

science



generation

# POPULATIONS IN BALANCE

## SCIENCE ACTIVITIES

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## Reader's Theater

## Learning About Guam's Ecosystem

*Setting: Elena, Rachel, and Miles are waiting outside to be picked up from school. Elena spots Rachel's dad's car, but doesn't recognize the driver.*

**Elena:** Where's your dad? Who's that driving his car?

**Rachel:** My dad can't pick us up today, so my cousin is driving.

**Miles:** What? Didn't your cousin just graduate eighth grade last year?

**Rachel:** No, my other cousin, Rob. He's a pilot in the navy and is visiting us while he's on leave.

**Elena:** Was he in a war zone?

**Rachel:** You should ask him. Hi, Rob!

**Rob:** Hey, Rachel! Long time no see! Uncle Steve sent me over to pick you and your friends up. Hop in.

**Rachel:** Yeah, I know. He texted me. Thanks.

*Elena, Rachel, and Miles get into the car.*

**Elena:** I hope I'm not being rude by asking, but were you in Afghanistan?

**Rob:** Nope, I'm stationed in Guam.

**Miles:** Guam? Where's Guam?

**Rob:** It's kind of near Hawaii.

**Miles:** Must be a nice place.

**Rob:** It's okay, but it's full of snakes.

**Elena:** No way! I hate snakes!

**Rob:** No kidding. Especially the brown tree snakes; they're everywhere! They're in the trees, in the bushes... Heck, I even found one in my bed once.

**Elena:** Do not tell me that.

**Rachel:** Can't people just get rid of the snakes?

**Rob:** They're trying. A lot of people use snake traps or dogs but nothing seems to work. You're not going to believe this, but just before I came here the Navy had me fly a helicopter over the jungle, and folks were chucking dead mice stuffed with poison out of the helicopter. The idea was to kill the snakes by having them consume the dead mice.

**Elena, Miles, and Rachel:** WHAT?

**Elena:** Did that really work? Do snakes eat dead mice? I thought they just ate live ones.

**Rob:** I knew you'd be interested in that, Rachel. Check out the newspaper article I brought you. It's there on the dash.

**Rachel:** *(reading)*

**Government Drops Dead Poisoned Mice from Sky in Another Attempt to Kill Tree Snakes**

*The U.S. Department of Agriculture experimented with a new method to reduce the **population** of the invasive brown tree snake. They put Tylenol tablets into dead mice, attached the dead mice to long strips of paper, and dropped them out of helicopters into the jungle. Acetaminophen is a chemical used in Tylenol and other drugs. It's safe for humans in normal doses but it is poisonous to snakes.*

*This environmental **disturbance** is due to snakes brought to Guam from the Solomon Islands by the military after World War II. Since then, the brown tree snake **population** has exploded. Government officials say Guam now has one of the densest **populations** of snakes in the world.*

**Miles:** That's crazy!

**Rob:** Yeah. They cause huge problems. Sometimes the power goes out because a snake damages the wires. They **prey** on pets and livestock. Keep reading.

**Miles:** Give me that newspaper, Elena! *(grabs it)*

**Miles:** *(reading)*

*The non-native brown tree snake eats reptiles, birds, and mammals. It is credited with driving many **native** bird species into extinction. Bird species such as the Sihek (Micronesian kingfisher), Chuguanguang (Guam flycatcher), Ko'ko (Guam rail), and chichirika (Rufous fantail) were all wiped out by the tree snakes. A few birds were captured before they went completely extinct. The Sihek and Ko'Ko are now being bred in captivity, with the hope that someday these species can be reintroduced to Guam once the island's ecosystem begins its **recovery**.*

*Scientists have also reported a huge decline in the **populations** of local mammals and birds. And since trees rely on birds to spread their seeds, the trees are also affected, thus demonstrating the **interdependence** of species on the island.*

**Elena:** I thought this was just disgusting at first, but it's actually a serious problem isn't it?

## Reader's Theater

## Comprehension Questions

**Rob:** When I left Guam they had snake-sniffing dogs at the airport.

**Elena:** That's to prevent the snakes from going other places, right? That would be really bad!

**Rob:** I know that people in Hawaii are really worried about the tree snakes showing up there and wiping out the **native** wildlife.

**Rachel:** I don't get why snakes are such a problem. Aren't there some birds or animals that eat the snakes?

**Rob:** There's nothing on the island that eats snakes.

**Elena:** There aren't any **predators**? No wonder the snake **population** is so big!

**Rachel:** Wait, couldn't they just bring a **predator** from somewhere else to wipe out the snakes? Is there some sort of animal that **preys** on snakes?

**Miles:** Like a hawk? Couldn't they just bring those to Guam to eat the snakes?

**Rob:** There's no **native** hawk species on Guam. Wouldn't bringing another non-native species cause even more problems?

