

Sponsored by the University of Colorado at Boulder **"Food Webs" Lesson Plan (Grades 3-8):**

Lesson Goals:

- Understand that trophic levels (i.e. producer, primary, secondary, and tertiary consumers) are titles given to organisms based on their food or energy source.
- Understand that food webs are representations of the flow of energy between different trophic levels.
- Experience the effects of loss of a species in a food web. Effects are different depending upon the trophic level of the species and the complexity of the web.

1. MATERIALS:

- Materials include:
 - 1 yarn ball per class
 - Lanyards with species pictures and names on them. See species compositions and numbers below.
 - Three scenarios are presented here, in increasing complexity. The Meadow ecosystem is best for younger students (elementary), and the Alpine and Grassland systems are better for middle schoolers.
- 2. <u>SETUP</u>:
- No materials require setup ahead of time. Activity setup is described below.
- 3. INTRODUCTION: What is a food web?
 - Make a web on the board with the class. The coyote is a fun base species. Write coyote on the top of the board and then ask students, "What does a coyote eat?" Write species up as they're mentioned and connect them to one another as appropriate.
 - See the "Meadow" food web diagram on page 3 of this lesson for a simple example.
 - The web will vary by class, but be sure they mention a small rodent or rabbit of some sort and insects you may have to lead them to the latter, or just tell them in a "Didya know..." sort of way that a large proportion of a coyote's summer diet on the plains is grasshoppers.
 - Once the web is complete:
 - Talk about food webs vs. food chains to address any confusion a food chain is just a simple food web!
 - Go through the different trophic levels (producer, primary and secondary consumers) on your coyote web if students haven't already discussed it with their class (most have). It's also a nice review, even if they've had it before.
- 4. <u>Overall question of the day</u>: What happens to a food web when one member is taken out?
 - Introduce this subject using the coyote web or a case study of your liking. Pikas or prairie dogs are good examples (they would be roughly in the same place as the rabbit in the web on the board). Pikas have disappeared from 10 of 25 historical locations in the Great Basin what effect is that having on the food web?

- Don't belabor this point now it will become clear to them once the activity is complete. I often don't take answers to the question at this point. I tell them to hold onto their ideas and share them once we've done the yarn ball activity.
- 5. ACTIVITY 1: What a tangled web we weave!
 - Circle students up in the classroom (or outside if it's a nice day and you have time!) in an area with minimal obstacles.
 - Hand out the species lanyards, trying to get an even representation of species. Be sure that all species in the middle of the web are handed out (i.e. shrews in the meadow or grasshoppers in the other two ecosystems). Also try to spread the species out throughout the circle so you don't have too many grasshopper clumps. ^(c)
 - Be clear about the ground rules:
 - 1. You can only throw to animals that you eat or that eat you (see guide at the bottom of this document).
 - 2. Make eye contact with and say the name of the person that you're throwing to (this avoids the embarrassment of getting nailed in the face with a yarn ball. NOTE: Tell students this only works if side conversations are kept to a minimum!)
 - 3. You cannot repeat people you have to throw to someone who doesn't have it yet (you may have to make a couple exceptions at the very end it all depends on how many grasshoppers you have and the order the ball was thrown in; e.g. you can end up with a hawk and a grasshopper, so may have to repeat a shrew to make it work...).
 - 4. HOLD ON to the string before you throw it! Very common mistake, so worth mentioning before you start.
 - Let them at it! Your main task as the teacher is be to make sure the rules are followed and to retrieve stray balls that are tangled around chair legs due to errant throws.
 - Once the web is complete, stand in the middle and let them appreciate their work. You can have them lift it up to eye level – it makes for a cool effect.
 - Now break the sad news: one species is going to perish on the count of 3! Oh no! Extinction rules:
 - 1. Who dies off?
 - Meadow: Shrews shrews often live in marshy meadow areas, so you can come up with a story about water pollution, for example.
 - Alpine: Pikas climate change has done them in!
 - Prairie: Prairie Dogs Misunderstood as agricultural pests, prairie dogs have been shot and poisoned.
 - 2. Shrews/pikas/prairie dogs release their strings on the count of 3.
 - 3. If another individual of a non-shrew species' string goes loose, even on just one side, that individual has to let go as well.
 - As you can predict, the whole web collapses. There is much excitement and sorrow!
 - Have students return to their desks and have someone collect lanyards. Ideally get a student to start rolling up your yarn ball.
 - Return to the board, draw the food web of the species in the yarn activity, and have students explain why the web collapsed. (See notes below for each specific system)

The Specifics, by Ecosystem:

Meadow Ecosystem:

- 3 hawks
 - 4 coyotes
 - 8 shrews
- 15 grasshoppers

Who Can Throw to Whom:

	Grasshoppers	\rightarrow	Shrews, Coyotes
•	Shrews	\rightarrow	Grasshoppers, Coyotes, and Hawks
•	Coyotes	\rightarrow	Grasshoppers, Shrews

■ Hawks →

Shrews

The Web:



Why Collapse?

The hawk and coyote no longer have a year-round food source. The kicker here is the grasshopper overpopulates, depletes its food resources, and then falls into a "boom and bust" pattern of sudden population increase followed by a sudden crash and a subsequent population increase again once their food source (plants) have replenished due to the grasshopper crash. Discuss overpopulation dynamics and why it's not always good to lose something that eats you.

Alpine (Pika) Ecosystem:

- 5 pikas
- 5 marmots
- 7 grasshoppers
- 8 ptarmigans
- 3 coyotes
- 2 hawks

Who Can Throw to Whom:

- Grasshoppers \rightarrow
- Pikas →
- Ptarmigans, Coyotes
- Hawks
- Marmots \rightarrow
- Ptarmigans \rightarrow
- Grasshoppers, Coyotes, Hawks Ptarmigans, Insects, Marmots
- Coyotes \rightarrow
- Hawks →
- Pikas, Marmots

Coyotes, Hawks



Why Collapse?

Hawks now rely entirely on marmots and ptarmigan for food. Marmots are a seasonal food source (hibernators), and ptarmigan are in small populations that cannot handle the increased predation pressure from hawks. Ptarmigan decline due to increased predation pressure, hawks decline due to decreased food resources. Marmots' fate is questionable; they are subject to decreased competition from pikas and decreased predation from hawks, but increased predation by coyotes. Grasshoppers are similar story – they are subject to decreased ptarmigan predation but increased coyote predation.

Prairie (Prairie Dog) Ecosystem:

- 5 prairie dogs
- 4 mice
- 6 grasshoppers
- 3 burrowing owls
- 6 snakes
- 2 hawks
- 2 black-footed ferret
- 2 coyotes

Who Can Throw to Whom:

- Mice \rightarrow
- Prairie Dogs \rightarrow

 \rightarrow

- Owls
- SnakesHawks
- Coyotes, Hawks, Snakes, Ferrets Snakes, Grasshoppers, Mice

Hawks, Owls, Snakes, Coyotes, Ferrets

- \rightarrow Coyotes, Mice, Prairie Dogs, Owls
- \rightarrow Mice, Prairie Dogs, Ferrets
- Ferrets
- → Hawks, Prairie Dogs

The Web:



Why Collapse?

Loss of the prairie dog leads to lack of food for snakes, owls, hawks, and ferrets, along with loss of habitat for all members of the community except hawks. Also, loss of the prairie dog leads to increased predation on other small mammals such as mice.







Coyote



Coyote



Coyote





Coyote



























Grasshopper



Grasshopper



Grasshopper









Grasshopper





Grasshopper



Grasshopper



Grasshopper







Grasshopper





Hawk



Hawk



Hawk



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