

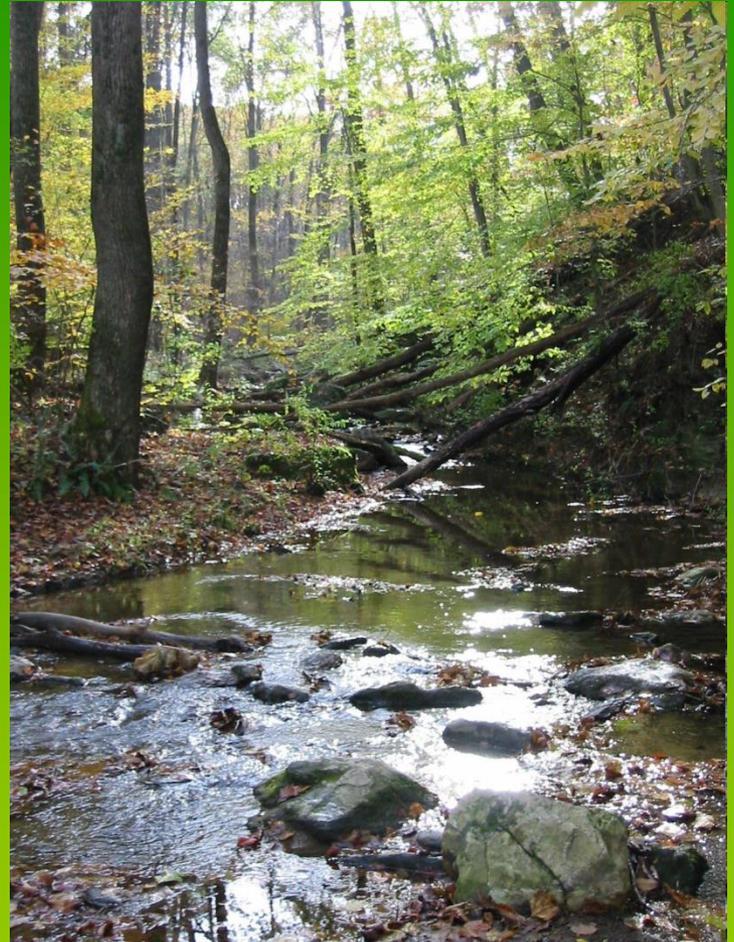
Introduction to Ecology and Ecosystems

Text Pages 8-13

BRAINSTORM!



- Ecosystem – the set of relationships between populations of species and between those populations and the non-living (abiotic) factors in their environment
- Ecology - a specific branch of biology which studies how organisms interact with each other



- So, in other words, ecosystems and ecology are concerned with organisms and the environments they interact with.
- Q: Do all ecosystems have the same types of organisms? Same number of different organisms?
- No! All ecosystems vary in their species composition and numbers...

- Biodiversity – the number of species in an ecosystem, and the variety within those species
- It is **very important** to ecosystems because every organism in an environment is connected to all other organisms in one way or another.



Q: Which location would have a higher biodiversity: your backyard or a coral reef?

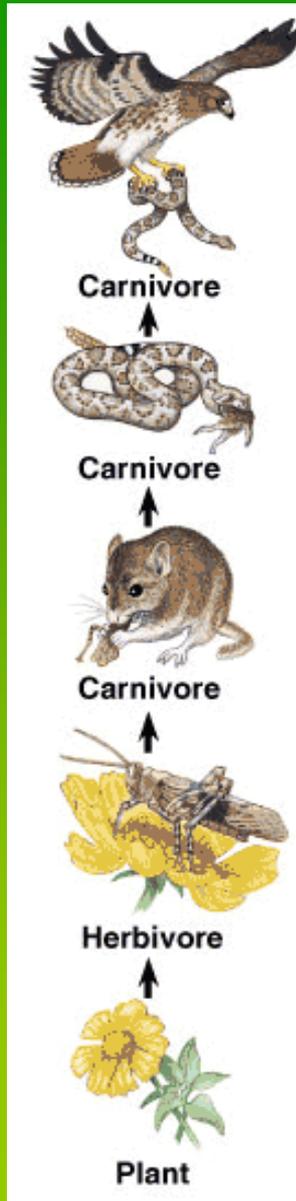
Usually, a coral reef. The answer depends on the number different of species in a given area.



