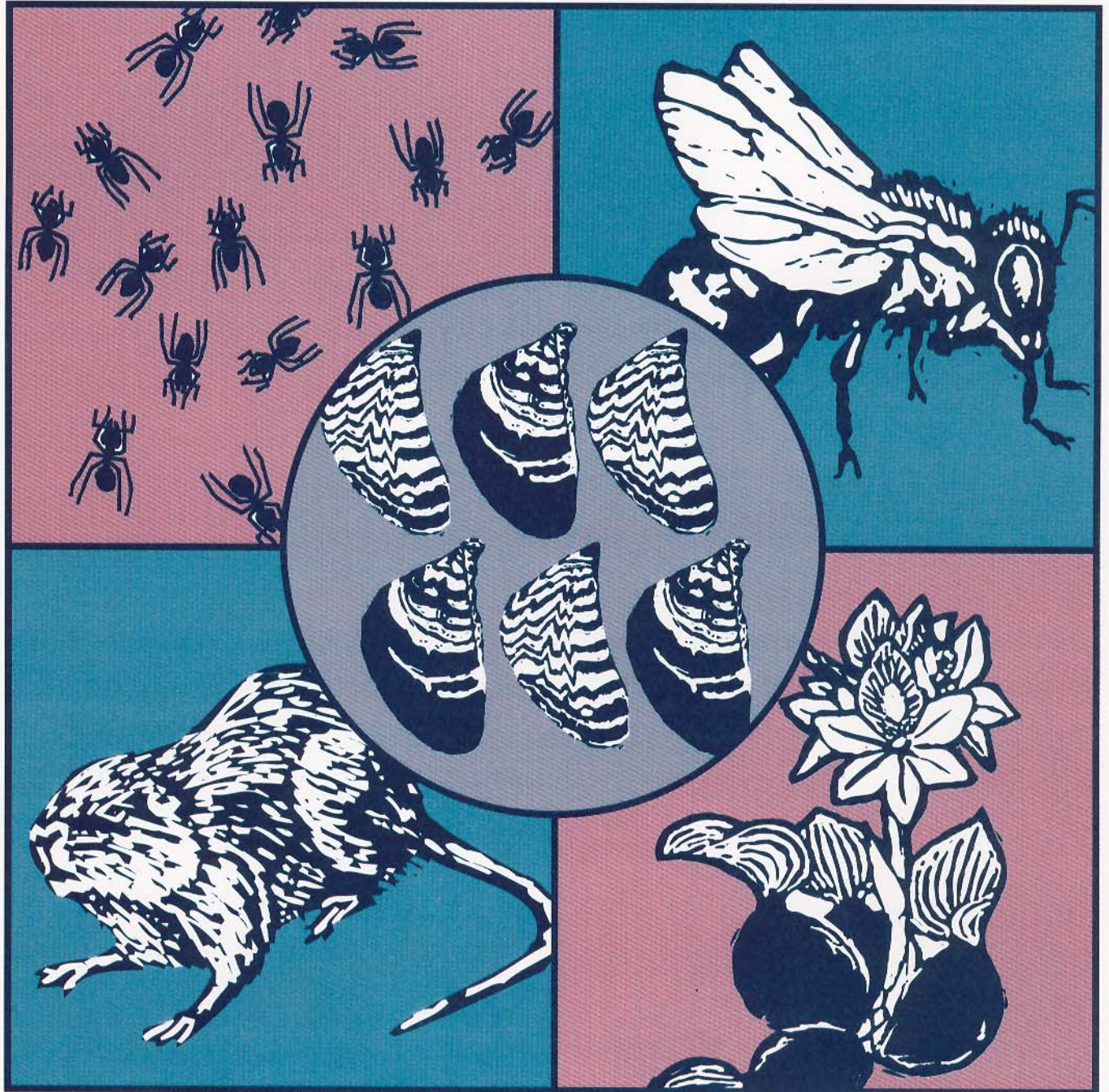
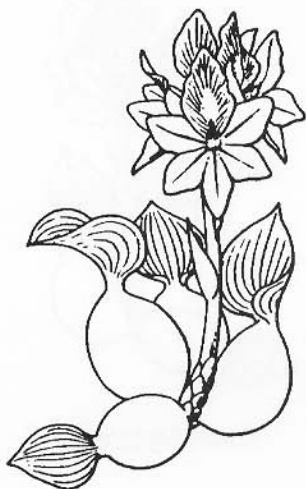


EXOTIC SPECIES



EXOTIC SPECIES IN THE GULF COAST REGION



Water Hyacinth



Kudzu



Nutria



Zebra Mussels



Argentine Fire Ant



Africanized Honey Bee

ACTIVITY I

WHAT ARE THE ADAPTATIONS OF WATER HYACINTHS?

