



Time:

60 minutes or more

Level:

6-8th grades

Goals:

Students will understand how disturbance and succession change a forest environment over time.

Objectives:

Students will define succession in relation to forest disturbances.

Students will model primary and secondary succession.

Materials:

Supplies

- Utah Forest Maps
- Modeling supplies

Equipment

- Technology equipment to view youtube video

Changes in Utah Forests

by Megan Dettenmaier and Hilary Lambert

Correlations to Core Curriculum:

Utah 8th Grade Science Standard 2: Students will understand that energy from sunlight is changed to chemical energy in plants, transfers between living organisms, and that changing the environment may alter the amount of energy provided to living organisms.

NGSS and CCSS-M Practices:

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

STEM Integration:

Students will use modeling to communicate understanding of scientific systems.

21st Century Skills:

Communication

Modeling

Looking for and using structure

Background Information:

- Without disturbances (i.e. fires, insects, secondary disturbance agents: floods, landslides, erosion), catastrophic disturbances may occur, disturbances make room for new species to become established. Models should begin with a disturbance.
- 2) Primary succession: first stage of succession in an ecosystem that has been disturbed where pioneer species dominate Pioneer species = species that are first to colonize following a disruption; these are shade **INT**olerant species - makes sense because there is no shade if there has been a disturbance where all the overstory has been taken out. Example: Aspen, pines
- Secondary succession: more shade tolerant conifers move in. Why would this be? Pioneer species are densely spaced, making it necessary for any new species to be able to tolerate shade. Example: spruces, firs

Did you know?

Forest fires are a part of a healthy functioning forest ecosystem

How do changes in a forest environment impact forest succession, composition, and biodiversity?

- What about the argument that increases in atmospheric carbon dioxide might facilitate faster growth, and more CO₂ uptake?
 - Since carbon dioxide is required for photosynthesis, atmospheric increases in CO₂ might facilitate faster tree growth, but this will require ample water and nutrient rich soils – two conditions that will likely hamper this rapid growth
- How does temperature impact forest growth?
 - Warmer temperatures will increase the length of the growing season and will likely shift the geographic locations that species can exist at (i.e. species that require warmer temperatures will be able to grow at higher elevations where it once was too cold). This means that species requiring cold temperatures might go extinct if they cannot shift to a higher altitude

How are Utah forests being impacted by insects? Who is winning? The forests or the bugs?

- Fires and drought will weaken forests' natural defenses to insects
- Mountain pine beetle, spruce beetle, and sudden aspen decline all threaten forests health; climate change may create favorable conditions for these insects to breed and expand their ranges.
- Defenses to these pests? Early detection can help, thinning, biological controls (introduction of non-native insects to attack forest pests, use of pheromones that deter insects from attacking trees)

Activity 1

Engage (10 min) - Show the following video from Bozeman Science introducing the concept of succession

<https://www.youtube.com/watch?v=V49lovRSJDs>

After the video pose the following questions and have a short think/pair/share discussion.

- What kind of changes happen in a forest?
- Who has heard of succession?
- What is a disturbance?
- How do different variables play into succession?

Explore and Explain (20-25 min) - Show students the Utah Forest Map, <http://forestry.usu.edu/files-ou/forestmapFINAL.pdf> and give them a brief introduction to it. Point out the paragraphs on the map border. Divide students into groups and do a jigsaw activity of these topics (fire, insects, disease, elevation, etc.).

1. Have each group spend a few minutes reading the information on the map, circulate among the groups and make sure they each understand the concept they are in charge of for the jigsaw
2. Each group should prepare a 1-2 minute explanation of their topic
3. Each group should share their understanding with the entire class. Presentations should reference the map.
4. Class discussion to make sure all types of forest disturbance are understood.

Elaborate (25 min, or more) - Students will work in groups to create an artistic model of forest succession. The types of model and how long students are given to create them is up to you and determined by your classroom materials. Some simple models could be comic strips or dioramas, if you have more time or want to incorporate technology you could have students make movies or animations. The goal is for students to follow the script below for what succession is and how it might happen in a given environment, and to narrate their model. Each piece of the script should be shown in the model in some way. Students should share their models with the class.

Model Script 1

There is a high-intensity fire that burns across the Uinta Mountains, scorching large swaths of spruce-fir, lodgepole pine, and aspen. The fire burned particularly hot due to the large amounts of beetle impacted fir that remained dead in the forest. What do you expect to happen to this area?

Pioneer species such as aspen and lodgepole pine will regenerate quickly after the fire. Lodgepole pine regenerate from seed, and aspen will regenerate from suckers. Spruce-fir (the secondary species) will not recover quickly after the fire, therefore it will likely take another disturbance to get spruce-fir to recolonize that area.

Model Script 2

There is an avalanche that on a sunny slope at 9,000 feet. This avalanche clears the slope of all the conifers and a small aspen grove. What might you expect to happen? The conifers that dominated the slope, including the small patch of aspen, are all leveled, leaving a path of destruction, but the aspen is spurred into action due to this disturbance; aspen shoots begin to emerge from the former aspen patch and because there is no other competition from other trees on the slope, aspen spread and are now the pioneer species.

Model Script 3

There is a large glacier that has been frozen for thousands and thousands of years, but recently it has started to melt, exposing ground that had been previously frozen and covered. What might you expect to happen? Depending on the ecosystem, pioneer species will move in - in Glacier Bay Alaska, where this happened, a variety of plants took turns as the dominant species, first, mosses and lichens, then larger plants such as willow, then taller shrubs that could outcompete willow such as alder dominated. Then even larger trees such as Sitka spruce and western hemlock dominated.

Assessment:

Use the rubric below to assess the models

Resources:

Websites

More videos about succession:

<https://www.youtube.com/watch?v=k03vxRYsJ4Y>

<https://www.youtube.com/watch?v=jJ0zqo1opv8>

https://www.youtube.com/watch?v=cMUnFyz_8mM

<https://www.youtube.com/watch?v=V49IovRSJDs>

Scoring Rubric

| Learning Objective | Exemplary (12 pts) | Proficient (9 pts) | Developing (6 pts) | Minimal (3 pts) | Score |
|--|--------------------|--------------------|--------------------|-----------------|-------|
| Models how a disturbance creates an environment in which succession can occur | | | | | |
| Models primary succession, mentions relevant species | | | | | |
| Models secondary succession, mentions relevant species | | | | | |
| Model is an artistic representation adhering to guidelines determined by the teacher | | | | | |

Student Name:

Points: /