**Elena:** Hawks might eat other things, too. I guess you can't tell them to just eat snakes.

**Miles:** What about using a disease that affects snakes?

**Rob:** That sounds kind of sketchy.

**Rachel:** Maybe the people on Guam should just eat the snakes.

**Miles and Elena:** Eww!

**Rob:** It's actually not bad.

**Elena:** I did NOT just hear that.

**Respond in writing to the questions. Then compare and discuss your answers with someone else.**

 Complete the following sentence to summarize the problems on Guam: The government is trying to kill the brown tree snake because \_\_\_\_\_  
\_\_\_\_\_

 The newspaper article mentions that the brown tree snake **population** has exploded. This means that the brown tree snake **population** has:

- disappeared quickly
- decreased
- blown up
- increased dramatically

 The newspaper says that the brown tree snake "is credited with driving many **native** bird species into extinction." This means that the species:

- no longer exist
- are hiding
- were driven to another place
- are threatened

**Discuss these questions with a partner:**

 The article mentioned that Guam has "one of the densest **populations** of snakes in the world." Can you explain this in a different way?

 How might the government find out if dropping poisoned mice from helicopters is effective?

 Plants depend on bees for pollination, and bees depend on plants for food. This is an example of **interdependence**. What are some other examples?

 Do you think bringing a **predator** that **preys** on brown tree snakes to Guam is a good idea? Why or why not?

Speaking Scientifically

Are ecological disturbances good or bad?

*It depends.*

The situation you read about on Guam is an example of a **disturbance** of an ecosystem. A **disturbance** is when something happens that messes up the normal way an ecosystem functions. We tend to think that **disturbances** are bad, and in the case of the snakes on Guam, it does indeed look like a difficult situation that is causing serious problems.

But in other cases, ecosystems depend on **disturbances** to maintain their health. Let's consider forest fires. In California, redwood trees don't get killed by forest fires. In fact, the tiny cones on the tree (like pine cones) drop their seeds during fires because that's the best time for the seeds to sprout into new trees. When a fire clears away all the dense underbrush, seeds have a much better chance of growing into trees. Only then does sunlight shine all the way to the forest floor.

The entire ecosystem depends on fire. Pretty amazing. The illustrations below are like a timeline of a fire. Try to complete the captions to explain how fire benefits the redwood tree and its ecosystem.



On a ridge about a kilometer away from a redwood grove, lightning strikes the dry grass and \_\_\_\_\_

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The fire spreads to \_\_\_\_\_

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The tiny redwood cones react to the heat of the fire and \_\_\_\_\_

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Since the forest floor is cleared of brush, \_\_\_\_\_

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## Speaking Scientifically

### Thinking More About Disturbances

A **disturbance** is when something happens that messes up the normal way an ecosystem functions.

- Sometimes **disturbances** to ecosystems are caused by humans, but other times they occur naturally.
- Sometimes **disturbances** benefit ecosystems, but other times they are harmful.

Read the chart below with a partner and see if you can think of an example to add in the final column.

|  | Examples:   | What's another example you can think of?                          |
|--|---|---|
| <input checked="" type="radio"/> True<br><input type="radio"/> False | Some <b>disturbances</b> are naturally-occurring.         | Damming of a creek by a beaver                                    |
| <input checked="" type="radio"/> True<br><input type="radio"/> False | Some <b>disturbances</b> are the result of human actions. | Development of land for farming or housing                        |
| <input checked="" type="radio"/> True<br><input type="radio"/> False | Some <b>disturbances</b> benefit an ecosystem.            | Swarms of native beetles feeding on dead and dying trees          |
| <input checked="" type="radio"/> True<br><input type="radio"/> False | Some <b>disturbances</b> harm an ecosystem.               | Accidental introduction of a non-native species without predators |

After a **disturbance**, a **recovery** usually follows.

An ecosystem that goes through a **disturbance** is usually able to “fix itself” over time. This process is called a **recovery**.

- Sometimes **recoveries** occur naturally.
- Sometimes **recoveries** involve humans who are trying to help.

Read the chart below with a partner and see if you can think of an example to add in the final column.