(Teacher Instructions)

Objectives

- To practice making observations and inferences
- To identify adaptations in water hyacinths

Description

Students will work in groups to identify the structural adaptations of water hyacinths and tell why the adaptations are helpful for survival.

Materials (per group)

Small clump of hyacinth plants (roots, stems, leaves)
Scapel or scissors
Small plastic tub or 5 gallon aquarium

Preparation

1. Obtain enough water hyacinths for each group to have a small clump of plants. They can be found in ditches, marsh channels, bayous, and ponds throughout the Gulf Coast region from May to frost.
2. Before class, fill each tub or aquarium with water and add one clump of hyacinth.

Procedure

1. At the designated point, stop the video tape. Have each group observe their hyacinth plants and make a list of the external characteristics.



Water Hyacinth

2. Have one student in each group break a single stem loose from the clump and, using a scalpel or scissors, cut crosswise through the stem. Have the students make additional observations.
3. Based on their observations, students should suggest how each of the hyacinth's characteristics has helped it to successfully adapt to an aquatic environment.
4. Using suggestions from each group, make a list on the board of the water hyacinth's adaptive characteristics. (**Information on the hyacinth in the Background section will be helpful.**) Compare and contrast the hyacinth to other aquatic plants such as water lilies, duckweed, and algae.
5. Continue the video, alerting students to check their observations with those provided by the narrator.

ACTIVITY II

INTRODUCE AN ALIEN!

(Teacher Instructions)

Objectives

- To identify adaptations that help various types of organisms survive.
- To predict the impact of an exotic species on a food web

Description

Students will read the description of a specific habitat and make inferences about environmental conditions within that habitat. They will then create an exotic (alien) species with adaptations designed to help it survive in the habitat. The students will predict the impact of the exotic on the habitat's food web and project its success/failure in its adopted environment.

Materials

Student instruction sheets for "Introduce an Alien!"

Habitat/Food Web Cards

Plant and Animal Cards

Unlined paper and pencils or pens

Markers or colored pencils

For the Plant and Animal Cards and the Habitat/Food Web Cards, copy matching pages (for example pages 17 and 18) on the back and front of one sheet of paper then cut and laminate the cards.

Procedure

1. Divide the class into groups of 3-4 students each.
2. Give each group a Habitat/Food Web Card, a Plant Card, an Animal Card, and a piece of unlined paper.
3. As a class, read the student instructions (page 16) step-by-step. Allow time for the students to interact and discuss options within their group at each step.

4. Help students synthesize the information about the habitats and food webs. Guide them, as necessary, in making inferences about the habitats. Inferences may include the following:
 - **Grassy Meadows:** sunny area, soil contains decaying organic material, wide variety of life, animals tend to be small, trees are nearby.
 - **Rivers and Streams:** wet area, wide variety of wildlife in and around the water, land and water come together at the shore or bank, water speed (current) is important.
 - **Salt Marsh:** rapid temperature and salinity changes, rich sediments, muddy with shallow water, water level changes with the tide, contains a variety of life, sunny, no trees — mostly grass.
 - **Pine Forest:** a few broadleaf trees are present but the dominant trees are pines, may have an understory of shrubs and wildflowers, shady, age of forest determines the variety of plants, and therefore the animals that live there.
 - **Sandy Beaches:** sunny, only the tough organisms survive — they must endure wind, salt spray, and the pounding of waves — getting food requires special adaptations, a large variety of animals live in the water, soil is sandy.

5. Allow time for students to complete the activity. Provide guidance as needed.
6. Have each group describe its alien species to the class.

Extension

Have students sketch or make a model of their habitat showing the presence of both native and exotic species. Display these on walls or in a media center, library, or other appropriate area for students, teachers, and parents to view.

INTRODUCE AN ALIEN!

(Student Instructions)

You are about to create a new exotic (alien) species and introduce it to a foreign environment. Read and follow the steps listed below to complete the assignment.

