AL GORE KNOWS HOW MANY NAPKINS YOU TAKE.
Who needs oil? I ride the bus.
4.C.3.a. Using one of the following examples, explain how population ability to respond to changes in the environment is affected by genetic diversity. Species and populations with little genetic diversity are at risk for extinction.

1. California condors
2. Black-footed ferrets
3. Prairie chickens
4. Potato blight causing the potato famine
5. Corn rust affects on agricultural crops
6. Tasmanian devils and infectious cancer
4.C.3.b. Using both of the following examples, explain how Genetic diversity allows individuals in a population to respond differently to the same changes in environmental conditions.

1. Not all animals in a population stampede.

2. Not all individuals in a population in a disease outbreak are equally affected; some may not show symptoms, some may have mild symptoms, or some may be naturally immune and resistant to the disease.
Introduction to biodiversity

• Conservation biology is a goal-oriented science that seeks to counter the biodiversity crisis, the current rapid decrease in Earth’s variety of life.

• Extinction is a natural phenomenon that has been occurring since life evolved on earth.

• The current rate of extinction is what underlies the biodiversity crisis.

• A high rate of species extinction is being caused by humans. Watch where you step.
2.D.3.b. Using one of the examples below, explain how disruptions to ecosystems impact the dynamic homeostasis or balance of the ecosystem.

1. Invasive and/or eruptive species
2. Human impact
3. Hurricanes, floods, earthquakes, volcanoes, fires
4. Water limitation
5. Salination
4.B.4.a.1 Describe how logging, slash and burn agriculture, urbanization, monocropping, infrastructure development (dams, transmission lines, roads), and global climate change effect life on Earth.
A great deal of this topic revolves around the concept of SUSTAINABILITY

- Here’s a good short introduction to what sustainability means. 2 min.
- What can you do at home to make our world more sustainable?
The Three Spheres of Sustainability

Social-Environmental
- Environmental Justice
- Natural Resources Stewardship
  Locally & Globally

Environmental
- Natural Resource Use
- Environmental Management
- Pollution Prevention
  (air, water, land, waste)

Economic
- Profit
- Cost Savings
- Economic Growth
- Research & Development

Social
- Standard of Living
- Education
- Community
- Equal Opportunity

Economic-Social
- Business Ethics
- Fair Trade
- Worker’s Rights

Adopted from the 2002 University of Michigan Sustainability Assessment
1. The three levels of biodiversity are genetic diversity, species diversity, and ecosystem diversity.
Genetic diversity makes a population stable over the long run

• Cheetahs are a great example.
• Reduction of their numbers due to habitat destruction has made them less genetically diverse than some populations of lab rats bred to be similar.
• One disease can trigger their extinction.
• Loss of species diversity.
• Much of the discussion of the biodiversity crisis centers on species.
• The U.S. Endangered Species Act (ESA) defines an **endangered species** as one in danger of extinction throughout its range, and a **threatened species** as those likely to become endangered in the foreseeable future.
• The local extinction of one species, like a keystone predator, can affect an entire community.
Here are a few examples of why conservation biologists are concerned about species loss.

- The IUCN reports that 13% of the known 9,040 bird species are threatened with extinction. That is 1,183 species!!!

- The Center for Plant Conservation estimates that 200 of the 20,000 known plant species in the U. S. have become extinct since records have been kept, and another 730 are endangered or threatened.

- About 20% of the known freshwater species of fish in the world have become extinct or are seriously threatened.
• Loss of ecosystem diversity.

• Some ecosystems are being erased from the Earth at an unbelievable pace.

• For example, an area the size of the state of West Virginia is lost from tropical forests each year.
Biodiversity is a crucial natural resource, and species that are threatened could provide crops, fibers, and medicines for human use.

The loss of species also means the loss of genes.

Biodiversity represents the sum of all the genomes on Earth.
One large scale experiment illustrates how little we understand ecosystem services.
• Biosphere II attempted to create a closed ecosystem, and had a forest with soil, miniature ocean, and several other “ecosystems.”

• In 1991, eight people entered and were supposed to be isolated for two years.

• The experiment failed and had to be stopped after 15 months.
3. The four major threats to biodiversity are habitat destruction, introduced species, overexploitation and food chain disruption

- Habitat destruction.
  - Human alteration of habitat is the single greatest cause of habitat destruction.
  - The IUCN states that destruction of habitat is responsible for the 73% of species designated extinct, endangered, vulnerable, or rare.
  - About 93% of the world’s coral reefs have been damaged by humans.
• Introduced species.

• **Introduced species** are those that humans move from native locations to new geographic regions.

• The Nile perch was introduced into Lake Victoria as a food fish, but led to the extinction of several native species.

Fig. 57.7a
• Overexploitation.

• This refers to the human harvesting of wild plants and animals at rates that exceed the ability of those populations to rebound.

• The great auk was overhunted and became extinct.

Fig. 55.8
• The African elephant has been overhunted and the populations have declined dramatically.

• The bluefin tuna is another example of an over-harvested species.

Fig. 55.9
Consider a basic growth curve of a species that is eaten by another species. Now, consider three scenarios and think where you “want” to be on this curve for each:

1. You are a manager of this endangered species.

2. You are an individual of this species (or consider humans!)

3. You are a predator that is “managing” this prey to optimize prey harvest over the long term.
Let's consider the effect of the predators on the prey growth and numbers. Remember: Logistic Growth… We can draw the growth curve (Nt vs. time).

Also remember: if we are a really smart predator, where do we want to keep our population? Not at K, but at the point where the population is replacing itself at the highest rate (which is often around \( \frac{1}{2} K \)).

This is the **optimal harvest problem** that wildlife managers and fish biologists, etc. deal with regularly.

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Loren McClenehan

1957

2007
3. Conserving species involves weighing conflicting demands

- Conservation biology highlights the relationship between science, technology and society.

- High profile organisms may be the most popular due to use as resources.

- Questions about human habitat needs also arise.

- The ecological role of the organisms must be addressed as well.

- Then there is that economy thing.
4. Restoring degraded areas is an increasingly important conservation effort

• **Restoration ecology** applies ecological principles in developing ways to return degraded areas to natural conditions.

• Biological communities can recover from many types of disturbances, through a series of restoration mechanisms that occur during ecological succession.
Fig. 55.21

- Recovery time (years)
- Spatial scale (km²)

Events:
- Meteor strike
- Ground water exploitation
- Industrial pollution
- Urbanization
- Salination
- Modern agriculture
- Flood
- Atomic bomb
- Volcanic eruption
- Acid rain
- Tsunami
- Oil spill
- Forest fire
- Land slide
- Tree fall
- Slash & burn
- Lightning strike
• **Bioremediation** is the use of living organisms to detoxify polluted ecosystems.

• Restoration ecologists use various types of organisms, like plants that absorb heavy metals, to *remove* many different types of toxins from ecosystems. Remember how good fungi are at this?
What’s the main problem?

• Too many people on earth for the amount of resources each person uses.

• It all boils down to how much fossil fuel has to be burnt for you to live the life you do.

• This is called your carbon footprint. Let’s calculate here.