WHAT IS ECOLOGY?

-Ecology: the branch of science that deals with how organisms interact with each other and their environments.

-Living things impact the environment and the environment impacts living things.
WHAT MAKES UP AN ECOSYSTEM?

Ecology encompasses all of life

– Organism: a single individual

– Population: all the interacting members of a species

– Community: all the interacting populations

– Ecosystem: all the living and non-living factors in an area

*LIVING: fungi, plants, animals, bacteria

*NON-LIVING: rocks, climate, water, soil
Levels of Organization

- Individual
- Population
- Community
- Ecosystem
- Biome
- Biosphere
SPECIES AND THE ENVIRONMENT

- Different species can tolerate different environmental conditions
- Adaptation is an evolutionary process that makes populations more fit in their ecosystem
INTERACTIONS BETWEEN SPECIES

When species interact, the interaction for each organism can be:

- Beneficial/good 😊
- Detrimental/bad 😞
- Neutral/no effect 😐
MUTUALISM 😊 😊

A mutually beneficial relationship

– Flowers and bees: Food for bees and pollination for flowers

– Clownfish and anemones: Clownfish get refuge and anemones get cleaning and nutrients

– Alligators and birds: Alligators get their teeth cleaned and birds get food
COMMENSALISM 😊 😞

One species benefits while the other is neither harmed or helped

– Strawberry poison arrow frogs and bromeliad plants: Frog gets a nursery and the bromeliad isn’t affected

– Flies and animals: Flies get wastes to feed off of and lay eggs in; animals not directly affected
PARASITISM 😊 😞

One organism benefits at the expense of the other organism

The parasite benefits and the host is harmed

Examples: ticks, tapeworms, lampreys, leeches, fleas
SYMBIOTIC RELATIONSHIPS

Symbiosis: Relationship between members of at least 2 different species that live in direct contact with each other.
OTHER RELATIONSHIPS

-PREDATION: one organism hunts and kills another for food

-COMPETITION: two organisms attempt to obtain the same resource
A new technology is developed that could target and kill ALL mosquitoes around the world. Would you support this technology or not?

This is ALL or NOTHING. Find partner or group to discuss with!
DO WE NEED MOSQUITOES?

-What roles do they play?
-What would happen if we got rid of them all?
-How do they impact the ecosystem?
MOSQUITOES

• Parasites (females only, some species only)
  – In Arctic, each caribou may lose 300 mL of blood to mosquitoes per day!
• Major vectors of disease / population control?
  – Malaria, yellow fever, dengue fever, encephalitis, West Nile virus...
• Alter caribou migration patterns, which has broader effects
• Food for birds—but not really?
  – Bird stomachs often contain relatively little mosquito, and we may be biased by their attraction to us, our dislike of them
• Food for fish, most definitely—but easily replaced?
• Eat detritus as larvae, but so do other things...
• Pollinate some plants...
FOOD WEBS

- Show the flow of matter and energy through a community
- Show the complex network of feeding relationships in an ecosystem
FOOD WEBS

- Organisms can be part of multiple levels

- Arrows point to where the ENERGY is flowing
FOOD PYRAMID

TROPHIC LEVEL:

an individual’s feeding position in the community
WHY IS THE FOOD PYRAMID A PYRAMID?
ENERGY IN AN ECOSYSTEM

- As you move up the pyramid: biomass and energy DECREASE
- Only about 10% of energy is transferred to each next level
- The rest is lost as heat
PRODUCERS

- Autotrophs
- Base of the food pyramid
- Determine what other forms of life can survive in that ecosystem and how much life can be supported
CONSUMERS

- Heterotrophs
- Gain energy by eating other organisms
- Primary, secondary, tertiary
CONSUMERS

- Herbivores: feed on producers only (plants)
- Omnivores: feed on producers and other consumers (plants and animals)
- Carnivores: feed on consumers only (feed on animals)
IN A WORLD FAR AWAY...

You discover an ecosystem full of life on a different planet...what does the ecosystem look like there?

You decide!

You CANNOT use any plants/animals found on earth!
YOU DECIDE!

1.) The name of your planet

2.) What are 5 abiotic factors of your planet? (lots of steep mountains, extremely cold/icy, poisonous gas in atmosphere, little water available, main color of the environment, thick clouds, hot lava pools, soil type)

3.) Names of 4 producers, 3 primary consumers, 2 secondary consumers, and 1 tertiary consumer

4.) List 5 adaptations animals would have and 3 adaptations plants (root system, stem covering, shape of leaves) would have on your planet

5.) How much biomass is there at each trophic level if there are 10,000 kg of producers? List each one and explain why.

6.) Draw/color/label the organisms in your ecosystem and draw arrows to create a food web
<table>
<thead>
<tr>
<th>A.</th>
<th>B.</th>
<th>C.</th>
<th>D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two male lions fight over a female lion.</td>
<td>A pack of wolves and a bear fight over a dead deer.</td>
<td>A praying mantis insect eats a grasshopper.</td>
<td>Ox pecker birds pick parasites off the water buffalo for food and the water buffalo have no parasites.</td>
</tr>
<tr>
<td>E.</td>
<td>F.</td>
<td>G.</td>
<td>H.</td>
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<td>A butterfly drinks nectar from a flower and the flower gets pollinated.</td>
<td>Spring Wood Tigers vs. Raiders</td>
<td>A fungus grows under a tree’s bark and causes it to grow slowly.</td>
<td>A tapeworm lives in the intestines of a person, causing illness and weight loss.</td>
</tr>
<tr>
<td>I.</td>
<td>J.</td>
<td>K.</td>
<td>L.</td>
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<tr>
<td>Barnacles attach to the skin of whales where they are able to capture food. The whale is not helped or harmed.</td>
<td>Fleas suck blood from a cat.</td>
<td>Lichens use trees as a place to grow and be protected. The tree is not affected.</td>
<td>Ants milk aphids for honeydew (food) and the aphids are protected from predators by the ants.</td>
</tr>
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<td>M.</td>
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<tr>
<td>A blue jay bird pulls an earthworm out of the ground and eats it.</td>
<td>You have harmless eyelash mites living in your eyelash follicles.</td>
<td>A lion chases, catches, kills, then eats a zebra.</td>
<td>A clown fish lives in a sea anemone. Clown fish guard them from butterfly fish and sea anemones give them a home.</td>
</tr>
</tbody>
</table>
Niche: role of an organism in an ecosystem

