

Plant Services Jigsaw

An important lesson to take from ecosystem ecology is the understanding that healthy ecosystems provide numerous “services” to the components of the ecosystem. Ecosystem Services is the term used to refer to the services that a healthy ecosystem provides for humans.

Objective: Students create a collective knowledge base about the ecosystem services provided by plants

Ecological Question: What do plants do for us?

Grade Level: 3-7 (easily adaptable for 7-12)

Setting: Classroom

Duration: 2 periods of 30-45 minutes of class time, allowing for student research between periods.

Materials you will need:

Research materials, pencil, paper,

Activity

1. Students brainstorm what services plants provide for us. Write these on the board as students name them. Help them by reminding them about pollination, photosynthesis and plant parts (roots help hillside avoid erosion; branches and trunks provide nesting sites; trees provide sap for birds like sapsuckers, the list goes on and on). Other services can include shade, gardens and pretty flowers.

2. Once the services that they come up with are listed, then either put these services in logical groups (you will need about 5 groups) or pick 5 services to examine more closely. These choices could be made primarily by students.

3. Then assign students, or let them assign themselves, to one of these five groups. So, for instance you may have groups like this:

Group 1: Pollination

Group 2: Habitat for birds

Group 3: Food for fungus

Group 4: Providers of oxygen

Group 5: Erosion prevention

This will have to be an even distribution, so that the same number of students is assigned to each group.

4. Then have them break apart, and put them in groups so that there is one representative of each group in this second set of groups. So this second round will have (using the example above) one pollination expert, one habitat for birds expert, one food for fungus expert, one providers of oxygen expert and one erosion prevention expert. Let them spend a few minutes learning who is doing what and realizing that together they form a collective knowledge about plant services.

5. From here, each student needs to spend some individual time learning about his/her topic. This can be by using reference books, the library, internet, or materials that the teacher has already prepared.
6. Once they have studied their topic, they should get into the *original* group of students who studied the same topic. They need to discuss what they learned and find a way to present it to those students who did not study this topic.
7. Finally, students reconvene with their second, heterogeneous group. Each student takes turns to present his/her topic. Each student must listen carefully, so that when they are assessed, they know the whole story about plant services. Assessment can be formal or informal, but students should be aware that they will be assessed (even if it is just a drawing or a nature journal entry) so they listen to their peers. It may be helpful to choose a leader who makes sure that only one person talks at a time.

How much water does it take to grow a hamburger?

Objective

Students analyze and diagram the resources that create the main ingredients of a hamburger (or other meal of choice).

Ecological Question

What does it take to have a hamburger?

Grade Level 3-8

Setting Classroom

Duration 20-30 minutes

Materials you will need (including handouts)

Paper and pencil

Activity

1. Begin by asking the students, "How much water does it take to grow our food?" If you have access to internet in class, you can ask them to go to <http://ga.water.usgs.gov/edu/sc1.html>. If not, give them some foods and ask for guesses about how much water is used to produce a serving of rice, an orange, a head of lettuce, a watermelon, a glass of milk or a hamburger!
2. Here are some answers (for one serving, unless indicated otherwise)
3. **Orange:** 14 gallons
French Fries: 6 gallons
Hamburger patty: 1,300 gallons
Lettuce: 6 gallons
Milk: 65 gallons
Rice : 35 gallons
Tomatoes: 3 gallons
Watermelon: 100 gallons
1 Egg: 120 gallons
Loaf of bread: 150 gallons
4. Ask them to draw a diagram or concept map (the best method for this information) breaking down a hamburger, or some other meal of choice, into its main ingredients and then listing the inputs needed to make or produce each ingredient.

Source: usgs.gov water science for schools

Some helpful data:

- a. Lettuce uses about 7 inches of water. In 2002 306,849 acres of lettuce was harvested in the US. So, about $1.24 \times 10^{13} \text{ cm}^3$ of water was used by lettuce in the country.
- b. Wheat uses about 13 inches of water in a growing season. In 45,519,976 acres of wheat was harvested in the US. So, about $1.84 \times 10^{15} \text{ cm}^3$ of water was used by wheat in the country.
- c. Corn uses about 20 inches of water in a growing season. In 68,230,523 acres of corn was harvested in the US. So, about $2.1 \times 10^{15} \text{ cm}^3$ of water was used by corn in the country.

Extension

Ask students to move beyond water in their concepts maps to consider other resources needed to grow or transport the ingredients in a meal.

Some helpful data:

- a. Lettuce and tomatoes are grown in California, 3000 miles from NY. As a whole, the US put 43,000 tons of fertilizer in 2002 and 1,229 tons of pesticides in 1997 on lettuce. In 1997, US farms used approximately 112,125 tons of fertilizers and 13,323 tons of pesticides on tomato crops.
- b. Wheat is grown primarily in North Dakota, Oklahoma and Kansas; all of which are about 1500 miles from NY. As a whole, the United States put 2,000 tons of fertilizers on US wheat crops in 2006 and 12,882 tons of pesticides in 1997.
- c. Corn, which is the main feed for cows, comes from Iowa and Illinois about 1000 miles from NY. As a whole, the United States put 8,000 tons of fertilizers on our corn crops in 2006 and 112,720 tons of pesticides in 1997.

Data Sources:

Crop water use maps for North Dakota <http://www.ext.nodak.edu/weather/cropwater/>

Fresh Market Tomato Production. Douglas C. Sanders. Department of Horticultural Science. North National Center for Food and Agricultural Policy. <http://www.ncfap.org/pesticide.htm>

USDA Economic Research Service. <http://www.ers.usda.gov/Data/FertilizerUse/>

USDA Census of Agriculture. <http://www.nass.usda.gov>

USGS water science for schools information website. <http://ga.water.usgs.gov/edu/>

Water Use in Vegetables: Western Head Lettuce. University of Arizona cooperative extension.