Stability and Change

• Ecosystems are characterized by both **stability and change**

• Change can be a healthy component of the ecosystem as long as an ecosystem is resilient (ability to recover)

• The resilience of an ecosystem depends on three factors: biodiversity, health, and disturbances
Biodiversity

- Biodiversity: a measure of the variety of organisms in a given area
- Based on a measurement of many factors
- The greater the biodiversity, the more roles in a food web to create stability
Biodiversity

• The group with the most biodiversity is the insects, with an estimated 30 million species
Properties of Biodiversity

1. Species Richness: The number of different types of species in an area
   - Varies with latitude (closer to equator the more species)
   - More sun light, better climate stability
Total Reptile Species Richness in the United States

Number of Species
- 0 - 6
- 7 - 16
- 17 - 25
- 26 - 43
- 44 - 74
Properties of Biodiversity

2. Species Evenness: the relative abundance of each type of species

This community shows more evenness as there are 4 "organisms" of each "species"
Properties of Biodiversity

• Which community has more species richness?
  • Neither, they both have four species

• Which has more species evenness?
  • Community 1 (the same number of each species)
Properties of Biodiversity

3. Genetic variation: a variety of traits is important to withstand environmental change or disturbances within an ecosystem
Properties of Biodiversity

4. Species-Area Effect: larger areas contain more species than smaller areas

- Islands closer to the mainland have more species than islands further away
Biodiversity Index

• Biodiversity index: a quantitative measurement of biodiversity
• Ecologists can better understand community structure
• High species richness and evenness and genetic diversity results in higher biodiversity
Biodiversity Index

• Biodiversity index = \frac{\text{# Species}}{\text{# Organisms}}

• The closer to 1 the biodiversity index is, the more diverse and healthy the ecosystem is (able to withstand disturbances)
Example Problems

• Calculate the biodiversity of sample A
  • 3 species/8 organisms = 0.375

• Calculate the biodiversity of sample B
  • 2 species/8 organisms = 0.25

• Which is more diverse?
  • Sample A
• Which sites have more richness?
  • A, C, and D

• Which sites have the most evenness?
  • A and C

• Which site has the highest biodiversity?
  • C
Threats to Biodiversity

• Evolution is the change in the traits of a population over (a very long) time due to environmental influence

• Change can be a healthy component of the ecosystem but also unhealthy when influenced by human impact

• Humans are changing the environment faster than the rate of evolution occurs
Threats to Biodiversity

• Currently in a period of high biodiversity
• Estimated by 2030, 20% of species will be gone
• Rainforest biome contains 1/5 of the world’s species but is quickly disappearing
Threats to Biodiversity

• Loss of biodiversity results in community instability
• Biggest threat to biodiversity is habitat destruction
Threats to Biodiversity

• Invasive species are the second largest threat
  • A non-native species that has the ability to spread quickly

• An invasive species can out compete native species and often lack natural predators in the area

• This can also cause a drastic change to the habitat
ATTENTION BOATERS...

DON'T MOVE A MUSSEL!

CLEAN - DRAIN - DRY - DISPOSE

manitoba.ca/StopAIS
Lionfish

Cane Toad

Faster and faster
Cane toads spread quickly for the first 50 years after their introduction on the east coast of Australia, but are now racing even faster across the north of the country. Predictions of how far they will spread in the future vary.

Island of the Sucre
Bermuda

Cane Toad range

Future distribution:
- One prediction suggests the cane toad could stick mainly to northern Australia
- A second suggests it could reach the south coast
- Both predictions suggest these areas will be invaded
Ice plant: native to South Africa. Brought to California in the early 1900s for stabilizing soil along railroad tracks.

Yellow Star Thistle: native to Eurasia. It was most likely introduced after 1848 as a contaminant of alfalfa seed.
California Invasive Species

Fire Ant: native to South America. Possibly introduced in ships’ ballast.

Mosquito Eating Fish: native to southeastern US. Intention introductions to control mosquitoes.
Prevent the Spread of Invasive Species

Before launching and before leaving...
Inspect everything!

ALERT!
Don’t move firewood!
HELP PREVENT THE SPREAD OF INVASIVE FOREST PESTS.
LEARN MORE
Loss of Biodiversity

• Loss of habitat and introduction of invasive species leads to a loss of biodiversity

• Less biodiversity leads to a loss in variation, one of the factors required for natural selection

• Eventually leads to extinctions as organisms cannot evolve as quickly as their surroundings change