WAVES, WETLANDS, AND WATERSHEDS

California Coastal Commission Science Activity Guide

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Chapter 3
Some Like It Wet

Earth is home to many creatures with many different needs, from polar bears to snakes. Everything that lives on Earth lives in a *biome*. A biome is an area of land with special plants, animals, climate, and soil. There are many different biomes on Earth. A wetland is a biome, so is a redwood forest and a desert. Biomes have plants and animals that, over time, have grown together to help each other live in their homes, whether their homes are a deep, wet jungle or a dry, sunny desert. Biomes contain a number of habitats that are specific to each biome. Here we will learn more about the wetland biome, the special *adaptations* of plants and animals who live in wetlands, and the many ways wetlands have been used in the past.

Wetlands, also called marshes, are part water and part soil. Sometimes they are covered with water, and other times they look dry but still have water hidden in the soil. Wetlands are found on our coast, near lakes, ponds, rivers and streams, and in inland mountains and river valleys. They can be salt water, fresh water, or a mix of salt and fresh, called brackish water. You may even have a wetland near your home or school.

New words

biome; wetland; adaptations; species; water table; ecosystem; habitat; environment; rare, threatened, and endangered species

Wetlands are one of California's most beautiful biomes, and one of its most special. Because wetlands are the place where land meets water, they provide habitat for plants and animals that live on land and in the water. Wetlands also have important jobs. Water that rushes off land during storms is slowed down when it hits wetlands, where it stays awhile before more slowly entering the ocean or larger bodies of water. Plants and animals thrive in this calm water, and use it for breeding and as a nursery for their young. On the coast, wetlands protect low-lying areas from storm waves—they slow the waves down before they hit dry land. Wetlands provide food and shelter for birds, young fish, small bugs, and other tiny creatures.

The birds, animals, and plants that live in wetlands have special *adaptations* to live in a part dry, part wet world. They have special body types and habits that help them eat and nest in wetlands. Wetland plants and animals rely on each other—they are all part of the wetland food chain. They can't live in a place that is all wet, such as a pond, or all dry, such as a meadow. The water and soil mixture has to be just right for a wetland to be a good home for wetland *species* (plant and animal types). Wetland species have some special adaptations, such as some wetland birds' beaks are just the right length to dig for bugs and worms that live in the mud under shallow water. And bees that live in a dry habitat nearby pollinate some wetland plants. Without these bees, the plants would not survive. These adaptations make wetland species special—many of these species can live no

California Coastal Commission Area of Critical Concern: Wetlands

Relevant California Science Content Standards, Grade 3: Life Sciences 3. a.-d

Grade 3 Activities

These activities will help students learn more about the roles wetlands serve as habitats, about a salt marsh food chain, and how some birds have adapted to become very picky eaters, limiting them to the habitats in which they can survive.

Activity Goals

3.1 Wetlands at Work

Students will:

1. Understand the beneficial functions of wetlands and how they are related to the students' needs.
2. Know that wetlands are a biome with unique habitats for many plants and animals.
3. Understand that wetlands have been used over the course of California history, and are considerably changed today.

3.2 Marsh Munchers

Students will:

1. Learn about the ecological roles salt marshes play.
2. Reinforce understanding of the concept of a food web.
3. Use body movement and pantomime to simulate the feeding motions of marsh animals and identify their interconnectedness in a food web.

3.3 Fill the Bill

Students will:

1. Understand the concept of adaptation.
2. Learn how adaptation in birds can lead to limitations in what they can eat and where they can live.

place other than wetlands. In fact, wetland habitats are home to 43 percent of the federally listed endangered and threatened species.

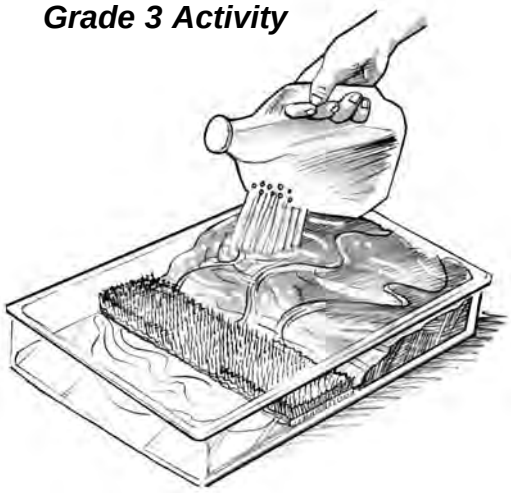
Wetlands are important places for birds that migrate with the seasons. These birds travel long distances and need a safe place to rest and pick up a bite to eat along the way. Wetlands serve this purpose.

