Biodiversity Lesson Plan 3
Biodiversity and Ecosystem Resilience

Teacher: Elena Martin   Grade Level: 9-12   Date: Summer 2016

AZ Science Standard:	*Strand 4: Life Science,* *Concept 3: Interdependence of Organisms;* *PO1: Evaluate how the process of natural ecosystems affect and are affected by humans* *PO2: Describe how organisms are influenced by a particular combination of biotic (living) and abiotic (non-living) factors in an environment.* *Concept 4: Biological Evolution: PO2: Explain how genotypic and phenotypic variation can result in adaptations that influence an organism's success in an environment*
AZ College and Career Readiness Standards:	*9-10.RTS.2. Determine the central ideas or conclusions of a text (activity); trace the text's (activity) explanation or depiction of a complex process, phenomenon or concept; provide and accurate summary of the text (activity)*
Enduring Understandings/ Essential Questions:	Biodiversity (the variety of life on Earth): All Ecosystems contain a variety of life that is interdependent./ How is biodiversity affected by human behavior? How does decreased/increased biodiversity affect life on Earth? How are humans dependent on biodiversity?
Content Objective: *Math Reading Writing Other:*	*Students will learn how genetic and phenotypic diversity increase ecosystem resilience.*
Language Objective:	Students will explain how biodiversity increases ecosystem resilience.

Vocabulary	Materials
Genetic diversity, disease resistance, phenotypes, genotypes, old growth forests, monoculture, organism interactions, insecticide	Set of 36 Index cards (one for each students), (see below)

Seasonality

Monsoon July-Sept.	*Autumn* Oct.-Nov.	*Winter* Dec- Feb.	*Spring* Mar.-Apr.	*Dry Summer* May-June

Guiding Questions: How does biodiversity lead to healthy ecosystems and prevent disease from spreading?

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Anticipatory Set:

Ask students to write a reflection in their notes in response to the following question:
How does Biodiversity lead to healthy ecosystems?

Think-Pair-Share
Share and compare your answer with your neighbor. How were your answers similar? Different?
Choose students randomly to share their answers – write a list of ideas on the board.

Activity/Investigation:

Background: When scientists speak of the variety of organisms (and their genes) in an ecosystem, they refer to it as biodiversity. A biologically diverse ecosystem, such as an old growth forest or tropical rain forest, is healthy, complex and stable. Nature tends to increase diversity through the process of succession.

The opposite of biodiversity is referred to as monoculture, or the growing of one species of organism, such as a lawn, a wheat field or cornfield. Because all of the species are identical, there are few complex food webs and disease can spread quickly. Monoculture is like a banquet table for disease organisms. Monoculture often requires extensive use of pesticides and herbicides (to fight nature's tendency to diversify communities) and is very labor and energy intensive (fighting nature is tough). Humans often try to reduce diversity because it is easier to harvest a crop (whether it is wheat, corn, a lawn or a secondary forest) if it all contains the same species, but this obviously creates serious problems.

Activity: Biological Diversity-How It Stops Disease From Spreading (by Katy Paris)

When a habitat is very diverse with a variety of different species, it is much healthier and more stable. One of the reasons for this is that disease doesn't spread as easily in a diverse community. If one species gets a disease, others of its kind are far enough away (due to the variety of other organisms) that disease is often stopped at the one or two individuals.

In this simulation, side one of the card represents the monoculture (the opposite of diversity) of second growth forests. In this case, Douglas Fir trees were planted after an old growth forest was cut down. A disease hits one of the Douglas Firs, and because of the proximity of the other Douglas Firs, disease spreads quickly.

On the other side of the card (side 2), a biological diverse community (an old growth forest) is symbolized. In this scenario, a Douglas Fir still gets a disease, but this time it does not spread because the other Douglas Firs are few and far between.

Side one of the card:

1. All cards marked with D (side 1 of card). Tell them they are all Douglas firs.
2. Each person gets 1 card.
3. Each person is to meet 5 other people and write their names on the card.
4. All are to remain standing after they write down the names.

5. I will symbolize the disease and I will touch one of the students. Ask that person to sit down (they are dead) and read names on their card. As the names are read, those students sit too since they have been "touched."
6. Then ask another one of those sitting (dead) to read the names on their card- continue until almost all are sitting.
7. Ask them to explain why the disease spread so fast (they are so alike genetically; lack of diversity).

Side 2 of the card:

1. Flip over card (label 2 of cards with D's for Douglas fir; the rest with other letters: N for Noble Fir, C for Western Red Cedar, M for Vine Maples, H for Western Hemlocks, W for White Fir, L for Lodge pole Pine, WP for Western White Pine, B for Bigleaf Maple, WD for Western Dogwood).
2. Explain that in some forests (esp. old growth), there are a variety of trees.
3. Repeat steps 2-6 above. This time only those students that are the same variety as the diseased tree that touched them will sit. Different variety trees don't sit (don't die) even if they are touched by a diseased tree.
4. Almost all of the students will remain standing (didn't die).
5. Ask students to explain why the disease didn't spread this time (genetic or biological diversity)

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Closure Question:
Similar to the anticipatory set, closure provides an opportunity for students to summarize their learning in their own words and make some sense of the activity they just completed.

Follow up questions (refers to the second of the card simulations)

1. What does biological diversity mean?
2. Why didn't all the different trees get the disease? (hint - genetics)
3. Why didn't the disease spread as fast among the Douglas firs as it did in the first simulation?
4. In which forest would you need to use more chemicals to control disease: the Douglas fir forest or the more diversified, old growth forest? Why?
5. Summarize what this simulation symbolized.
6. Which forest would have more diversity of wildlife? Why?
7. a. If you cut down the variety in a piece of forest you owned and replanted with 1 type of tree, what will happen to much of the wildlife that was adapted to that forest? (Hint: they cannot just move elsewhere. If other habitats are good, they will probably be near carrying capacity already.)
   b. Will this fate happen to all the wildlife? Explain.
8. Many species can only live/reproduce in 1 type of forest. The spotted owl is an example - it can only live and successfully reproduce in old growth forests(big, old cedars, hemlocks, etc.). If these old growth forests are cut down, it's unlikely this owl will survive. Environmentalists call it an "indicator" species." What does this mean? Why be concerned about 1 species?
9. Growing one plant, as is the case of growing only Douglas fir, is called monoculture. Give an example of growing one plant a) in your home (obvious) b) in farms
10. Why would you need to use more insecticides in monoculture? Is this good or bad?
11. If you wanted to help wildlife, what would you with regards to the landscaping of your own home?