

Ecology



Do Organisms live in Isolation?

- *No!*
- *Organisms interact with their surroundings*
- *Ecology – the study of how living organisms interact with each other and with their environment*





Ecology

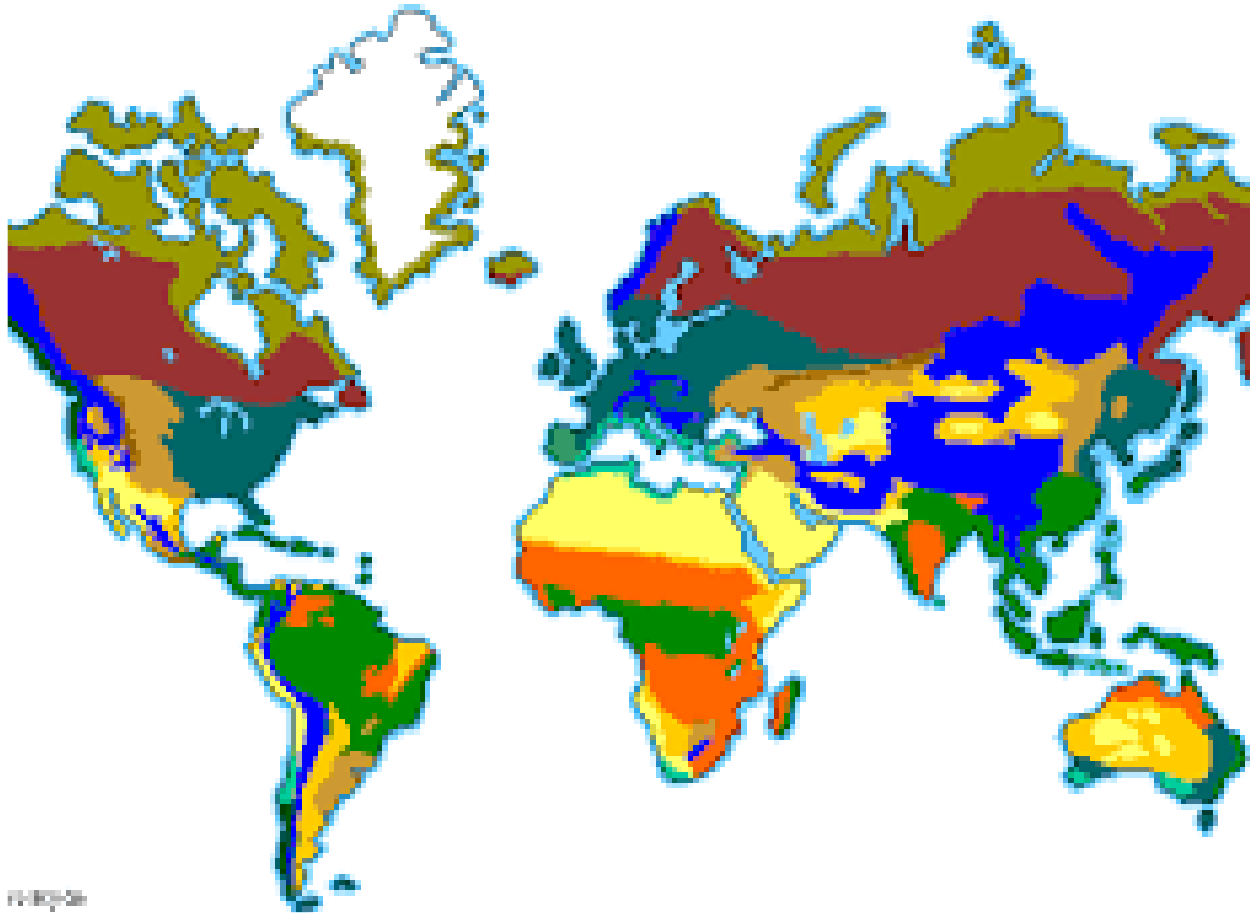
- Life science can be studied at different levels
- Biosphere – any area in which organisms live

Research in Ecology

- Ecology involves:

- Geology
- Soil Science
- Geography
- Meteorology
- Genetics
- Chemistry
- Physics

