

# THE BIODIVERSITY DILEMMA

## *Lesson Plan*

**Subjects:** Environmental science, life science, language arts/writing

**Lesson Summary:** Students will learn what biodiversity is, what causes the loss of biodiversity, what the status of biodiversity is, and what they can do to help preserve biodiversity.

**Objectives:**

The students will be able to:

- 1) Define biodiversity
- 2) List the three levels at which biodiversity exists
- 3) List several ways that biodiversity helps them
- 4) Explain what a keystone species is
- 5) List the five causes of loss of biodiversity
- 6) List several things they can do to help preserve biodiversity

**Materials:**

Each student will need the following:

- 1) Computer with internet access
- 2) Paper
- 3) Pen or pencil
- 4) Copy of the biodiversity database activity
- 5) Copy of the biodiversity writing assignment
- 6) Copy of the writing instruction sheet, editing form, and FCAT rubric

**Teacher Preparation:**

- 1) Print out a copy of the biodiversity database activity and the biodiversity writing assignment. Photocopy enough for everyone in your class.
- 2) Make sure the computers are ready for the students so there is no lost time.
- 3) Make sure there are enough copies of the three components of the writing lesson. You can print out and photocopy new ones or reuse the old ones.

**Procedures:**

- 1) The students start by reading "**The Biodiversity Dilemma.**"
- 2) Ask them to read the biodiversity overview. (20-30 minutes)
- 3) When they have finished reading, pass out the biodiversity database activity and ask the students to complete it. (20-30 minutes)
- 4) Pass out the biodiversity writing assignment and ask the students to complete it. (30 minutes)
- 5) Have the students get out the writing instruction sheet, the editing form, and the FCAT rubric. Using these forms, they should edit their OWN paper. (20-30 minutes)

Total Time estimates:

**Two 50-minute class periods**

## The Biodiversity Dilemma: What is Biodiversity?

The word **biodiversity** is short for biological diversity, it describes the number of different kinds of plants and animals in a specific area.

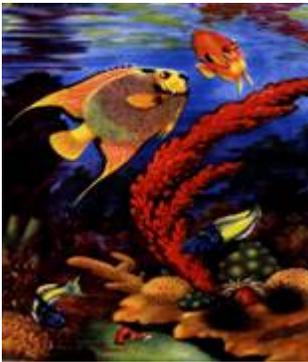
### ***Levels of Biodiversity***

This diversity can exist at three different levels. All are very important and related to each other:

**Genetic level:** This includes the variety of genetic information within a species or population. The more diverse its genetic code, the more likely a species will survive changes in the environment.

For example, we have different types of apples. Some kinds are more resistant to disease than others, while others may tolerate warmer climates.

Two examples of how important genetic diversity is are as follows: The loss of Potato blight wiped out the potato crop in Ireland in 1845 and 1846 causing starvation and immigration of two million people. It took 80 years to find a resistant potato in Mexico and breed that resistance into US and European potatoes. When southern corn blight hit the U.S. in 1970, it reduced corn production 15%, and took three years to breed a resistant variety from the strains already on hand in the seed banks.



**Species level:** This level includes a variety of different species within an ecosystem habitat that enables the system to remain stable even with changes or disturbances. For example, the salt marsh is full of a variety of different species including fish, crabs, herons, gulls, etc. that help enrich the system.

Most efforts to restore endangered species populations are targeted at this level. The Florida panther, manatee, red-cockaded woodpecker, and Florida scrub jay are all species that represent important biodiversity in Florida. Often, by protecting their habitats, we also protect an ecosystem.

**Ecosystem level:** This level is the variety of different kinds of *ecosystems* within a region that enable the regions to cope with changes or disturbances. For example, migrating birds need two different kinds of ecosystems in two different parts of the world as well as in healthy ecosystem rest stops along their route.

As we lose many different types of ecosystems to development and consumption of natural resources, this level of global diversity decreases. For example, filling in mangrove swamps to build high-rise hotels on the coast or cutting down rain forests for grazing land and the sale of prized natural resources such as mahogany and rubber is dramatically decreasing the *resiliency* of ecosystem diversity.