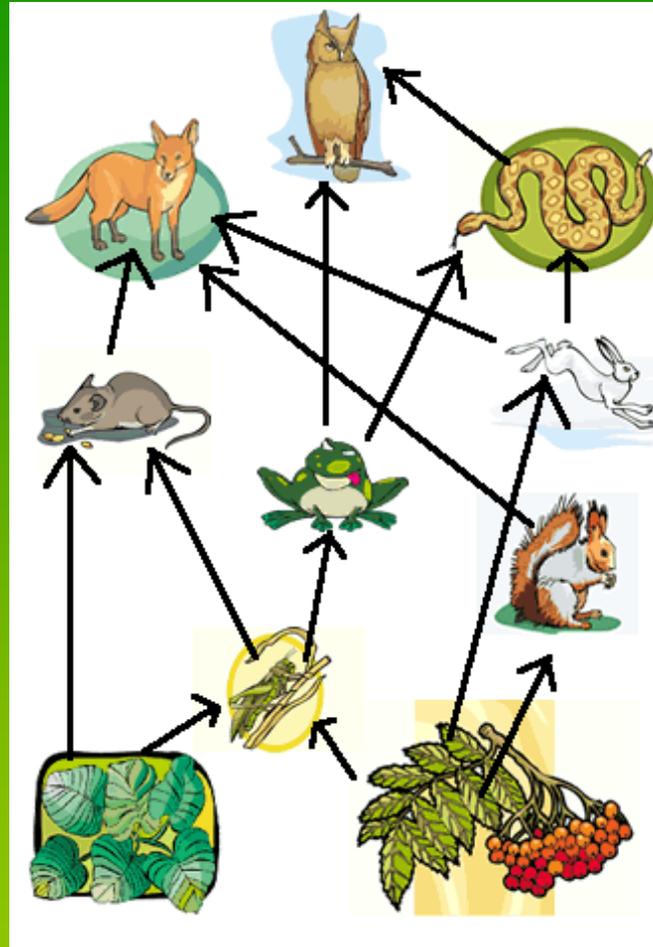
Q: What's the difference between a food web and food chain?

- **Food chain** – a step-by-step sequence linking organisms that feed on each other starting with a food source and continuing through the other organisms that feed on it
- **Food web** – a diagram that tries to show the energy transfer relationship between many organisms in an ecosystem.

Food Chain



Food Web



Q: What is always found at the bottom of a food chain?

There are two major groups of living organism...

- **Producers** – an organism that uses photosynthesis or another form of chemical synthesis to make food; aka *autotrophs*
- **Consumers** – an organism that must eat producers or other consumers as food; aka *heterotrophs*

Consumers

Herbivores
(plant eaters)

Carnivores
(animal eaters)

Omnivores
(eat both plants **and animals**)

Saprobies
(decomposers)



Types of Consumers:

- 1. Herbivores** - animals that eat plants
(Ex. Moose, Rabbits)
- 2. Carnivores** - animals that feed on other animals (Ex. Lions, Hawk)
- 3. Omnivores** - animals that eat both plants and animals (Ex. Humans, Bears)

4.Saprobies – also known as decomposers or saprotrophs. They break down and live off **Detritus** (wastes from plants and animals, including their dead remains) to get nutrients for their own use but in doing so also release valuable nutrients back into the soil or water that can be used by producers (Ex. Fungi)

Q: Nutrients in food chains/webs are always eventually returned back to the soil. If saprobies/detritivores/decomposers didn't exist, what would happen? There will be no recycle of matter.

Endangered Species and Extinction

All over the world, frog
populations are in decline.

Worksheet 1:



Video: Why are frogs disappearing?

