

TITLE: Michigan Ecology

Submitted by: Jennifer Bellore. Jennifer.bellore@farmington.k12.mi.us
School: North Farmington High School, Farmington Hills, Michigan
Date: June 2006

Level: High School Biology
Duration: 4 Class Periods

During June of 2006, I spent a week immersed in the quiet wilderness of Isle Royale. As I stepped on the island, I felt the rest of the world fade and all the resources needed for the journey were provided by the island or carried in our packs. I am proud to tell people of my journey and express my exhilaration at what was accomplished with a group of 10 strangers on the largest island in Lake Superior. Although the experience will be different, I look forward to another adventure on the island.

The group of teachers participating provided an incredible wealth of resources. Our course leader proved to be an incredible teacher allowing us to explore, question and absorb the environment around us. The course supplied me with knowledge of Isle Royale, new resources to probe, and an appreciation for a remote part of Michigan. In one week I gained the motivating factor needed to make comprehensive modifications needed on my Ecology Unit. The unit derived its cohesiveness from my Isle Royale education and the unit is now focused on Michigan ecology from invasive species to wolf and moose.

My students have already benefited from more real world examples in my classroom. While conducting a Biogenesis/Abiogenesis lab I spoke with students about boiling drinking water while hiking. We discussed the experiments of Needham and his conclusion that Abiogenesis had indeed occurred after observing growth of microorganisms in broth boiled and sealed in a flask. We discussed how not all the microorganisms were killed leading to growth within the flask and how this might relate to a wilderness experience.

The following lessons are part of a Biology I ecology unit. This class is most often taken by 9th and 10th graders.

GOAL: Students will become familiar with various species found in Michigan while gaining additional knowledge about the ecology of our state.

OBJECTIVES: Many of the Constructing and Reflecting benchmarks (Sections I and II of the Michigan Curriculum Framework) are integrated into each lesson. Most specifically:

- I.1.HS.1 Ask questions that can be investigated empirically.
- I.1.HS.4 Gather and synthesize information from books and other sources of information.
- II.1.HS.3 Show how common themes of science, mathematics, and technology apply in real- world contexts.
- II.1.HS.6 Develop and awareness of and sensitivity to the natural world.

- III.5.HS.1 Describe common ecological relationships between and among species and their environments.
- III.5.HS.2 Explain how energy flows through familiar ecosystems. Explain the relationship between the quality and quantity of habitat as it relates to the carrying capacity of living organisms.

- CS1.3 Design and conduct scientific investigations.
- CS3.3 Describe general factors relating population size in an ecosystem.
- CS3.4 Describe responses of an ecosystem that cause it to change.
- CS3.5 Describe how nutrients cycle through an ecosystem.

LESSON 1: Michigan - What are we?

KEY: *A. commensalism* *B. competition* *C. mutualism* *D. parasitism* *E. predation*

- | | |
|--------------------------------------|--|
| _____ 1. +, + symbiotic relationship | _____ 5. two females fighting over a male |
| _____ 2. +, 0 symbiotic relationship | _____ 6. an organism that wants to kill its source of food |
| _____ 3. +, - symbiotic relationship | _____ 7. Athlete's foot |
| _____ 4. Heartworm in a dog | |

_____ 8. flea on a dog

_____ 9. an organism that does not want to kill
its source of food

Now let's look at some examples that are more specific to Michigan Ecology:

- _____ 1. Have you experienced black flies while camping? Black flies require a blood meal for their egg development and often bite humans. They can transmit a nematode that causes "river blindness." The nematode and human show...
- _____ 2. Great Lakes snapping turtles often consume young waterfowl and fish.
- _____ 3. A single Cricket Frog in Michigan consumes 4,800 insects a year!
- _____ 4. A Bull Frog actually tries to capture the same foods as humans: duck and fish.
- _____ 5. The fight between Bull Frogs and Humans isn't too much of a competition. Humans actually catch Bull Frogs for food.
- _____ 6. Sea Lampreys attach to the side of trout in Lake Superior, causing a temporary decline in their population in recent years. Sea lampreys use their raspy disc-shaped mouth full of teeth to strike and hold fast to fish. They make holes in the sides of their victims and feed on blood and body fluids.
- _____ 7. The Cattle Egret feeds with the help of grazing animals. They eat insects that are only stirred up by the grazing movements of cattle and horses. The relationship between the Egret and these grazing animals is...
- _____ 8. In some areas, the Cattle Egret, in addition to getting insects with the help of its grazing neighbors, has been shown to eat ticks off of the grazing animals. Now, the relationship between the Egret and grazing animals is...
- _____ 9. In the Great Lakes, invasive Zebra Mussels filter out most of the phytoplankton that other native filter-feeders need to survive.
- _____ 10. This past year, Michigan had its first human case of West Nile Virus, a virus carried by mosquitoes to their hosts. Birds and horses are the common victims of the virus. The virus in a bird, horse, or human is...
- _____ 11. The West Nile Virus lives part of its life in a mosquito, which is the vector for the disease, but the mosquito is not affected.
- _____ 12. The pitcher plant obtains some of its mineral nutrients from a fungus that lives at the roots of the plant. The fungus obtains sugars, starches, proteins and lipids from the plant roots.
- _____ 13. Pitcher plants are carnivorous plants who trap organisms in an attractive (if you're an insect) deep cup that has slippery sides so insects cannot climb out. Some pitcher plants contain insect larvae, which feed on the trapped organisms, and the pitcher plant absorbs the insect's excretions to obtain nutrients.
- _____ 14. In 1981-82 *Canine parvovirus* entered the wolf population of Isle Royale when a visitor from Chicago brought an infected dog to the island. It is a [contagious virus](#) affecting [dogs](#). The disease is highly infectious and is spread from dog to dog by physical contact and contact with [feces](#).
- _____ 15. The moose on Isle Royale are plagued by ticks, which distract them from feeding and cause hair and blood loss. According to researcher Rolf Peterson, tens of thousands of ticks may be found on a single moose.
- _____ 16. There are 32 varieties of orchids on Isle Royale. [Bees](#) pollinate the yellow lady slipper species.
- _____ 17. The sundew is an insectivorous plant. It is a member of the family [Droseraceae](#) that lure, capture, and digest insects using glands covering their leaf surface. It has digestive enzymes that break down gnats.



LESSON 2: Michigan Invasive Species

Directions: Research an invasive (exotic) species that is currently found in Michigan. Print out a copy of the first page of your main source of information and staple it to this page. Be sure to cite all sources of information

Background:

1. Define invasive species. _____

2. What is a non-native species? _____

3. Native species. _____

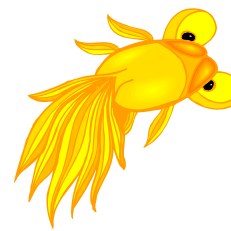
4. What is an Exotic Plant? _____
5. Are all non-native plants invasive? _____

Research:

6. What is the name of the invasive species you are researching? _____
7. Where is it found in Michigan? _____
8. What type of environment is it found in? _____
9. How can it be identified? (What does it look like?)
10. What is the native location of the species? _____
11. When and how did it arrive in the United States? In Michigan?
12. How is this species disrupting communities or ecosystems?
13. Define abiotic. List abiotic factors present that allow it to thrive in its new environment.
14. List biotic factors present that allow it to thrive in its current environment.
15. Draw a food chain that would be present in this organism's environment.
16. What organisms are threatened by the presence of this invasive species? Why are they threatened?
17. Have any methods been used to stop the spread of the invasive species? Describe them.
18. What is the future outlook for this species? Do scientists feel that they will be able to stop its spread? Do they want to stop it from spreading?
19. What is ecology? How is this activity relevant to the unit we are currently studying?
20. List all websites that were used to research your invasive species. Don't forget to list your sources.