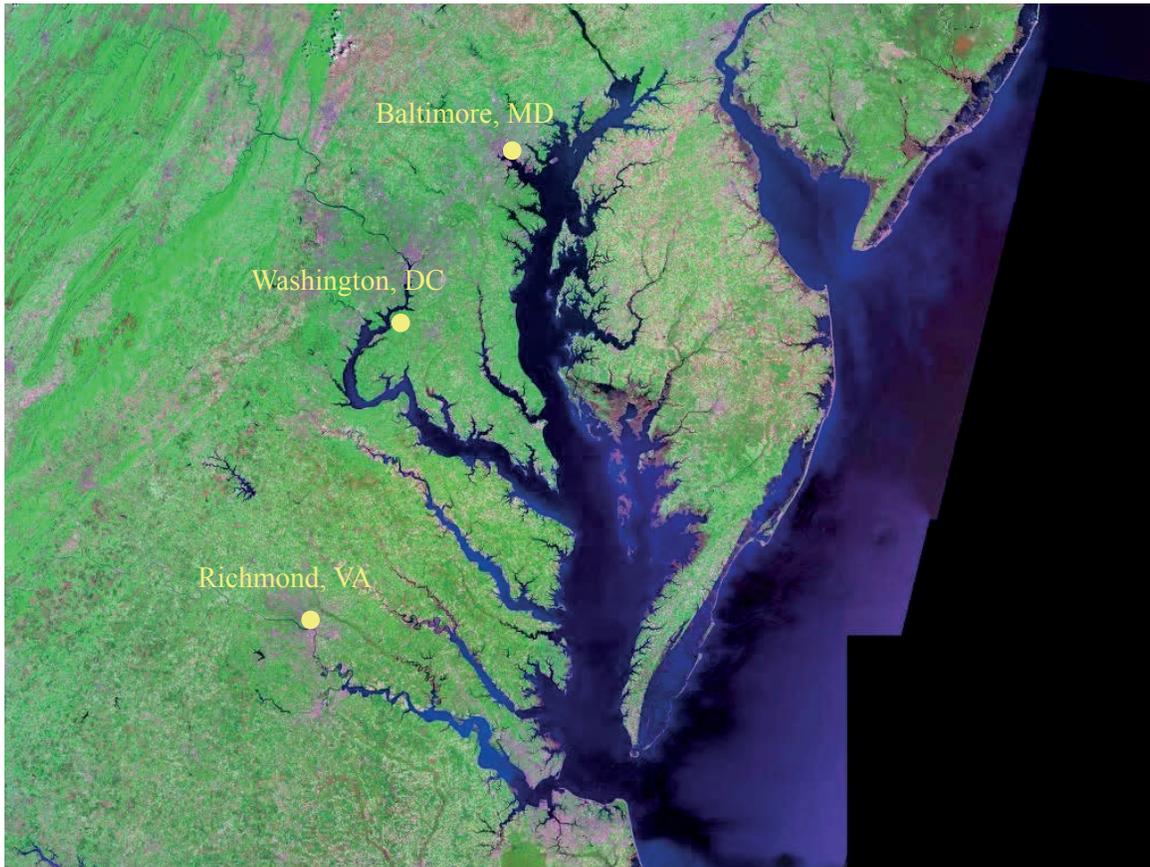
|  | Examples:                                       | What's another example you can think of?           |
|--|---|--|
| <input checked="" type="radio"/> True<br><input type="radio"/> False | Some <b>recoveries</b> are naturally-occurring. | New trees sprouting from seeds after a forest fire |
| <input checked="" type="radio"/> True<br><input type="radio"/> False | Some <b>recoveries</b> are managed by humans.   | Non-native species of snakes poisoned on island    |

## Speaking Scientifically

### An Important Story About Disturbance and Recovery

The Chesapeake Bay is the largest estuary in the United States. The bay's health is not good, but communities near the bay in Maryland and Virginia are trying to turn things around. They are doing all kinds of things to remind people about ways to keep the bay water cleaner. They really want the oysters in the Chesapeake Bay to thrive again like they did many years ago.

Why is a little oyster such a big deal?



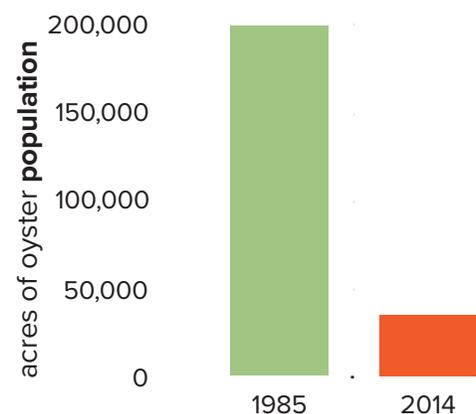
#### The Heroic Chesapeake Bay Oyster!



Oysters filter water through their systems in order to feed on microscopic floating plants and animals called plankton. But as the oysters filter the water for food, they also make the water clearer. With clearer water, sunlight can shine through the water and nourish more plants in the water. With more sunlight, the plankton **population** is healthier, so the oysters have enough to eat. It's a great example of **interdependence**.