<http://www.kqed.org/quest/television/disappearing-frogs>

<http://science.kqed.org/quest/video/>

Study of Frogs

Q: Why do you think frogs can act as important indicators of the health of an ecosystem?

- They live in both **aquatic** and **terrestrial environment**, therefore exposed to hazards in both ecosystems.
- They are a part of two very different food chains (pg 11); adults eat insects, are eaten by birds; tadpoles eat algae and detritus.



Q: What would happen to the population of insects if adult frog populations decreased? Increase

Q: What would happen to algae populations if tadpole populations decreased? Increase

Why are frogs disappearing all over the world?

- Amphibians have been very resilient – they have survived mass extinctions (dinosaurs), ice ages, periods of global warming, droughts, flood, growth of the human population (until recently).

Why are frogs disappearing?

- Loss of Habitat
- Air and Water Quality Problems
- UV Radiation
- Climate Change



1. Loss of Habitat

- Wetlands, ponds and lakes with clean water are needed to breed and lay eggs
- Forests and fields are needed for feeding and growth.
- Humans interfere by clearing forest and fields to built highways, clear land and draining wetlands for housing developments, etc.

2. Air and Water Quality Problems

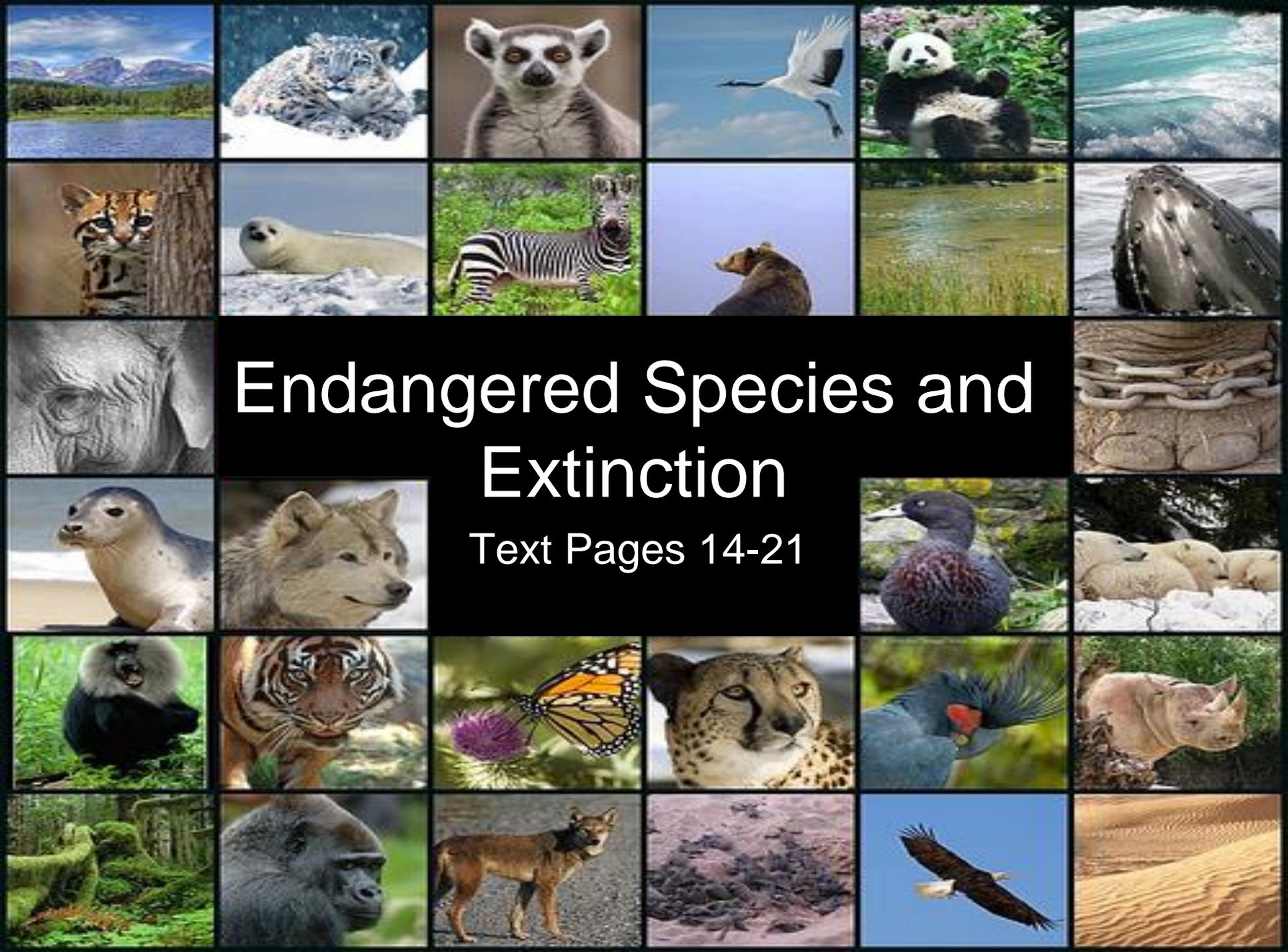
- Pollution
- Frog's have thin, moist skin through which pollutants can pass through easily (e.g. acid rain)
- Pollutants affect reproduction. It can decrease sperm mobility which decreases fertilization. It can also cause deformities in frog embryos.

