

Ecology - Defined

Introduction

- scientific study
- interaction of plants and animals and their interrelationships with the physical environment

Ecology - Levels of Organization

Abiotic factors (non-living factors)

Chemical (elements and compounds)

- *Law of minimum*
 - rate of growth is limited by the amount of essential nutrients

Ecology - Levels of Organization

Physical factors

water
soil

climate
light

temperature
atmospheric gases

- *Range of Tolerance*
 - too much or too little of a factor may act as a limiting factor
 - influence distribution of a species

Ecology - Levels of Organization

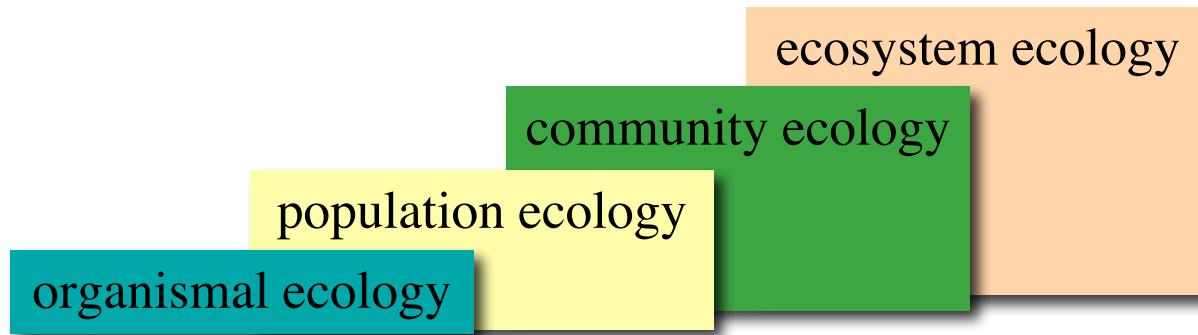
Biotic factors

- living component of a biological community

Ecology - Levels of Organization

Hierarchy of Interactions

- interactions --> organisms and environment
- increasing complexity



Ecology - Hierarchy of Interactions

Organismal Ecology

- evolutionary adaptations of an organism to its abiotic environment

Ecology - Hierarchy of Interactions

Population Ecology

- factors that affect population size and density
- *population* - a group of individuals of the same species living a particular area

Ecology - Hierarchy of Interactions

Community Ecology

- interactions between species --> affect community
- community - a group of populations in a specific habitat

Ecology - Hierarchy of Interactions

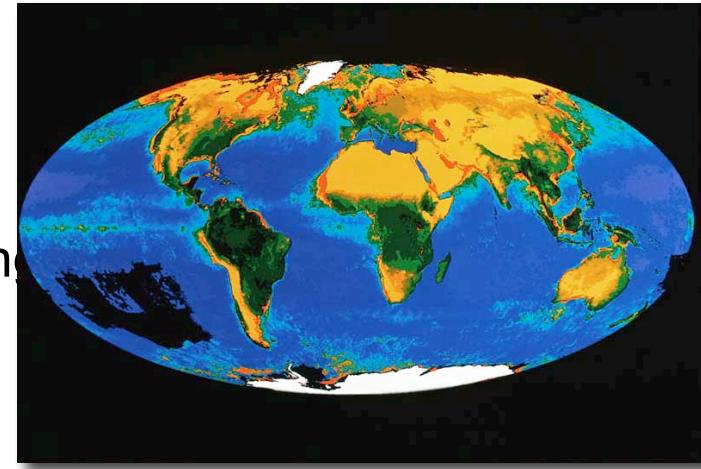
Ecosystem Ecology

- energy flow (cyclic events) between biotic and abiotic factors
- ecosystem --> community + abiotic factors

