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Ecological Equilibrium

Daniel Esler
The College at Brockport, mr.esler@gmail.com

Daniel Esler
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Level 1 Lesson Plan

Ecological Equilibrium

Objectives

Upon completion of this lesson, students will:

- Have been introduced to computer modeling
- Have a better understanding of setting up and utilizing the functions of Microsoft Excel
- Have a better understanding of the complexities of the ecological equilibrium time and evolution have created

Materials/Tools Needed

Computer with access to Interactivate Activities (CD or Internet connections) and Microsoft Excel

Grouping/Target Audience

Work in groups of 2. For students in grades 7-9.

NYS Standards

STANDARD 1—Analysis, Inquiry, and Design
Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.
M1.1b Identify relationships among variables including: direct, indirect, cyclic, constant; identify non-related material
Key Idea 3: Critical thinking skills are used in the solution of mathematical problems.
M3.1 Apply mathematical knowledge to solve real-world problems and problems that arise from the investigation of mathematical ideas, using representations such as pictures, charts, and tables.
M3.1a Use appropriate scientific tools to solve problems about the natural world
Key Idea 1: Engineering design is an iterative process involving modeling and optimization finding the best solution within given constraints); this process is used to develop technological solutions to problems within given constraints.
STANDARD 2—Information Systems
Students will access, generate, process, and transfer information, using appropriate technologies.

Key Terms *Food Web, Equilibrium, evolution*

Lesson Outline

Focus and Review - Students will be reminded of the relationships of organisms within an ecosystem. This can be done with Level 1 or level 2 questions such as "If the population level of rabbits was to suddenly rise due to a higher amount of edible plants, what would happen to the population of wolves? What kind of relationship is this between the plants and wolves?" Or, "How are wolves and grains related within an ecosystem?"

Objectives - Through this lesson, students will gain a better understanding of the inter-relatedness of organisms within an ecosystem and all of the variables that go into creating the balanced relationships. Idealistically, students will be able to deduce the strength of evolution and the incredible amount of trial and error time has provided when creating the equilibriums within our environment.

Teacher Input - The teacher should deliver insightful questions for students while the students are manipulating the variable parameters of the wolves and rabbits. Suitable questions are "What characteristics do you think are more important to a specie's fitness?" Or, "What do you think are the relative life spans of wolves and rabbits in the wild where there is an equilibrium already in place?"

Guided Practice - The teacher will guide students through accessing the Interactive activities and creating their spreadsheets. The instructor may also want to walk students through a few trials and show them the viewing and manipulating options within the activity as well as a few simple Excel functions such as SUM and AVERAGE.

Independent Practice - Students will run many trials of the "Rabbits and Wolves" Activity from the Interactivate Website. They will run trials both before and after manipulating the parameters of the wolves and rabbits and create a spreadsheet from their collected data. From this, graphs and charts can be created and the most realistic parameters can be discovered.

Closure - Through collected classroom averages, the most realistic parameters (those that produced the most rabbit and wolf iterations) can be determined. One can easily make the point of evolution here (trial and error).

RABBITS AND WOLVES

Directions: *Follow the procedure below and answer the questions in the spaces provided.*

Procedure

1. Open Rabbits and Wolves activity from the Activities list within the INTERACTIVATE Index
2. Open Microsoft Excel and create a spreadsheet with the following Information:

	First Trial- Normal parameters	
	Iterations Wolves survived	Iterations Rabbits Survived
Averages		

2nd trial -	
Iterations Wolves survived	Iterations Rabbits Survived

3. Run **1** trial of the Wolf and Rabbit program. Stop the model once one of the species disappears from either the field or the graph (your teacher should have shown you how to view the 'Population Graph'). Fill in the table you've created in Excel with the number of iterations it took for the first species to be completely wiped out. This could be either the wolves or rabbits.
4. Repeat this **9** more times; always filling in the number of iterations it took for the first species to disappear.
5. Average the number of iterations within each species using the =AVERAGE() function in Excel.

Questions: What are the averages? Wolves_____ Rabbits_____

What species is better fit to survive in this environment? _____

What two behaviors could you change that might improve the survival of the weaker species? (Look to parameters for ideas)

1.

2.

6. Your goal is to improve the lengths of **BOTH** species' survival. Change ONE parameter (make sure to show what you changed on your Excel worksheet next to "Second Trial – "), save it, and run the model **10** times, recording the outcomes and calculating averages as you did above.

Questions: What are the averages? Wolves_____ Rabbits_____

What species is better fit to survive in this environment under the new parameters? _____

Was the parameter you chose to change to improve the survival of the weaker species a good idea or did it end up reducing the number of iterations?

What are two more characteristics you could change to improve the lengths of both species' survival?

1.

2.

7. Your goal is to improve the lengths of **BOTH** species' survival. Change ONE more parameter (create a third section in your Excel spreadsheet for a Third Trial and label it accordingly), save it, and run the model **10** times, recording the outcomes and calculating averages as you did above.

3rd trial -	
Iterations Wolves survived	Iterations Rabbits Survived

Questions: What are the averages? Wolves_____ Rabbits_____

What species is better fit to survive in this environment under the new parameters? _____

Was the parameter you chose to change to improve the survival of the weaker species a good idea or did it end up reducing the number of iterations?

Conclusions:

1. Why do you think it might be useful thinking about the wolves' and rabbits' natural characteristics when choosing parameters to change?

2. What do you think the separate groups in your classroom determining the best parameters represent in the environment? Why?

3. What parameters or other organisms do you think this model is lacking? (Write at least three)

4. Why is the earth covered with so many species of organisms (millions and millions) when it is so difficult to keep more than two organisms in a balance?

RUBERIC

	4 Points	3 Points	2 Points	1 Point	0 Points
Questions	13-15 Questions answered correctly and completely	9-12 Questions answered correctly and completely	5-8 Questions answered correctly and completely	1-4 Questions answered correctly and completely	0 Questions answered correctly and completely
Conclusions	All four conclusion answers are well thought out, justified, and have complete sentences	Either one conclusion is completely incorrect or the conclusions are lacking either organization, justification, or completeness	Either two conclusions are completely incorrect or the conclusions are lacking two of the following: organization, justification, or completeness	Either three conclusions are completely incorrect or the conclusions are lacking three of the following: organization, justification, or completeness	Either four conclusions are completely incorrect or the conclusions are lacking four of the following: organization, justification, or completeness
Spreadsheet	Met all of the following criteria: clarity, complete, organized, and accurate	Met 3 of the 4 criteria: clarity, complete, organized, and accurate	Met 2 of the 4 criteria: clarity, complete, organized, and accurate	Met 1 of the 4 criteria: clarity, complete, organized, and accurate	Met 0 of the 4 criteria: clarity, complete, organized, and accurate