Huge flocks of migratory birds use freshwater marshes, but their numbers have been declining because of the activities of humans. The largest remaining fresh water marshes in California are the Creighton Ranch Reserve, a relict of Tulare Lake, the San Joaquin Marsh Reserve in Orange County, and the Gray Lodge north of Sutter Buttes, the most intensively used wetlands in the Pacific Flyway. Freshwater marshes once covered the Great Central Valley, where runoff from the mountains accumulated in basins.

Today, many wetlands are near big cities that are growing fast. In the past, the value of wetlands was not well recognized, so people often filled them in with dirt to create more buildable land. As a result, a lot of wetlands were destroyed, and many of the plants and animals that depend on wetlands have become rare or endangered. A plant or animal is *rare* or *endangered* if it is in danger of becoming extinct soon. Nearly 75 percent of rare or endangered bird species rely on wetland habitats. See the concept map on page 12 to see how the many facets of wetlands relate to each other, and to us.

To protect wetland plants and animals, the state of California has created laws that limit the amount of development that can occur in wetlands. This way, wetlands can still do their many important jobs: provide homes and nurseries for specialized plants and animals, slow down water when it runs off from land, protect coastal areas from big waves, filter out sediments and contaminants, and be wonderful, peaceful places for us to enjoy.

Grade 3 Activity



Science skills

- Gathering and analyzing information
- Predicting
- Experimenting

Concepts

- Wetlands are important parts of California watersheds.
- Wetlands protect our coast.
- Wetlands slow down water runoff, filter it, and release slowly over time.
- Wetlands support life forms adapted to a part wet, part dry habitat.

California Science Content Standards

3. Life Sciences
Adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept:
3.b. Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grasslands, and wetlands.
3.c. Students know living things cause changes in the environment in which they live: some of these changes are detrimental to the organisms or other organisms, and some are beneficial.
3.d. Students know when the environment changes some plants and animals survive and reproduce; others die or move to new locations.

Activity 3.1
Wetlands at Work

Students learn what makes a wetland, and observe or create a model that demonstrates the buffering and filtering effects of wetlands.

Background

Most of California's wetlands have already disappeared from the landscape, and only now are we beginning to see the consequences and realize the importance of this previously overlooked habitat. Wetlands serve critical biological and physical functions.

Biological functions of wetlands include:

- Wetlands are a source of *high primary productivity and habitat* for year round and migrating bird and fish species.
- Wetlands have important roles in *providing for humans*; they provide recreation, flood protection, water quality maintenance, and food.
- Wetlands are *nurseries* for 75-90 percent of all the fish and shellfish harvested in America. This natural resource accounts for $111 billion dollars in sales and provides one and a half million jobs.

Physical and hydrological functions of wetlands include:

- *flood control* in low-lying areas; they act as protective natural sponges by capturing, storing, and slowly releasing water over a longer period of time.
- *storm buffers*: coastal marshes can dissipate wave energy.
- *reduce erosion*: wetland plant roots hold soil in place, reducing erosion caused by tidal action.
- *ground recharge to aquifers*: freshwater wetlands collect water.
- *improve water quality*: wetlands act as sediment sinks, effectively trapping, precipitating, and recycling waterborne constituents from run-off. Wetland plants remove small amounts of nutrients, trace metals, and other compounds and incorporate them into plant tissue. Artificial wetlands are used to treat wastewater.
- *contribute oxygen*: the highly productive wetland plants contribute oxygen to the atmosphere through photosynthesis.

This activity focuses on the physical and hydrological functions of wetlands—how wetlands work from the ground up. Because of the unique factors that create wetlands over time, a balance is created of soil, moisture, and plants. Once wetlands are permanently drained, the conditions that created such productive soils are lost, along with their benefits, and once a wetland is altered this balance is difficult to restore. Understanding the unique natural features found only in wetlands reveals why they are so important to plants and animals, including humans.

This activity is divided into two sections, *Build a Working Wetland* and *From Marsh to Marina.* Because of the length of the activities, it is advised to conduct them on different days.

California Mathematics Content Standards

Number Sense

3.2. Add and subtract simple fractions (e.g., determine that 1/8 + 3/8 is same as 1/2). (Extension #2.)

California English-Language Arts Content Standards

Writing

1.1. Create a single paragraph:
a. Develop a topic sentence.
b. Include simple supporting facts and details. (Extension #4.)