- Biomes – a large community of plants and animals that live in the same place



PHOTO

Research in Ecology

- *Biomes include:*

- *Aquatic*
- *Deserts*
- *Forests*
- *Grasslands*
- *Tundra*

- *Research*

- *Field Studies*
- *Laboratory Studies*



Organisms & Environments

- *Organisms have the ability to:*
 - *Grow*
 - *Reproduce*
- *To grow and reproduce, organisms must get materials and energy from the environment*
- *An organism's environment includes two types of factors:*
 - *Abiotic – part of the environment that are not living (sunlight, climate, soil, water and air)*
 - *Biotic – parts of the environment that are alive, or were alive and then died (plants, animals and their remains, bacteria, fungi and protists)*





Organisms & Environments

- *Ecology studies the interactions between biotic factors, such as organisms like plants and animals, and abiotic factors*
 - *Animals breathe in air (abiotic)*
 - *Plants (biotic) absorb carbon dioxide (abiotic) and need water (abiotic) to survive*

Review Questions

1. What do ecologists study?
2. In a forest, what are five biotic factors present? Five abiotic factors?
3. What is a biome? Give an example.

Levels of Ecological Organization



Levels of Ecological Organization



- *Ecosystems – all living things in an area interacting with all of the non-living parts of the environment*
- *Ecosystem Level of Organizations*
 - *Species – a group of individuals that are genetically related and can breed to produce fertile young*
 - *Population – a group of organisms belonging to the same species that live in the same area and interact with one another*
 - *Community – all of the populations of different species that live in the same area and interact with one another (composed of all of the biotic factors)*
 - *Ecosystem – composed of biotic and abiotic factors in an area*

Levels of Ecological Organization



- *Biosphere – the part of the planet with living organisms*
- *Ecologists study ecosystems at every level (individual organism to biosphere)*

Review

1. Define species.
2. What is an ecosystem
3. Define population. How is a population different from a community.

A stylized, colorful landscape illustration. In the foreground, a green hill features a purple flower with a dark brown stem and small white curls. The background consists of rolling hills in shades of blue and white, suggesting a sky or distant terrain.

Features of Populations

What is a population?

- Population – a group of organisms of the same species, all living in the same area and interacting with each other.
- Ecologists study populations to see how healthy or stable they are, how individuals of a species interact with each other, and how populations interact with the environment
- Factors that describe a population
 - Population size – the number of individuals that make up the population
 - Population density – the number of individuals of the same species in an area



What is a population?



- Dispersion – how individuals in a population are spread across an environment (population density and dispersion have an effect on reproduction and population size)
- Birth rate – the number of births within a population during a specific time period
- Death rate – the number of deaths within a population during a specific time period
- Growth rate is BIRTH RATE – DEATH RATE