Ecology - Hierarchy of Interactions

Biosphere

- the global ecosystem
- sum of all life and their surroundings



Ecology - Organismal Ecology

Types of evolutionary adaptations

Morphological

- change in body shape or structure over time

reversible changes: growing heavier coat in the winter

irreversible: “flagging” of trees

Ecology - Organismal Ecology

Physiological

- internal processes and functions
- acclimation - a response by an animal that enables it to tolerate a change in a single factor in its environment
(example: temperature)

Ecology - Organismal Ecology

Behavioral

- changes in behavior occur when organisms enter a new niche

Ecology - Population Ecology

Population Density

- the number of individuals of a species per unit area
- measured with sample plots

Ecology - Population Growth Models

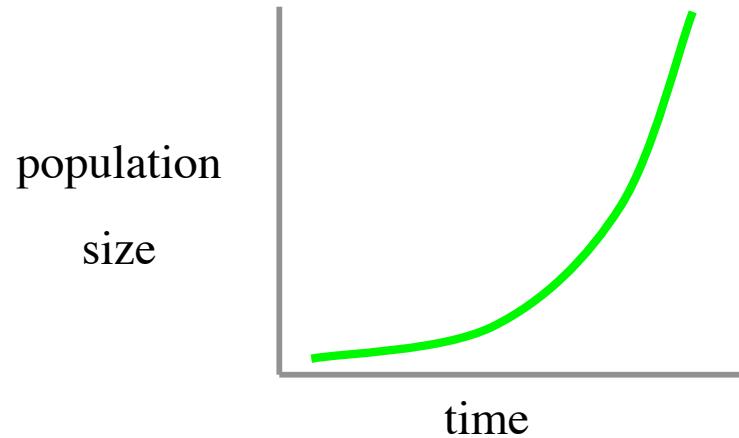
Unlimited, ideal conditions

- growth is exponential and explosive

Exponential Growth

- unregulated
- ex. bacteria

$$G = 2^n$$



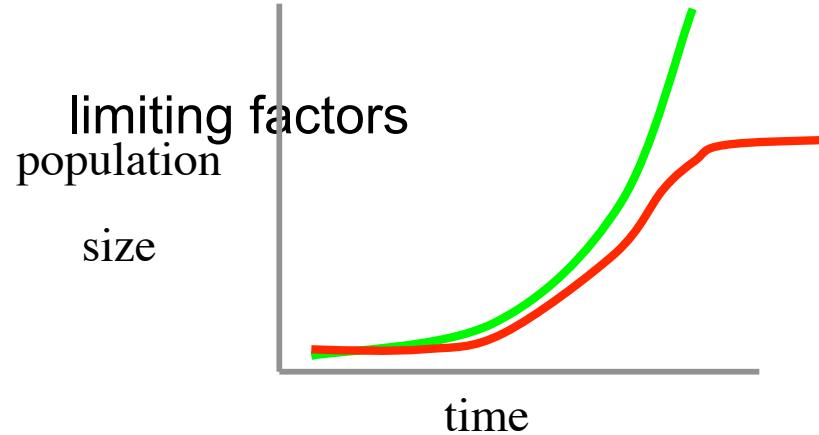
Ecology - Population Growth Models

Limited Environment

- growth is exponential at first
- environmental factor(s) limit growth
population-limiting factors

