

Name: _____
Mr. Willis
Biology: _____
Date: _____

Unit II
Science Methods
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II



Island Ecology Project

OBJECTIVE: To design a functioning, balanced island ecosystem.



Created by Anadia Groeneman, MS

An extremely wealthy woman has decided to purchase an island from the government. The island is 112,000 m² and is made up of temperate forest that has been untouched for the last 50 years. The island was sold for a bargain price because it was used during the 1940's for nerve gas experiments. Due to these experiments, all vertebrate life was killed on the island. Presently there are still no vertebrates except for migrating birds. The new owner is not daunted by the past history since the insects and plant life have been unaffected by the experiments and are thriving. The island's net productivity due to the plant life alone is roughly **6,000** kilocalories (kCal) per square meter each year. The owner recognizes the possibilities that are open to the island and is anxious to have the island teeming with life as soon as possible. She has recruited your biology class to develop a plan to re-colonize the island with the missing vertebrates. Your team needs to consider the different species and their diets. Use what you know about food chains, webs, and energy flow in an ecosystem to complete this activity. ***Make sure you work as a group, read all directions, and follow all the steps in order! Also make sure you each write down all the answers on your own answer sheets. This is a 100 point in-class project.***

1. **Calculate the energy available for the island.** To do this: multiply the size of the island in square meters by the productivity of the island in kilocalories (kCal) per square meter. This is the amount of energy available for the entire island for one year. Put a box around your answer.

2. **Now choose the animals you would like to include on the island.** The different species you can choose from are in the folder given to you. Beneath each picture is the relevant data you need to know, including diet and weight. You must choose 8 different species. Keep in mind that you are trying to reconstruct an ecosystem – remember what you learned about numbers of species per trophic level and the types of animals in each level. You would like to end up with a balanced ecosystem. **Write your species names below and what they eat.**

- Now construct a food web with the animals.** Do this in pencil on a separate sheet of paper first. Place producers and insects on the web (remember they are the only living animals provided on the island). Then once you are sure the animals are in the correct spots you need to have me approve it before you move on. Once approved, put your web on the big sheet of paper. A small picture of each species should be drawn above its name. Finally draw arrows to show the flow of energy between species. Draw a sun below your web showing the rays hitting the plants.
- Now you are going to fill in the chart below.** You will find the information for the first three columns with the animal's picture.

Example: I know from the picture of a deer that it weighs 75 lbs. From the species sheet I also know that the energy requirements are: $Wt \text{ (lbs)} \times 30 \text{ (kCal/day)}$. This formula goes into the third column. Now, plug the weight into the formula to determine the amount of energy needed for a deer each day (multiply 75lbs x 30 kcal to determine that a deer will need a total of 2250 kCal per day). This goes into the fourth column. Continue with the next species.

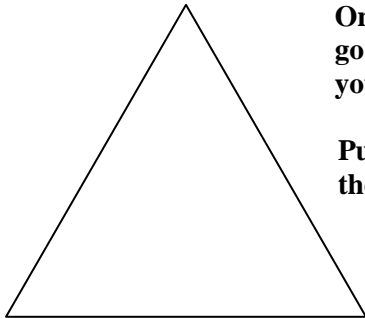
Species	Weight	Energy requirements for species (formula given on species sheet)	Energy needed for your specific animal each day (kCal)
White tailed deer	75 lbs	$75 \text{ (lbs)} \times 30 \text{ (kCal/day)}$	2250 kCal/day

Species Name	Weight	Formula for Energy required for species (formula given in folder)	Energy needed for your animal each day (kCal)

- Now calculate the amount of energy available for one day on the island.** Take the amount from step 1 and divide that by 365. Round the number to the nearest 100,000. Write your answer below.

6. Now that your chart is filled in you are going to construct an energy pyramid.

First you'll need to draw in lines on the pyramid below for as many trophic levels as you need. Then fill in the pyramid below with the amount of energy that is available for each level. **Hint:** Your bottom or first trophic level is the producers – this is the total amount of energy available on the island that you just figured in step 5. Now calculate the energy available per day at each trophic level by using what you learned in class about the energy loss as you move up a pyramid. Show your work below as to how you figured out the amount at each trophic level.



Once you all agree on the pyramid, construct the one that will go on your poster. Use the handout of a pyramid given to your group. Place all your animals in the correct trophic level.

Put the numbers that you figured out for each trophic level in the correct boxes below.

Now you and your group need to determine the population size, how many of each species, you would like to have on the island. You know how much energy each species needs per day so you can then use that information to figure out how many species can be supported in that trophic level. Make sure you stay within your energy range. But also make sure that you use as much of your energy as possible. **If you run out of energy for the species that you chose to put on the island place an X through them on your pyramid and on your food web.**

First trophic level

Energy available for a day:

Second trophic level

Energy available for a day:

(Species name)	(# in population)	x	(energy for 1)	=	(energy for population)
_____	_____		_____		_____
_____	_____		_____		_____
_____	_____		_____		_____
_____	_____		_____		_____

Total energy: _____

Does your total energy fit with in the amount available at that level?

If not you need to refigure your population sizes.

Third trophic level

Energy available for a day:

(Species name)	(# in population)	x	(energy for 1)	=	(energy for population)
_____	_____		_____		_____
_____	_____		_____		_____
_____	_____		_____		_____
_____	_____		_____		_____

Total energy: _____

Fourth trophic level

Energy available for a day:

(Species name)	(# in population)	x	(energy for 1)	=	(energy for population)
_____	_____		_____		_____
_____	_____		_____		_____
_____	_____		_____		_____
_____	_____		_____		_____

Total energy: _____

7. **Congratulations you have colonized the island!!** Now complete the following questions.

Questions:

1. Did you have enough energy for all the species you wanted to have on the island? If not which ones did you not have the energy for? Explain why you ran out of energy for those species?

2. Which species did you have the smallest population of? Why?

3. Which species did you have the largest population of? Why?

4. **On your pyramid label which species are the primary consumers.** What would happen if all the primary consumers were wiped out by disease? Would the other species on the island be able to survive? Explain your answer.

5. Critical thinking: Is it best to have a large population with only a few different species, or is it best to have many different species but only a small population of each? Why? Consider what may happen in the future on this island.

Island Ecology Project Extension

Reflect on what you accomplished in your project and answer each of the following with a detailed response. Since you will be presenting your island ecosystem to the class write the population size of each of your species on your web in red marker.

1. What was the source of energy for your ecosystem? Was this source biotic or abiotic?
2. There were many different concepts that you should have kept in mind while choosing your island species. Give three specific characteristics that determined energy usage for each species that should be investigated before colonizing an island ecosystem. Explain each of your three choices and why it is important.
3. If you were to go back to your island in 10 years time what do you predict it will be like? How will each of the populations have changed over the years? Is there any organism that will have their population increase indefinitely? Explain.

