What's Disturbing About a Disturbed Wetland?

Overview

Students learn how wetlands are organized (around trophic interactions) and the effects that disturbances have on this organization. They also construct simulated wetlands and create disturbance scenarios.

Title

What's Disturbing About a Disturbed Wetland?

Investigative Question

How are the organisms in a wetland organized and how are they affected by various disturbances?

Overview

Students learn how wetlands are organized (around trophic interactions) and the effects that disturbances have on this organization. They also construct simulated wetlands and create disturbance scenarios.

Objective

Students deduce the impacts of disturbances on wetland food webs and manipulate these webs to reflect those effects.

Materials

Student Pages 1, 2, and 3; materials for making overhead transparencies and a transparency marker.

Time

Two 50-minute class periods.

Advance Preparation

1. Make an overhead transparency of Student Page 2 or of the food web generated by the class in the introductory activity.
2. Make copies of Student Pages 1, 2, and 3.
3. Find and read material on wetland food webs.

Introducing the Activity

1. Introduce the concepts of food chain, food web, and food pyramid by sketching out several examples on the chalkboard. Students must be familiar with the terms associated with these ecological concepts. Remember to point out that some organisms feed on more than one trophic level and that arrows in the web (representing energy flow) lead from the organism being eaten to the one doing the eating. The snapping turtle, for example, is classified as a carnivore, but it also eats plants upon occasion. The completed food webs may look complex, but in reality the concept is relatively simple.
2. Conduct a classroom poll by asking students what types of plants and animals they would expect to find in wetlands. Make a list on the chalkboard of their suggestions.
3. Help students to group their list of plants and animals into four trophic categories: primary producers, primary consumers (herbivores), secondary consumers (carnivores), and detritivores. Be sure students understand that some animals feed on organisms from different trophic levels and are classified as omnivores.
4. Each student constructs a food web based on the list of organisms on the chalkboard and any additions to that list they care to make. Compare these webs and note the various permutations.
5. As a class, construct a food web on the chalkboard that incorporates suggestions from the student webs. Discuss the completed web. What are the top carnivores in this food web? Which organisms have the most arrows leading to them? from them? What does the pattern of arrows tell us about the overall functioning of the food web?

6. Make a permanent drawing of this food chain or assign a student or group of students proficient in drawing to do so. Make a transparency of this drawing and multiple copies if you wish to substitute it for the food web shown on Student Page 2. Either the student-generated web or the one provided on Student Page 2 may be used in the activity described below.

Procedure

1. Distribute copies of Student Pages 1, 2, and 3. (Remember, you may substitute the food web created by the class for the one shown on Student Page 2.) Students take these pages home for study and return the following day with a diagram of how each of the three scenarios on Student Page 3 may have affected the wetland food chain on Student Page 2. For example, students cross out organisms that may have been killed by the disturbance and the arrows that go from them and to them. Students should be prepared to interpret their revised food chains.
2. The following day, as a class activity, project the transparency you have made of the food web on Student Page 2 or the one created by the class in the introductory activity. Begin by asking, organism by organism, how scenario one affected the food chain. Erase organisms that were killed (or nearly eliminated) by the disturbance as well as the energy lines flowing to and from those organisms. Ask for comments on how the surviving organisms are likely to be affected. What happens when a food web is out of balance?
3. Repeat this procedure for scenarios two and three. You or your students may develop additional disturbance scenarios for this activity.
4. Combine all three disturbance scenarios and note the results.
5. Discuss the post-disturbance food webs. Are there tradeoffs between agricultural disturbance and the quality of the wetlands (food production versus the benefits of wetlands)? Encourage students to speculate on the values of wetlands.

Assessing the Activity

Ask each student to write a wetlands story that will serve as the basis for a food web. The story should include herbivores, carnivores, omnivores, and detritivores and several disturbances (drought, attempted draining for farming, chemical spill, etc.). Students then create food webs (before and after disturbances) based on their stories. These might be done as posters and displayed beside the stories that inspired them. A sample paragraph from a wetlands story is given below.

