Slide 1

Grade level: 5; **Duration**: 45 Minutes; **Setting**: Virtual; **Standards:** 4.1.4.A**,** 4.2.5.B, 4.1.5.C **Vocabulary**: Ecosystem, Food Chain, Food Web, Photosynthesis, Endangered, Threatened, Public Lands; **Objectives**: Students will be able to: construct a freshwater marsh ecosystem, specifically “The Muck”; Identify an important Pennsylvania wetland for the state endangered American bittern; Explain why marsh habitats are important to American bittern survival and how they can protect them; define public lands; describe ways to safeguard marsh ecosystems. **Materials:** Printable food chain handout (provided- separate handout), “The Muck” ecosystem cards (provided- separate handout), PowerPoint script (provided- separate handout), and red sticky arrows (alternative: draw arrows). **Extensions:** Take a field trip to “The Muck” or another freshwater marsh and observe the plants and animals (safely). **Note:** Ten or more visitors on State Game Lands require a permit. To apply for a permit, call your local Game Commission office. **(Click)**

Slide 2

Ask students: “What is an **ecosystem**?” By the end of the discussion, make sure that students have generated the answer an ecosystem is a community of the living and nonliving things interacting with each other in their environment. Briefly explain that the living and nonliving things are linked together through **nutrient cycles** and **energy flows**. The nutrient cycle is the way in which nutrients move between organisms and the physical environment and then recycled back into the environment. Energy flow is how one organism gets energy to do the things it needs to survive. Some examples of ecosystems are wetlands, forests, deserts, grasslands, and the ocean. Today we will learn about a freshwater marsh ecosystem and a special bird that relies on that ecosystem to survive. **(Click)**

Slide 3

That special bird is the American bittern. American bitterns are wading birds that live around freshwater marshes. American bitterns require large wetland habitats. They are most likely found in marshes and wetland borders along lakes, ponds, rivers and streams. American bitterns seem to prefer to breed in extensive freshwater marshes, especially those with dense stands of cattails and thick patches of bulrushes, grasses and sedges and pockets of open water. During migration, bitterns can visit a variety of wet habitats including small marshes, ditches and wet meadows.They are classified as **wetland birds**. American bitterns are masters of disguise and

seldom seen. Their overall light and dark stripes running the length of their body **camouflage** them among the cattails and bulrushes (plants) of the marsh. It's not just their color that makes them blend in, when the American bittern feels alarmed, it will stretch its neck, with its beak pointing to the sky so that the streaks of its feathers line up with the plants around it and then freezes in place. This behavior makes them nearly invisible to their **predators** that may be looking right at them. **(Click)**

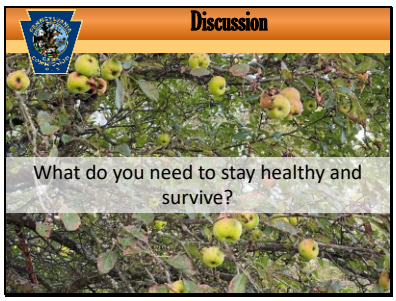
Slide 4

American bitterns also hunt their **prey** by hiding among the plants and standing motionless waiting for their prey to pass by. American bitterns eat fish, crustaceans, amphibians, reptiles and small mammals. They also eat dragonflies, grasshoppers, and water beetles. **(Click)**

Slide 5

You may not see this elusive bird, but you may hear its loud "Onk-a-chonk" sound at dawn and dusk when it is most active. Go to this link to hear the American Bittern: https://macaulaylibrary.org/asset/246731141**(Click)**

Slide 6



Ask students: “What are some of the things you need to stay healthy and survive? By the end of the discussion, make sure students have generated the answers of a healthy habitat that provides food, water, shelter, and space. **(Click)**

Slide 7

Throughout the years, negative and positive impacts have been made to the environment. One negative impact is wetlands have declined by more than 50 percent in Pennsylvania over the past two centuries. They have declined due to drainage for agriculture, development, pollution, and other factors. Today, marsh habitat remains at a risk of being lost or decreased. **(Click)**