Logistic growth

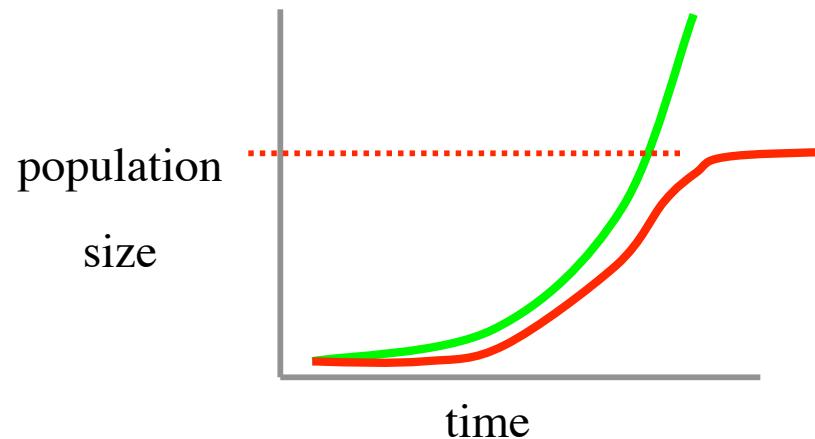
- growth slowed by



Ecology - Population Growth Models

Carrying capacity

- number of individuals in a population that the environment can support



Ecology - Factors Limiting Growth

Density-Dependent Factors

- logistic model
- increasing population density reduces the resources available to organisms --> limits population growth
- *intraspecific competition*
 - competition between individuals of the same species for the same limited resources

Ecology - Density-Dependent Factors

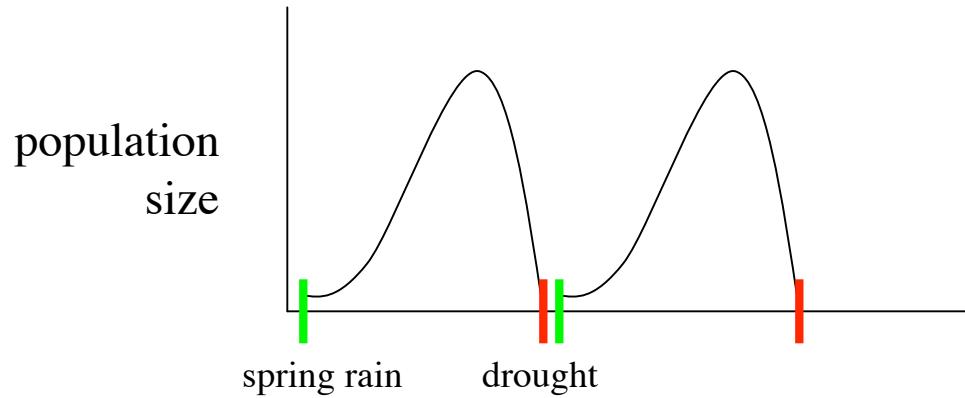
Population growth is a Density-Dependent Factor

- a population-limiting factor whose effects intensifies as the population increases in size
- growth rate depressed by: \uparrow death rate or \downarrow birth rate
- example: food supply (*Law of minimum*)
amount of wastes (*Law of tolerance*)

Ecology - Factors Limiting Growth

Density-Independent Factors

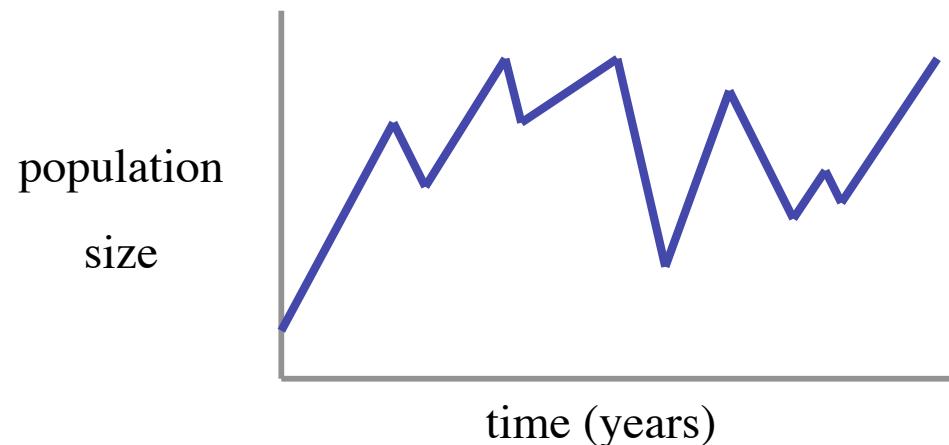
- unrelated to population density
- ex: flood, fire, drought