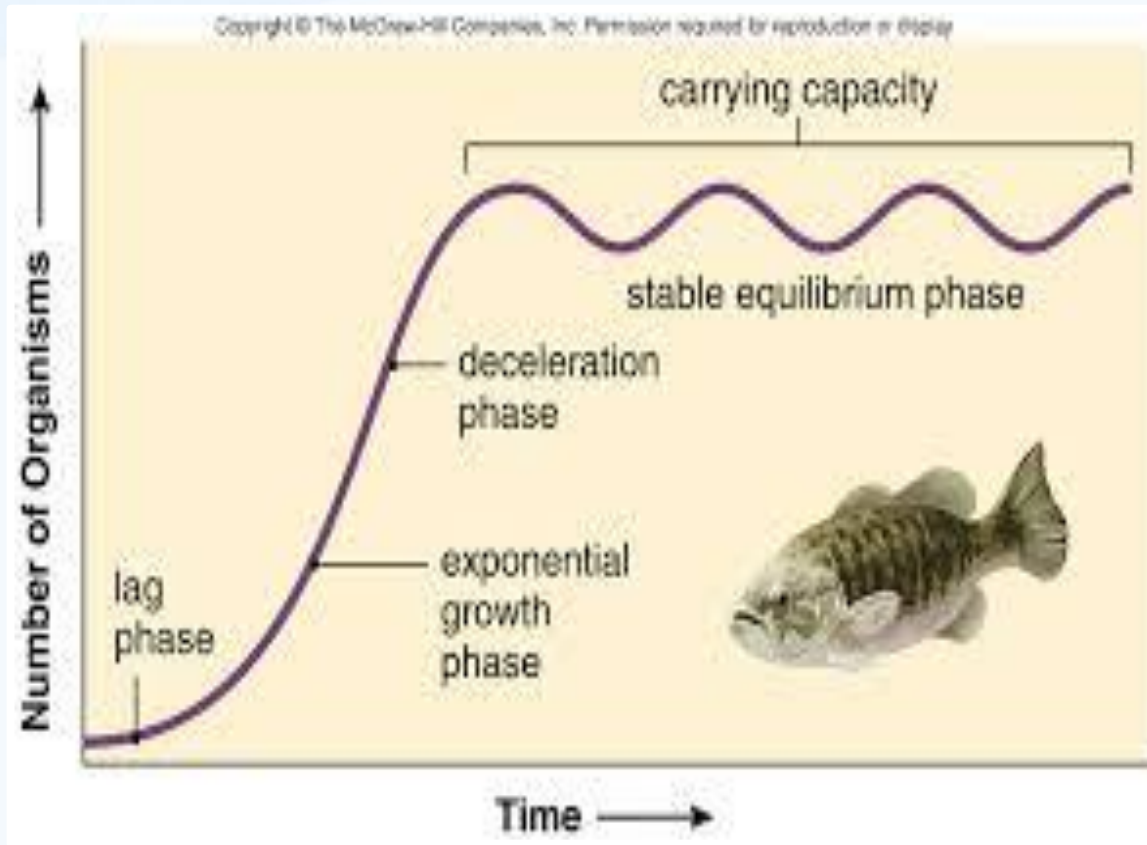
Review

1. Define population.
2. What is population dispersion? Describe the possible dispersion patterns for a population.
3. Would all the deer and mice living in a forest be a population? Why or why not?
4. What is the growth rate?

Population Growth Patterns



Population Growth



- Population Growth Rate – how quickly a population is increasing or decreasing
- Factors that affect population growth
 - Age of organisms that first reproduction
 - How often an organisms reproduces
 - The number of offspring of an organism
 - The presence or absence of parental care
 - How long an organism is able to reproduce
 - The death rate of offspring

Population Growth

- For an ecosystem to be stable, populations in that system must be healthy
- Different Strategies to increase reproduction
 - Altricial organisms – helpless at birth, parents give them a lot of care
 - Precocial organisms – have a longer period of development before they reach maturity (can take care of themselves at birth)



Migration

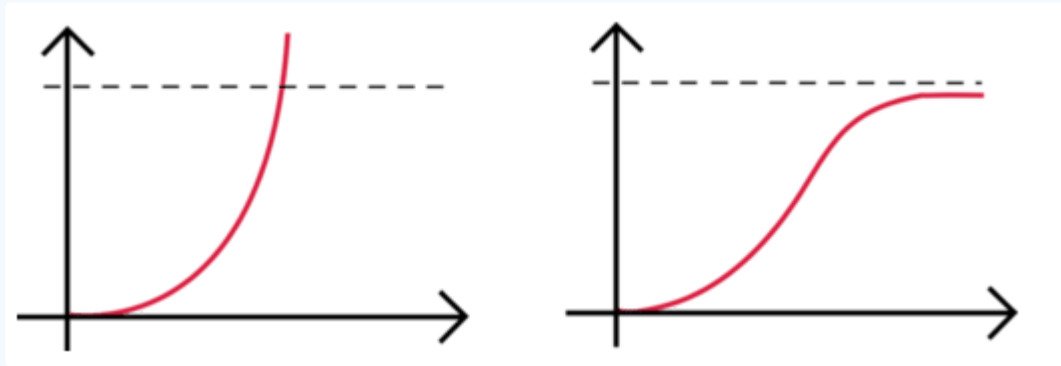
- Migration – the movement of individual organisms into, or out of, a population
- Two types of migration:
 - Immigration – the movement of individuals into a population from other areas (increases population size and growth rate)
 - Emigration – the movement of individuals out of a population (decreases the population size and growth rate)
 - Migration with growth rate:

$$\text{Growth rate} = (\text{birth rate} + \text{immigration rate}) - (\text{death rate} + \text{emigration rate})$$



