Learning Experience 5

Making Connections

DO NOW
How many average size deer ticks do you think it would take to equal your height? What about other objects?
Average size of deer tick = 3mm (about 0.10 inches)

HOOK
Ranger Chris has decided to help by providing you with information about the organisms he's observed over time.

Teacher Prep/Materials
- Laptop cart/computers
- EcoMUVE
- Experience 5 Presentation & Do Now
- Tree Ring Tool: http://goo.gl/kRXje3
- Tree Ring Worksheet
- Scale of the Universe Website http://htwins.net/scale2/
- Experience 5 - Scientist Roles Perspectives Sheet

Summary
Students will discuss concepts of scale and complete various activities, such as the Tree Ring Tool (optional) and the Experience 5 - Scientist Roles Perspectives Sheet to help connect biotic and abiotic factors with the concept of scale.

**Teacher feedback after using EcoMUVE with students the first year was that the tool and associated Learning Quest difficult for students to use. The purpose, if done correctly, is to show that two trees from the same geographic area display different growth patterns due to biotic factors (being eaten) not from abiotic factors (rain, temp, sunlight) as students would assume. The Tree Ring Tool can be done as a demonstration while projecting the tool and using the calipers as a demo. Students can follow along then discuss in groups to answer the question: "Which tree ring came from which island? How do you know?"*

Analyze (5 min.)
Refer back to the Do Now activity while exploring the Scale of the University website: http://htwins.net/scale2/
Ask students to share either in small groups or whole class creative comparisons of size of objects to demonstrate an understanding of scale.

Explore (30 min.)
1. Discuss what abiotic or biotic factors in the environment might have caused the growth of the trees to differ from year to year.
    - **Abiotic** – the amount of sunshine, rain or nutrients in the soil may affect growth
    - **Biotic** – the number of herbivores (like deer or herbivorous

Time
45 minutes

Key Vocabulary
Tree Rings
Biotic
Abiotic
Scale
Magnification
Cellulose
Life-history traits

Additional Websites
Powers of Ten Video
http://youtu.be/0fKBhvDjuy0

insects – like moth larvae) eating a tree's leaves may affect the growth of the trees

2. The abiotic conditions are generally similar for the two islands. They are exposed to about the same amount of rain and sunshine and are situated on similar soils. Therefore, it is most likely that the differences in tree growth are due to biotic factors in the environment
3. *Optional: Tree Ring Tool and Experience 5 - Tree Ring Tool Worksheet*
4. In a whole class discussion, ask students the following questions: What different organisms can you see at different magnifications of the Rotting Log? Can you imagine what you might see if you could go even smaller?
    - Bacteria are only visible if we use microscopic powers to zoom in to 200 times the power of our own eyes. Meanwhile, we need to use a map – which is a small representation of the entire island – in order to understand where we are on the island. This helps demonstrate that there are different spatial scales over which we can examine an ecosystem.
    - There are important things happening at each scale! Also, scientists have to use very different tools (microscopes versus maps) and approaches for studying the different things they find at different scales.
5. Display images of the rotting log in front for the class to see and discuss time scale and change:
    - Growth and the breakdown of plants and animals
    - Trees trunks have cellulose – a tough, fibrous compound that gives trees and plants their strong trunks and stems. It creates structure to their cell walls. This material is difficult to break down. Only certain organisms, like termites, are able to digest cellulose. But, they are only able to do so because they have symbiotic protists in their gut that help in digesting cellulose! Change can happen at different speeds (rates)!
    - It can be important to think about the time scale (hours versus days versus years) over which changes are happening in a forest.
    - Many organisms in the forest ecosystem grow at different speeds and have different life spans. Ask students: What are other examples where the time scale over which something happens is different in the forest? Can the students think of examples of this? Some examples:
        - The plants in the forest grow at different rates. The trillium and ferns grow to reach their maximum size (or maturity) very quickly (within one summer) while the trees can take many years to reach maturity.
        - Bacteria can double their population size within days, insects may have to wait a number of months before they reach maturity, mice reach maturity after 6-8 weeks and can have 5-10 litters of offspring per year, while wolves and deer have only one litter per year and must wait multiple years before they reach maturity.
    - These characteristics of different species are referred to as their life-history traits. Life-history traits are things like how long

it takes to reach maturity, how many offspring each parents tends to have, and how long the organisms are likely to survive. ● Paying attention to differences in the time scale over which things are happening can help the students interpret the changes they are seeing on the islands. *Note: Because the life history traits are different for different species, each will respond to changes in the environment according to a different schedule. For example, acorns are a preferred food for mice. In years when acorn production has been high, mouse populations will respond quickly to the increase in resources. Thus a change in the acorn availability will cause a change in the mouse population during the next year. On the other hand, deer are a preferred food for wolves. When deer populations are high, wolf populations will also increase, but the changes in the wolf* population *will take a number of years to become apparent. This is due to the longer generation time, or life-history traits, of the population of wolves compared to mice. These differences in time scales can help to explain some of the changes students will notice on the islands over time.* **Review, Extend, Apply (10 minutes)** Distribute the Experience 5 - Scientist Roles Perspectives Sheet. Have students begin working on this sheet to revise their hypothesis from their scientist perspective and take into consideration biotic and abiotic factors.	