1. Read your Habitat Card. List the characteristics about the habitat that you need to remember in creating your new species.
2. A food web that occurs in the habitat is illustrated on the back of your Habitat Card. Study the food web and imagine how all the organisms in the habitat contribute to the well-being of each other and the habitat as a whole. Notice that some animals eat plants and others eat animals.
3. Now, look at your Plant and Animal Cards. Notice the questions on the back of the cards. Answering these questions will help you to describe the organism you are about to create. Work with your group to answer each of the questions.
4. Within your group decide whether to create an exotic plant or animal.
5. After agreeing on its characteristics and adaptations, draw a sketch of your alien species.
6. Include a food web, using the Habitat/Food Web Card as a guide. Show where your exotic fits into the food web.
7. Predict the impact of your exotic species on the habitat. Will any native species die out? How successful will your organism be in finding food, protecting itself, and adapting to the habitat? What benefits might it have? What harm might it cause?
8. Select one group member to describe your alien to the class. Everyone should be prepared to answer questions the class or teacher might ask.

**PLANT
CARD**

**PLANT
CARD**

**PLANT
CARD**

**ANIMAL
CARD**

**ANIMAL
CARD**

**ANIMAL
CARD**

Plant Adaptations

1. What are the plant's requirements for food, soil, water, light, and temperature?
2. What are its growth habits? (fast or slow growing? tree, shrub, vine or wildflower?)
3. What pollinates this plant?
4. What special adaptations does this plant have (thorns, poisons, color, scent, shape, etc.)?
5. How big does this plant grow?
6. How did your species get here?
7. How will you control it?

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Animal Adaptations

1. What does the animal eat?
2. In what temperature range is the animal active?
3. How does it reproduce? How often? In what numbers?
4. What is the behavior of the animal? (passive or aggressive)
5. Are there any other special adaptations (color, size, location of body parts, poison, claws, stingers, and fangs)?
6. How did your species get here?
7. How will you control it?

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HABITAT — FOOD WEB CARD

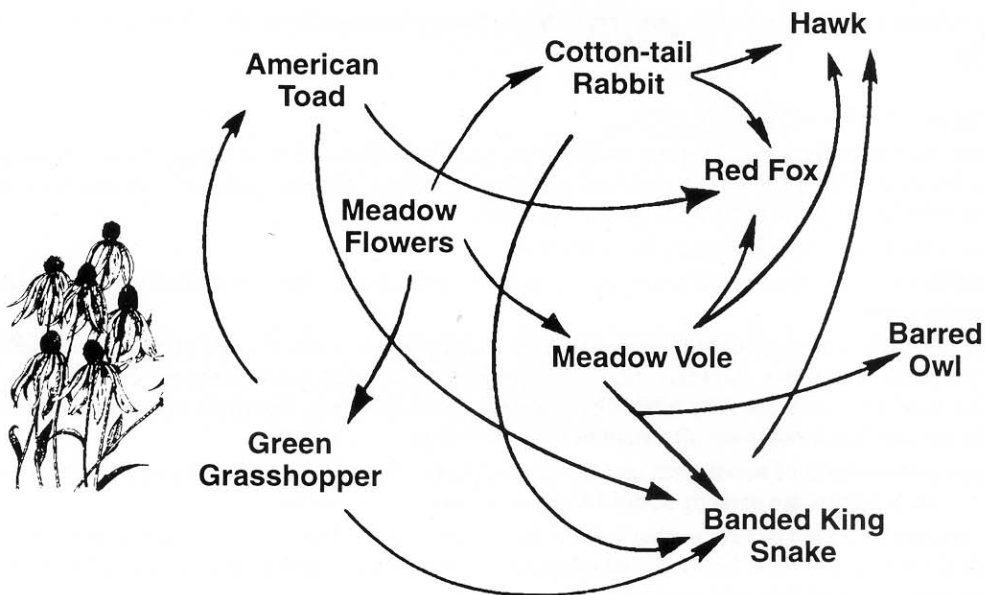
GRASSY MEADOW

In the Gulf Coast area, a grassy meadow is usually a temporary clearing in the midst of a forest, along a forest edge, or along a roadside. Some facts you should know in order to create an alien species that can live in a meadow are:

- Plants here thrive with a full day of sun, but do not grow well in shade.
- Grasses are successful because they spread through a network of underground stems. They do not have to rely on seeds to reproduce.
- Flowers are pollinated by wind. Their seeds are light and blow freely to new areas.
- As old leaves rot, they act as compost — they hold moisture in the soil, shade roots, and return nutrients to the soil.
- A thick mat of grasses and decaying leaves develops in the meadow, keeping most other plants from growing. Exceptions include wildflowers such as goldenrod, meadow beauties, and clovers, which force their way through the mat in early spring.
- Flowering plants attract insects that feed on them and help in pollination.
- Animals that live in the meadow include worms, insects, toads, snakes, tortoises, birds, and mammals. Mammals such as rabbits and mice eat plants and their seeds. Other mammals such as moles and shrews eat insects. Reptiles like snakes feed on small mammals and birds. Birds of prey — the hawks and eagles by day and the owls by night — also scan the meadow in search of food such as mice and small birds.
- Some animals find shelter in the ground or on the plants, while others return to trees that surround the meadow.

The grassy meadow may seem like a sunny and serene playground for buzzing insects, but in reality, it is an area of fierce competition for food, space, and shelter.

GRASSY MEADOW



HABITAT — FOOD WEB CARD

SANDY BEACH AND DUNE

Sandy beaches form as erosion breaks rocks into tiny grains of sand. Currents and wind move the grains of sand up and down the beach forming swells called dunes. Some facts you should consider in creating an alien species that can survive on the sandy beach are:

- Sea oats are plants that help hold grains of sand together on a beach. They grow horizontal, underground stems called runners that produce the blades of a new sea oat plant. These blades trap blowing sand to help form sand dunes.
- Plants must be adapted to the drying conditions caused by the perpetual wind. Some have a waxy covering on their leaves. Other plants prevent water loss by tilting their leaves away from the sun. Some store water in thick stems, and others have many fibrous roots that provide an increased surface area through which water and minerals can be absorbed.
- Animals living closest to the surf are the toughest for they are pounded by waves, tumbled by backwash, and then exposed to the drying sun and wind.
- Animals that live higher up the beach must endure high winds, salt spray, higher temperatures, and dry surface conditions. Their food often consists of dead organisms washed ashore by waves.
- Creatures such as coquina clams and mole crabs burrow into the sand when they are not scouring it for something to eat. Ghost crabs emerge from their holes to feed, while the clams filter food from the water.
- Various species of birds patrol the shoreline for food.
- Nocturnal animals like raccoons and opossums search the beach for food.
- Sea turtles and horseshoe crabs lay their eggs on the beach.
- Animals that live in the dunes include small reptiles and mammals; these attract bird predators such as hawks. Insects and their predators are also common in dune areas. Bog plants such as gentians and bayberries are found in the moist hollows between dunes.

Each beach inhabitant has special adaptations that allow it to live in this rigorously drying environment. Some adaptations allow the organisms to store water or to go for long periods without moisture while others enable them to hide.