> On a warm, muggy summer day the sun shines on a vast expanse of marsh, providing energy for green plant growth, both above and below the surface of the still water. These plants are food for a number of animals. Large, floating lily pads are eaten by water lily leaf beetles. During the summer, however, many of the water lilies are killed with a chemical herbicide that was used to allow easy passage by fishing boats. Below the surface mayfly nymphs graze on submerged plants and on the smaller plants (phytoplankton) that grow on the surfaces of the submerged plants. Tadpoles and copepods (nearly microscopic crustaceans related to shrimp) also rely on these phytoplankton for energy. In time, these large and small plants, along with other organisms, die and sink to the bottom of the marsh where bacteria and fungi decompose them into a rich layer of detritus (decayed plant and animal parts). Many other organisms rely on this layer of detritus for food, including green plants, crayfish, bullhead catfish, and small crustaceans called amphipods. But there are other grazers in the marsh. Mallard ducks eat large quantities of seeds from aquatic vegetation, but they also supplement their diets with mayflies, amphipods, and even an occasional tadpole. Muskrats feed mostly on larger plants but eat crayfish when they can catch them.

Extending the Activity

Students work together to construct a mural depicting an undisturbed wetland food web and at least two versions of that web showing what happens when human activities disturb a wetland. Pictures for the mural may be drawn by students or their drawings may be combined with those on Student Page 2. Photographs and illustrations gleaned from magazines *(National Geographic, Ranger Rick, National Wildlife*) may also be incorporated. When the mural is complete, students provide a title and a few lines of explanatory text for each web.

State Goals

11,12 (Objectives 12.4.07, 12.4.13, 12.7.28)

Concept

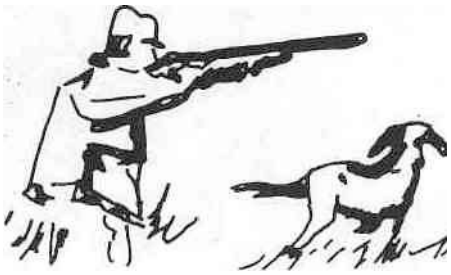
Wetlands are organized around trophic interactions (who eats whom) and these can be disrupted by outside interference (both natural and human-induced).

Safety and Waste Disposal

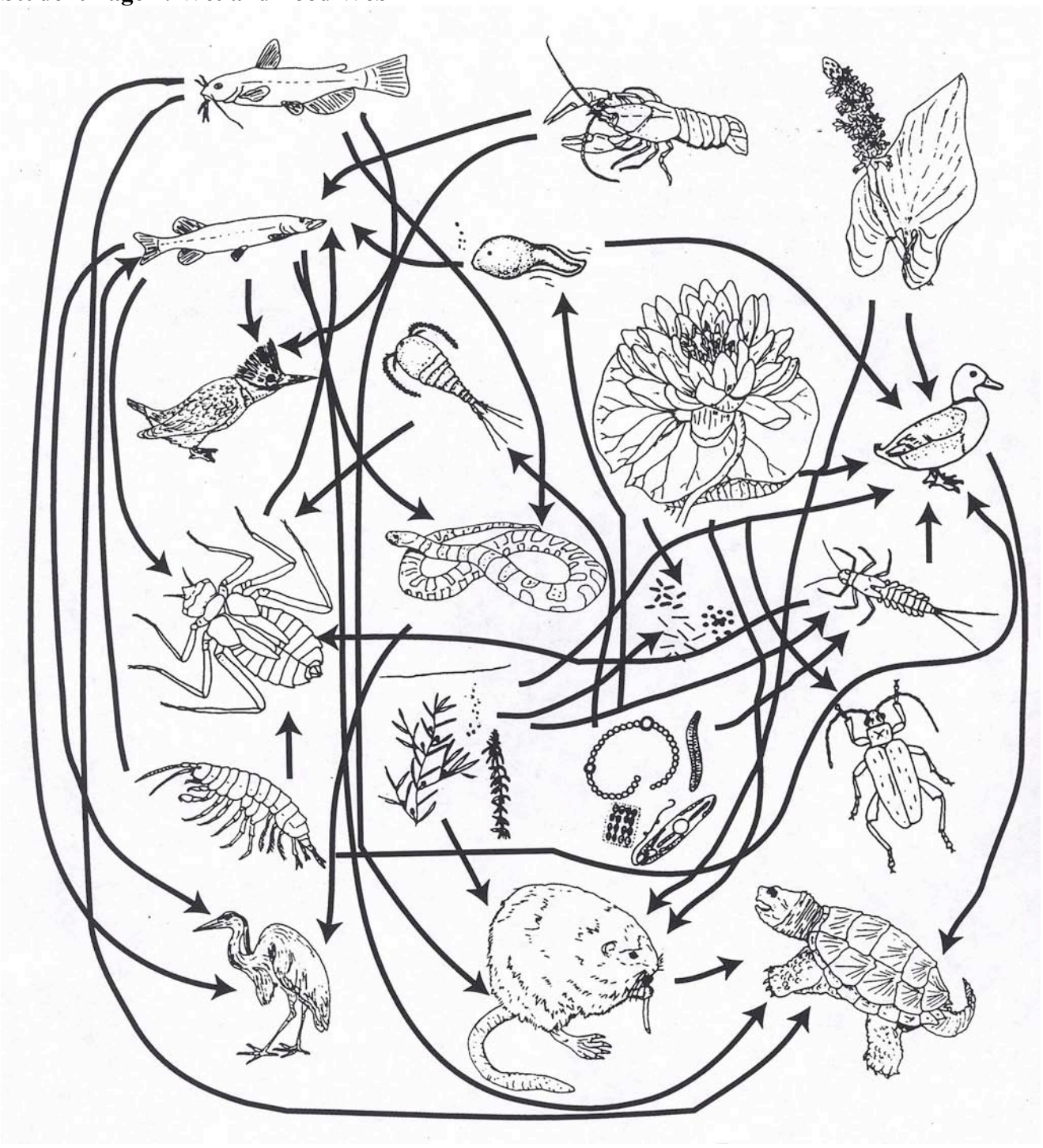
No dangerous or hazardous materials are used.

