

## Lesson: Just go with the (Energy) Flow - Outdoors

**6th grade Colorado Academic Standard 2.2: Organisms interact with each other and their environment in various ways that create a flow of energy and cycling of matter in an ecosystem.**

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**FEO 2.2.a: Students can develop, communicate, and justify an evidence-based explanation about why there generally are more producers than consumers in an ecosystem.** Students can explain why there are more producers, such as piñon, juniper, grasses, etc., in the local Durango environment than consumers by explaining the 10% energy transfer rule.

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**Vocab: trophic levels, producer, consumer, decomposer, scavenger, ecosystem, food web, energy pyramid (10% energy transfer rule), biomass, invasive, native, competition**

**Grade: 6th**

**Topic: Trophic Levels**

**Brief Lesson Description:** In this lesson, students will learn about trophic levels, and more specifically, how all communities are upheld through producers who convert the sun's energy. Students will also learn how energy and matter is cycled throughout an ecosystem.

**Performance expectations:** Students should be able to hike to education site, observe ecological phenomena, and gather information about numbers of organisms living in different trophic levels.

**Specific learning outcomes:** Students will be able to provide evidence as to why there are more producers than consumers, and how important it is to monitor local producers.

### Supplies:

**TK journals for kids**

**4 x # of kids stakes**

**Pencils**

**# of kids- handouts**

**# of pamphlets for native plants + animals**

**Snacks**

**Candy as incentives**

**Measuring tape**

### **ENGAGE**

- Walk students to area where there is a significant amount of plants and trail disturbance.
- Explain where we are firstly. Who rides bikes here? Hike? It is a place where a lot of people are!

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- Ask “What is living in this area? Or what is the most abundant organism? What do you see?”
  - Plants, duh!

### EXPLORE

- Allow students to walk around to look at different plants. Tell them they have to find ONE animal.
  - THEN, split the group up into two... This is a race!
    - Have all numbered “1” try and find at least 20 chamisa plants
    - All numbered “2” have to find at LEAST 2 animals
  - Gather back in a group
    - Did group #2 do it?

### EXPLAIN: concepts and vocabulary

- Did group #2 do it? Time to learn why they did not!
  - Within an ecosystem, there are many different organisms that occupy specific niches or roles! These are called **trophic levels**.
    - Plants: name some in the area, ie. chamisa, piñon, junipers etc.
      - These are **producers** because they **photosynthesize**: get all of their energy from the sun... use the sun’s energy to make SUGAR (or glucose)
      - This is where all of our bioavailable energy comes from, and the only way all the other organisms can survive. Where else would we get our energy from?
    - Animals: name some in the area: rabbits, deer, mice etc: these are **primary consumers**, that eat only producers
      - Some insects, snakes, bobcats, etc.: **secondary consumers** that eat primary consumers.
      - Some **tertiary consumers** that eat secondary consumers: ie. the top of the food chain like bears, cougars, hawks, eagles etc.
      - QUICK NOTE: some organisms can occupy multiple trophic levels, ie. a bear eats berries but also eats bunnies, fish, etc.
      - Some non-traditional trophic levels are **scavengers** (eat from consumers that are already dead) or **decomposers** (eat from all trophic levels)
    - In terms of numbers, which level contains the least number of individuals?
      - The tertiary! Why?
        - Only 10% of energy gets passed on to the next trophic level. **10% RULE**. Organisms are extremely inefficient.
          - When an animal eats food, a lot of it goes into bodily maintenance (immune systems- fighting off disease, breathing, pumping blood, having a

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functioning brain→ so much of humans' energy goes straight to the brain.. This is why we are smarty pants), and a lot of it is excreted as waste. Only 10% goes into actual **biomass** (body mass)

- This concentrates chemicals, or toxins in the highest trophic levels
  - **Biomagnification:** high concentrations of toxins in higher trophic levels
    - Happens a lot with herbicides.  
Example: the feminization of frogs by Atrazine, a common herbicide used on monoculture. The frogs (leopard frogs- *Rana pipiens*) are secondary consumers of insects!
- SO, in recap, EVERYTHING depends on producers.
  - ***They are essential to life as we know it!***
  - Many producers make life possible for a few tertiary consumers... just not that much biomass at the top of the food chain!
    - So, if there were to be some kind of disturbance that would affect a lot of the producers, some of the higher trophic levels may completely die out! This is scary.
- What kind of threats do producers face?
  - Disturbances: biotic (human, grazers, etc.) and abiotic (fire, glacier, etc.)
  - Competition: from **invasive** plant species
    - Knapweed, toadflax, thistle, etc!
    - All come from Eurasia and have no biological check and balances in this new ecosystem, and can completely out-compete all of the **native** plants
  - Disturbances that CAUSE competition!
    - All the previous disturbances, along with the presence of invasive plant species, cause even MORE damage!
      - Native plant species take a while to colonize areas of disturbance, and invasive plants don't at all- they can completely take over an environment.
      - The native plant species go down, then the entire food web goes down.
    - How can we prevent this? What is a disturbance that we can control?
      - Human! → trails are a disturbance
      - Stay on trails, make trails sustainable: the more erosion, the more disturbance, and the more areas invasive plants can grow.

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- Restore trails that aren't sustainable
- Pull up invasive weeds! (or take the right precautions)

### **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:** Handout with ecological definitions defined. Pre-lab questions. Experiment counting plants and animals in a plot.