

## The Food Chain Game

(Heavily adapted from a game produced by “Project Wild”)

*Basic ecological concept:* ENERGY FLOW

*Other ecological concept:* How toxins can move through food chains.

*Key concept statement:* “Energy from the sun flows through all living things.”

*Enrichment activity:* Tell the story of Rachel Carson, and how she publicized the way DDT moved through the food chain.

*Equipment:*

30 “Plants” per player—“Plants” are made from crumpled pipe cleaners

10 Plants of a bright Yellow color (plus extras to use as needed)

20 Plants of a dark Blue color (plus extras to use as needed)

1 paper bag per Grasshopper

*Introduction:*

Say something like this:

“This is the Food Chain Game!

“A food chain starts with energy from the sun, which is converted into food by plants, and then plants eat the animals. The food chain ends up with an apex predator.

“In our food chain, there are four organisms.

“First there are Plants. Plants convert the Sun’s energy into food. In a food chain, we call them ‘producers’ because they produce food.

“Then there are Grasshoppers. Grasshoppers are called ‘herbivores’ because they eat Plants. In a food chain, we call them ‘primary consumers’—they are first link in the food chain.

“Next up in this food chain, we have Vagrant Shrews. Vagrant Shrews are called ‘insectivores’ because they eat insects, or we can call them ‘carnivores’ because they eat other animals. In a food chain, we call them ‘consumers’.

“At the top of this food chain are Barn Owls. Barn Owls are carnivores. In a food chain, we can call them consumers, or since they are at the top of the food chain we can call them ‘apex predators.’

“So that’s how this food chain works—

“Plants—producers that convert energy from the sun into food

“Grasshoppers—primary consumers—get energy from eating plants

“Vagrant Shrews—get energy from eating other animals

“Barn Owls—get energy from eating other animals.

“Energy comes from the Sun and moves up along the food chain to the apex predator.

“Now we’re going to play the Food Chain Game. We’ll start with the easy version, and then do the more complicated version.”

*Easy version of the Food Chain Game:*

Find a large enclosed play area. Show everyone the boundaries, and tell them that this is the Habitat.

Now divide up the players into Grasshoppers, Vagrant Shrews, and Barn Owls.

For each Barn Owl, there are 3 Vagrant Shrews.

For each Vagrant Shrew, there are 3 Grasshoppers.

So for 13 players: 1 Barn Owl, 3 Vagrant Shrews, 9 Grasshoppers.

Each Grasshopper gets a paper bag, which represents their body.

Tell the rules of the game (see below).

All players must close their eyes while you scatter the Plants in the Habitat.

*Rules of the game:*

1. First the Grasshoppers have about 30 seconds to hunt for Plants (more time for big Habitats) before Vagrant Shrews and Barn Owls start hunting. While Grasshoppers are finding food, the Vagrant Shrews and the Barn Owls watch from the edge of the Habitat. Remind Vagrant Shrews and Barn Owls that they are predators, which means that they will want to watch quietly so as not to scare away their prey—while Grasshoppers are finding Plants, Vagrant Shrews and Barn Owls can quietly move anywhere around the edge of the Habitat, but they must not step into the Habitat.

2. Next, Vagrant Shrews begin hunting. They have about 15 seconds to hunt for Grasshoppers (depending on size of the Habitat; the leader should see that each Vagrant Shrew gets a chance to tag at least one Grasshopper) before the Barn Owls start hunting. Vagrant Shrews catch their prey by tagging a Grasshopper. When a Grasshopper gets tagged, they have to give their paper bag with Plants to the Vagrant Shrew who tagged them, then they go to the edge of the Habitat to become compost. While the Vagrant Shrews are hunting, the Grasshoppers that are still alive can continue to hunt for Plants (the leader should have extra Plants to throw out into the Habitat if needed).

3. Finally the Barn Owls begin hunting. They have about 30 seconds to hunt for Vagrant Shrews. Barn Owls catch their prey by tagging a Vagrant Shrew. When a Vagrant Shrew gets tagged, they have to give all their paper bags to the Barn Owl who tagged them, then they go to the edge of the Habitat to become compost. While the Barn Owls are hunting, any Vagrant Shrews and Grasshoppers that are still alive can continue to find food.

*Scoring:*

Each time an organism eats, it gets energy from what it eats.

So once you eat a Plant, it turns into Energy. All these things in those paper bags? They aren't Plants any more, now they are Energy.

But it also has to use up Energy to find food, and to avoid being caught by something else.

So let's pretend each organism used up half its Energy, and only passes along half its Energy to whatever organism eats it. [We're ignoring the color of Plants/Energy this game.]

Grasshoppers, count your Energy. Half of that is your total energy.

Vagrant Shrews, count your Energy. A quarter of that is your total energy.

Barn Owls, count your Energy. An eighth of that is your total energy.

Let's pretend (and we're really making these numbers up)—let's pretend you need 4 total Energy to have children. If you have 4 total Energy, then you get to remain the same organism next round. And I'll assign everyone else to be a new organism. [Use same proportions.]

*Complicated version of the Food Chain Game:*

*Rules of the game:*

The basic Rules are the same, but scoring is going to be different this time!