### ***Ecosystem, Species, and Genetic Resiliency***

All three levels of diversity are essential to maintain life on earth as we know it today. Each level must be protected because they all depend on one another and must be resilient in order to survive. It is the variety of genes, species, or ecosystems that makes all three levels resilient.

### ***The Importance of Biodiversity***

Here is an analogy to help you understand what biodiversity does:

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Let's pretend I'm giving you a free ticket for a flight to Hawaii. You'll take it, right? You might ask, "What's the catch?" Well, the catch is that the plane...is losing rivets...not too many....just a few every hour. You might want to know a few things about rivets and airplanes; like...how many rivets does a plane have? How many does a plane need to fly? Are some more critical than others? Can rivets function alone - or do they only work in sets?

That's a lot like our ecosystems and species diversity. We know plants and animals help our ecosystems provide ecological services - like the photosynthetic plants that give you food energy, and the decomposers that enrich your soil so trees are able to grow in order to provide shade you.

Suppose we asked these questions: "How many species do we have on this eco-ship?" "How many do we need?" "Are some more important than others?" "What is the minimum number we need to function?" We don't know the answers. Now think about it, wouldn't you like to keep as many of these rivets as possible?

### ***How Biodiversity Benefits Humans***

So, when we lose biodiversity, we lose access to many different plants and animals that we might need. Here are some specific ways that biodiversity helps us:

Scientists use the genetic diversity in our food crops so we can continue to grow plants that are resistant to pests and disease. Many of our prescription drugs were first made from plants and animals. If we continue to lose species, especially those not well researched such as those in tropical forests, will lose out on potentially valuable medicinal cures.



Ecosystems also help clean the air we breathe and the water we drink.

Without wetlands to purify water and forests to screen out pollutants from the air, we would need machines to provide this service.

Biodiversity stabilizes the ecosystem. It keeps our options open for the future. There may be resources out there that we don't yet understand their potentials, and we don't want to destroy them before we even know about them. Biodiversity also increases the beauty of the planet. What would Florida be without herons, eagles, or zebra long-wing butterflies?

### ***Saving a Whole Ecosystem or Just One Animal in it?***

So should we try to save whole ecosystems or just one animal at a time?

Trying to preserve either a single animal or even the ecosystem are both good ideas if in the long run they work to save the area. When you try to save an individual animal, especially a *keystone species*, you must provide it with a place to live and food to eat. What better place than its own *habitat*. Also, in the process of saving an ecosystem, you save all of the other plants and animals in that ecosystem by default. Sometimes it is easier to get people excited about saving an important animal like a parrot or a panda rather than an ecosystem. So we use some animals as ambassadors to get attention and operate in the limelight so we can protect the lesser known plants and animals in the ecosystem.

### ***What is a Keystone Species?***

A keystone species is one on which many other species in the ecosystem depend. For example, in a longleaf pine sandhill, if you were to take out the gopher tortoise, a keystone species, then the ecosystem would change dramatically. For example, the gopher tortoise digs burrows to live in and shares these homes



## The Biodiversity Dilemma

with hundreds of other animals. Without a protective place to live, all of those other animals might die.



Image courtesy of [Ohio Historical Society](#)

### EXTINCTION

It is true that *extinction* is a natural process, but never before has it occurred at such a fast rate. And, depending on your view, it is not happening because of natural reasons now. Due to human actions and changes in our ecosystems, we have seen the extinction of thousands of species in just the last two hundred years; it is natural for only about one species to go extinct every hundred years.

## Causes of Loss of Biodiversity

The easiest way to remember the five main causes of biodiversity loss is to think of the acronym HIPPO. It stands for:

### Habitat loss

Some plants and animals require specific habitats and cannot live without them. Because of increasing development and other changes to the ecosystem, plants and animals are losing their needed habitats.