3. Ultraviolet Radiation

- Increase in UV radiation is caused by damage to the ozone layer, due mainly to the release of various gases such as chlorofluorocarbons(CFCs) into air.
- Passes right through skin, causing sunburns and cellular damage

4. Climate Change

- Climate might become drier.
- Higher temperatures cause aquatic ecosystems to dry up - this affects all stages of the frog's life cycle.
- Humans interfere by emitting excess CO₂ into air caused more heat to be trapped by the atmosphere.



Endangered Species and Extinction

Text Pages 14-21

Unfortunately, extinction and endangerment also result from the declining health of ecosystems. Toxins, from pollutants, enter an ecosystem at the bottom of a food chain but eventually make their way to the top.

Classification for At-Risk Species

- Extinct
- Endangered
- Extirpated
- Threatened
- Vulnerable



Classification for At-Risk Species

- | <u>Classification</u> | <u>Description</u> |
|-----------------------|--|
| • extinct - | • no longer found anywhere |
| • endangered - | • close to extinct everywhere |
| • extirpated - | • no longer exist in one area |
| • threatened - | • likely to become endangered |
| • vulnerable - | • at risk due to low or declining numbers in certain areas |

Example of an extinct species:

The great auk

The Great Auk has been extinct since 1844.



The Great Auk, black and white, hugely beaked and shaped rather like a Penguin, could hardly be confused with any living bird. Its upright stance separates it from the vast majority of birds, its enormous beak marks it out from any Penguin.