2.2. Write descriptions that use concrete sensory details to present and support unified impressions of people, places, things, or experiences. (Extension #4.)

California History-Social Science Content Standards

3.1.1. Identify geographical features in their local region (e.g., deserts, mountains, valleys, hills, coastal areas, oceans, lakes). (Extension #3.)

3.1.2. Trace the ways in which people have used the resources of the local region and modified the physical environment (e.g., a dam constructed upstream changed a river or coastline).

Vocabulary

Runoff, flood retention, sedimentation, wetland buffer, basin, soil erosion

Objectives

Students will:

- Define and identify a wetland.
- Understand that wetlands are a biome with unique habitats for plants and animals.
- Identify the beneficial functions of wetlands to the ecosystem.
- Relate the beneficial functions of wetlands to their daily lives.

Activity 3.1a
Build a Working Wetland

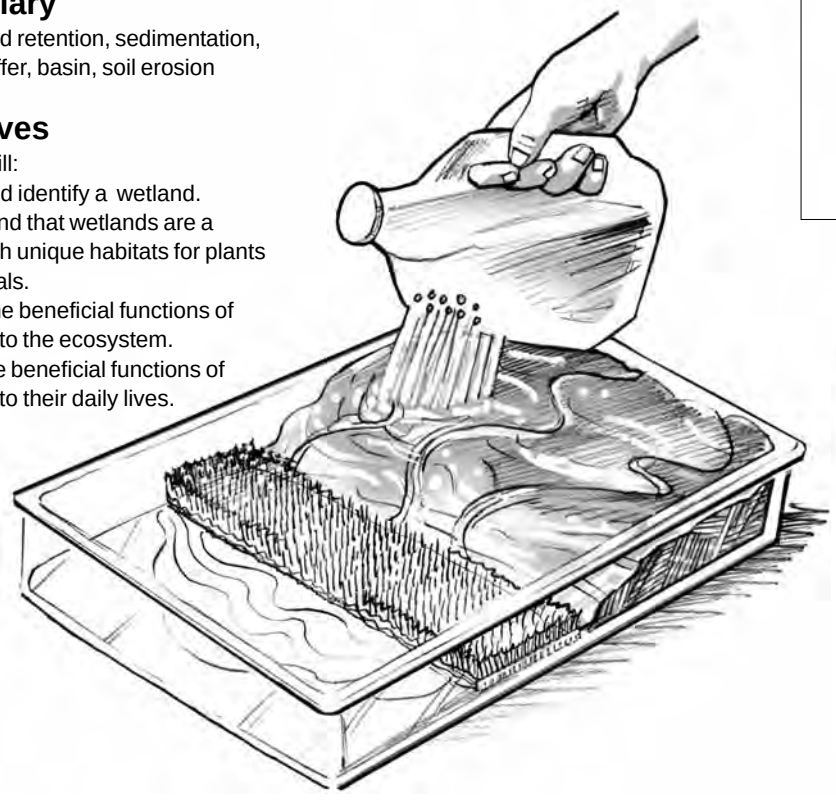
Note: this activity may be completed as a teacher-led demonstration or a small group hands-on activity (small group activity, 2-4 students per model, is recommended). Adjust instructions to meet either case.

1. Ask students what they know about wetlands. What is a wetland? Have they ever been to one? Are they large or small? How can you tell if someplace is a wetland? Students will learn what a wetland is and why wetlands are special places. *Wetlands have unique qualities: part wet, part dry; shallow basins that collect water. Wetlands perform important functions: filtering pollutants and sediments from runoff, reducing flood damage, and preventing soil erosion. Wetlands provide a special habitat for plants and animals adapted to a part wet, part dry environment.* Project the concept map (see "Wetlands at Work" worksheet) on an overhead projector and discuss with students.

2. Create a wetland model or provide materials for students to create their own. Discuss its features (*sprinkling can is rain, clay is watershed, carpeting or sponge is wetland, and catch basin is water body or ocean at end of the watershed*). The model will demonstrate these functions. **PREDICT**. If we make it "rain" on the watershed before we put in the wetland, what do you think will happen to the rainwater? (*Rain runs downhill and pools up at the lowest end.)*

Make a Wetland Model

1. Spread layer of modeling clay in half the pan to represent land. Leave other half empty to represent lake or ocean.
2. Shape clay in pan to gradually slope down to water. Smooth along sides of pan to seal edges. Make meandering streams in clay that lead to water.
3. Cut indoor-outdoor carpet, sponge, or florist's foam to fill the space across the pan along the edge of the clay. This represents a wetland buffer between dry land and open water. This must fit well—the model won't work if there are large spaces under the wetland or between it and the sides of the pan.



