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# K-12 Partnership Lesson Plan

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# *Forest… of… Fortune!*

# *Management of natural resources in Michigan*

## Overview

Students explore the natural areas that are managed around Michigan (e.g. forests, lakes, rivers, prairies). Students will learn about the needs of the many interest groups that managers must satisfy when making a management plan. Students will then become National Forest managers of mini-stands in order to simulate the decisions that need to be made when creating a management plan and some of the unpredictable events that take place.

**Objectives**

At the conclusion of the lesson, students will be able to:

* Name the types of natural areas that are managed in Michigan (and elsewhere)
* List examples of considerations (interest groups, funding, policy, etc.) that managers need to satisfy when creating a management plan
* Describe the relationship between profitability and sustainability
* Discuss some techniques that are used for management of forests

**Length of Lesson**

Two 50-min class periods (one to talk about management needs and styles, one to simulate managing a national forest)

**Grade Levels**

7-12

**Standards covered (NGSS)**

Disciplinary Core Ideas:

 *Middle School*

* **MS-LS2-1**: analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem
* **MS-LS2-4**: construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations
* **MS-LS2-5**: evaluate competing design solutions for maintaining biodiversity and ecosystem services
* **MS**-**ESS3-4**: construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth’s systems

*High School*

* **HS-LS2-7:** design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity
* **HS-LS4-6**: create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity
* **HS-ESS3-2**: evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios

Cross Cutting Concepts:

* Cause and effect
* Systems and system models
* Stability and change of systems

Science and Engineering Practices

* Developing and using models
* Constructing explanations and designing solutions

***Previous Michigan Standards Met:***

* **E1.2f, B1.2f**: critique solutions to problems, given criteria and scientific constraints
* **E1.2g, B1.2g**: identify scientific tradeoffs in design decisions and choose among alternative solutions
* **E1.2k, B1.2k**: analyze how science and society interact from a historical, political, economic, or social perspective
* **E2**.**4b**: explain how the impact of human activities on the environment can be understood through the analysis of interactions between the four earth systems
* **B2.3C**: explain how stability is challenged by changing physical, chemical, and environmental conditions as well as the presence of disease agents
* **L3.p2B**: describe common ecological relationships between and among species and their environments
* **L3.p4A**: recognize that, and describe how, human beings are part of earth’s ecosystems. Note that human activities can deliberately or inadvertently alter the equilibrium in ecosystems
* **B3**.**4A**: describe ecosystem stability. Understand that if a disaster such as flood or fire occurs, the damaged ecosystem is likely to recover in stages of succession that eventually result in a system similar to the original one
* **B3.4B**: recognize and describe that a great diversity of species increases the chance that at least some living organisms will survive in the face of cataclysmic changes in the environment
* **B3**.**4C**: examine the negative impact of human activities
* **B3**.**5C**: predict the consequences of an invading organism on the survival of other organisms
* **E.ES.07.41**: explain how human activities change the surface of the earth and affect the survival of organisms

**Materials**

* PowerPoint
* Student worksheet
* World-view matching worksheet
* Materials for simulation
	+ Slices of bread (forest plot)
	+ Toothpicks of different colors (tree species)
	+ Gummy bears (black bears)
	+ Licorice rope (recreational path)

**Background**

Every acre of public land (National, state, county, city parks, Forest Service, all water bodies) is managed in some form. Humans impact all land based on what we decide the purpose of a particular natural area should be.

Managers often have conflicting goals that they are required to meet (profit, recreation, wildlife habitat, natural area and sporting). These requirements are put forth either through funding pressures, legal policy or interest groups. These goals are conflicting due to the varying levels of invasiveness on the ecosystem. Managers will often segment land into many different pieces to create areas that can each meet one or two of these goals. By fragmenting the land, all of their management goals can be met on a subset of the land.

In this lesson we simulate how managers develop management plans for stands of forest. Student managers must decide their rate of harvest, diversity of tree species, whether to manage with fire or for course woody debris, whether to leave openings for regeneration and wildlife, etc. The student managers then must bear the consequences of the events that the wheel of uncertainty lands on. Varying management strategies will have different consequences for each event.

### Activities of the session

1. Before lesson, prepare materials for the simulation. Create a spinning wheel with spaces for each event listed in the student worksheet (natural fire, disease, threatened species, invasive vine, increased market, nothing happens). Three spaces should include “nothing happens”, giving a total of 8 different event spaces. This is your wheel of chance. Alternatively, create a stack of event cards with several copies of each event. Place these event cards face down.
2. Present the PowerPoint **(attached)**. Encourage discussion of local natural areas (state parks, local lakes). The slides at the end of the presentation are part of the introduction to the forest simulation.
3. Pass out world view worksheet. In groups, ask students to match each quote to each world view (anthropocentric, ecocentric, biocentric). Discuss as a class which perspective students identify with.
4. Pass out the student worksheet **(attached).**
5. Explain to the students that they are managers for a portion of a national forest and that they will need to create a management plan for their forest. Make sure they know that even though the forest is a natural area, the state and federal governments often raise money from timber harvests.
6. a) Have the students decide how they will manage their plot using the choices given in the worksheet. b) Give the students management plans and have them choose the correct options in the worksheet
7. Distribute the trees including extras for regrowth rounds.
8. Have the students set up their stands with the arrangement they chose (rows, scattered, gaps)
9. SETUP/GROWTH: Subtract units for management choices (coarse woody debris, fire, building paths)
10. EVENT: Spin the wheel or draw an event. Follow the event directions. There are 8 events total, including 3 where nothing happens.
11. HARVEST: Add units gained from harvest and from recreation
12. Follow the BETWEEN ROUNDS instructions on the Events page.
13. Repeat steps 7-10 twice more.
14. Discuss the results of the different management plans. You can group people together by management decisions (coarse woody debris, fire, planting in rows/scattered, etc.) for more discussion.
15. Final results can vary. The point of the activity is not to show that clear cutting is better than preserving wildlife habitat or vice versa, but to show that managers need to take a lot into consideration and making money can often conflict with wildlife preservation. People value things differently and a large profit does not necessarily mean great management.
16. The students should answer the short questions at the end of the activity.
17. Collect the student worksheets and use them to assess student learning.

**Resources**

* Powerpoint, student worksheet, and world view worksheet are included on the “Forest of Fortune” lesson page on the KBS GK-12 website.

**Extensions and Modifications**

The lesson can be used as is for grades 7-12. Lower grades may need to reduce the number of events or remove the events that would cause the most confusion during the adding and subtracting portion.