



TEACHER GUIDE

FOOD WEBS: CYCLING OF MATTER AND FLOW OF ENERGY • GRADES 6-8

COMMON MISCONCEPTIONS

- **Plants get some energy from the nutrients in the soil. Some middle school students struggle with the idea that plants make their own food.**
Students often think that photosynthesis is not the only way plants get energy. Since plants are planted in soil that we sometimes fertilize, some students believe that some energy comes from the soil.
- **Predator and Prey populations are similar in size in an Ecosystem: Some middle school students believe that the number of predators is equal to the number of prey.**
The idea that an ecosystem can only support a specific number of living things is challenging for some students. Because only 10% of the energy is passed on through each level of a food chain, there are larger numbers of living things towards the bottom of a food chain.

PHOTOSYNTHESIS

The process of photosynthesis is vital to the survival of a food chain or web. Plants are the foundation of energy for all living things above them in a food chain. Using energy from the sun, along with carbon dioxide and water, plants go through a chemical reaction to create sugar and release oxygen. The original molecules of carbon dioxide and water are rearranged through this chemical process to create sugar and oxygen.

DECOMPOSERS

When living things die, organisms called decomposers break down the dead material. They do this by eating the flesh of dead animals and plants. The cells within the decomposers go through the process of cellular respiration and molecules such as carbon and water are released into the soil. Decomposers are sometimes eaten by consumers. In this case, the energy from the decomposers goes through the process of cellular respiration in the consumer. The molecules remain the same in number throughout these processes because matter is always conserved. Molecules are constantly being rearranged to form new substances through chemical reactions such as cellular respiration.

ENERGY TRANSFER IN AN ECOSYSTEM

Plants make their energy source from the sun's energy through photosynthesis. They then use approximately 90% of this

energy for plant functions, and some is released as heat. This leaves approximately 10% of energy stored in the plant for the next level of the food chain. The primary consumers then eat the plants and obtain 10% of the original energy of the plant. The primary consumer then uses 90% of the energy obtained from the plant for bodily functions and some is released as heat. This means that only 10% of what was obtained from the plant is available to the next level in the food chain. This is only 1% of the original energy of the plant. For this reason, the lower levels of a food chain are more populous than the levels above. There would be many plants, followed by several primary consumers, a few secondary consumers, and perhaps one or two tertiary consumers.

TEACHER TIPS

This topic was introduced in 5th grade. To challenge students more, work with ecosystems and living things that might not be as familiar to students. This may challenge them to research what types of food different organisms consume.

ABOUT THIS LESSON

This lesson was created by the National Science Teaching Association (NSTA) to pair with the Generation Genius video and support NGSS.

They have requested we provide the following background with this lesson:

The Next Generation Science Standards (NGSS) are the national standards on how students learn science, and they are based on contemporary research presented in *A Framework for K–12 Science Education (the Framework)*. The shift in science teaching and learning required by the Framework is summarized in this infographic: [A New Vision for Science Education](#).

At the start of each Generation Genius lesson, students are presented with a phenomenon, then they try to explain it. Students will notice they have gaps in their knowledge and ask questions, which motivates them to build ownership of science ideas they need in order to explain how or why the phenomenon occurred. The way students build ownership of science and engineering ideas is through active engagement in the science and engineering practices (SEPs). This process of sensemaking, or doing science to figure out how the world works, is one of the major shifts the *Framework* encourages.

To engage in the SEPs, students should be part of a learning community that allows them to share their ideas, evaluate competing ideas, give and receive critiques, and reach consensus. Students can start by sharing ideas with a partner, then with a small group, and finally, with the whole class. This strategy creates opportunities for all students to be heard, build confidence, and have something to contribute to whole-class discussions. Each Generation Genius lesson provides conversational supports to facilitate such productive student discussions to contribute to sensemaking.

Excited to continue your shift toward the new vision for science education? Check out the [Generation Genius Teacher Guide](#) page on the NSTA website for resources and strategies to engage every student in your classroom in **doing** science.

