

CHAPTER 2

ECOLOGY





CHAPTER 2 : ECOLOGY

2.1 Ecosystem Concept

2.2 Energy Flow Through Ecosystem

2.3 Biogeochemical Cycle

2.4 Conservation and Management

2.5 Population Ecology



2.5 Population Ecology

At the end of this topic, students should be able to:

- a. Explain biotic potential and environmental resistance and their effect on population growth.
- b. Explain carrying capacity and its importance.
- c. Describe natality and mortality and their effects on the rate of population growth.





Population Ecology

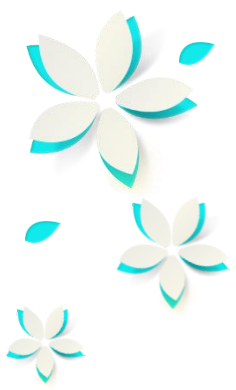
The study of population in relation to their environment

Including environmental influences on population density and distribution, age structure and variations in population size.

A sub-field of ecology that deals with the dynamics of species populations

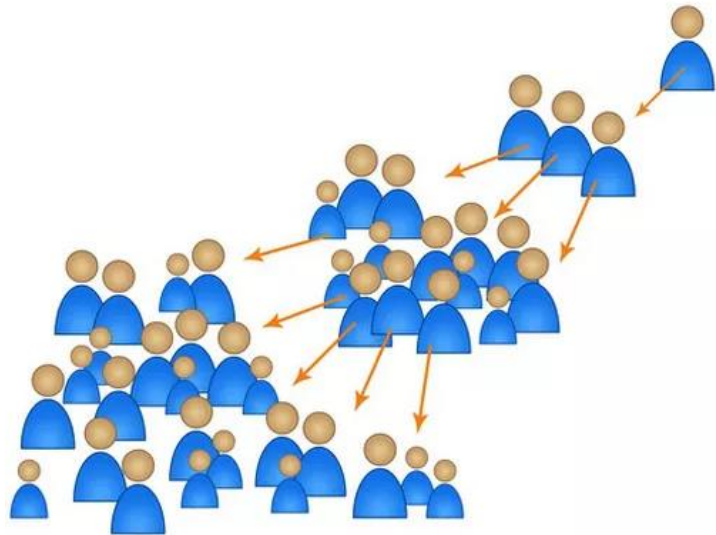


The term population ecology is often used interchangeably with population biology or population dynamics.



Population Growth

The increase in the number of individuals in a population



A population will increase in number when the available resources are greater than required at that particular time.

- a. Explain biotic potential and environmental resistance and their effect on population growth.

Biotic Potential (r)

" Power of organisms to reproduce and survive"

Chapman (1925)



"Maximum number of offspring an organism can produce under ideal conditions."



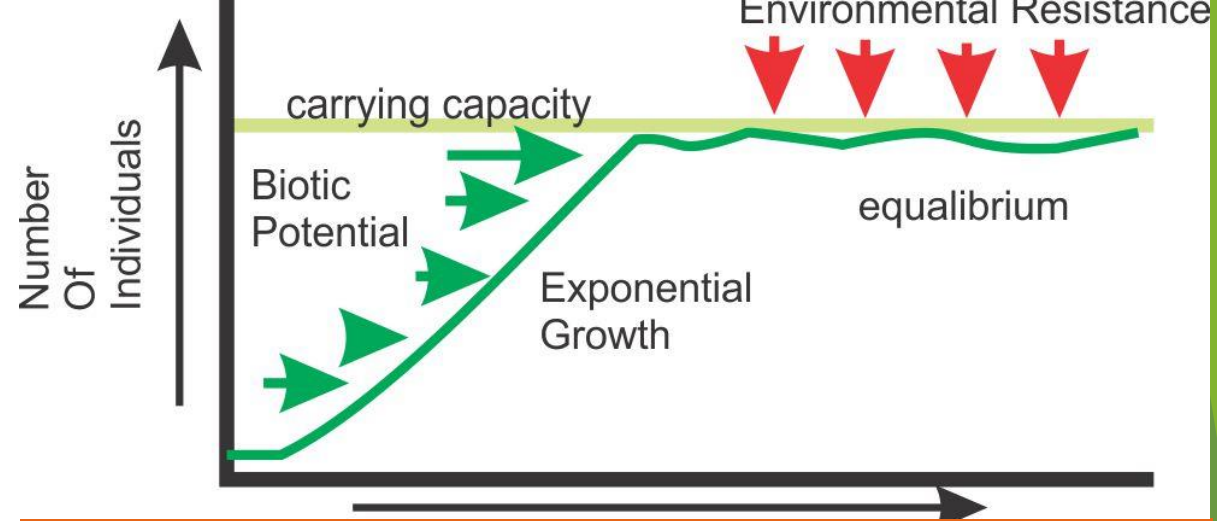
- a. Explain biotic potential and environmental resistance and their effect on population growth.