Student Page 1: Background Information

The impact of humans on wetlands reached epic proportions during the last quarter of the nineteenth century and has continued throughout most of the twentieth century. Wetland habitats have been destroyed by any means deemed appropriate to further urban, industrial, and agricultural development. Pesticides leached from surrounding agricultural land have entered the food chain, often with devastating effects on such nontarget organisms as ospreys and eagles, and have been deposited in sediments, further toxifying the environment and often causing "mysterious" dieoffs of mussels and fish. Altered streams rush between high levees sending loads of floodwater downstream; their associated wetlands, once breeding ground for large numbers of aquatic organisms, have become cornfields. Generations of hunters have adversely affected waterfowl populations, not so much by direct kill but by the indirect effects of spent lead shot pellets deposited on the bottoms of lakes and marshes. In most cases, ducks die after swallowing only one or two pellets. The only solution to wetland destruction appears to be to "just say no" to further destruction. (Note: since 1991 lead shot is illegal for waterfowl hunting in the United States.)



Student Page 2: Wetland Food Web



Student Page 3: Disturbances in a Wetland

Scenario One

Due to current agricultural practices (fall plowing, for example, which leaves the soil exposed to the erosive effects of wind and water as opposed to conservation tillage, which leaves the stubble in the fields to hold the soil over the winter months), large quantities of soil are washed from agricultural fields into adjacent wetlands. When the soil reaches the wetlands, it clouds the water (turbidity), thereby reducing the light level and inhibiting aquatic plant growth. About half of the soil settles to the bottom, changing the character (including depth) of the wetland. These sediments also contain fertilizer and pesticides and herbicides that have washed from farm fields. These chemical residues are capable of killing insects and altering plant growth by eliminating some species and accelerating the growth of others.

Scenario Two

Spent lead and steal shot from the guns of waterfowl hunters is often found in large quantities in wetlands. Waterfowl eat the shot while feeding and become sick and die. Because lead lasts a long time and is toxic (poisonous) to most organisms (steel shot is not toxic), it remains in the food web and affects other organisms as well.

Scenario Three

A chemical spill from a nearby factory kills all of the fish in the wetland but leaves most other organisms intact. In high doses, however, the chemical can adversely affect large carnivores that may be eating the dead fish.

Combine scenarios one, two, and three. What is their combined effect on the wetland food web?