Slide 8

Under the Endangered Species Act, a species may be listed as either endangered or threatened. **Endangered** means a species is in danger of extinction throughout all or a significant portion of its range. **Threatened** means a species is likely to become endangered within the foreseeable future. In Pennsylvania, the American bittern is listed as a ***state*** endangered species and protected under the Game and Wildlife Code, and all migratory birds are protected under the Migratory Bird Treaty Act of 1918. Although not listed as endangered or threatened at the federal level, the American bittern is a species of high

concern in the Upper Mississippi Valley/Great Lakes Region of the North American Waterbird Conservation Plan and is a U. S. Fish and Wildlife Service migratory bird of conservation concern in the Northeast. It is listed as state endangered because of its dependency on specialized marshes; wetlands have declined by more than 50 percent in Pennsylvania over the past two centuries. Marshes remain at risk from sedimentation, eutrophication, chemical pollution and, to a lesser degree, encroachment. Habitat protection is essential for the recovery of this species.

Slide 9

Pennsylvania has several lands that are **public lands**. Public lands protect natural resources and allow anyone to visit these lands for recreation (unless there are restrictions). The Game Commission owns public lands called **State Game Lands**. The primary purpose of State Game Lands is to provide habitat for wildlife and to provide people a place to lawfully hunt and trap. These lands are also used by people for other recreational activities such as wildlife watching and hiking. **(Click)**

Slide 10

"The Muck" is a large freshwater marsh located on State Game Land 313 in Tioga County. It is a warm-water headwater wetland of Marsh Creek. **(Click)**

Slide 11

The Muck is an important place because it is a known American bittern breeding area. This marsh area supports a good population of American bitterns and other uncommon wetland birds. Because of its importance to birds, it was designated as an Important Bird Area (IBA) by the Pennsylvania Audubon Society in 1999. There are a lot of plants and animals that live within and around this marsh and they really rely on the marsh as part of their habitat to provide what they need to survive. This marsh provides food, water, shelter and space for many plants and animals. **(Click)**

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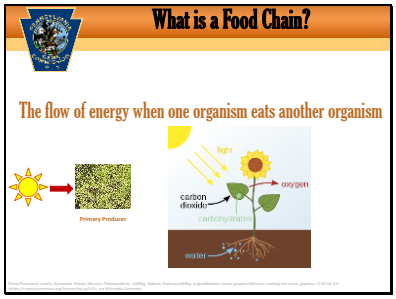
How would you describe a **freshwater marsh ecosystem**? What are the living and nonliving things in this type of ecosystem? A freshwater marsh in Pennsylvania usually has a variety of microscopic organisms, emergent aquatic plants (ex. cattails and sedges), insects (ex. dragonflies and water beetles), amphibians (ex. bullfrogs and red-spotted newts), reptiles (ex. Northern water snake and painted turtle), birds (ex. American bittern and marsh wren), and mammals (ex. muskrat and beaver). **(click)** Can you think of any other plants or animals that may live in a marsh? Abiotic components are the nonliving factors that impact an ecosystem. Water, light, and temperature are examples of some abiotic factors that influence the ecosystem. **(Click)**

Slide 13



Let's look how these plants and animals interact with each other and how **energy** moves through an **ecosystem**. *Provide students the food chain handout and red sticky arrows*. A **food chain** is a feeding relationship between species. It is the transfer of food energy when one organism eats another organism. Let's first think about energy. The energy for most ecosystems comes from the sun. How does an ecosystem make use of this energy? It starts with primary producers- plants. Plants make their own food through a process called **photosynthesis**. Plants use energy from the sun to convert water and carbon dioxide into food. Duckweed is

a plant found at “The Muck”. The duckweeds are the smallest flowering plants known and provide energy for many different species that eat it. Have the students place a red sticky arrow from the sun to the plants with the arrow pointing toward the plants since the plants get energy from the sun. **(click)**

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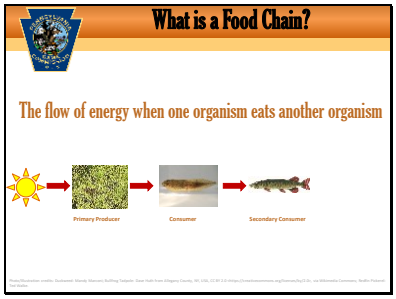
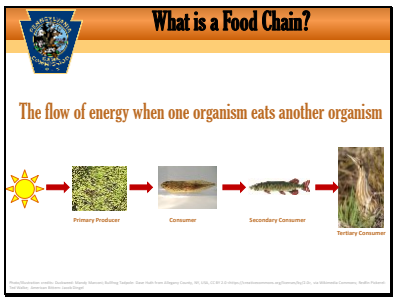