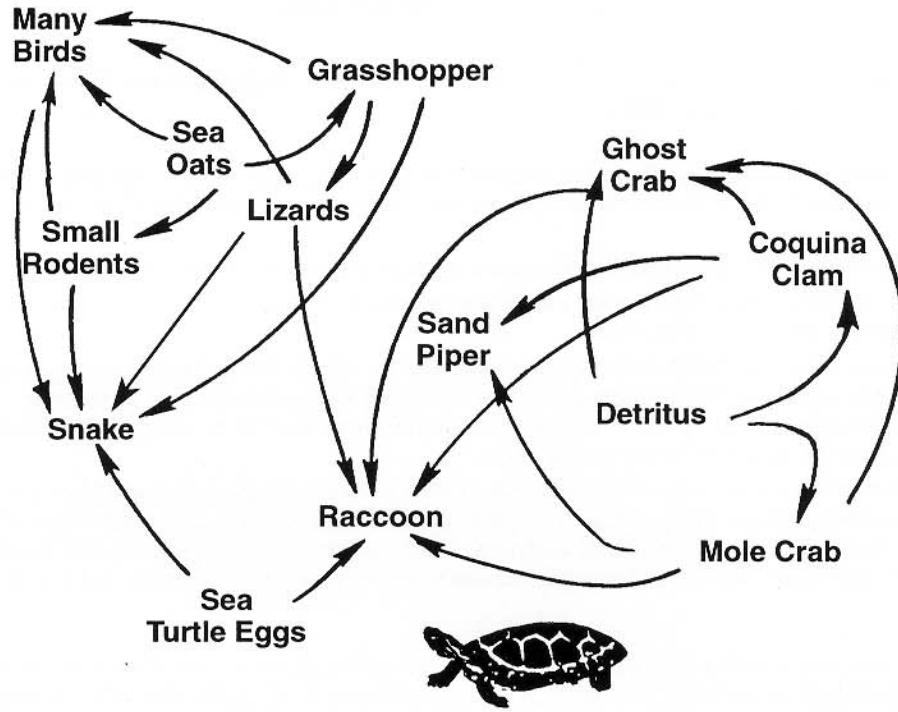
HABITAT — FOOD WEB CARD

PINE FOREST

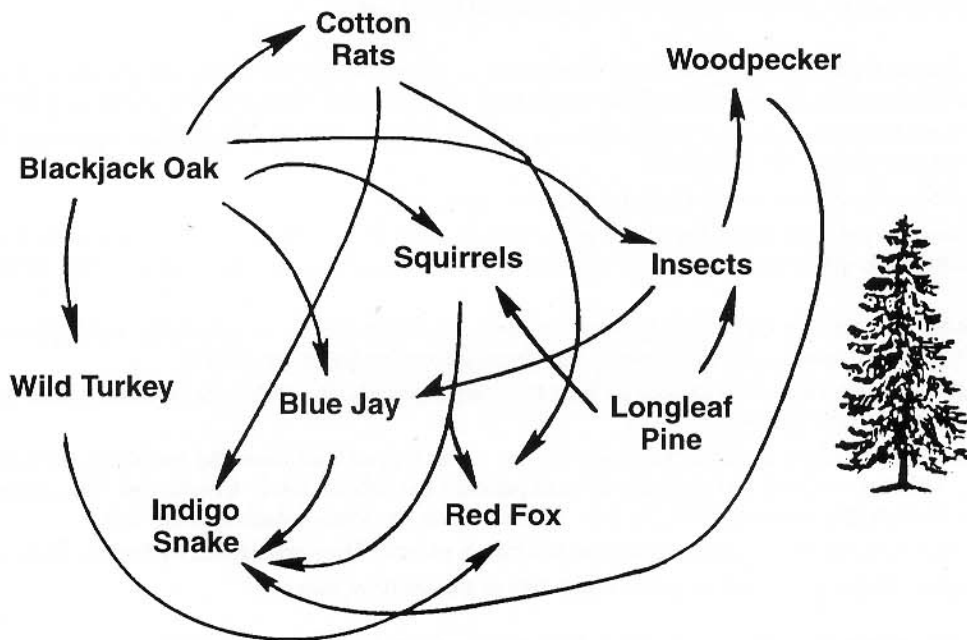
Many of the Gulf Coast's forests are dominated by pine trees. Some facts you should consider when designing an alien to live in a pine forest are:

- The soil of the pine forest is sandy and slightly acidic.
- Wild fires help to clear out the understory of slower growing hardwoods such as oak and hickory trees. Pines can survive these fires because of their thick bark and high growing branches. The saw-palmetto quickly recovers from a fire because new leaves grow from its large root to replace burned ones.
- Young pine forests have thick canopies that shade the understory.
- Ground-dwelling wildlife find little food in the young pine forest but animals that feed on bark-insects can find a wealth of food on pine trunks.
- As the pines get older, they allow enough light to the understory to support some other types of plants — deer's tongue, partridge pea, and poison ivy. Animals such as white-tailed deer, mice, and rabbits eat these plants. The understory provides food and cover for song birds like warblers and nuthatches. Squirrels, raccoons, wild turkeys, woodpeckers, bobcats, and black bears are all native to the pine forest.
- Old growth pine forests are mixtures of needle leaf and broad leaf plants. In this mixed forest you can find many species of oak trees; their acorns are used by about 185 different species of wildlife.
- Older pines may be infected by a kind of fungus that softens their inner wood. These trees are valuable nesting sites for the red-cockaded woodpecker. The holes this woodpecker makes may be used as hiding places by other wildlife like flying squirrel, bluebirds, and wood ducks.
- The gopher tortoise digs tunnels in the soil. These tunnels are then used for hiding and protection by other wildlife.