Carassius auratus auratus



LESSON 3: Ecological Relationships

Ecological Studies

Purpose: How do adaptation, competition and predation explain the relevant abundance of organisms in a habitat?

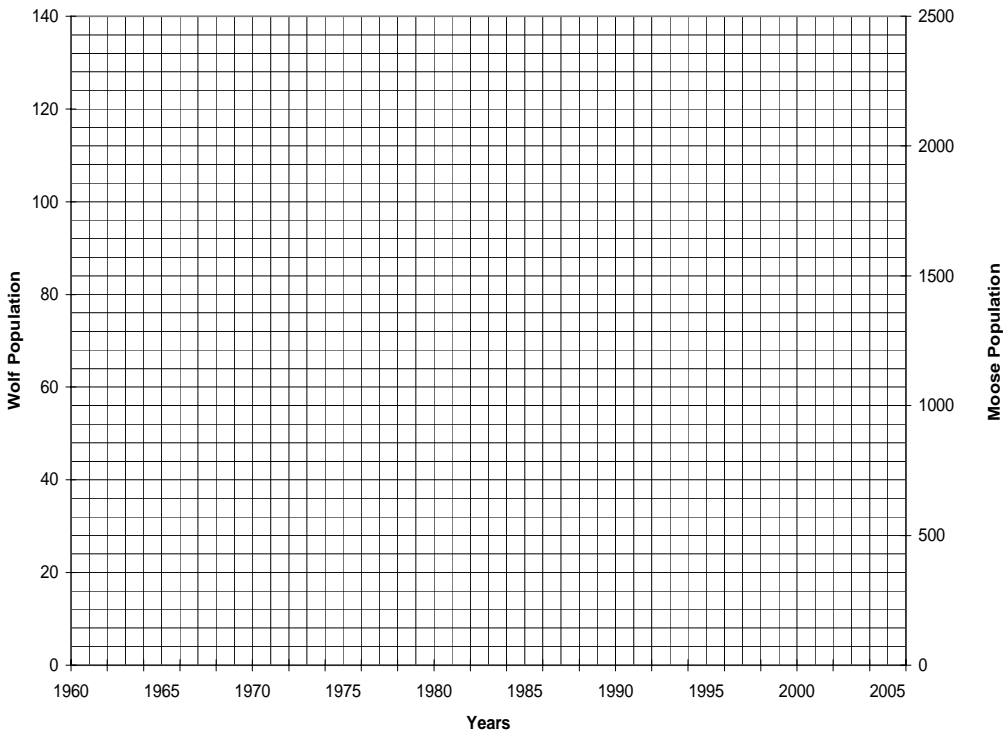
Introduction: Sometime in the early 1900's moose arrived on Isle Royale. Scientists are still uncertain if they swam (15 miles from Canada in cold Lake Superior), were brought by hunters or crossed on a ice bridge. In 1948, a pair of Eastern Timber Wolves crossed an ice bridge from Canada and became the only wolves on the island.

During the summer, Moose spend around 8 hours a day consuming the nutrients (30-40lbs) of mountain ash and other plants in order to store enough energy to survive a winter eating twigs and balsam fir needles.

Wolves are the top predator on Isle Royale and their diet consists primarily of Moose. Wolves hunt in packs and kill moose once every 4-10 days.

Directions: Using the Wolf/Moose data construct two line graphs on the chart below. Be sure to include a key on your graph, the title and axis (x & y) are labeled for you.