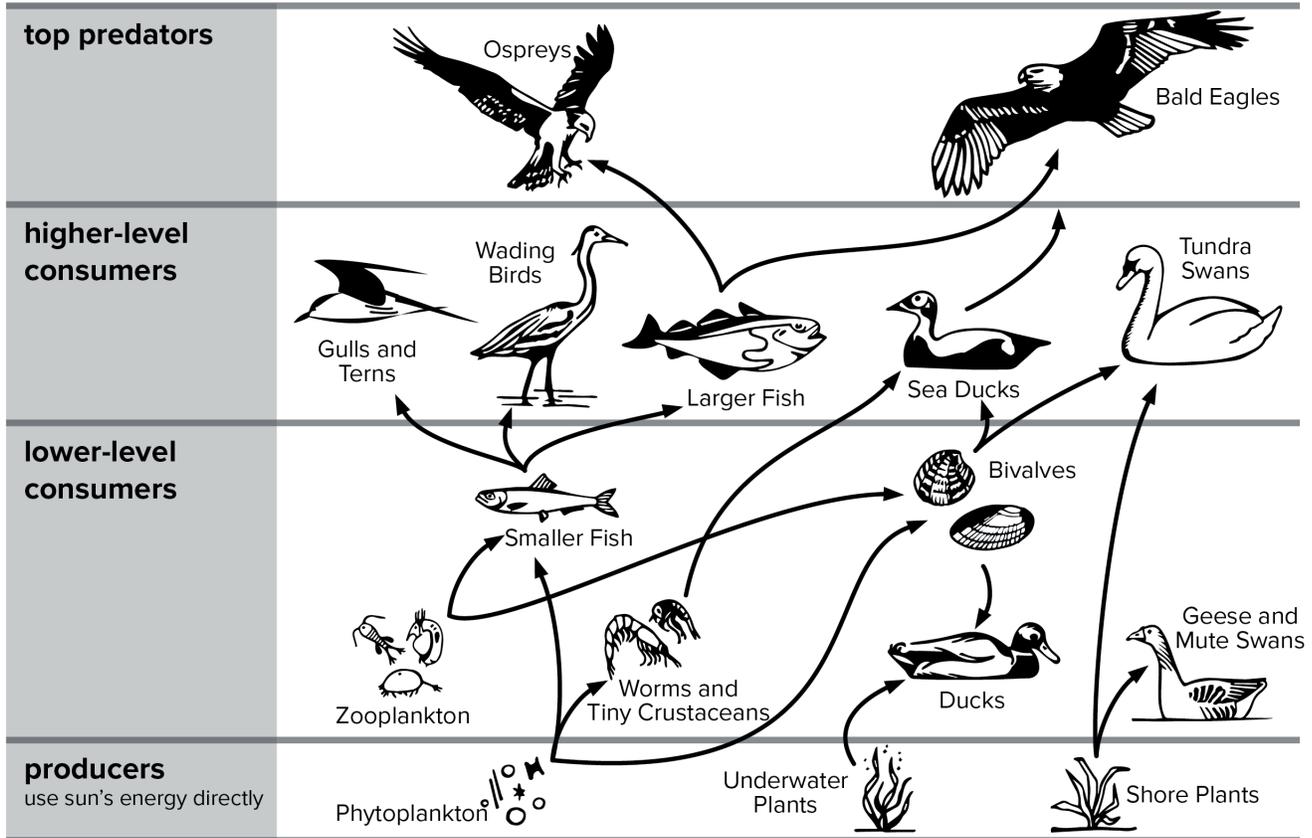
However, the oyster's **population** has declined. Some say it's because fishermen are taking too many. Others say it's because of pollution. Scientists think the problem is a combination of a lot of factors.

The area of the bay **populated** with oysters used to be 200,000 acres. Now the area is reduced to about 36,000 acres. Some estimate that many years ago oysters could filter the bay in four days. Now it takes 325 days.



Speaking Scientifically

A Chesapeake Bay Food Web



Why is the oyster's job so important?

Oysters are shown in the food web above in the bivalves group. Oysters not only eat plankton, they also make the water better for plankton. Above you can see two types of plankton that many other animals depend upon. Zooplankton are tiny animals and phytoplankton are tiny plants.

 Looking at the Chesapeake Bay Food Web above, use the arrows to trace a single food chain. Then fill in this chart:

for example:  
 PHYTOPLANKTON are eaten by... SMALLER FISH are eaten by... LARGER FISH are eaten by... OSPREYS

are eaten by...                      are eaten by...                      are eaten by...