Exponential Growth

- Population Growth can be described with two models
 - Exponential growth – occurs as a population grows larger, dramatically increasing the growth rate
 - Would happen if a population was given unlimited resources (food, water, land, moisture, oxygen, and other environmental factors)
- Carrying capacity – the upper limit to the population size that the environment can support
 - Logistical growth – the carrying capacity growth



Review

1. List three factors that affect population growth.
2. Compare altricial organisms to precocial organisms.
3. What is the overall equation for birth rate?
4. Does a typical population show exponential growth? Why or why not?
5. Define carrying capacity.

The background features a stylized landscape with rolling green hills in the foreground and middle ground. The sky is composed of horizontal, wavy bands of light blue and white. On the left side, a purple and pink flower with a dark brown stem and small white curls grows on a green hill. The text is written in a brown, cursive font on the right side of the image.

Limiting Factors to Population Growth

Limiting Factors to Population Growth



- Limiting Factors – resources or other factors in the environment that can lower the population growth rate
- Can include:
 - Low food supply
 - Lack of space
 - Lower birth rates
 - Increase in death rates
 - Lead to emigration
- When organisms face limiting factors, they show logistical growth

Limiting Factors to Population Growth

- Competition for resources like food and space cause the growth rate to stop increasing



Food Supply as a Limiting Factor



- If there are 12 hamburgers at the lunch table and 24 people sit down to eat, will everyone get one hamburger?
 - You could split in half
 - What if more people keep coming to sit?
- Organisms that can not get food will die or will find a new place to live
- Food has a dramatic consequence on population
- Population small – more food resources
- As population increases, the food supply may decrease

Other Limiting Factors

- *Other limiting factors include:*

- *Light*
- *Water*
- *Nutrients or minerals*
- *Oxygen*
- *Disease*
- *Parasites*
- *Temperature*
- *Space*
- *Predation*
- *Weather*
- *Human activities*



Review

1. What is a limiting factor?
2. What are three examples of limiting factors?
3. When organisms face limiting factors, what type of growth do they show?