Time to complete

Activity 3.1a: 90 minutes if students make models in small group activity; 50 minutes for teacher-led demonstration.
Activity 3.1b: 50 minutes or less.

Mode of instruction

Classroom demonstration or independent group work with classroom discussion.

Materials

1. Photocopy of "Wetlands at Work" and "From Marsh to Marina" worksheets, one for each student. Overhead transparency of "Wetlands at Work."
2. Overhead projector
3. For each model (Activity 3.1a):
   - Modeling clay
   - Long shallow pan: a 13" x 9" baking pan, or a roller paint pan
   - Scraps of indoor/outdoor carpeting, florist's "Oasis" foam, or sponges
   - One-half gallon plastic milk jug w/lid
   - Cup of soil
   - Jar of muddy water

Preparation

Teach this as an alternation between teacher-led discussion and demonstration, or, if students make their own wetlands, as a discussion with activity completed by groups.

Outline

Before class

1. Review background information.
2. Photocopy two worksheets and overhead transparency.
3. If teaching this as a demonstration, make the wetland model.
4. If students are making the model, assemble materials.
5. Make the milk jug sprinkler.
6. If doing extensions, check section for materials to decorate models.

During class

1. Discuss the usefulness of models.
2. Review with students; list characteristics of a wetland on board.
3. Hand out "Wetlands at Work" worksheet.
4. Conduct demonstration or lead students in small group activity.
5. Students complete worksheet, whole class discussion on responses.
6. Pass out "From Marsh to Marina."
7. Students complete worksheet, whole class discussion on results.

3. Fit the piece of carpeting or sponge into the wetland area, and sprinkle some "rain" on the land. **Compare results to prediction.** Students observe and describe what is happening. (*Some of the water is slowed down by the wetland carpeting.*) Excess runoff slowly flows into the body of water. Point out the wetland absorbed some of the water (pick up the wetland and squeeze some water out to prove it).

4. **PREDICT:** What do you think will happen if the wetland is removed? (*The water will not be absorbed; it will flow more quickly into the body of water.*) Remove the carpeting and pour out water. Pour the same amount of water on model at the same spot and rate as before.
Compare results to prediction. Have students note differences. *(The water should fill the body of water much more quickly and may eventually overflow and flood the land that is no longer protected by the wetland. Most wetlands are shallow basins that collect water and slow its rate of flow and retain water for a time. This slowing process reduces flooding and soil erosion.)*
PREDICT: If a wetland is filled in and houses are built on the fill, what might happen to the houses during a severe rainstorm? Why? (*They might be flooded because the wetland will not be there to absorb and slow the rush of water from higher ground.*)

5. Pour the water from the last demonstration out of the model, squeeze out and replace the piece of carpeting. Explain this demonstration will be just like the first, except soil will cover the clay.
PREDICT: What do you think will happen to the bare soil when it rains? (*The rain should pick up and carry some, but not all, of the sediment over the land and into the body of water, representing topsoil erosion.)*

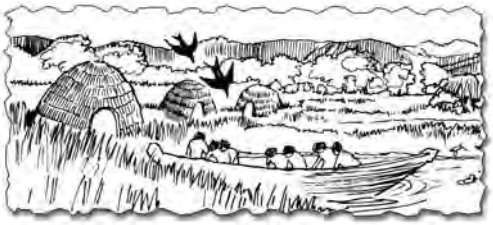
6. Spread soil over the clay and make it rain, or pour muddy water from jar onto the land. This water represents polluted runoff and sediment from the watershed.
Compare results with prediction. Compare the water that ends up in the body of water with the water in the jar. What do you think happened? Discuss results. *(Soil particles trapped by carpeting, which made water in catch basin much clearer than the muddy water in the jar. The "uphill" side of the wetland should be coated with trapped sediment.)*

7. Remove carpeting, pour out basin, and try experiment again. What happens without the wetland in place? Ask: Why did all the dirt particles end up in the body of water this time? (*The thick mat of plant roots traps silt and filters out pollutants as the carpet or sponge did in the model. Silt and pollutants end up in lakes, rivers, and other waters.*)

