



# Living World

➤ **Biosphere:** thin layer of the living world that surrounds the nonliving world.

➤ air organisms

➤ soil water



# Biomes

- Major communities of organisms occurring together at relatively large scales, such as at the landscape-level.
- Tundra
- Deciduous Forest
- Grassland
- Tropical Rainforest
- Taiga (conifers)
- Chaparral (scrub)
- Desert



# Why do Biomes Differ?

- **Great differences in climate of earth**
- **Living organisms require specific ranges in season, temperature, sunlight, rainfall and require interactions with other specific organisms**
- **Each major type of climate develops a characteristic type of vegetation**
- **Each type of plant life supports a characteristic variety of animal life.**

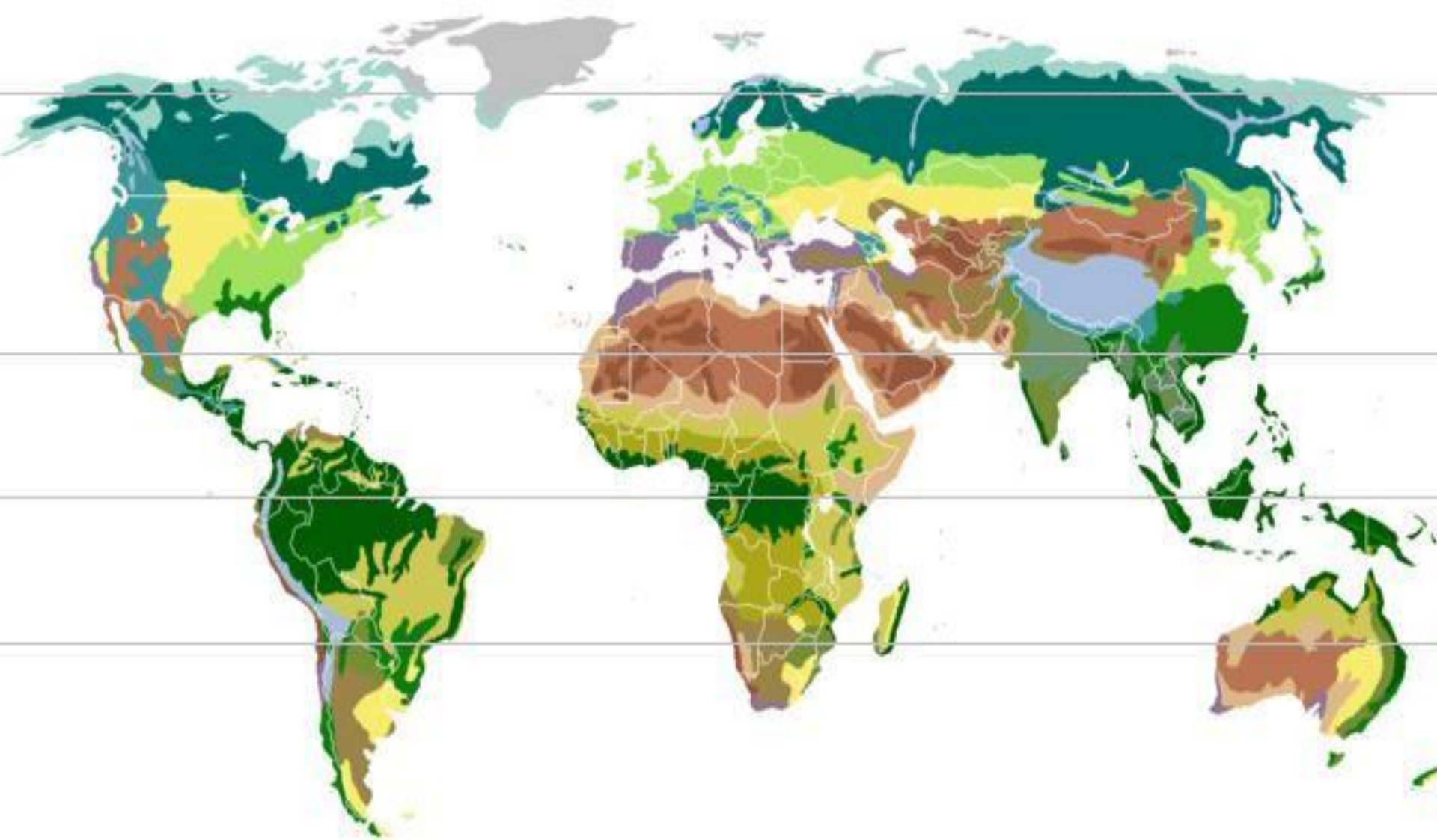




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<http://en.wikipedia.org/wiki/File:Vegetation-no-legend.pt.JPG>

**Do biomes affect the size of  
populations?**

**Think about this as we discuss  
what a population is.**



# Populations

- A population is a group of organisms of the same species that live and interact in the same place at the same time.
- A population is made up of individuals of the same species that interbreed.





# Four Rates Determine Population Size

- Population numbers change due to:

- **Mortality**: death rate

- **Natality**: birth rate

- **Immigration**: movement of new individuals into the population

- **Emigration**: movement of current individuals outside the population



# Size of a Population

- Size of any population is the result of the relationships among these rates.
- Which factors most influence the trend of :
  - Humans
  - Mule Deer
  - Red Wolves
  - **WHY????**



