Products and Other Teacher Resources:

- 6.6_UnitChallenge_Teacher_ExemplarOrganismModel
- 6.6_UnitChallenge_Student_InvasiveSpeciesPredictionChart- contains example answers for both students and teachers
- 6.6_UnitChallenge_Teacher_ExemplarManagementDecisionMatrix- shows different management/ prevention strategies
- Presentation - explains how individual species are affected by invasive species and arguing how the ecosystem should be managed
- 6.6_UnitChallenge_Teacher_ExemplarEcosystemPriorityDecisionMatrix used to decide which ecosystem will be a priority for invasive species management
- 6.6_UnitSummaryTable_TeacherVersion
- 6.6_UnitChallenge_Teacher_MustHaveOrganisms- list of organisms that must be included in each group for a successful unit challenge.
- 6.6_UnitChallenge_StudentProductChecklist- list detailing what each student product should contain.

Unit Challenge Student Resources:

- 6.6_UnitChallenge_Student_FactSheetVirtualBinder
- 6.6_UnitChallenge_Student_OrganismModel-Print 11x17 to ensure students have adequate space
- 6.6_UnitChallenge_Student_InvasiveSpeciesFactSheets
- 6.6_UnitChallenge_Student_InvasiveSpeciesPredictionChart
- 6.6_UnitChallenge_Student_ManagementDecisionMatrix- Students select an appropriate management/ prevention strategy
- 6.6_UnitChallenge_Student_EcosystemPriorityDecisionMatrix - Students decide which ecosystem should be a priority for invasive species management
- 6.6_UnitChallenge_Student_InvasiveScoreSheet
- 6.6_UnitSummaryTable_StudentVersion

Lesson Sequencing Table

Lesson #	Lesson Questions	What students do...	# days
1	[Unit Challenge Questions] ● What can cause the number of organisms in an ecosystem to increase, decrease, or disappear over time? ● How and why do ecosystems change?	Students explore Michigan ecosystems and think about biotic and abiotic components they can and cannot see. They receive their Unit Challenge: they must help the state of Michigan determine which ecosystems should be protected from an invasive species based on scientific evidence.	2
2	● What do organisms need to live, grow, and reproduce? ● How is the number of organisms in a population related to the things they need to live, grow, and reproduce?	Students will model how limited resource availability influences individuals and the growth of a population.	2
3	● What happens to organisms and their populations when they must share limited resources with other organisms?	Students will model how competition between organisms can influence individual survival and the number of organisms in a population.	2
4	● How do changes in predator population size affect prey populations and the overall ecosystem?	Students will explore data on predators/prey interactions and how the individual populations change over time.	2
5	● How can a relationship between two species benefit both species? ● How can this beneficial relationship affect each population?	Students will examine examples of mutualism in nature and will look at what can occur when two populations are interdependent as a result of their mutualism.	2
6	● What is the effect on populations of organisms when the abiotic components of an ecosystem change?	Students will model how environmental factors such as disturbances can impact populations of organisms.	2-3
7	● What might be the effects of adding a new species to an ecosystem?	Students will examine the effects that invasive species introduction can have on ecosystems and their native species.	3
8	● How can we best compare multiple solutions to a problem?	Students use a decision matrix to compare management strategies for the Unit Challenge Scenario.	3
9 - Unit Closer	[Unit Challenge Questions] ● What can cause the number of organisms in an ecosystem to increase, decrease, or disappear over time? ● How and why do ecosystems change?	Students will revisit the anchor phase of Lesson 1 and present their conclusions for the Unit Challenge Scenario. Finally, students will construct an argument for why a specific ecosystem should be given priority.	3

Select Assessment Tools

The tools below are just **some** of the assessment opportunities that are available in this unit. The tools in this section have undergone more formal review.

Pre-Post Assessment:

- 6.6_PrePost_StudentCopy

- 6.6_PrePost_StudentExemplar

Embedded Assessment:

- Lesson 05 Check Your Progress

    - 6.6_L05_Check_Teacher_EA_Instructions&Rubric

    - 6.6_L05_Check_Student_EA_StudentCopy

    - 6.6_L05_Check_Teacher_EA_StudentExemplar

- Lesson 07 Check Your Progress

    - 6.6_L07_Check_Teacher_EA_Instructions&Rubric

    - 6.6_L07_Check_Student_EA_StudentCopy

    - 6.6_L07_Check_Teacher_EA_StudentExemplar

Unit Challenge Student Product Rubrics:

- 6.6_UnitChallenge_Teacher_EcosystemPriorityMatrix_Teacher_InstructionsRubric

- 6.6_UnitChallenge_Student_EcosystemPriorityDecisionMatrix

- 6.6_UnitChallenge_Teacher_ExemplarEcosystemPriorityDecisionMatrix

Unit Content Resources:

- [Unit NGSS Connections](#)

- [Prior and Future Knowledge](#)

- [Unit Materials List](#)

- Unit External Web Links*

- Unit Overview Video*

- Compiled Gotta Have Checklist*

- Teacher Background Content Resources*

  *Available to teachers who have completed the Unit Primer as part of the Mi-STAR Professional Learning Program.

Unit Advance Preparation:

- Consult the Unit Materials Shopping List
- Complete the Unit 6.6 Planning Tool