The duckweed may go into the mouth and into the body of a bullfrog tadpole. **(click)**The tadpole can use that energy to grow and reproduce; it also stores some energy in its body. *Have the students place their arrow from the plant to the animal that is eating it*. *Help students to place the arrow the correct way by telling them to think about the arrow going into the mouth of the animal that is eating something*. Since the tadpole is eating the duckweed, the arrow is going to point toward the tadpole (**click**). **(click)** The next organism is the redfin pickerel fish. This fish is an ambush predator, it hides in the plants until its prey approaches, when the prey gets close enough, it will lunge and grab it. The fish is going to get some energy from eating the bullfrog tadpole. Place the arrow toward the fish’s mouth. (**click**) **(click)**

Slide 15



(**click**) The last organism in our food chain is the American bittern. The redfin pickerel may end up in the stomach of the American bittern. The American bittern will get energy from the redfin. Place the arrow toward the bittern's mouth (**click**). Here we are seeing how the energy flows from one organism to another. This is an example of a food chain. If this is a food chain, than what is a food web? **(click)**

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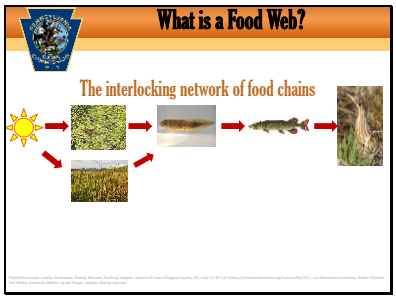
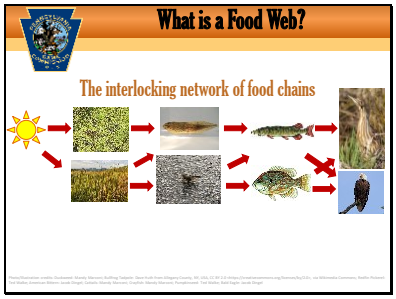


A food web is an interlocking network of food chains in an ecosystem. When you start with a food chain you can turn it into a food web. To make our food chain into a food web, we need to add two things: more organisms and more arrows. *Students are welcome to follow along by drawing or writing the names of the organisms and then drawing arrows (they will construct a food web later in the lesson).* The first organism we are going to add are cattails. **(click)** Cattails are one of the most common plants in a marsh, they can grow up to nine feet tall and have a flowering spike. Cattails and any algae that grows on them are an important food for many animals. Some of the energy from this cattail will go to the tadpole when it has a little snack. *How should we place the arrow?* **(click)** The tadpole now has some options for food, it can feed on the leaves of duckweed or cattails (or algae on the leaves), and that's how you know this is starting to turn into a food web,

when these animals start to have a bunch of different options. **(Click)**

Slide 17



(click) Crayfish may get energy to live and reproduce by eating the stems and leaves of cattails, too. How would we place the arrow to show where the energy goes? **(click**) Crayfish may have pinchers, but they are not safe. They are prey to many animals including the redfin pickerel. *Place the arrow* **(click**). A pumpkinseed sunfish lives in "The Muck" **(click)** and it may get its energy by eating the crayfish. *Place the arrow.* **(click)** The American bittern now has more options, too. It can eat the redfin pickerel or the pumpkinseed fish. Place the arrow where the energy is going- remember it goes into the mouth of the animal eating the other animal. **(click).(click**) bald eagles fly over the marsh looking for a meal, they are birds of prey and feed heavily on fish. They may catch a pumpkinseed with their sharp talons and eat it for dinner. *Place the arrow* **(click**). Or it may eat a redfin pickerel. *Place the arrow* **(click) (click).**

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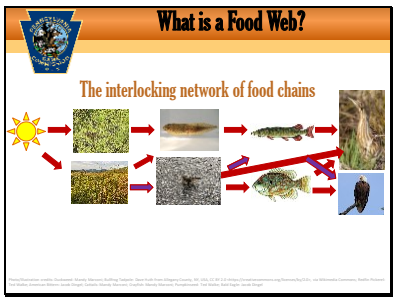