# Population Rate Changes


- **What do mortality and emigration have in common?**
- **What do natality and immigration have in common?**
  - **What must an organism be able to do to immigrate or emigrate?**
  - **How does a plant incapable of movement establish a new population?**



# Passive Dispersal

- Used by organisms incapable of movement
  - Animal
    - Wind
    - Water





■ **In the same way that the web of life connects individuals, it also connects populations.**



# The Environment

- Two Components:
  - Biotic: all living parts
    - Plants, Animals
  - Abiotic: all nonliving parts
    - Soil, space
    - Sunlight, water, wind



# Population Numbers Limited

- The environment limits a population's size
- Environment may slow, kill or enhance an individual's growth/life and hence affect the size of the population.



# Limiting Factor

- Any biotic or abiotic factor that can **affect (+/-)** the growth of a population.
  - Temperature
  - Moisture
  - Amount of Sunlight
  - Food Resources...



**Identify the limiting factors in  
the next slide**





**Author's own picture  
Tucson, AZ**





# Limiting Factors

- Limiting factors may be measured alone, however each factor affects the other, and **together**, they affect population size.
- The effect may be either direct or indirect.



# Water

- **Water is an important abiotic factor.**
  - **All organisms need water.**
- **Almost all chemical reactions needed to keep an organism alive take place in water.**
- **Water molecules are a part of many chemical reactions.**



# Limiting Factors

- Consider water.
- Do all organisms have the same needs?
  
- Evaluate the next 2 pictures and discuss their water needs. Is this limiting factor the same for both plant species?