Example of an endangered species: Whooping crane

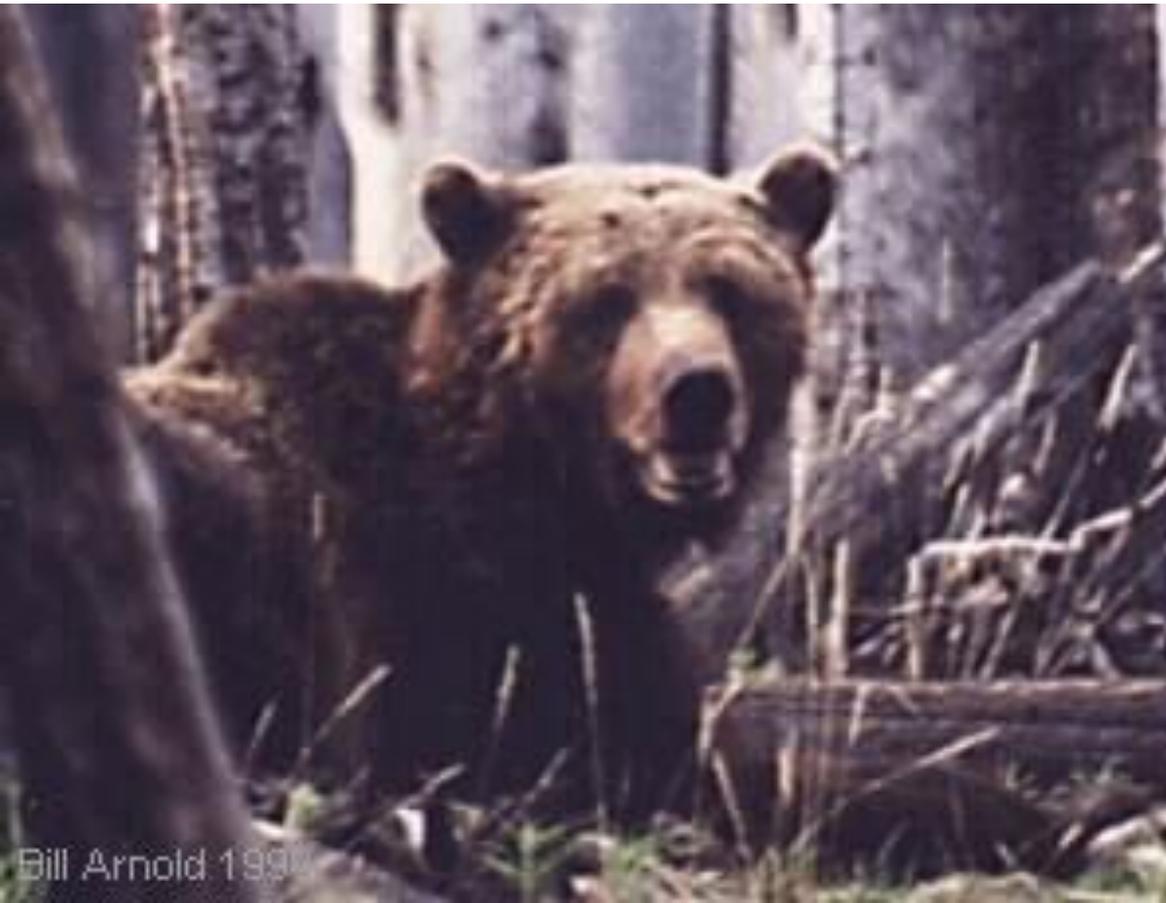


The number one cause of death of adult cranes is collisions with power lines during migration.

Conservation efforts since 1938 have resulted in a slow increase. Including those in captivity, there are now 320 whooping cranes in the world.

Example of an extirpated species: grizzly bear

No longer found in Manitoba and Saskatchewan, but still found in the mountains of Alberta and B.C.



NATIONAL PARK SERVICE PHOTO

Bill Arnold 1990

Example of a threatened species:

Wood Bison

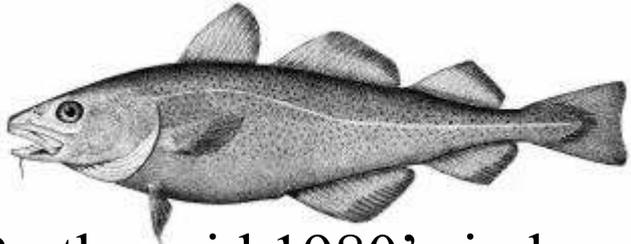
Wood Bison are the largest native land animals in North America. In 1940 pure Wood Bison were thought to be extinct. In 1957 a herd of about 200 Wood Bison was discovered by Federal Wildlife officers in the remote north west part of Wood Buffalo National Park.



Today the Wood Bison have been downgraded from "endangered" to a "threatened" species in Canada.

Example of a vulnerable species:

Atlantic Cod



Since the 1500's the cod fish has been sought off the Newfoundland coast. At first they were caught by hooks and lines, but since the 1600s to the present they have been caught by nets.