Ecology - Population Growth Models

Natural Populations

- exhibit both density dependent and independent growth factors



Ecology - Community Ecology

Key Properties of Communities

species diversity - richness and relative abundance of species

form of vegetation - type and structure of dominant plants

stability - ability to resist change

trophic structure - feeding relationships among community species

Ecology - Interactions in Communities

Interspecific competitions

- may occur when populations of 2 or more species rely on the same limiting resources

Ecology - Interactions in Communities

Niche

- the functional position of an organism in its environment; comprising time, space and tolerance range.

Principle of competitive exclusion (Gause's principle)

- states that no two organisms can occupy the exact same niche within the environment

Ecology - Interactions in Communities

Three outcomes of competitive exclusion:

1. the less competitive species will be forced into extinction
2. one of the species will evolve to use a different set of resources
3. one species will migrate to another habitat

Ecology - Interactions in Communities

Predation

- interaction between species in which one species (predator) consumes another species (prey).
- animals consuming plants is also considered predation
- predator-prey relationships are subject to natural selection

Ecology - Interactions in Communities

Predator Adaptations

- development of senses to identify prey (sight, smell, chemical sensors)
- structures to catch, subdue or consume prey (claws, teeth, mouth parts)
- speed, agility
- camouflage



Ecology - Interactions in Communities

Development of plant defenses

- immobile plants rely on anti-predator devices such as:

chemical toxins --> poison, distasteful flavors
structures --> thorns, spines

Ecology - Interactions in Communities

Animal defenses

Avoidance

- passive responses (hiding, feigning)
- active (escaping or defending)
- other (alarm calls, mobbing, distraction)

Ecology - Animal defenses - Coloration

Camouflage (cryptic coloration)

- coloration or form which blends in with an accustomed background
- passive defense
- makes organism difficult to locate



Ecology - Animal defenses - Coloration

Aposematis (warning coloration)

- organisms with chemical defenses are brightly colored
- warning to predators



Ecology - Animal defenses - Mimicry

Batesian mimicry

- mimic species evolves a coloration or appearance of a distasteful or poisonous species



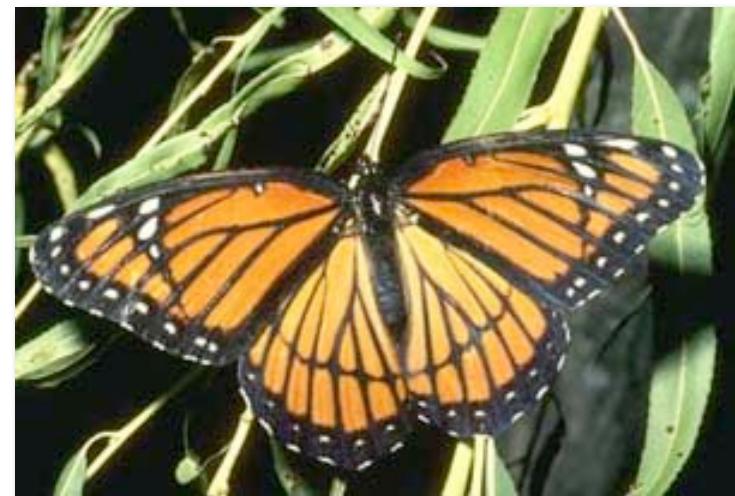
Ecology - Animal defenses - Mimicry

Batesian mimicry

Monarch butterfly



Viceroy butterfly



Ecology - Animal defenses - Mimicry

Transformational mimicry

IO Moth



Giant Swallowtail larvae



Ecology - Animal defenses - Mimicry

Müllerian mimicry

- two or more species with individual defense mechanisms come to resemble each other



Cuckoo bee



Yellow jacket wasp



Ecology - Animal defenses - Mimicry

- predators also use mimicry against prey



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