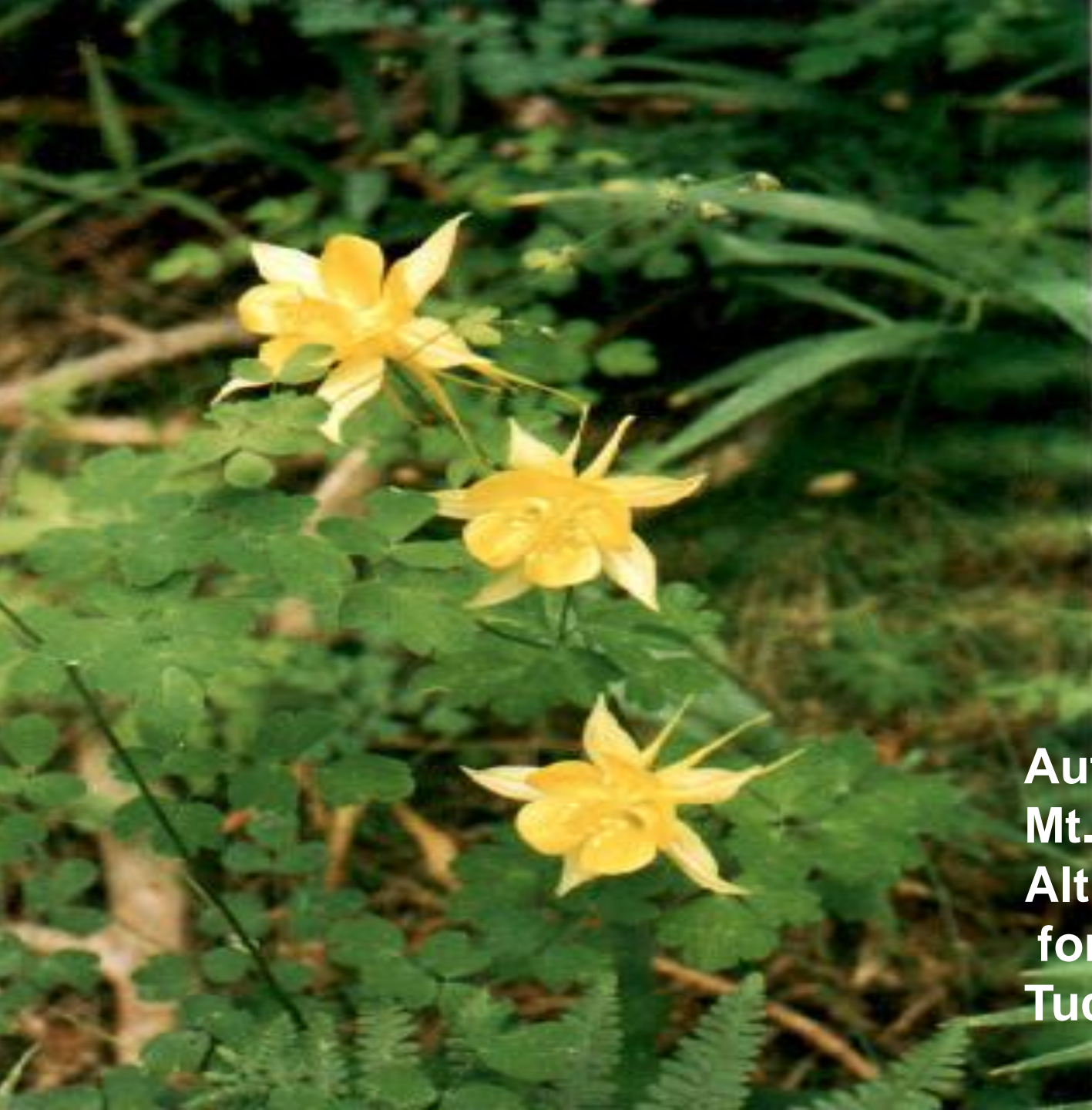




# Saguaro Cactus

**Author's Picture  
Tucson, AZ**





■ **Columbine**

**Author's Picture  
Mt. Lemmon,  
Altitude for conifer  
forests  
Tucson, AZ**



# Populations and Limiting Factors

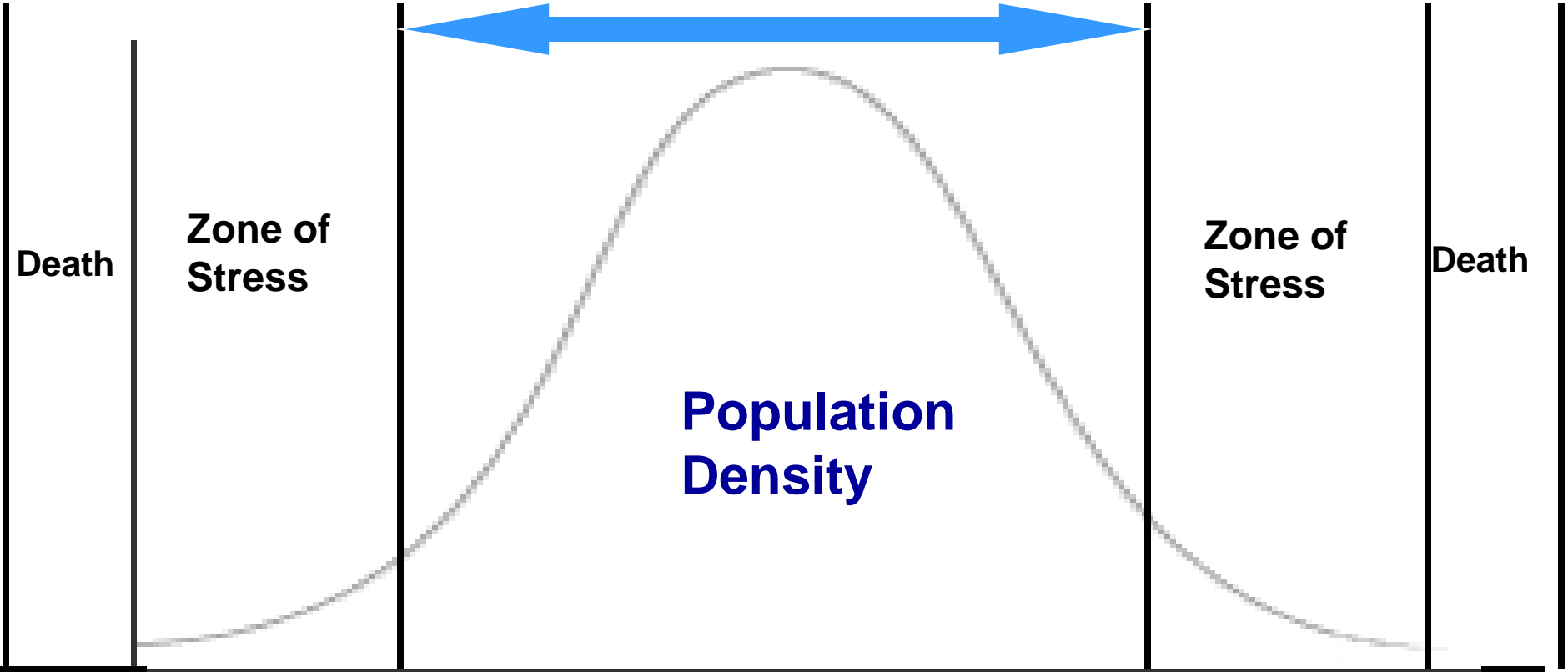
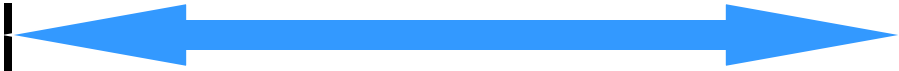
- Limiting factors affect the density (number) of the population.
- Under **optimum conditions**, the population will be favored and be able to reach maximum numbers.
  - Must limiting factors have a negative connotation?



**Range of Tolerance**



**Optimum Range**



**Zone of Stress**

**Zone of Stress**

**Death**

**Death**

**Population Density**

**Limiting Factor**  
**Water, Temp., Sunlight...**

# Tolerance Graph

**Why is this always a bell-shaped curve?**

**Which variable changes?**

**Explain how rainfall amounts differ in need for deciduous forests and cacti.**



- **Why did bluebirds and wood ducks suffer population declines??**
- **What was their environmental limiting factor??**
- **How did humans rescue these two species??**



# Space as a Limiting Factor

- Organisms require different amounts of space (**abiotic factor**).
- Space needs relate to a **biotic factor** – the availability of food energy.
- Why do space needs differ for plants and large meat-eating predators???