By the mid 1980's independent studies were showing that the cod stocks were declining and the ages of the fish being caught were decreasing at an alarming rate. Many environmental problems have been associated with the drop in cod numbers. A change in ocean currents in the North Atlantic is responsible for a two degree drop in water temperature. Since cod have a very narrow range in which their roe (eggs) can survive, these temperature changes have destroyed their reproductive cycle. Other factors that may be harming the cod stocks include an explosion in the seal population off the coast of Greenland and the increased melting rate of the Greenland glaciers.



Extinction

- Humans have had a profound effect on other organisms; the extinction rate has increased considerably as the human population rate has grown (Fig 2, pg 16) (e.g. passenger pigeon - wiped out due to commercial hunting and habitat destruction).
- Current projections are that one species will become extinct every 30 minutes in the early years of this century.

Extinction

Extinction has occurred continuously throughout the history of our planet. We know this based on evidence from the fossil record. However, there have been periods of time where large-scale extinction (mass extinction) has occurred. Most often caused by catastrophic events (meteors, massive volcanic eruptions)

Extinction

- 438 MYA – marine organism's
- 360 MYA – marine organism's
- 245 MYA – 80% of all species
- 65 MYA – dinosaurs

Facts

- The number of species in an ecosystem determines its *biodiversity*. A decrease in biodiversity can threaten the stability of an ecosystem.
- Extinction of one species can cause entire food chains to collapse.
- Extinction does occur naturally, however, in modern times, human activities are the major causes of extinctions. Ex. NL Pine Marten