- Herbivore, carnivore, or producer?
- What conditions can it tolerate? (Soil pH, humidity, etc.)
- Necessary resources, shelter, or territory
PLANT ADAPTATIONS

- **Desert**: sharp spines, water storage in leaves, protected by thick waxy cuticles (most outer layer)

- **Cold/Dry climates**: small surface area for leaves and thick epidermis to protect from cold weather
PLANT ADAPTATIONS

-Aquatic: flexible leaves, stomata on the upper surface

-Tropical: large/broad leaves to get access to sunlight, water loss isn’t as much of a problem
List and describe 3 environmental issues or challenges that you think are important.

• Why is it important?
• What do you think could/should be done?
HUNGRY AS A HIPPO

WOULD YOU EAT A HIPPOPOTAMUS?
WHAT WOULD YOU DO?

- You are a member of Congress in session to vote for a recently proposed bill.

- The bill proposes the plan to import thousands of hippos from Africa, settle them in the swamps along the Gulf Coast in Louisiana, sell the hippos for meat, and therefore transform America into a nation of hippo eaters.

- The bill asks for $250,000 and the approval of the government.

Would you, as a member of Congress, vote for this bill to be passed or not?
- All cows in the United States have been abducted by aliens, and we are now facing a meat crisis.
- Meat prices go way up and people are going hungry.
- The region the hippos would be imported to is unused by human because it is a large, swampy area.
- Hippo meat is safe and tasty.
- Hippos would be fenced in to farms where they could not roam free or escape.
DECIDE...

• What would you have to know about hippos before you can make a decision? (at least 3 things)

• What would you have to know about the ecosystem the hippos would be imported into before you can make a decision?

• What are potential impacts or issues hippos might cause for people or other organisms?

• Plan an argument to support your decision.
PLOT TWIST...

- This proposal really happened in the United States in 1910
- It was popularly referred to as “The Hippo Bill”
- Reason for the bill: the meat industry was facing a crisis
  - Many people were immigrating to the United States
  - There was less available land for cattle grazing
  - Beef prices were going up steadily
WHY HIPPOS?

• William Newton Irwin: a researcher with the U.S. Department of Agriculture laid out his plan in a 1909 article titled "Animals That Should Be Introduced And Bred For Economic And Profitable Meat Production" and caught the eye of a Louisiana congressman
  
  • Lots of offspring
  • Ten thousand square miles of unused gulf could be used as a farm for semiaquatic hippos
  • Plants called water hyacinths were growing rapidly and taking over the area…but hippos eat water hyacinth! (win-win, right?)
WHAT HAPPENED TO THE HIPPOS?

• Presented to Congress on March 24, 1910
• The hearing went well and generated great interest: major papers ran articles praising the idea
• Congress was unable to act on the Hippo Bill during the session…they were short 1 vote!
• Plans to reintroduce the bill were never followed through with
NATIVE VS. NON-NATIVE SPECIES

- **Native**: naturally found in an ecosystem

- **Non-native species**: not naturally found in the ecosystem
  
  *Also called invasive species
  
  *Cause harm to the native species
  
  *Normally invade due to human activity
WHAT’S SO BAD ABOUT NON-NATIVE SPECIES?

DIRECT IMPACT ON THE ECOSYSTEM:
- Preying on native species
- Out-competing native species for food/resources
- Causing/carrying disease

INDIRECT IMPACTS ON THE ECOSYSTEM:
- Changing food webs
- Decreasing biodiversity
- Altering ecosystem conditions
NON-NATIVE SPECIES: ZEBRA MUSSELS
-Came to the U.S. from Eurasia in ship water released into the Great Lakes
-Spread dramatically since 1988: out-compete native species for food and habitat
-Colonize rapidly and clog piping, pumps, wells, storage tanks
Quagga Mussels on ABS Pipe from Lake Mead, NV
NON-NATIVE SPECIES: RATS, CATS, AND DOGS

-Hawaiian rail: bird native to the main island

-Isolated geography free of predatory mammals: evolved to become flightless

-No defense against non-native predators brought by humans

-Completely extinct along with many other flightless island bird species
NON-NATIVE SPECIES: WATER HYACINTH

- Aquatic plant introduced to the U.S. as a decorative plant in 1884 by the Japanese.
- Crowds out native species: reduces sunlight for submerged plants and aquatic organisms, consumes the oxygen in the water (killing fish).
- Clogs waterways and intake pipes.
WATER HYACINTH

-In 1910: proposed to import and release hippopotamus from Africa into the rivers of Louisiana, eat the hyacinth and produce meat

-Directly blamed for starving subsistence farmers in Papua New Guinea

-In Cambodia: people use it to make baskets