### Invasive species

When an *invasive species* is introduced, into an ecosystem, it can change the entire makeup of that ecosystem. Over time, it may push out many of the native plants and animals. For example, melaleuca has replaced indigenous species in South Florida.

### Population Growth

The growth of the human population is increasing at an exponential rate, there are more and more people depleting resources and taking away natural habitats to provide for homes, farms, and roads.

### Pollution

Humans continually contaminate the air, water, and soil with their everyday lifestyles. This makes it a bigger challenge for plants and animals to survive.

### Over consumption of natural resources.

Many scientists believe there are enough resources on the planet if humans only use what they need. However, when we have three TVs in one home, or enough clothes for a month, we are wasting valuable resources. The energy and other raw materials used to make these products come from the environment. The use of these resources often brings disruption or pollution to the plants and animals. (The U.S, makes up 5% of the world population, yet we consume more than 50% of the earth's natural resources.)

## Ways to Preserve Biodiversity

Here are just a few examples of ways people are already helping preserve biodiversity:

- Landscaping urban areas for wildlife;
- Restoring degraded coastal habitats by planting mangroves or sea grass;

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- Restoring longleaf pine forests by supporting prescribed fire;
- Adding species to the *Endangered Species List* protects animals, plants, and habitat;
- Developing environmentally friendly manufacturing practices; and
- Keeping gene banks to preserve genetic information for use later.

Here are some ways you and your friends and family can get involved:

- Use native plants in the landscape to provide food for native insects, birds, and other wildlife;
- Conserve natural resources;
- Support zoos and botanical gardens that keep seed banks and live specimens of animals that are extinct in the wild; and
- Recycle, reuse, and of course, reduce consumption!

### ***Bibliography***

Keystone species at [Biodiversity Loss: Cascade Effect](#).

Extinction rates at [Species: Unprecedented Extinction Rates and It's Increasing](#).

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### ***Database Activity***

You can start thinking about preserving biodiversity right now by exploring the biodiversity of a Florida ecosystem, the Florida sand pine scrub. The sand pine scrub ecosystem is one of Florida's most endangered ecosystems. Of course, all the native plants and animals that are adapted to and depend on the scrub are threatened too. Find out more about this special place and one particular special bird, the Florida scrub jay. It only lives in Florida's scrub ecosystem. Select the [Florida Environments Online](http://palm.fcla.edu/feol/) database. [<http://palm.fcla.edu/feol/>]

1. Search on the term "scrub jay" in the keyword field.
2. Scroll down until you see an article titled "The Florida Scrub Jay," by Raymond Fernald.
3. Click on that title.
4. Next to where it says "Electronic Access," click on the code that has the letters "jpg" at the end. This will open the article's table of contents.
5. Click on "Title." This will open the document so that you can read it. (This may take a couple of minutes to download, just be patient.)
6. When you finish reading that page, scroll down to the bottom of the page and click "next."
7. Keep reading and clicking "next" until you have read the entire article.
8. Take notes on the scrub jay and its ecosystem as you read the articles.
9. On a separate piece of paper, write a field guide entry for the scrub jay. Look at field guide entries for other birds at <http://www.enature.com> for examples. (Don't copy the scrub jay entry; everyone will know you did!)
10. In your field guide entry, you need to include the following things:
  - description of the habitat it lives in
  - what it eats
  - what eats it
  - its range
  - what it looks like
  - how it nests
  - what kind of family group it has
  - what kind of legal protection it has
  - how big of an area a family of scrub jays needs.

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### *Writing Assignment*

**Writing Situation:**

The mockingbird is Florida's current state bird. It receives special attention due to this status. The endangered Florida scrub jay is an important part of the biodiversity of the Florida sand pine scrub ecosystem.

**Directions for Writing:**

Before you begin writing, think about the importance of saving the Florida scrub jay and how it might help conserve more acres of important sand pine scrub in Florida. Now persuade the reader that changing the Florida state bird from the mockingbird to the scrub jay might help protect the scrub jay and the sand pine scrub.