# Limits to Population Size - Biotic

- **Predators**
- **Disease**
- **Competition**
- **Environmental Stress (temperature...)**

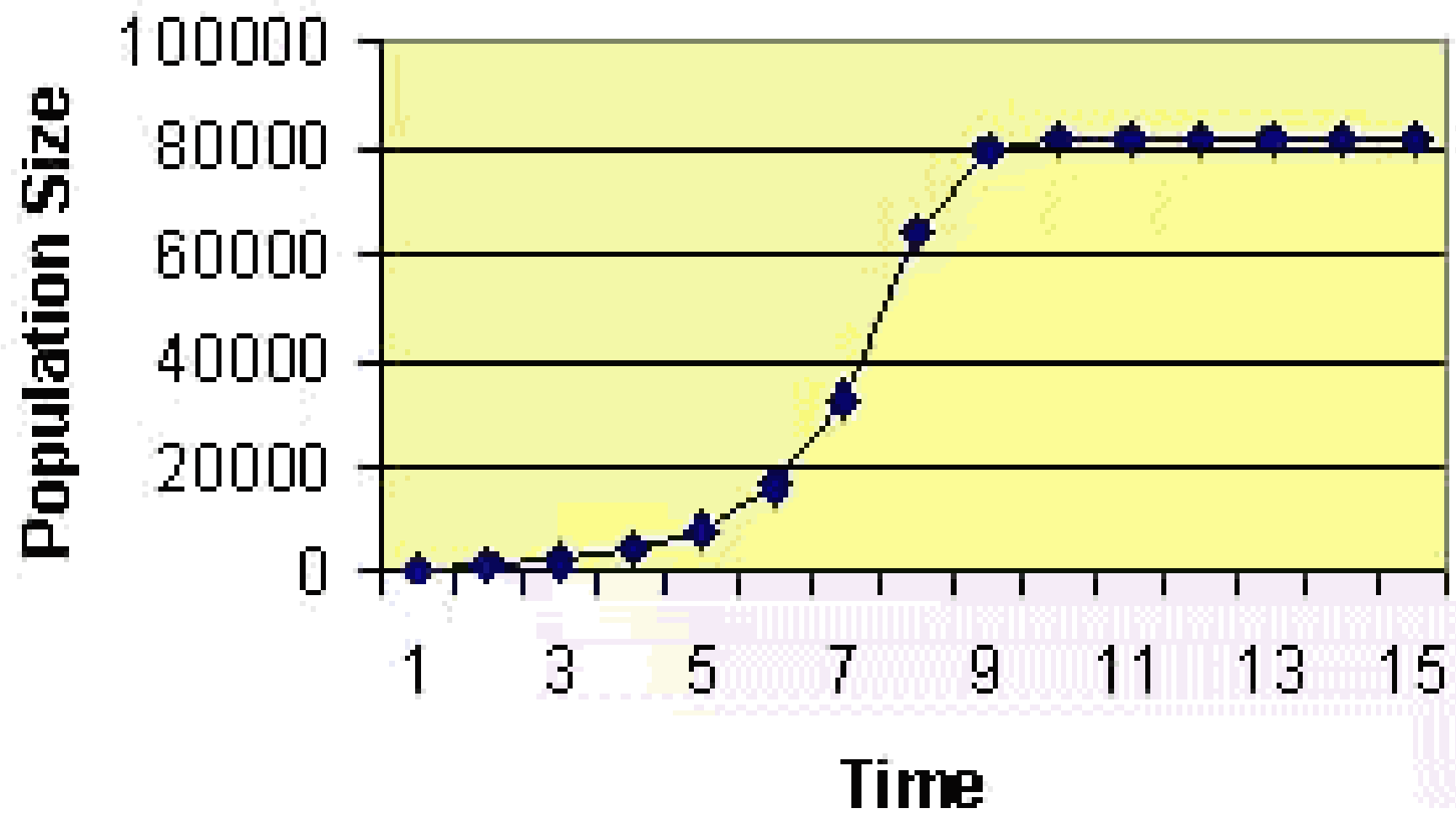


