Lesson: Ecological Disturbance - Outdoors

8th grade Colorado Academic Standard 2.1: Human activities can deliberately or inadvertently alter ecosystems and their resiliency.

FEO 2.1.b Students can analyze and interpret data about human impact on local ecosystems. Students can analyze and interpret data on native and invasive plant species composition in different disturbed or undisturbed areas in Durango.

Vocab: Ecosystem, disturbance, ecological succession, vector, competition, invasive, habitat fragmentation biodiversity.
Grade: 8th
Topic: Impact of Trails

Brief Lesson Description: In this lesson, students explore the impacts of trails as an ecological disturbance, and how species composition of an ecosystem can be affected.
Performance expectations: Students should be able to make hypotheses, collect and record data, and draw conclusions about species composition in different ecological zones.
Specific learning outcomes: Students will be able to explain why certain species of plants grow in undisturbed versus disturbed areas and the intersectionality of disturbance and trails. They will be able to communicate how to make trails less of an ecological disturbance.

Supplies:
TK journals for kids
lengths of 20 ft rope (paracord works) depends on # of kids
Pencils
# of kids- handouts
# of pamphlets for invasive weeds
Snacks
Candy as incentives

Lesson Plan
ENGAGE

- Walk students to area where there is a significant amount of invasive plants and “disturbance.” Gully in Horse Gulch, or flat area near powerline.
    - Explain where we are firstly. Who rides bikes here? Hike? It is a place where a lot of people are!
        - Ever see any animals?
    - Ask what plants they see in this area.
        - Which are native?
        - Which are invasive? Have them guess!
        - Hand out the pamphlets with the types of invasive plants found in this area

Lesson: Ecological Disturbance - Outdoors

EXPLORE

- Allow students to walk around to look at different plants.
    - See if they can identify all the invasive plants of the area with their pamphlets.
        - Where did they see the most invasive plants?

EXPLAIN: concepts and vocabulary

- We are standing within a unique **ecosystem** that is being affected by a **disturbance**
    - **Ecosystem:** a biological community of interacting organisms and their physical environment
        - Ask students: what disturbance do you see in this area?
            - Trails! There are also other types of disturbance
                - **Ecological succession**: the process in which an ecosystem restores itself after a disturbance
                    - **Primary**: caused by glaciation, only bare rock is left.
                        - The only organism that can colonize bare rock is lichen (fungus and a photosynthetic partner): fungal partner breaks down rock by secreting digestive enzymes and sequestering minerals important for biological processes; photosynthetic partner (cyanobacteria or algae) makes sugar! And the two share resources to be able to survive.
                    - **Secondary**: fire, clear cutting, trails, intense grazing by animals such as cows.
                        - Soil is still intact! Plants can usually still grow. Different species of plant colonize faster than other plants: for example, bushes and grasses will often be the first colonizers in an area of disturbance (they grow way faster), whereas it takes pine tree seeds 2 years to germinate (and then WAY longer to get to full size).
                - Trails are a type of **secondary succession**, but also present *unique* issues as a disturbance.
                    - Humans as **vectors** for **invasive plants**- we carry their seeds!
                    - Invasive plants do many things to an environment
                    - They colonize areas of disturbance (especially in areas affected by edge effect! FASTER than native plants because they don't have the ecological checks and balances in this unique, new ecosystem

Lesson: Ecological Disturbance - Outdoors

        - Invasive plants (out)**compete** native plants
            - Most are from Eurasia, where there is a similar climate: high and dry and cold.
- Ecological consequences of all of this!
    - **Habitat fragmentation:** inability for genes to be spread across a barrier (in this case, it is a wide trail with a bunch of invasive plants, and not native plants)
        - Wind cannot carry pollen across huge areas without little “pit stops” on other tall things/trees- invasive plants tend to be smaller
        - This can eventually lead to the death of an ecosystem from the ground up.
            - All **producers** (convert sun’s energy to sugar, essentially are the backbone of the entire food web) die, and then all **consumers** (primary, secondary, etc.) and the entire food web will collapse eventually.
    - Decrease in **biodiversity** (ie. number of species in an area), which is bad! Want there to be as many species as possible- indicator of ecosystem health.
        - Without many different types of plant species, not as many consumers will be able to survive.
- How can we prevent this?
    - Reduce habitat fragmentation by making trails less of a disturbance
        - Sustainable trails: not a lot of erosion- causes more disturbance
        - Make trails thinner, and not as wide
    - Restore trails that aren’t sustainable- reroute new trails and foster environments where native plants can recolonize
    - Pull up invasive weeds! (or take the right precautions to eradicate)

ELABORATE: applications and extensions

- This is how we can justify trailwork!
    - Makes it better for trail users (ie. not riding in a rut), but also way better for the environment
    - Trails are also an essential and necessary part of the community
        - Trails are fun! And also good for health
        - Working on them brings people together

EVALUATE: Hand out with ecological definitions defined. Pre-lab questions. Experiment cataloguing different species of plants with belt transect.