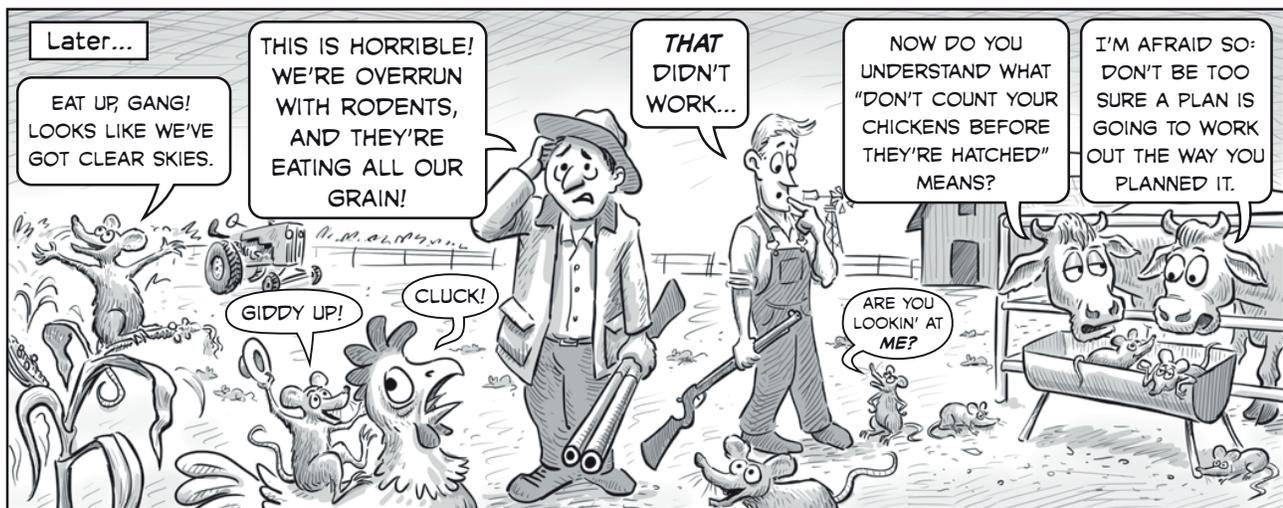
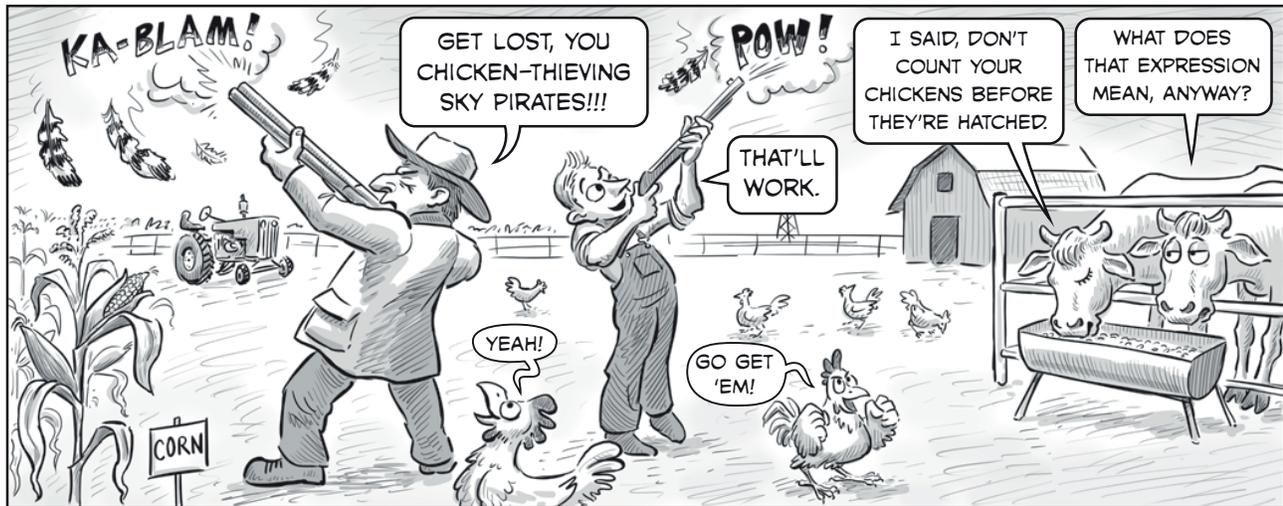
Discuss with a partner all the problems that could occur if there were not enough of those little oysters. Imagine that the water were too cloudy for the sun to reach the plankton and the submerged aquatic vegetation. Could this affect a top **predator** such as the osprey or the bald eagle?

Human Impact

Based on a True Story Somewhere in the United States

(...except for the talking cow part.)

Consider the events of this cartoon from a scientific perspective:





Town Hall Meeting

Today your class is going to simulate a **town hall meeting**.

Here's the situation: Just as Maria thought, hawks are indeed helpful in controlling mice and other rodents. Therefore, the fish and game warden of Cluck County made a new rule and put up the sign shown on the right.

Of course, different people in the community have different opinions about this new rule.



Meeting attendees:

Here is a description of their mindsets when entering the meeting:

farmers



The farmers are confused and angry about the rule. If a hawk is on THEIR private property, they should have every right to kill it. Losing chickens to these nasty **predators** is expensive, stressful, and very harmful to their business. Poultry farmers **produce** eggs and chickens consumed by people all over the state. They realize that the new rodent problem might be due to fewer hawks, but they prefer to try other ways to control the rodents.

environmental activists



The environmental activists consider the hawk to be a beautiful bird with an especially important place in the community. They worry about hawks becoming an endangered species. They know that ecosystems are complicated and **interdependent**, and they worry that other people don't think about unintended consequences. Furthermore, they are suspicious that the farmers will use poison to control the rodents, which they think could be very harmful.

fish and game warden/ biologists



The fish and game warden and wildlife biologists want to prevent harmful **disturbances** to the environment and to protect **native** species. They are concerned about the rodent **population** becoming too large, thereby hurting natural grasslands and farm crops. They are not sure how long the ban on hawk-killing should last. They are a bit worried that the county counselors will change the rule because of complaints and not because of scientific evidence.

county counselors



The county counselors are the elected representatives of the people of Cluck County. They want to do the responsible thing, but they also want to keep everyone happy. They are worried about the rule **disturbing** the farmers' businesses. They respect the scientists and the game warden, but wonder if they overreacted by banning all killing of hawks and birds of **prey**. They are also somewhat concerned that the environmental activists will organize demonstrations against the rule, which they believe would make the county look bad.

**Town Hall Meeting**



**Rules for the town hall meeting:**

Each team gets times to

- \* make an opening statement
- \* comment on or question what other teams say
- \* make a closing statement

There will be two town hall meeting simulations. You will participate as a character during one of them. During the other, you will observe and fill out a checklist.