(click) The American bittern may snack on a crayfish, too. We can continue adding organisms that live in "The Muck" and more arrows to enlarge our food web. Ask students to look at the food web. Does this food web look a little confusing to you? It's okay if it does. If you ever look at a food web and it looks a little confusing to you, just follow the arrows, like you are connecting the dots. For example, you may start with the cattails **(click)** and follow the arrow to the crayfish, then follow the arrow to either the redfin pickerel, the pumpkinseed, or the American bittern, **(click**) lets follow it to the pickerel, and then to the bald eagle **(click)**. Here we connected arrows from the cattails to another organism and then another organism until we got to the bald eagle, showing a food chain within a food web. Remember food webs are just a bunch of food chains put together. **(click)**

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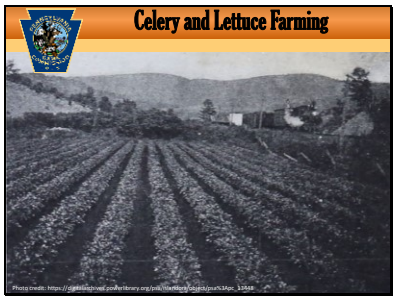

"The Muck" is a reclaimed wetland. This means the land was once a wetland, but then drained and used for something else, and then turned back into a wetland. Historically, some people viewed wetlands as breeding grounds for mosquitoes and disease, and often drained and filled them in for other uses. "The Muck" was drained in the 1890s to grow celery and lettuce. While the land grew celery and lettuce it no longer provided wetland habitat. That means when this area was farmed, cattails, aquatic insects, frogs, fish, wetland birds including the American bittern,

and other wetland animals could not survive here. **(click)**

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By the 1970s, the celery and lettuce farming was no longer profitable. Since the celery and lettuce farming was no longer profitable, someone thought this could be a wetland once again. It could be a healthy environment, provide a home to many animals, and become a place people could visit and hunt. The wetland was restored through efforts of the Game Commission and other conservation organizations. Now, many plants and animals live here. Beavers keep the water levels high with their dams. Muskrats make homes out of the cattails. American bitterns and other rare wetland birds breed in this marsh. Canada geese and many other animals thrive here. People visit here to wildlife watch, hunt (when lawful), take wildlife photos, and other recreational enjoyment. **(click)**

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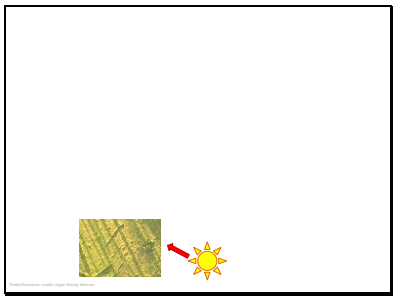
Wetlands provide other benefits, too. One benefit is flood control. Wetlands act like sponges and soak water from flooded streams and waters. They also help filter pollution. Rainwater may carry harmful pesticides or animal waste from farms. Wetlands act like a strainer and help filter the pollution out before it makes it to larger bodies of water. Some plants will take up the pollutants and make them less harmful, other pollutions may get buried in the wetland soil where bacteria and other organisms break it down until it is gone. **(click)**

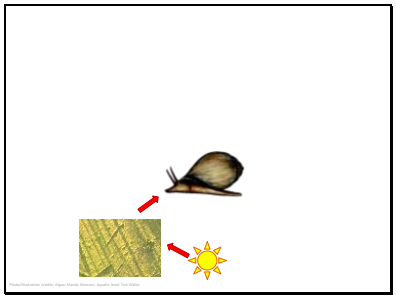
Slide 22



Let's build a larger food web together from "The Muck" ecosystem. *Provide students with the marsh organism cards*. You will need your marsh organism cards and red sticky arrows. Flip over your food chain paper and use the back. What does every food chain and every food web start with? The sun. **(click)** Look through your organism cards and see what organisms make their own food, you're looking for something that is or looks like a plant. Show your cards that look like plants (algae and aquatic plants). While you are holding your cards up, read the back of the cards. Both are correct answers, but for now we are going to go with the algae. Place the algae card to the left of the sun **(click).** Place one of your red sticky arrows between the sun and the algae to follow the energy from the sun to the algae. The algae is absorbing the energy from the sun to produce its own food, so the arrow should point

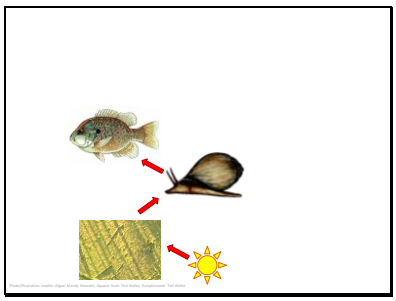
to the algae from the sun **(click) (click).**