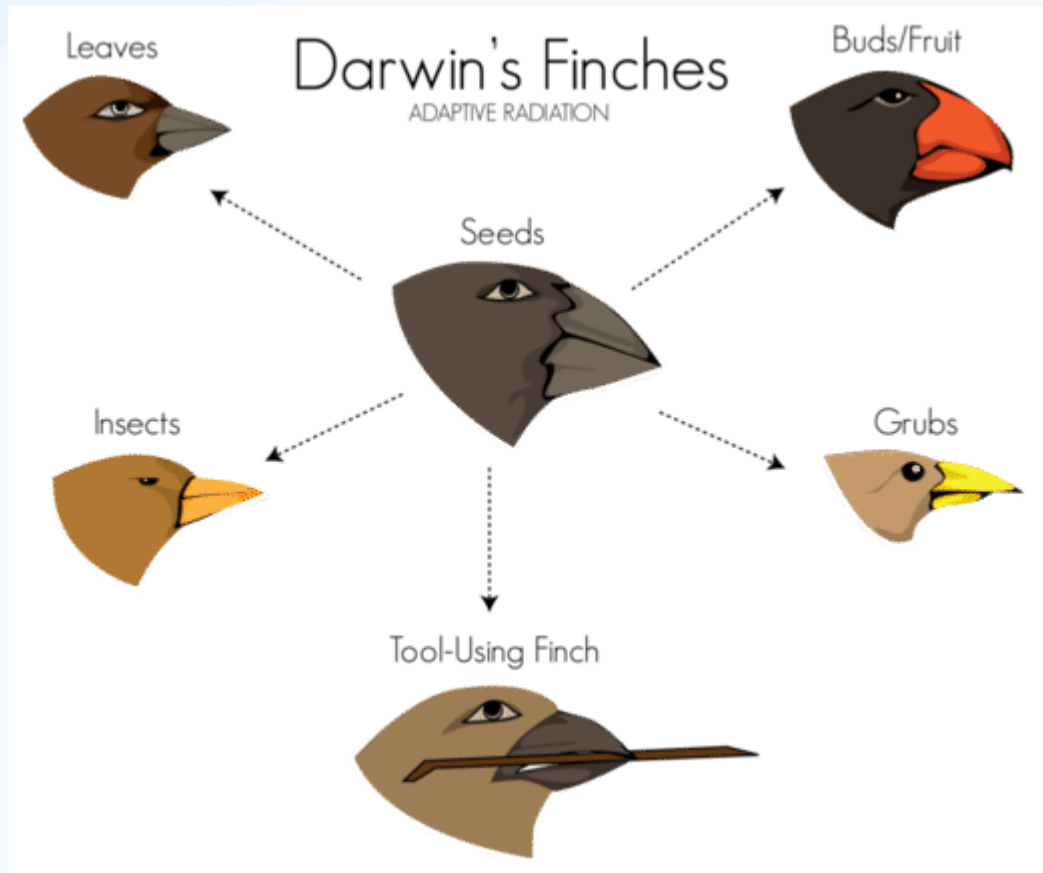


Competition



Competition

- *Ecology – the study of how living organisms interact with each other and with their environment*
- *Competition – occurs when organisms strive for limited resources*
- *Intraspecific competition – when members of the same species compete for the same resources*
 - *The organism that is better adapted to that environment will survive*
- *Interspecific competition – when individuals of different species strive for a limited resource in the same area*
 - *Different traits that make them more able to survive*



Competition

- *Competitive Exclusion Principle* – species less suited to compete for resources will either adapt, move from the area, or die out.
- *Character displacement* – For two species to coexist in the same area, they may adapt by developing different specializations
- *Competition for resources within and between species plays an important role in evolution through natural selection*

Review

1. What is the difference between intraspecific and interspecific competition?
2. What is the competitive exclusion principle?
3. How can competition contribute to evolution through natural selection?
4. What has to be true about available resources for competition to exist?

A stylized illustration of a landscape. The foreground features rolling green hills in various shades of green. On the left, a purple and pink flower with a dark brown stem and small white curls grows on a hill. The background consists of a blue sky with wavy, layered bands of light blue and white. The word "Predation" is written in a brown, cursive font in the center of the image.

Predation

Predation

- Predation – a predator organism feeds on another living organisms or organisms
- Predator lowers the prey's fitness
 - Keeps the prey from surviving, reproducing, or both
- Predator-Prey Relationships – essential to maintain the balance of organisms in an ecosystem





Predation

- *Types of Predation*
 - *True predation – when a predator kills and eats its prey (traits that help these predators: camouflage, speed, heightened senses)*
 - *Grazing – predator eats part of the prey but does not usually kill it*
 - *Parasitism*
- *Predators play an important role*
 - *Singles species would become dominant over others if there were no predators*
 - *Keystone species – have a large effect on the balance of organisms in an ecosystem*

Predation

- Prey also have adaptations for avoiding predators
 - Camouflage
 - Mimicry – uses appearance to copy or mimic another species



Review

1. *What is predation?*
2. *What's the difference between grazing and true predation?*
3. *What sorts of adaptations do prey have for avoiding predators?*
4. *Predators can be a keystone species. What does this mean?*

Symbiosis



Symbiosis

- Symbiosis – a close and long-term relationship between different species
 - Mutualism – a symbiotic relationship in which both species benefit (bacteria that lives in an herbivore's intestines)
 - Commensalism – a symbiotic relationship in which one species benefits while the other is not affected (spiders build their webs on trees)
 - Parasitism – a symbiotic relationship in which the parasitic species benefits while the host species is harmed (live inside or on the surface on their host)
 - Parasites: hookworms, roundworms



Review

1. *What is symbiosis?*
2. *Distinguish between mutualism and commensalism.*
3. *Describe an example of a symbiotic relationship.*
4. *What's an example of a parasite?*