To prepare to PARTICIPATE in the town hall meeting simulation:

1. Find out from your teacher which team you are on.
  - farmers
  - environmental activists
  - game warden/biologists
  - county counselors
2. Read the mindsets of each team very carefully so you can play the role well. Remember, you are representing a character, not your own opinion.
3. Get together with the other members of your team and develop good arguments that you can make during the meeting. If you are on the county counselor team, think about ground rules you would like to share at the beginning of the meeting so that people with different opinions about the issue will handle themselves appropriately.
4. Decide who on your team will present an opening statement and who on your team will present a closing statement. The remaining members of your team will handle questions from other groups or the counselors.

*Get this information from your teacher.*

I have been assigned to:

- participate in the first town hall meeting and observe the second.
- observe the first town hall meeting and participate in the second.

The students in my group are:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

To prepare to OBSERVE the town hall meeting simulation:

1. Study the form on the next page.
2. While you observe the other group's town hall meeting simulation, write a check mark when you hear someone from a team make a good point. Jot a few words to remind yourself of any really good points. Attempt to note at least one good point from each team in the other group.
3. Also listen for the week's focus words. If you hear them used correctly by anybody participating in the simulation, circle them in the appropriate place on the form.
4. Be ready to comment on what you observed after the simulation.

**Town Hall Meeting**

**Observation Checklists**



Below are forms for you to use while you are observing the town hall meeting (when it is not your turn to participate).



I heard the farmer team make some really good points:

Good point #1:

Good point #2:

I noticed that the farmer group used some of this week's focus words:

|             |            |                 |
|-------------|------------|-----------------|
| native      | population | prey            |
| disturbance | recovery   | consumer        |
| producer    | predator   | interdependence |



I heard the environmental activist team make some really good points:

Good point #1:

Good point #2:

I noticed that the environmental activist group used some of this week's focus words:

|             |            |                 |
|-------------|------------|-----------------|
| native      | population | prey            |
| disturbance | recovery   | consumer        |
| producer    | predator   | interdependence |



I heard the fish and game warden/biologist team make some really good points:

Good point #1:

Good point #2:

I noticed that the fish and game warden/biologist group used some of this week's focus words:

|             |            |                 |
|-------------|------------|-----------------|
| native      | population | prey            |
| disturbance | recovery   | consumer        |
| producer    | predator   | interdependence |



I heard the county counselors team make some really good points:

Good point #1:

Good point #2:

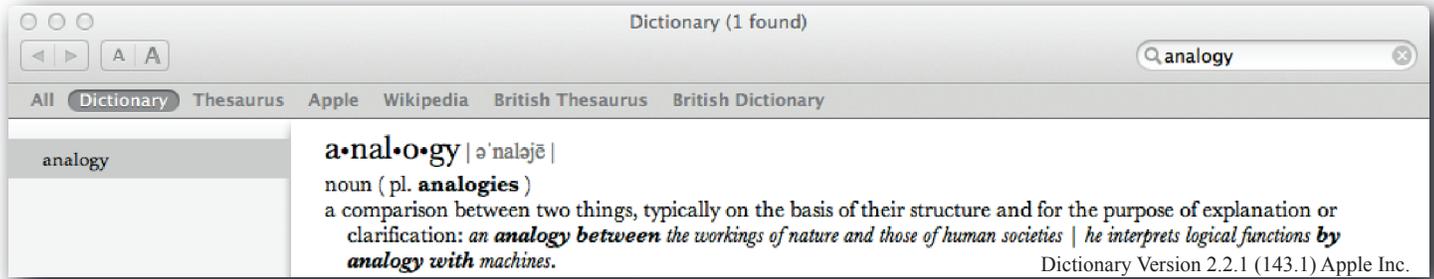
I noticed that the county counselors group used some of this week's focus words:

|             |            |                 |
|-------------|------------|-----------------|
| native      | population | prey            |
| disturbance | recovery   | consumer        |
| producer    | predator   | interdependence |

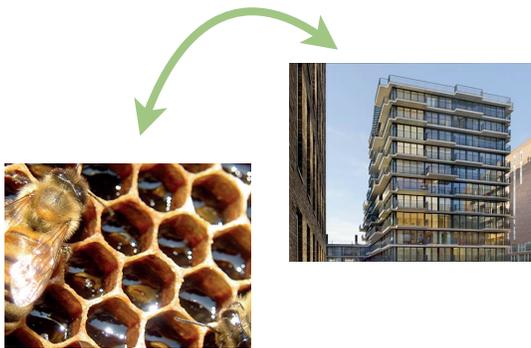




More About Analogies



**Analogies** can be very helpful in science. They use something we're familiar with to help us understand something we're less familiar with. Discuss each analogy below with a partner and respond to the questions in writing.



- 🗨️ How are a beehive and an apartment building similar?

✍️ \_\_\_\_\_

\_\_\_\_\_
- 🗨️ But, of course no analogy is perfect. What are important differences between the two?