# Carrying Capacity

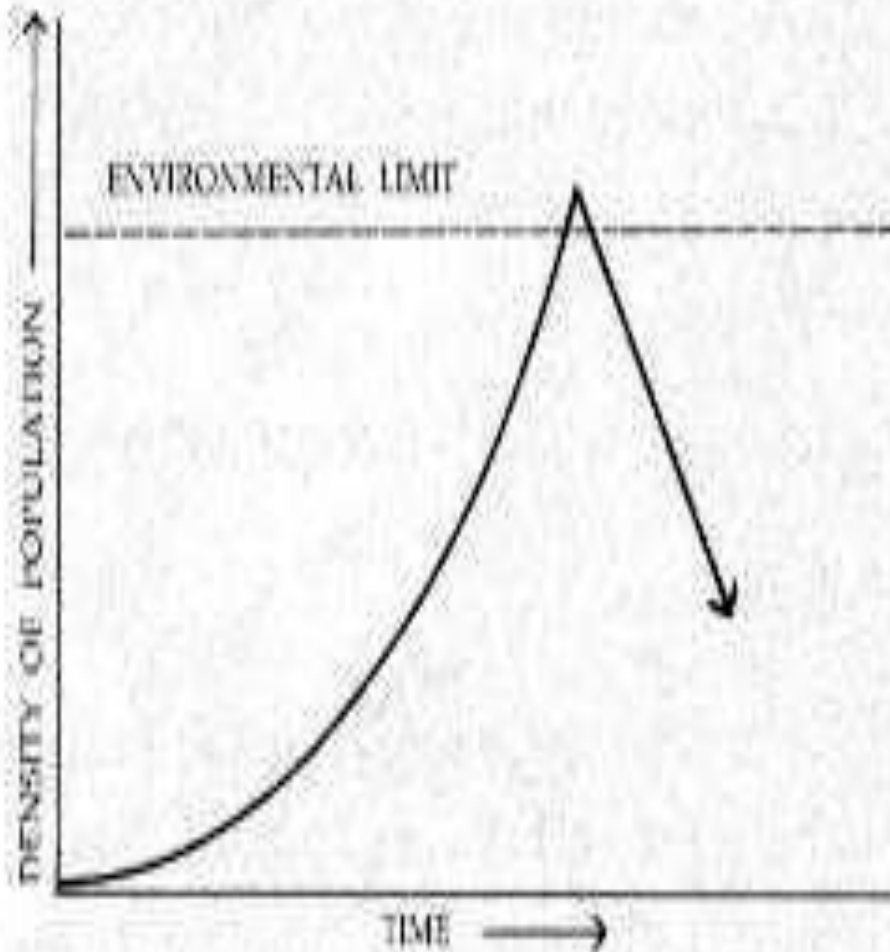
- The greatest number of individuals that a space can support indefinitely **without degrading the environment**



