Lesson: Darwin in Durango - Outdoors

Grade: 7th

7th Grade Science Learning Standard 2.1: Individual organisms with certain traits are more likely than others to survive and have offspring in a specific environment.

FEO: 2.1a: Students can develop, communicate, and justify an evidence based explanation for why a given organism with specific traits will or will not survive to have offspring in a given environment. Students will be able to explain differential success and reproduction of plant species (Pines vs. gambel oak) based on their adaptations to specific microclimates (south and north facing aspects) in the local Durango area. Students will also explore the impact of trails on the success of these species as well.

FEO: 2.1b: Students can analyse and interpret data about specific adaptations to provide evidence and develop claims about differential survival and reproductive success. Students can gather, analyse, and interpret data such as tree height, seed size, and bush size (correlation with size of root system) and how each trait may confer an advantage to reproductive success of an individual.

<u>Differential Success of Pines and Gambel Oaks in Durango Ecosystems (Test Tracks)- Intended as outdoor activity!</u>

- **Performance Expectations:** Students should be able to point out different microclimates (north and south facing slopes) and be able to hypothesize adaptations that plants in different microclimates have. They will also identify different phenotypes of one species of plant (ie. height in trees) and how this confers
- **Specific Learning Outcomes:** Students should be able to identify plant species and their adaptations to the microclimate that they live. Students should also be able to determine the best plant adaptations to survive and reproduce in a specific climate. Furthermore, students should be able to identify effects that trails have on local ecosystems.

<u>Supplies</u>
TK journals for kids
Pencils
# of kids- handouts
# of pamphlets for identifying ponderosa and oak
Snacks
Candy as incentives

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- **Engage: Standing looking at Test Tracks**
    - What is an **ecosystem**? Organisms that live together in a specific place
    - Name some organisms that may live in this area in an ecosystem. Can be brief!
        - Plants: Piñon pine, one seed juniper, bitterbrush, indian ricegrass, junegrass, mountain-mahogany, utah juniper → Piñon-Juniper Shrubland.
        - But also: Scrub oak, serviceberry, smooth sumac, mountain-mahogany, skunkbrush, snowberry, scarlet gilia, needle-and-thread → montane shrubland
        - AND: Rocky mountain juniper, ponderosa pine, Douglas Fir, lodgepole pine, quaking aspen, mountain muhly, wax currant → Montane forest.
    - How is it possible to have all these different plants (from supposedly different ecosystems) in the same area with the same soil?!
        - **Microclimates** and **aspect.**
            - North vs. south facing slopes
            - South facing:
                - **Species composition**: Gambel oak, juniper, piñon, grasses, sage.
                - **Climate**: snow melts faster, soil drier, hotter, drought resistant plants
            - North facing:
                - **Species composition**: Ponderosa, Douglas Fir, etc.
                - **Climate**: Colder, wetter, more shade because of trees, so shrubs have to be low light tolerant
    - What is an **adaptation**?
    - Postulate some **adaptations** that these microclimates would favor in an individual.
        - Try to get them thinking about water conservation within a plant
        - Will ALL plants that **germinate** (ie. start growing) show these specific traits (**phenotype)**?
            - NO! Introduce the idea of **natural selection and DARWIN!**
                - Only certain individuals will survive: the most “fit” to survive in a specific environment. Certain traits will disappear because those individuals cannot survive in an environment.
                - **Genetic variation** within a population: some individuals with certain traits will survive better! If there is not genetic variation, there is no genetic plasticity, or ability for individuals to “adapt”.
                - *Pinus ponderosa* (ponderosa pine): needs sunlight, short trees will not survive! Resistance to rust/ parasites. Cannot grow in low moisture soil.

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        - HOW TO TELL IF A PONDEROSA IS EXPERIENCING AN INFECTION OF BARK BEETLE: fine dry frass (sawdust-like) on ground and in the crevasses of the bark, brood (pupa are white, adults are brown to black), small pitch tubes (less than 1/4th of an inch in diameter) underneath bark there is a blue-ish stain (the rust that the beetle carries with it and will ultimately kill the tree), yellow or discolored needles!
        - If a tree fights it off, large pitch tubes!
    - *Quercus gambellii* (gambel oak): living on a drier side of the mountain, super drought resistant, needs to be able to conserve water! Thick, waxy leaves aid in that. Less wax= more water loss= death.
        - Pretty complex and large root systems that can gather a lot of water
        - Potentially phytotoxic to ponderosa seeds!!! Whoah.
- **Explore: Have the group split up into two groups: one go to montane shrubland (south facing), and the other go to montane forest (North facing).**
    - Distribute handout!
        - Look for plant individuals that look like they are dying.
            - Note specific phenotypes (ie. small, thin bark, small sap tubes, infected with fungus!) that *may be* contributing to the individual's survival. If this individual dies, what will the **gene pool** lose?
                - What would an evolutionary trend be for each species?
                - Ie. ponderosas get bigger and bigger with large pitch tubes, scrub oak gets more and more drought resistant- more extensive root systems and more phytotoxic qualities to squelch growth of larger trees.
- **Explain: vocabulary**
    - **Ecosystem** (a community of organisms and their physical habitat)**, adaptation** (trait or set of traits that an organism has acquired to survive in a specific habitat, a result of natural selection)**, aspect** (direction of slope of a hill/mountain)**, organism** (any contiguous living system, such as an animal, plant, fungus, archaeon, or bacterium, capable of some degree of response to stimuli, reproduction, growth and development and homeostasis) **, microclimate** (climate of a small and specific area that may or may not differ from the surrounding area)**, population** (a group of organisms from the *same* species in which breeding occurs), **species composition** (number of different species in a certain habitat)**, germinate** (when a previously dormant seed produces seeds and starts to grow)**, phenotype** (the physical expression of **genotype,** or genes)**, genetic variation** (the variation of phenotype- and therefore genotype- that is

necessary for a healthy population of organisms and therefore a healthy ecosystem)**, natural selection** (the theory of evolution proposed by Darwin, in which the fittest individuals reproduce and pass on their traits to offspring, whereas other less fit individuals do not)**, gene pool** (the term for the collective genotypes of all organisms in a population)**.**

- **Elaborate: How does this knowledge inform us on how to build trails in each respective microclimate?**
    - North facing
        - More big trees, more developed root systems, less erosional effects because of this! Ecosystems stay intact. Trails would be good here.
    - South facing
        - Less complex root systems here, so slightly more prone to erosion, especially when snow melts faster (less mediated by shade) and also scrub oak is more sensitive to disturbance (think about size and resilience).

- **Evaluate**
    - Handout!
        - Observation section
        - Quiz/evaluation section