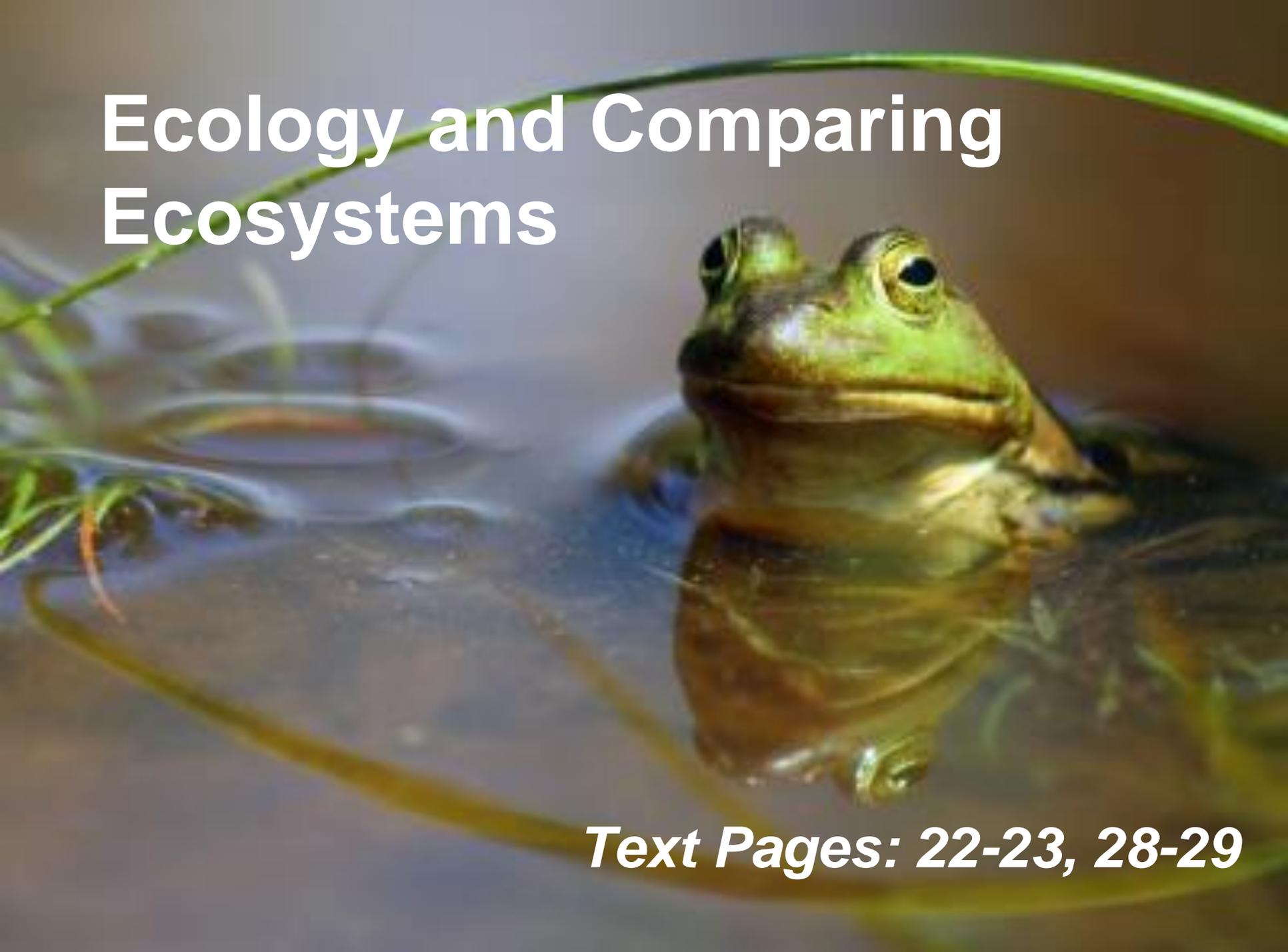
Worksheet 2: Extinction



Worksheet 3: Value of wolves



Ecology and Comparing Ecosystems

A close-up photograph of a green frog sitting in a pond. The frog is the central focus, with its head and upper body visible above the water. The water is dark and has several ripples around the frog. A thin green stem or leaf is visible in the upper left corner, curving across the top of the frame. The background is a soft, out-of-focus brownish-green.

Text Pages: 22-23, 28-29

Ecology

- Ecology is the study of how organisms interact with each other and with their environment.

- **Abiotic Factor** – non-living factors in the environment which influence living (biotic) organisms (Ex. Light, oxygen, carbon dioxide (CO_2), water, temp, space, nutrients)
- **Biotic Factor** – a factor in an ecosystem created by the presence and roles of other living things (Ex. Producers, consumers, disease, competition for food, symbiosis, predator-prey relationships, etc.)



The abiotic factors are the soil quality, precipitation, nutrient, space and temperature within an ecosystem. These factors determine what types of plants (producers) can grow in a particular habitat which in turn determines the type of animals that can exist in a particular ecosystem.

- The biotic factors are living organisms that interact with other species by competing for food, habitat, and mating. Other species within the ecosystem is a source of food supply and also can spread diseases with the ecosystem.

Video:

<http://www.youtube.com/watch?v=O3CZFfyed3M>

- Organisms rarely live in complete isolation; they usually live with other members of their own species in a **population**. They also live in the presence of and share their habitats with other organisms in **communities**.



Population – all the members of the same species living in the same ecosystem or habitat

Community – the collection of all the populations of species in an ecosystem or habitat

When a biologist studies a community, they look at how biotic factors affect each population as well as how abiotic factors affect organisms within the community.

- However, individual ecosystems rarely have sharp boundaries, therefore, organisms can move between ecosystems freely.
- **Ecotones** are the “grey” area between ecosystems where organisms from both can interact with each other.



- They contain species from both bordering ecosystems and often contain greater biodiversity than each individual ecosystem.
- Ecosystems with higher biodiversity (more species) tend to be less fragile and can survive natural changes in the environment. Therefore, ecotones help to guard against extinction.



Activity: Case Study!

Comparing ecosystem

Pages 28-29

Letters A-H, K-L and #1

Ecological Succession

Not in Text!

- Decades ago, most ecologists thought that biological ecosystems and communities always exist in a state of equilibrium, or stability, unless disturbed by humans. In other words, the communities maintained a relatively constant composition of species.