# Carrying Capacity

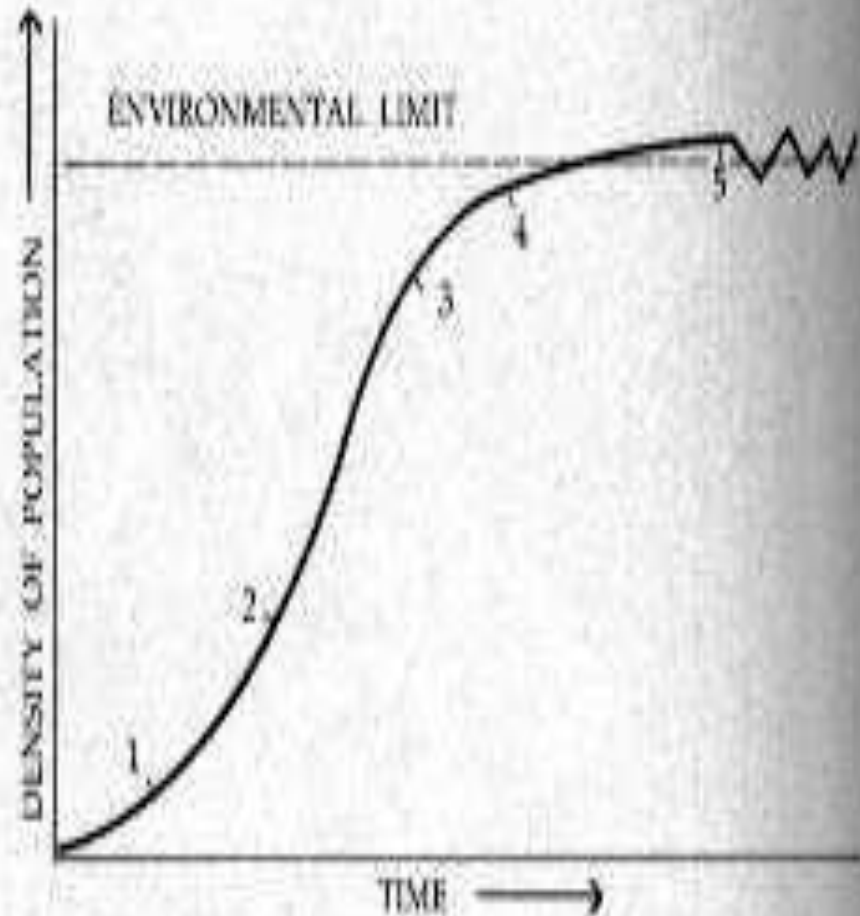


# Growth Curves



(a)