1. First the Grasshoppers have about 30 seconds to hunt for Plants (more time for big Habitats) before Vagrant Shrews and Barn Owls start hunting.. While Grasshoppers are finding food, the Vagrant Shrews and the Barn Owls watch from the edge of the Habitat. Remind Vagrant Shrews and Barn Owls that they are predators, which means that they will want to watch quietly so as not to scare away their prey—while Grasshoppers are finding Plants, Vagrant Shrews and Barn Owls can quietly move anywhere around the edge of the Habitat, but they must not step into the Habitat.

2. Next, Vagrant Shrews begin hunting. They have about 15 seconds to hunt for Grasshoppers (depending on size of the Habitat; the leader should see that each Vagrant Shrew gets a chance to tag at least one Grasshopper) before the Barn Owls start hunting. Vagrant Shrews catch their prey by tagging a Grasshopper. When a Grasshopper gets tagged, they have to give their paper bag with Plants to the Vagrant Shrew who tagged them, then they go to the edge of the Habitat to become compost. While the Vagrant Shrews are hunting, the Grasshoppers that are still alive can continue to hunt for Plants (the leader should have extra Plants to throw out into the Habitat if needed).

3. Finally the Barn Owls begin hunting. They have about 30 seconds to hunt for Vagrant Shrews. Barn Owls catch their prey by tagging a Vagrant Shrew. When a Vagrant Shrew gets tagged, they have to give all their paper bags to the Barn Owl who tagged them, then they go to the edge of the Habitat to become compost. While the Barn Owls are hunting, any Vagrant Shrews and Grasshoppers that are still alive can continue to find food.

*Scoring:*

At the end of play, the leader calls all the organisms into the center of the Habitat to explain scoring. Have the Grasshoppers stand together, the Vagrant Shrews stand together, and the Barn Owl(s) stand together.

For all organisms that were left alive, have them pull the Plants out of their paper bag. Tell them that Plants colored Yellow have pesticide. This pesticide takes many years to break down, and so it accumulates in the food chain. [This models mercury-based chemicals, etc.]

Score as follows:

Organisms that were eaten:

—You get 1 point for contributing to the food chain

Grasshoppers:

—Any Grasshopper that ate more than 2 Yellow dies, score is zero

—Any Grasshopper that ate no Yellow, 1 point for every 3 Plants

Vagrant Shrews:

—For each Plant colored Blue, 1 point

—For each Plant colored Yellow, -1 point (that's minus one)

—Zero or less means you die

Barn Owls:

—For each Plant colored Blue, 1 point

—For each Plant colored Yellow, -1 point (that's minus one)

—A Barn Owl with a negative score does not die, but their health is impacted, and they are too weak to reproduce

*Follow up conversation:*

Review first:

—What was it like to play the game? What was it like to be each organism?

—In the first round, what did you think when you learned how much Energy you needed to reproduce (to have children)? Was that a fair number, or do you think it should have been more or less? Was it harder to be a Grasshopper, a Vagrant Shrew, or a Barn Owl?

—In the second round, what did you feel like when you found out about the pesticide?

OK, harder questions:

—How do you think animals would feel if they knew that all of a sudden their food had pesticide in it? [Point out that the Grasshoppers did not know ahead of time which color of Plant would kill them—that would be true in the real world, where insects do not know when a pesticide has been used (that's how pesticides kill insects!). And of course higher predators can not know if their prey has accumulated any pesticides in their bodies.]

—Is there any way for Grasshoppers, Vagrant Shrews, and Barn Owls to play this game so they are less likely to get killed by pesticides? [Remember, you have to get energy from the sun; and once certain pesticides are in the food chain, they stay there!]

NOTES:

(1) This food chain is very generalized, and should not be taken as an accurate model.

(2) The food chain in the original version of this game included Plants, Grasshoppers, Vagrant Shrews, and Hawks. These species does not really make up a food chain in our bioregion, so I felt I should change the species. If we try to imagine a similar food chain for our bioregion (Santa Cruz Mts. and surrounding lowlands), the following species might work:

—there are various grasshoppers in our area, including e.g. species of coneheads/katydid, and I stuck with generic grasshoppers

—of the 3 main species of Vagrant Shrew in our area, the Vagrant Vagrant Shrew is probably most relevant, as it prefers “open grassy situations” whereas other Vagrant Shrews in our region are more likely to be forest dwellers (California Department of Fish and Game, 1999. California's Wildlife, Sacramento, CA. Written by: J. Harris, reviewed by: H. Shellhammer, edited by: S. Granholm, R. Duke. <http://www.sibr.com/mammals/M003.html>)

—for the Vagrant Vagrant Shrew, Barn Owls, not Hawks, are reported to be the most important predator (along with Bobcats). Barn Owls do not have the same problem with thinning shells that some Hawks have (a fact in the original games), but bioaccumulation of toxins is a problem for owls (<https://www.owlpages.com/owls/articles.php?a=59#toxicology>).

[Why I dropped Hawks from the game— Of the hawks in our region, smaller hawks specialize in other food (e.g., Cooper's Hawk specializes in birds); larger hawks (e.g., Red-tails) are more interested in larger mammals than Vagrant Shrews; Northern Harriers take a great many small mammals, but they tend to hunt in habitats (marshlands) that do not have a large number of Vagrant Shrews in our area. Barn Owls, on the other hand, are a major predator of Vagrant Shrews, so they are the obvious raptor from our bioregion to substitute in this food chain.]



**Barn Owl**



Credit: painting by Nancy Halliday from Kays and Wilson's *Mammals of North America*, © Princeton University Press (2002)

Vagrant Shrew