Slide 23



Now find the card that has the aquatic snail. When you find it, hold it up and read the back of the card. The aquatic snail eats algae. Place the aquatic snail above the sun **(click)**. Now we need to make another connection between the algae and the snail. Use another arrow to show the feeding relationship between the algae and the snail. Which way will the arrow point? Remember the arrow points to the mouth of the animal eating something. Since the snail is getting energy from the algae, we are going to place the arrow toward the snail **(click) (click).**

Slide 24



Look for the organisms that eat snails and hold up your cards (bullfrog and pumpkinseed). Great job! Those are the right answers, but we are only going to choose the pumpkinseed. Place it above and to the left of the aquatic snail **(click).** Show the feeding relationship, using your arrow, between the aquatic snail and the pumpkinseed**.** Which way will the arrow point? Right **(click), i**nto the mouth of the pumpkinseed **(click).**

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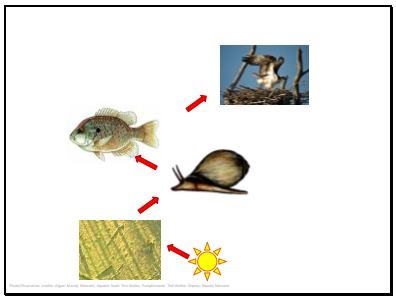

What organisms will eat a pumpkinseed? Hold your cards up (American bittern and osprey). You're right. For now, we are just going to choose the osprey **(click)**. Which way will the arrow go? Into the mouth of the osprey **(click).** At this point it doesn't look like a food chain because it zigzags on your paper, but this is a food chain. There is only one arrow in-between each organism **(click).**

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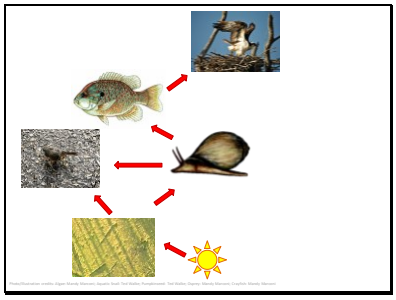
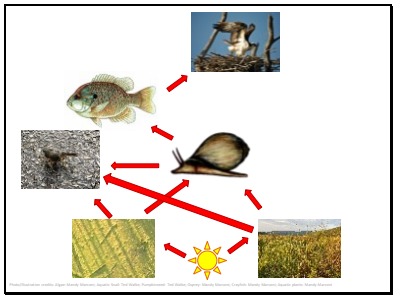


You have four cards left: a bullfrog, aquatic plants, a crayfish, and an American bittern. Out of those four cards, which organism eats algae? The crayfish **(click)**. Show the feeding relationship between the algae and the crayfish by placing your arrow between them **(click)**. Does the crayfish eat anything else on your paper? Yes, aquatic snails. Using another arrow, show the feeding relationship between the aquatic snail and the crayfish. Remember the arrow goes into the mouth of the organism eating something. **(click) (click).**

Slide 27



You have three cards left, a bullfrog, aquatic plants, and an American bittern. Let's add another producer to our food web. Show me the organism card that makes their own food. Right, aquatic plants. Add the aquatic plants card to the right of the sun on the bottom of your paper **(click)**. Place one of your red sticky arrows between the sun and the aquatic plants to follow the energy from the sun to the aquatic plants **(click).** There are two organisms on your paper that eat aquatic plants. Which organisms eat aquatic plants? Both the aquatic snail and the crayfish eat aquatic plants. Using another red arrow, show how some of the energy from the aquatic plants goes to the aquatic snail. Remember the arrow points to the mouth of the organism eating something **(click**). Now make a connection between the aquatic plants and the crayfish using a sticky arrow **(click) (click).**

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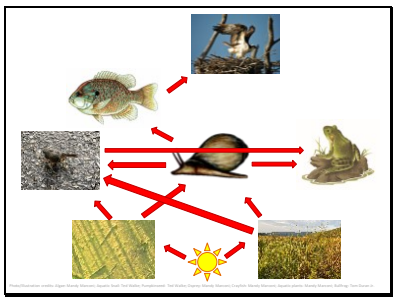
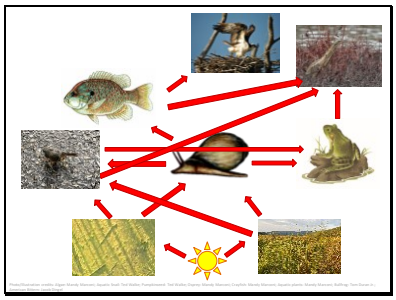