SANDY BEACH & DUNE



PINE FOREST



HABITAT — FOOD WEB CARD

RIVERS AND STREAMS

In a rainy area like the Gulf South, many rivers and streams drain the land. Some facts you should consider when designing an alien to live in a river or stream are:

- The speed of the river or stream depends on the amount of water in it and the slope of the land. Although most land in the Gulf Coast area is flat, at times enormous amounts of water from heavy rains flow over it toward the Gulf of Mexico.
- Some streams are clear. Others are a rich brown stained by dead vegetation. Others are muddied by eroded soil.
- Plants growing in or on the edges of rivers and streams must be able to adapt to the speed of the water, the changing water level, and the sediments in the water.
- In rivers and streams where the waters flow rapidly, currents carry the food and dissolved oxygen needed by aquatic organisms. Plants and algae that live here quickly recover after strong currents tear them apart. Some plants like watercress are flexible and have slick coverings so that water flows over them easily. Plants such as mosses form great cushions so that water flows around them.
- In rivers and streams where water does not flow rapidly, plants such as cattails, reeds, and lilies may grow. These plants offer food and shelter to many animals, including fish, like bass and bream, amphibians like frogs and salamanders, reptiles like water snakes and snapping turtles, insects like mosquitoes and dragonflies, and birds like kingfishers and bank swallows. Raccoons and otters are mammals that search for food at the edges of rivers and streams.

Water and land are intertwined in this habitat. Runoff from rain provides nutrients and water for aquatic organisms. Land organisms may depend on water for a variety of supplies, including food and shelter. (For example, cattails, with their roots in the water, provide a place for red-wing blackbirds to build nests.)

HABITAT — FOOD WEB CARD

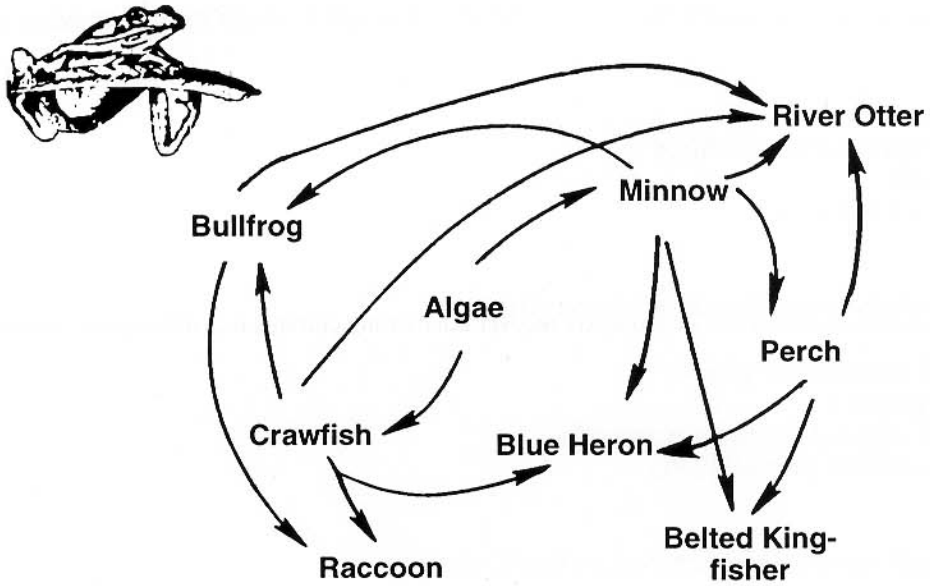
SALT MARSH

The salt marsh is a highly productive area that links the oceans with fresh water rivers and streams. Some facts you should consider as you design an alien species to live in the salt marsh are:

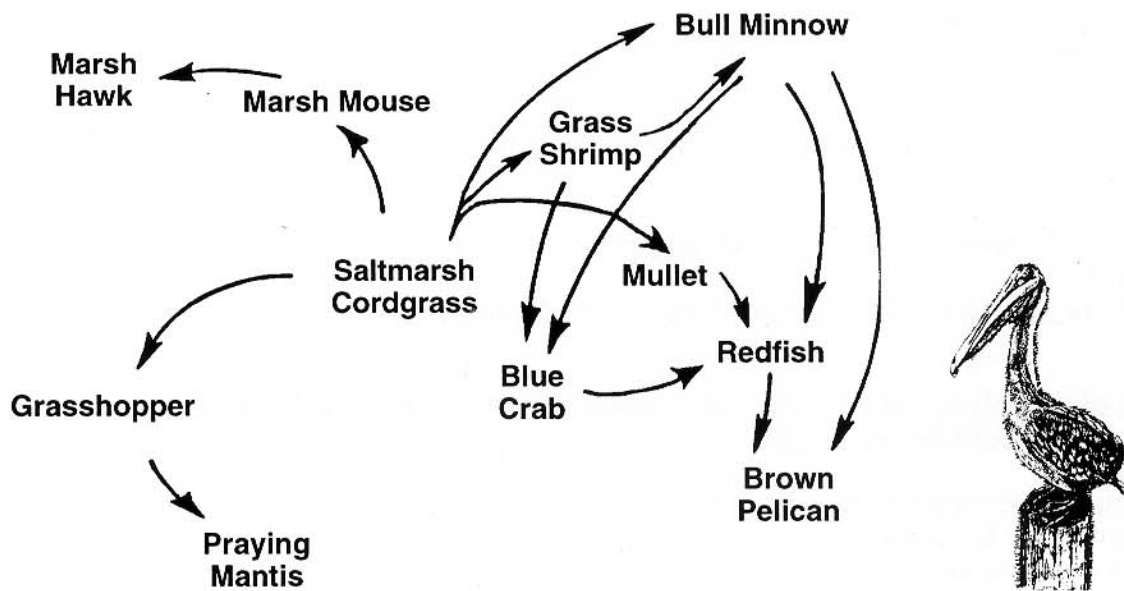
- All organisms that live here must adapt to harsh conditions — daily rise and fall of the tide causes periods of wetness and dryness and variations in salinity occur with each influx of fresh water from rain-swollen rivers.
- All organisms must have adaptations that allow excess salt to be removed from their bodies. *Spartina*, a marsh grass, excretes salt through its leaf pores.
- Sediments provide a rich bottom in which many different plants grow.
- Common grasses growing throughout the marsh are cordgrass and black needlerush. The tides wash dead fragments from these grasses into the marsh channels. This detritus becomes the basis for many salt marsh food webs.
- Shrubs grow in the sediments trapped by salt marsh grasses. Common bushes are bayberry, and yaupon holly. Blossoms from marsh pinks, swamp mallows, and oxeye daisies brighten the marsh.
- Tall grasses and shrubs provide cover as well as food for marsh animals like crabs, shrimp, and clams that live in the water surrounding the grasses.
- Birds nest in the stems of plant, and insects eat the leaves. Long legged birds hunt the muddy flats for insects and crustaceans. Other water fowl like ducks, gulls and pelicans eat fish for food. Crustaceans like shrimp, crab and crawfish eat detritus (decaying matter). In turn, they are eaten by otters, which also eat fish.
- Meadow voles scurry along the ground beneath the tall marsh plants. They are hunted by hawks, owls and snakes.
- Lizards stalk insects in the grass, and terrapins chase fish in the shallow waters.

Although the grasses seem to dominate the marsh at first glance, closer examination reveals a large variety of wildlife.

RIVER & STREAMS



SALT MARSH



EVALUATION QUESTIONS

MULTIPLE CHOICE: Select the BEST answer for each statement.

1. Which of the following adaptations would **NOT** be helpful to an exotic species in a new habitat?
 - A. a general diet
 - B. a broad temperature tolerance
 - C. a specific diet
 - D. an aggressive lifestyle
2. The water hyacinth would be most damaging to
 - A. submerged freshwater plants
 - B. salt marsh grasses
 - C. understory vegetation in pine woods
 - D. sand dune sea oat populations
3. The zebra mussel most likely arrived in the United States
 - A. through the port of Mobile, Alabama
 - B. carried in the ballast water of ships
 - C. by migrating through Central and South America
 - D. during an exhibit at the Aquarium of the Americas in New Orleans
4. Africanized honey bees originated in
 - A. Africa
 - B. South America
 - C. North America
 - D. Europe
5. The most beneficial characteristic of the nutria is its
 - A. fur
 - B. ability to remove huge tracts of vegetation from marshes
 - C. meat
 - D. ability to build burrows in the banks of waterways
6. Which of the following pairs of exotics show possible commercial value in water purification (cleaning) systems?
 - A. water hyacinths and nutria
 - B. nutria and fire ants
 - C. fire ants and zebra mussels
 - D. zebra mussels and water hyacinths