Environmental Resistance

$$\frac{(K-N)}{K}$$

K

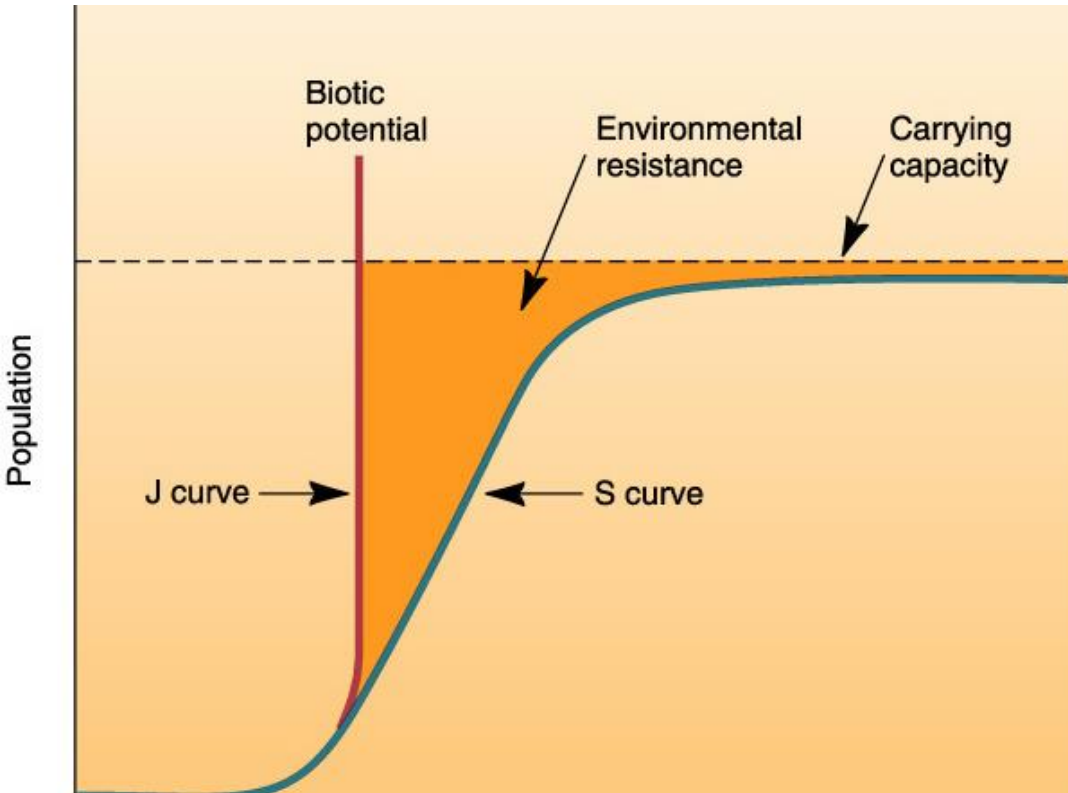
K= carrying capacity
N= population size



“All those environmental conditions that prevent populations from achieving their biotic potential.”



a. Explain biotic potential and environmental resistance and their effect on population growth.



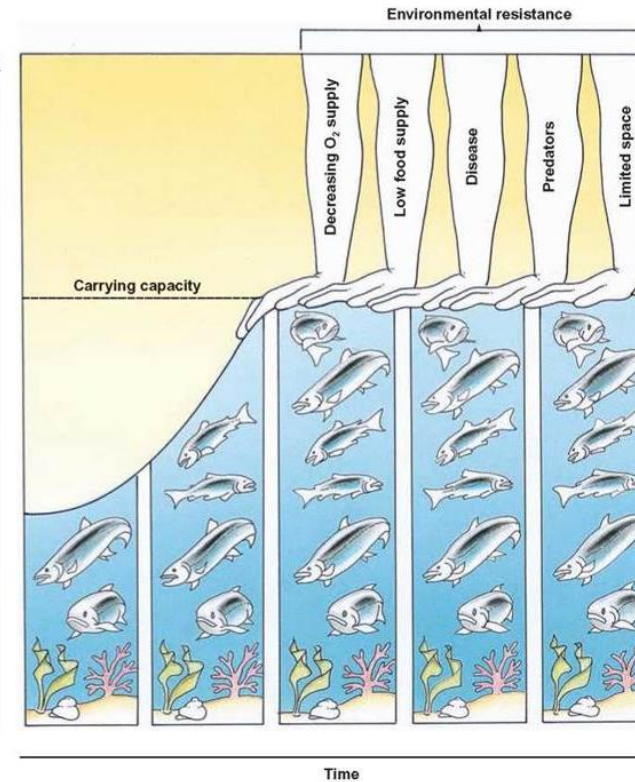
Reality:

When populations become too large,

- