BIOL3007 - May 2016 Ecology Lab:

This assignment carries 20% of your course work:
Date due: Friday 22nd July 2016 but can be submitted before.
Instructions:

The following are guidelines to help you, but your laboratory must follow the format of a laboratory report with all the relevant sections:
Name:
Aim
Apparatus
Method with relevant theory
Results
Analysis of Results
Discussion
Conclusion

Open the Simulator at
http://www.learner.org/courses/envsci/interactives/ecology/ecology.html?initLesson=1
(if the simulator does not open by clicking here copy the link and paste in the address bar of your browser).
Download and record you results in the word file “Tables for Ecology Lab”

1. Submit your answer by email to sanshore@gmail.com
2. Use the following protocol for your filename: your_name_biol3007_2016_ecology_lab
3. Failure to name your answer file appropriately and / or submit to the above email address will result in it not being accepted.

Producers
In any given ecosystem, most organisms will carve out a niche for themselves where they can obtain all of the necessities to survive. Often, different species within the ecosystem will compete for the resources that a niche provides. However, certain species live well together—symbiotically, parasitically, or by staying out of each other's way. For example, lichen and moss, often the primary colonizers of a new ecosystem, tend to live fairly harmoniously in each other's vicinity. Let's see what happens in this model.
Activity 1
Two Producers
Imagine the ecosystem is newly forming—the previous ecosystem has been destroyed by fire or flood—and the first colonizers of the successive ecosystem are, of course, producers.

1. Make sure next to the lesson it says ***Producers***
2. Choose two species of plants in the simulator.
3. Predict what will happen in this young system and record your prediction in the Table 1.
4. Click Step  to see the starting population.
5. Then click run  to start the simulation. It runs for 100 days. Each time run is clicked it goes another 100 days.
6. Run for 500 days and stop if it seems to be a steady state, otherwise continue for another 500 days.
7. Repeat 3 time steps and recording your prediction and the actual population numbers for both plants.

Table 1: Two Producers

Activity 1		Population X 1000											
		Predicted after 100 days	Starting	100 days	200 days	300 days	400 days	500 days	600 days	700 days	800 days	900 days	1000 days
Run 1.	Plant A												
	Plant B												
Run 2.	Plant A												
	Plant B												
Run 3.	Plant A												
	Plant B												

Activity 2
Three Producers

1. Repeat for 3 producers

Table 2: Three Producers

Activity 2		Population X 1000											
		Predicted after 100 days	Starting	100 days	200 days	300 days	400 days	500 days	600 days	700 days	800 days	900 days	1000 days
Run 1.	Plant A												
	Plant B												
	Plant C												
Run 2.	Plant A												
	Plant B												
	Plant C												
Run 3.	Plant A												
	Plant B												
	Plant C												

Assess the data with the following questions in mind:
What assumptions does this model make about co-dominance as well as the general terrain of the ecosystem?
Do you find one producer to be dominant? Why might one producer be dominant over another?

When the ecosystem contains plants only, one species of plant out-competes the other(s) and takes over. This illustrates the "competitive exclusion principle," which theorizes that no two species can occupy the same niche at the same time in a particular locale if resources are limited. The presence of a consumer is needed to keep that plant in check and allow the other species to survive.

Introducing an Herbivore

Activity 3

One Producer and One Herbivore

Now you'll introduce an herbivore into the environment. In theory, an herbivore native to the ecosystem should feed primarily on the dominant species.

1. Click on herbivore A (the rabbit) and choose "eats plant A."
2. Remember clicking Step 

allows you to see the starting population in the Table 3.
3. Predict and record what will happen to the population numbers in the ecosystem.
4. Then, run the simulator and record your results.
5. Run for 500 days and stop if it seems to be a steady state, otherwise continue for another 500 days.
6. Repeat 3 time steps and recording your prediction and the actual population numbers for both plants

Table 3: One Producer and One Herbivore

Activity 3		Population X 1000											
		Predicted after 100 days	Starting	100 days	200 days	300 days	400 days	500 days	600 days	700 days	800 days	900 days	1000 days
Run 1.	Plant A												
	Herbivore A												
Run 2.	Plant A												
	Herbivore A												
Run 3.	Plant A												
	Herbivore A												

Assess the data with the following questions in mind:

What is the trend of the populations?

How do producer population numbers with the presence of an herbivore compare to the primary colonizer model?

Activity 4

Two Producers and one Herbivore

In this system, the herbivore may consume enough of the dominant species to give the non-dominant species a chance for proliferation and survival.

Now you'll introduce an herbivore into the environment with more than one producer. But the herbivore feeds only ***ONE*** producer.

7. Chose All off.
8. Select TWO producers
9. Click on herbivore A (the rabbit) and choose "eats plant of your choice."
10. Remember clicking Step  allows you to see the starting population in the Table 4.
11. Predict and record what will happen to the population numbers in the ecosystem.
12. Then, run the simulator and record your results.
13. Run for 500 days and stop if it seems to be a steady state, otherwise continue for another 500 days.
14. Repeat 3 time steps and recording your prediction and the actual population numbers for both plants

Table 4: Two Producers and One Herbivore

Activity 4		Population X 1000											
		Predicted after 100 days	Starting	100 days	200 days	300 days	400 days	500 days	600 days	700 days	800 days	900 days	1000 days
Run 1.	Plant A												
	Plant B												
	Herbivore A												
Run 2.	Plant A												
	Plant B												
	Herbivore A												
Run 3.	Plant A												
	Plant B												
	Herbivore A												

Assess the data with the following questions in mind:

Is one producer still dominant over the other? Why might one producer be dominant over another?

If the simulation included decomposers, how would your current results change?

Activity 5
Three Producer and one Herbivore feeding ONLY on ONE plant

In this system, the herbivore may consume enough of the dominant species to give the non-dominant species a chance for proliferation and survival. However, additional species may become extinct because of competition for resources.
Repeat for three producers and an herbivore feeding ONLY on ONE plant

Table 5: Three Producers and One Herbivore

Activity 5		Population X 1000											
		Predicted after 100 days	Starting	100 days	200 days	300 days	400 days	500 days	600 days	700 days	800 days	900 days	1000 days
Run 1.	Plant A												
	Plant B												
	Plant C												
	Herbivore A												
Run 2.	Plant A												
	Plant B												
	Plant C												
	Herbivore A												
Run 3.	Plant A												
	Plant B												
	Plant C												
	Herbivore A												

Activity 6
Three Producer and one Herbivore feeding ONLY on TWO plants
Repeat for three producers and an herbivore feeding ONLY on TWO plants.

Table 6: Three Producers and One Herbivore

Activity 6		Population X 1000											
		Predicted after 100 days	Starting	100 days	200 days	300 days	400 days	500 days	600 days	700 days	800 days	900 days	1000 days
Run 1.	Plant A												
	Plant B												
	Plant C												
	Herbivore A												
Run 2.	Plant A												
	Plant B												
	Plant C												
	Herbivore A												
Run 3.	Plant A												
	Plant B												
	Plant C												
	Herbivore A												

Activity 7

Three Producer and one Herbivore feeding ONLY on THREE plants

Repeat for three producers and an herbivore feeding on THREE plants.

Table 7: Three Producers and One Herbivore

Activity 7		Population X 1000											
		Predicted after 100 days	Starting	100 days	200 days	300 days	400 days	500 days	600 days	700 days	800 days	900 days	1000 days
Run 1.	Plant A												
	Plant B												
	Plant C												
	Herbivore A												
Run 2.	Plant A												
	Plant B												
	Plant C												
	Herbivore A												
Run 3.	Plant A												
	Plant B												
	Plant C												
	Herbivore A												

The primary colonizers of an ecosystem, the producers, are also the harbingers of primary succession. As these pioneer plants die and decay, they add organic material to the soil, which, over time, will allow for secondary succession—generally larger and more delicate producers such as trees.

Assess the data with the following questions in mind:

How do disturbed areas 'recover 'for example after fires, logging, development and abandonment?

What would urban areas look like if they are abandoned?

How are humans contributing to the creation of a vastly rapid form of succession?

How are we speeding up the effects of the competitive exclusion principle and thereby altering the outcome of that ecosystem's natural succession?

Keeping the ideas of succession and the competitive exclusion principle in mind, think of the many factors that may go into sustaining an ecosystem. Is there any way we can all get along and live side by side with nature (sustainable living)?

Food Web

Now that you have a sense for the interrelationships between the trophic levels, see how big you can make your food web and still have all of the species you add survive through the end of the simulation run.

Activity 8: One Organism at Each Trophic Level

First you'll run a less than "real-life" scenario. Choose only one organism from each trophic level and make sure that the food chain goes in a straight line from one trophic level to the next, i.e., Herbivore A eats Plant A, Omnivore A eats Herbivore A, and the Top Predator eats Omnivore A.

Record your results:

Table 8 - ***One Organism at Each Trophic Level***

Organism	Population Changes			
	Increased / Decreased / Oscillated Initially	Population Pyramid Level	Steady state / Extinct	Shape of curve S-Curve / J-Curve
Plant A				
Herbivore A				
Omnivore A				
Carnivore A				

Activity 8: Sustainable Ecosystem

Ecosystems have an extremely complex web of cause and effect. Changing one connection or altering the population of any species within an ecosystem can have dire, cascading effects on all others within that ecosystem.

Try to develop a sustainable ecosystem with all the organisms.
If you do post a screenshot in your write up.
Discuss your findings with the following questions in mind:

Was your prediction correct? How did you arrive at your prediction? What differences were there between your prediction and the simulation?
What would happen to this imaginary ecosystem if the producers were to die out?
Did any of the species increase in number? What could account for this increase? Which species decreased in number and what might account for this decrease?
Which populations would benefit the most from the presence of decomposers?
Were you able to modify the parameters so that each species survived? Explain how you decided what changes to make.
Which way does energy flow and how does eating an organism result in energy transfer?
Consider the following:
How does a natural ecosystem offer suggestions toward a more economical and eco-friendly human model?
How do humans affect the greater food web? In this model, how could humans who do not live in the ecosystem still manage to alter the flow of energy within the web?