✍️ \_\_\_\_\_

\_\_\_\_\_

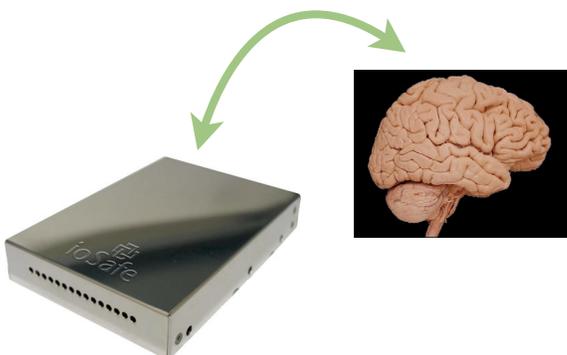
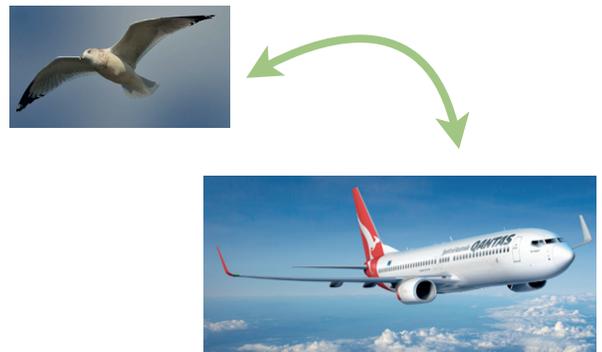
- 🗨️ How are a bird and an airplane similar?

✍️ \_\_\_\_\_

\_\_\_\_\_
- 🗨️ But, of course no analogy is perfect. What are important differences between the two?

✍️ \_\_\_\_\_

\_\_\_\_\_



- 🗨️ How are a computer's hard drive and a human brain similar?

✍️ \_\_\_\_\_

\_\_\_\_\_
- 🗨️ But, of course no analogy is perfect. What are important differences between the two?

✍️ \_\_\_\_\_

\_\_\_\_\_

## Don't Let Statistics Mislead You

The white area on this map represents the area of land that drains into the Chesapeake Bay. This area is called the bay's *watershed*.

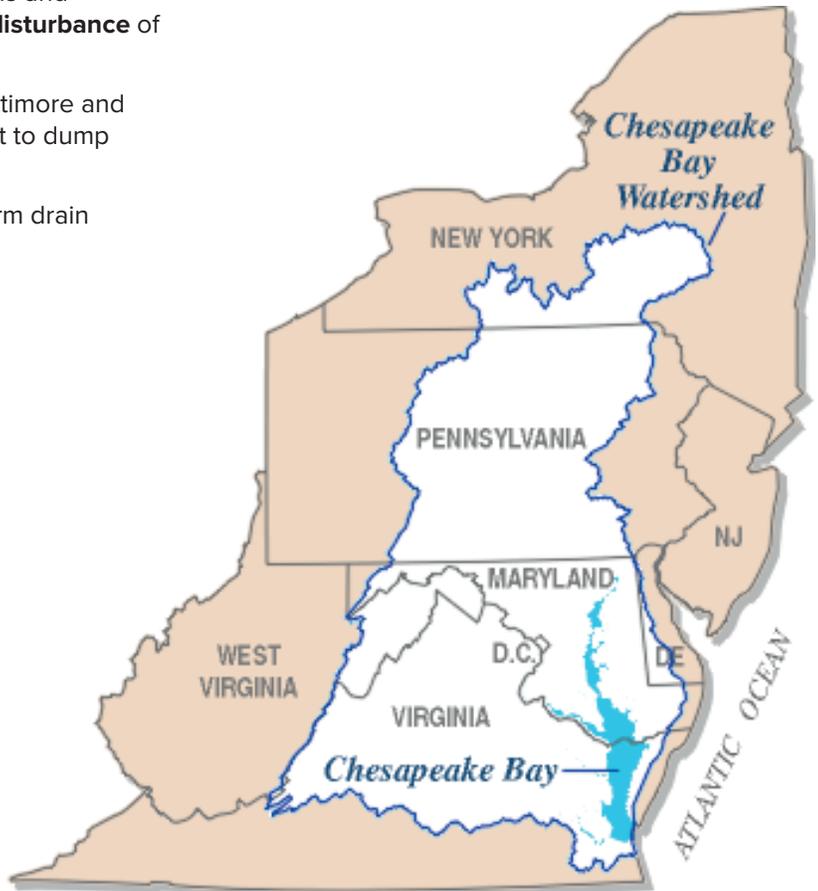
This part of the United States has large **population** centers with paved roads. When rainwater flows from these roads and eventually reaches the bay, this contributes to the **disturbance** of the bay's ecosystem.

In an attempt to help the bay **recover**, cities like Baltimore and Washington label storm drains to remind people not to dump pollutants.

The chart below shows what percentage of the storm drain pollution in the bay comes from each area.

|                      |     |
|----------------------|-----|
| Delaware             | 1%  |
| District of Columbia | 1%  |
| Maryland             | 29% |
| New York             | 3%  |
| Pennsylvania         | 23% |
| Virginia             | 41% |
| West Virginia        | 2%  |

Source: EPA Phase 5.3 Chesapeake Bay Watershed Model 2009 Scenario



Consider this: You hear a student who looked at these data say:

*“Delaware and D.C. do a much better job keeping storm pollution out of the bay than Maryland and Virginia!”*

There is a MAJOR problem with this student's logic. What is it? What would you say to help someone understand that looking at the percentages alone could be misleading?