You have two cards left, a bullfrog and an American bittern. Which organism eats aquatic snails? The bullfrog **(click)**. Place the bullfrog to the right of the aquatic snail. Use a sticky arrow to show the feeding relationship between the bullfrog and the aquatic snail **(click)**. Bullfrogs eat a lot of different animals. There is something else on your paper the bullfrog eats. Can you figure out what else a bullfrog may eat? Crayfish. Make a connection from the crayfish to the bullfrog. Remember the arrow points to the mouth of the organism eating something **(click)(click).**

Slide 29



Now you have one card left, the state endangered American bittern **(click**). Determine what organisms on your paper the American bittern eats. Hint: You will need three more sticky arrows. Who can name an organism an American bittern may eat? American bitterns eat the pumpkinseed, crayfish, and bullfrog (**click**). Your food web is done. You just created a realistic food web from “The Muck”. If you ever go there, you might see some of these plants and animals. All these animals depend on each other. There are many more plants and animals that live in this ecosystem. Can you think of any? Ex. Raccoons, dragonflies, other insects, songbirds, beavers, muskrats, snakes, turtles, and other aquatic plants. We could add all those animals to our food web and show the feeding relationships between the different organisms, but we are not going to do that. **(click).**

Slide 30

Sadly, there are threats to marshes and other wetlands. Some of these threats are road salts, animal waste (ex. dog poop), fertilizers, and pesticides. They may runoff into wetlands which can exceed the wetland's natural ability to absorb such pollutants. Another threat is **invasive species**. Invasive species are harmful plants or animals that don't belong in the wetland; they can be introduced on purpose or accidently. They may change the ecosystem to be less diverse and cause animals to leave to another area where their needs can be met. Litter can also enter a wetland and harm wildlife. Can you think of any other threats (Climate change, drought, draining for agriculture or construction, sewage release, dumping, dams that can increase or decrease the flow of water, etc.)? These threats mess up the homes of the plants and animals that live in these wetlands **(click).**

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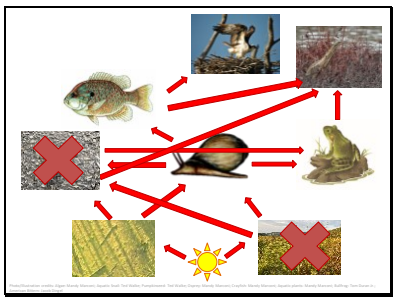

What do you think would happen if pollution made it to a wetland and affected the aquatic plants? Aquatic plants don't have legs to pickup and move away. They may not survive **(click**). What would happen to the crayfish if there are no aquatic plants to feed on? If it's lucky, maybe it could move to another environment and find food, if it cannot move, it may not survive (**click)**. Either way, the crayfish will no longer be in this ecosystem because it had to move away, or it didn't survive. If the aquatic plants and crayfish are no longer in the wetland, what may happen to the bullfrog? Pumpkinseeds also eat crayfish (we didn't show this feeding relationship on our food web). What might happen to the American bittern if there are no cattails to hide in or fish to feed on? Would the American bittern be able to survive in the marsh? Pollution that enters a wetland can change the entire ecosystem. It's our job to make sure this doesn't happen **(click).**

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Have you ever seen litter on the ground? What about oil in a parking lot? Or someone that didn't pick up their dog's waste (poop). This is pollution, and when it rains it can get into our wetlands and other bodies of water. We need to work together to make sure this doesn't happen. We need wetland ecosystems and food webs to be nice and healthy and we can help, and it is easy. If we keep the land clean, we can help keep our wetlands healthy. We can throw away our garbage or recycle it, pick up after

our pets, adults can make sure their cars are not leaking oil, and we can use reusable bags instead of plastic bags that sometimes end up in our waterways. Can you think of anything else that you can do to help protect wetlands? If we keep our yards and streets clean, we can help keep pollution out of wetlands and keep wetland ecosystems healthy for all the organisms that live there **(click).**

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Review what the students have learned and answer any questions they may have.