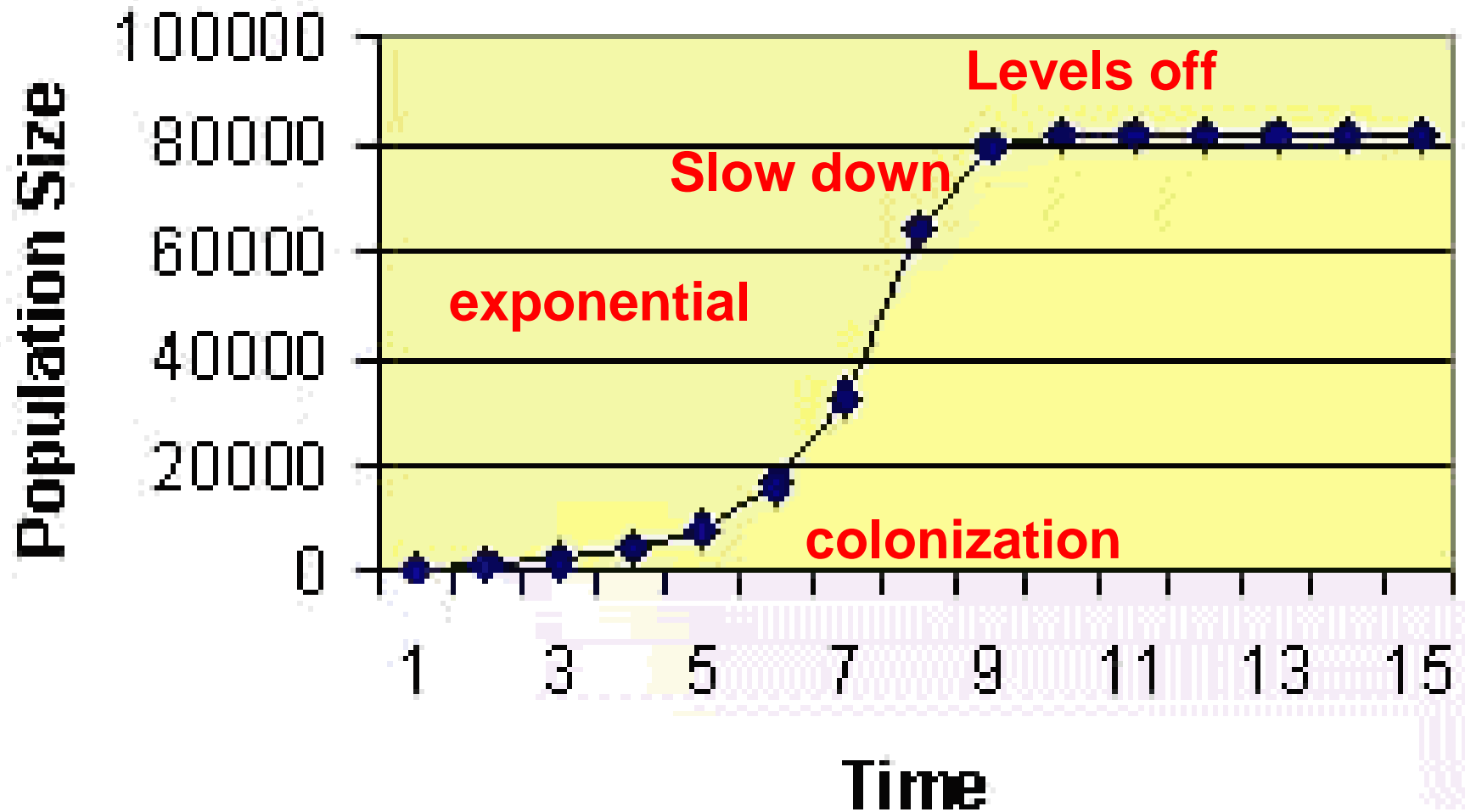
**Boom and Bust**



(b)

**Sigmoid (S-shaped)**

# Carrying Capacity





# Growth of a Population

## 1) Sigmoid (S-shaped) Curve

- Once carrying capacity is reached
  - # deaths should = # births
- Environmental resistance builds up in form of
  - 1. disease
  - 2. famine
  - 3. predation
- Results in slowed rate of increase
  - Population reaches equilibrium
    - Most common



# Growth of a Population

## 2) Exponential Growth (Boom and Bust)

- #s increase exponentially (doubling)
  - Exceeds carrying capacity
  - CRASH (resources exhausted)



# Boom and Bust

- **Exponential curves typical for:**
  - **Insect plagues**
  - **Lemming populations**
  - **Blooms of algae**
  - **Rodents**



# Exponential Patterns

- **Single Housefly**
  - **Lays ~120 eggs**
  - **Half are female**
- **Each female capable of 7 generations/yr**
  - **6,182,442,727,320 flies in one year!!!**



# Carrying Capacity

- Most important measure in determining population size.

■ WHY???

- Represents the ability of abiotic and biotic factors in the environment to provide necessary resources





- **How do humans affect the carrying capacity of ecosystems????**



# Global Stability

**Threatened by:**

- **Direct Harvesting**
  - **Pollution**
- **Atmospheric Changes**
  - **Habitat Loss**



# Litter Decomposition Rates

## Litter Decomposition Rates

(Refuse Industry Production, Inc.,  
Garbage in America –  
The Choice is Yours)

Aluminum Can	80-100 years
Glass Bottles/Jars	1,000,000 years
Rubber Boot Soles	50-80 years
Leather	up to 50 years
Nylon Materials	30-40 years
Plastic Bags/Disposable Diapers	10-20 years
Newspaper	2-4 weeks
Orange or Banana Peel	2-5 weeks
Cigarette Butts	1-5 years