Isle Royale Wolf/Moose Data



YEAR	MOOSE	WOLF
------	-------	------

1960	637	22
1961	639	22
1962	668	23
1963	717	20
1964	727	26
1965	773	28
1966	898	26
1967	1039	22
1968	1299	22
1969	1348	17
1970	1522	18
1971	1583	20
1972	1507	23
1973	1634	24
1974	1478	31

YEAR	MOOSE	WOLF
1975	1462	41
1976	1277	44
1977	1055	34
1978	1072	40
1979	939	43
1980	861	50
1981	797	30
1982	765	14
1983	783	23
1984	813	24
1985	1001	21
1986	1025	20
1987	1380	16
1988	1653	12
1989	1397	12
1990	1216	15
1991	1313	12
1992	1590	12
1993	1879	13
1994	1770	17
1995	2422	17
1996	1163	22
1997	500	24
1998	699	14
1999	720	22
2000	822	25
2001	940	19
2002	1048	18
2003	750	19
2004	601	26
2005	520	27
2006	450	26

Analysis:

1. When did the wolf population peak? _____
2. When did the two major peaks in the moose population occur? _____

In 1981-82 a visitor brought a dog with Canine parvovirus to the island (not a good move) and the virus entered the wolf population. Label this point "virus" on your graph.

3. What effect did the virus have on the wolf population? _____

1996 was a severe winter (spring came late).

4. What effect did this have on the moose population? _____

5. Was the wolf population affected in the same way? _____ Why? _____

6. What long term effects might the 1996 winter have on the wolf population? Give 3.

Use your graph to answer the following questions:

7. Look what happened to the moose population following the severe winter (late spring), and see if you can identify which other years had severe winters in the past.
8. How many wolves will be on Isle Royale in five years? _____ Why do you think this? _____
9. What occurs with the wolf population as the moose population
 - a. Increases? _____
 - b. Decreases? _____
10. If the moose population if the wolf population
 - a. Increases? _____
 - b. Decreases? _____
11. What type of relationship exists between wolf and moose on Isle Royale? _____

LESSON 4: Food Webs of Michigan

Objective: Start with the animal that you signed up for and create a food web that would be found in the Michigan ecosystem where that animal lives.

Guidelines:

1. At least 12 organisms that are all interconnected
2. Include a picture of the organism you signed up for
3. Give the common name of each organism
4. You may only include 2 producers – be sure to give their common names
5. All organisms must live in the same biome and all feeding relationships must be accurate.
6. Label **ALL trophic levels** of each organism. Some may occupy multiple trophic levels
7. Must include at least one fourth order consumer
8. Do not include the sun

Directions for Microsoft Word XP:

1. Open Microsoft Word XP
2. Go to "Insert", "Text Box"
3. Click on the screen to create a text box
4. Type in the name and trophic level of the organism in the text box
5. Repeat the procedure to add another animal to your food web.
6. Click on the arrow at the bottom of your screen next to "Auto Shapes".
7. Drag the arrow from one text box to another to show the transfer of energy.

ASSESSMENT:

Each lesson will be graded based on correct answers to questions on assignments, as well as a test at the end of the ecology unit.

REFERENCES:

Goodrich, Marcia. 2006. Lean Times on Isle Royale. <mlgoodri@mtu.edu>

Michigan Department of Education. (1996). *Michigan Curriculum Framework*. Lansing, MI : Michigan Department of Education.

Peterson, Rolf O. & Vucetich, John A. 2006. *Ecological Studies of Wolves on Isle Royale 2005-2006*. Michigan Technical University Press. Houghton MI.

Peterson, Rolf O. *The Wolves of Isle Royale*, Willow Creek Press, Minocqua, Wisconsin, 1995.

Shelton, Napier. 1997. *Superior Wilderness*. Isle Royale Natural History Association, Houghton, Michigan.

ADDITIONAL/INTERNET RESOURCES:

www.biology.usgs.gov

www.earthwatch.org (Predator Prey Population Cycles)

www.isleroyale.national-park.com

www.isleroyalewolf.org

www.nwf.org/wildalive/wolf/ (National Wildlife Federation Wolf Trunk-2 week loans)

www.timberwolfinformation.org/ (Book Lists)

www.wolf.orgT (International Wolf Center-Notes from Field by David Mech-Curriculum)