## Positions on a Spectrum

1. "Hunting is an important tradition that helps the environment."
2. "Killing animals for sport is barbaric."

Obviously, these are two very different points of view on the issue of hunting!

Let's consider some information about deer hunting in the United States:

A century ago, the deer **population** was endangered due to the environmental **disturbances** brought on by the development of cities and towns. In recent years, however, the deer **population** has increased dramatically. In fact, most **native** deer species in the United States have **recovered**.

Hunting advocates say that the **recovery** of the deer **population** is partly due to all the money that hunters pay in licenses and fees to be able to hunt. This money goes to local governments and is used to create safe habitats for **native** animals, like deer, to thrive.

Deer overpopulation in some areas can cause problems for humans who live in or near their habitat. Deer collisions with cars can cause serious injury. Deer can damage gardens and crops. Hunters argue that hunting helps with these problems by reducing the number of deer to a natural level. They say that if you care about helping **native** species, you should accept the role that hunting can play in their survival.

Other people believe that it is unnatural for humans to hunt at all. They point out that when a tiger **preys** on a wild boar in nature, it does not need a shotgun. They say that the argument that it is natural for humans to hunt makes no sense at all. Still others think that hunting is moral only if you consume the animal that you kill.

What do you think?

Below is a spectrum that shows simplified positions at each end. Most people in the U.S. would take a position somewhere between the two extremes. Jayden and Mya are two seventh graders who found their place on the spectrum by thinking carefully about the issue. Can you do the same?



With proper regulation, hunting can be a major help in maintaining healthy ecosystems.

1. Discuss the issue and write your position as Mya and Jayden have done here:
2. Why do you hold the position that you hold?
3. What kinds of evidence or arguments might move you in one direction or the other?

## Examining the Focus Words Closely

### SciGen Unit 7.4

|  Scientific or<br> Everyday Use |  Definition |  Try using the word...  |
|---|--|--|
|  <b>native</b><br>adjective  | originally from a place  | <i>The elderberry tree is <b>native</b> to Cape Cod in Massachusetts. Do you know of a <b>native</b> tree in your area?</i>                      |
|  <b>native</b><br>noun   | a person who is originally from a place  | <i>A person who was born in Boston is a <b>native</b> of Boston. Describe yourself as a <b>native</b> of somewhere.</i>                          |
|  <b>population</b><br>noun   | a group of animals or plants of the same species in an ecosystem                             | <i>The <b>population</b> of brown tree snakes on Guam is increasing because of the lack of predators. What <b>populations</b> are declining?</i> |
|  <b>populate</b><br>verb   | to live in or occupy a place   | <i>Who <b>populates</b> the area around colleges and universities?</i>   |
|  <b>interdependence</b><br>noun  | when two or more parts depend on each other  | <i><b>Interdependence</b> is demonstrated by the Chesapeake Bay oyster. How?</i>   |
|  <b>disturbance</b><br>noun  | an interruption in the normal way an ecosystem works   | <i>Are <b>disturbances</b> to ecosystems always bad?</i>   |
|  <b>disturb</b><br>verb   | to change the arrangement of something; to bother someone or something                       | <i>The detectives on the TV show C.S.I. are careful not to <b>disturb</b> the evidence at a crime scene. How?</i>                                |
|  <b>recovery</b><br>noun   | the process when an ecosystem returns to normal  | <i>Do you think <b>recovery</b> from the snake infestation on Guam is possible?</i>  |
|  <b>recover</b><br>verb  | to return to a normal condition after a problem  | <i>Haiti is still <b>recovering</b> from a devastating earthquake. What other countries are <b>recovering</b> from disasters?</i>                |
|  <b>consumer</b><br>noun   | an animal that eats other living things (like plants or other animals)                       | <i>Do higher level <b>consumers</b> eat more plants or more animals?</i>   |
|  <b>consumer</b><br>noun   | someone who buys things or services  | <i>How does the government protect <b>consumers</b> from harmful foods and dangerous products?</i>   |
|  <b>producer</b><br>noun   | a living thing that makes its own food through light and very simple substances              | <i>Seaweed is an example of a <b>producer</b> in an ocean ecosystem. What are some <b>producers</b> in a desert ecosystem?</i>                   |
|  <b>produce</b><br>verb  | to make something happen or develop  | <i>How do effective coaches <b>produce</b> results?</i>  |
|  <b>predator</b><br>noun   | an animal that preys on (hunts and eats) other animals                                       | <i>Eagles and ospreys are considered top <b>predators</b> in the Chesapeake Bay ecosystem. Why?</i>  |
|  <b>prey</b><br>noun   | an animal that is hunted and killed for food by a predator                                   | <i>Can you think of some examples of <b>prey</b> that are larger than their predators?</i>   |