3.1.a. Results and reflection

Students write their answers on the "Wetlands at Work" worksheet.
1. What happens where there is no wetland? (*Silt and pollution rushes into the body of water.*)
2. How might muddy water affect fish? (*It is harder for them to see and breathe with clogged gills, could lead to their death.)*
3. How might the muddy water affect other animals and plants? (*Settling sediment smothers bottom dwelling animals who filter feed, blocks sunlight*

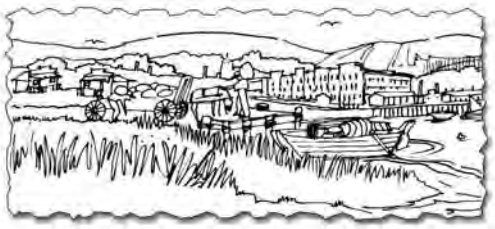
needed for plant growth, lowers visibility of animals who fish, introduces toxins and eliminates food sources, disrupts food chain)
4. How might all of this affect students' lives? (*Decrease in natural resources and food sources; decline in quality of drinking water [freshwater wetlands only]; impacts on recreation such as swimming and fishing; change in how things look; changes in economy from fewer harvestable species.*)



Activity 3.1b
From Marsh to Marina

Salt marshes can be great places to make a living! Native Americans living along the coasts knew this—so did the earliest European settlers. This activity gets students to think about how people have used (and abused) salt marshes over the years.
(From Marsh to Marina was adapted from *NatureScope: Wading into Wetlands*, National Wildlife Federation. Learning Triangle Press, 1997. Reproduced with permission of The McGraw-Hill Companies.)

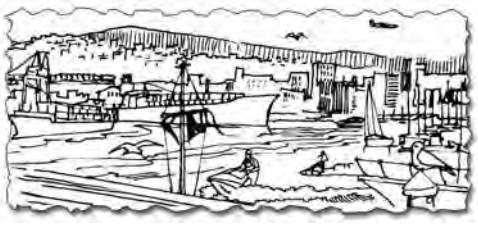
1. Pass out "From Marsh to Marina" worksheet and a blank piece of paper. Explain that the pictures represent ways people used salt marshes through time. You may want to let the students color the pictures. Have students cut out the pictures and try to arrange them in order, from top to bottom, from past to present.



2. When everyone has finished, go over the answers. Students glue pictures in correct order, and label the time period of each picture:

Picture 1: 1600	Picture 4: 1950
Picture 2: 1700	Picture 5: 2000
Picture 3: 1850	

3. Use the following information to talk about each picture:
Picture 1. Native Americans were the first people to use the resources of California's salt marshes. In the West, the Miwok, Chumash, and Ohlone tribes depended on the salt marshes along the Pacific Coast. The Native Americans found game in salt marshes—especially in the fall, when huge flocks of ducks and geese migrated through. Native Americans gathered oysters, clams, and other shellfish in the tidal creeks of salt marshes; built special fish traps out of brush; and scooped trapped fish into buckets.
Pictures 2. Many Europeans settled near salt marshes during the 1700s and 1800s. Living near the marsh wasn't an easy life. Europeans were unaccustomed to the mosquitos and other biting insects. Cattle would occasionally have to be destroyed when they sank too far down into the marsh mud to be rescued. But there were advantages to marsh living, too. There was plenty of food, and the vast fields of salt marsh hay made good grazing grounds.



Picture 3. By the late 1800s, many salt marshes in North America were settled. People began to have a big impact on the ecology of the land. Have the students compare this situation with that depicted in Pictures 1 and 2. When there were few people, the marsh could easily recover from their impacts, but with more people, the damage is more serious and long-lasting. Students may name the ways they see that the people are affecting the marsh.
Pictures 4 and 5. By the 1950s, people had drastically changed many original salt marshes. Few people recognized the marshes' importance in their natural state. To turn them into "useful" places, they filled them in

and built airports, houses, and buildings. Students may determine how the wildlife in Picture 1 and Picture 5 differ (*fewer species in picture 5; shorebirds, deer, and other salt marsh animals gone; few places for birds*).

Results and Reflections

Students describe what could happen to water, sediments, homes, and wildlife when wetlands are destroyed. This can be accomplished either by writing a simple paragraph, or creating an illustration of a wetland that has been filled, drained, or paved over, and subsequent effects on plants, animals, and humans.