7. Which of the following describes the harmful effect of exotics on native ecosystems?
- A. They cause the loss of native species.
 - B. They disrupt food webs.
 - C. They spread rapidly, taking over their new habitat.
 - D. All of the above.
8. Which of the following is NOT a way that exotic species enter a new area?
- A. deliberate human introduction
 - B. accidental human introduction
 - C. natural migrations
 - D. evolution
9. Species whose ancestors came from a foreign land are called
- A. endemics
 - B. natives
 - C. exotics
 - D. floras
10. The role or function of a species in its environment is called its
- A. niche
 - B. food web
 - C. habitat
 - D. ecosystem
11. Which of the following is an ecosystem?
- A. the sun
 - B. a television
 - C. the freezer section of a refrigerator
 - D. an aquarium containing fish and algae
12. Species whose populations are declining and nearly extinct are classified as
- A. endangered
 - B. endemic
 - C. exotic
 - D. threatened

DISCUSSION: Use your best writing skills — spelling, punctuation, and grammar — in responding to the following statements.

1. Identify an exotic species that lives in the Gulf Coast area and explain its impact on native organisms and habitats.

2. What usually happens to native species when an exotic species is successful in its adopted habitat? Explain your answer.

3. Describe two ways exotic species may be introduced in a new area and give an example for each.
 - a.

 - b.

4. Explain why an exotic animal that eats a wide variety of foods can adapt to a new area more quickly than one that eats only a few types of food.

5. A local nursery imports a beautiful, fast growing exotic plant. Once established in a yard, the plant spreads quickly because its roots give off a toxin that kills other plants growing near it. When temperatures dip below freezing, this exotic species dies. Predict its impact on local plants.

6. A storm washes several king snakes onto a small barrier island where some sea bird species come to nest each spring and summer. King snakes eat small birds and bird eggs. Predict the outcome of this situation. Will the snakes be able to survive in their new habitat? What will be the impact on the sea bird populations?

7. Attack or defend the statement, "all exotic species are harmful in their new environments."

EVALUATION — ANSWERS

MULTIPLE CHOICE:

- | | |
|------|-------|
| 1. C | 7. D |
| 2. A | 8. D |
| 3. B | 9. C |
| 4. B | 10. A |
| 5. A | 11. D |
| 6. D | 12. A |

DISCUSSION:

The following examples of answers should be modified by the teacher to fit appropriate grade level expectations.

- Answers will vary. Refer to the Background Information section for the names and impact of the exotic species highlighted in the video.
- Successful exotic species usually harm native populations.
 - Native species have natural enemies such as parasites, disease, and predators. Because these natural enemies have little if any effect on a new exotic species, the exotic population may grow faster than that of the native species. Natives that are in direct competition with the exotic for food, water, shelter, and space may be deprived of their habitat needs.
 - Over time, these native populations may decline in number, die out completely, or move to new habitat areas where the exotic has not invaded.
- Exotic species may be introduced:
 - accidentally by humans — as when attached to a boat or plant or in something like soil or ballast water being transported into an area.
 - on purpose by humans — to provide food, sport, beautification, pets, or as a treatment for another exotic.
 - by natural migration — as in the case of the armadillo and Africanized honey bee which migrated from South America.
- An exotic animal that eats a variety of foods does not have to spend as much time and energy looking for food. This allows more time for it to find a mate and seek hiding and nesting space, all of which are necessary for survival. An exotic animal that eats only a few types of food may have to spend all of its time and energy looking for food. If its food is not available or is in limited supply, it will become weak and eventually die.
- The exotic plant would spread rapidly the first year, but low winter temperatures would kill it. The following year, native plants would begin to grow again in the area where the exotic had grown, unless its root toxins were still in the soil. If the toxins continued to kill new native growth, erosion of the soil would eventually occur.
- Since king snakes eat small birds (nestlings) and bird eggs, their impact on the sea bird population over a period of years would be catastrophic, especially if the snakes represented a breeding population. Fewer and fewer sea birds would survive to return and nest. The bird populations would dwindle and they may begin to nest at a different site. Eventually, with less food available, the king snake population would also decline. In time, as the snakes died off, new colonies of birds might return to the barrier island.
- Answers will vary. The following are some reasonable responses.

Attack:

 - Exotic pets provide entertainment and companionship for their owners.
 - Exotic plants such as roses and many ornamental shrubs and trees add beauty to neighborhood landscapes.
 - Exotic crops such as wheat, cotton, and soy beans provide food and clothing for humans.

Defend:

 - Most exotic species that succeed in the wild cause harm to the established ecosystem. They may disrupt the food web, dominate and/or damage habitat shelter and nesting sites, and ultimately drive out native species with whom they compete for food, water, shelter, and space.

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