- Most biological communities are constantly changing because of disturbances, , both natural or human, prevent them from reaching a stable state.
- Disturbance is an event that changes a community by removing organisms or altering the availability of resources. Ex. Storm, fire, flood, drought, volcanic eruption, glacial activity, human activity.

Q: Do all disturbances have the same effect on an ecosystem? Why/why not?

Depends on frequency and severity

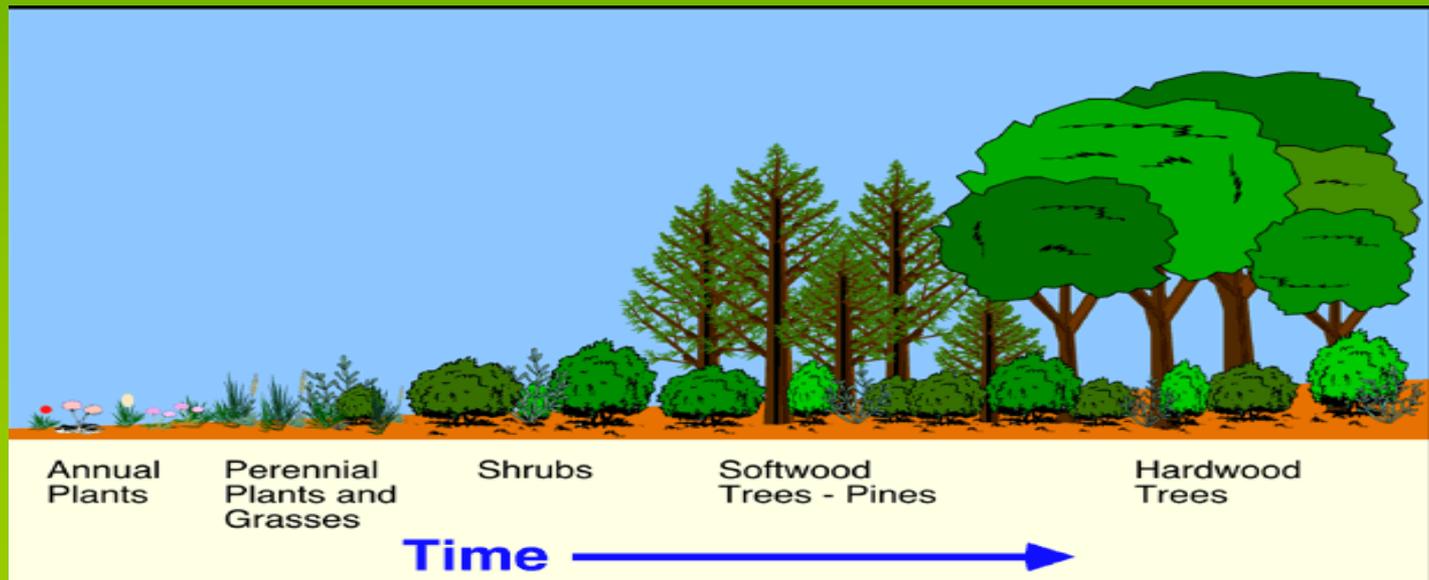
- If a disturbance is severe enough to strip away all existing vegetation, the area will be recolonized by a variety of species which are gradually replaced by other species, which in turn are also replaced in a process known as ecological succession.

- **Primary succession** occurs in a lifeless area where soil has not yet formed (ex. new volcanic islands). This process can take hundreds to thousands of years.

Lichens/Mosses → Soil → Grasses/Shrubs → Final Species of Trees/Plants



- **Secondary succession** occurs when an existing community has been cleared by some disturbance that leaves the soil intact (ex. Fire, human disturbance). In this case, the area slowly begins to return to its original state.



- Seeds are brought in by wind or animals, producing grasses and shrubs that are eventually replaced by trees and other dominant vegetation.

- Once a community has recovered from a disturbance, through ecological succession, it is called a **climax community**.





Assignment 1