Conclusions

Wetlands are important parts of the watershed and the natural landscape. They provide beneficial services such as filtering sediment out of water, and slowing down the rate at which the water enters larger bodies of water, as well as providing habitat for many native species. Wetlands have been used for many purposes throughout history, but are now vanishing. Without wetlands, plants and animals that depend on this unique environment will disappear.

Extensions and applications

1. Have students landscape the models with plants and animals attached with toothpicks. Use an assortment of materials. Some ideas:
   - Cotton swabs for cat tails. Paint sticks green and cotton brown, or paint toothpicks green and stick bits of brown clay to the tops.
   - Long pine needles for reeds. Make trees by gluing pieces of green sponge onto twigs. Dried flower heads make nice trees.
   - Photocopy, cut, and color wetland creatures from page 19 and glue them onto toothpicks.
2. Almost all of California's wetlands have been filled. Only 10 percent remain. Demonstrate with 10 blocks: take 9 away, what is left represents how many wetlands remain. Only 1/10 remain. What fraction has been filled?" i.e. 10/10 – 1/10 = ?
3. Students may identify a wetland in the local area (see Appendix B) and relate information to their community.
4. Have students write a paragraph, containing a topic sentence and at least three supporting sentences, to describe their experience if they were a wetland plant. What would they see, hear, smell and feel?
5. Have students read a book about a wetland plant or animal (such as an egret, pickleweed, or leopard shark) and complete a book report.

ANSWER KEY
1-C, 2-A, 3-E, 4-B, 5-D

Adapted from

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Wetlands at Work

Answer these questions after your teacher has shown the wetland model.

1. What happens where there is no wetland?

_____

_____

2. Can fish live in muddy water or water with pollution in it? Can they see, or breathe?

_____

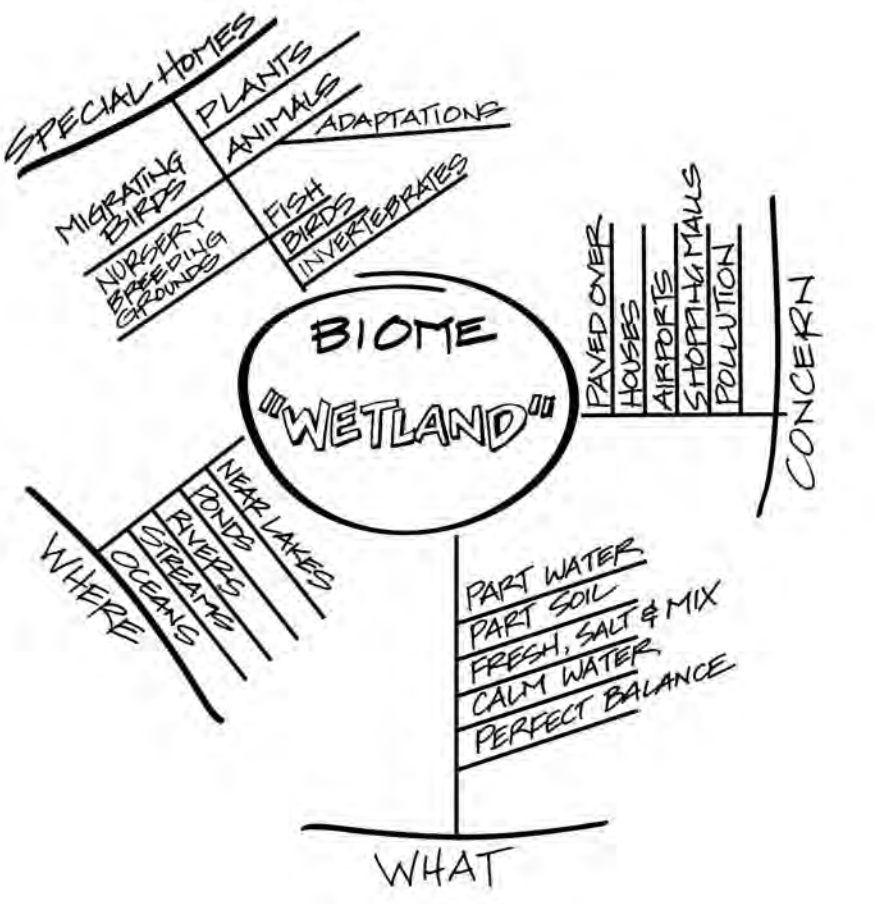
_____

3. Can other plants and animals live in the muddy or polluted water?

_____

_____

4. Here are words that tell why wetlands are special. Draw a picture of a special wetland.



From Marsh to Marina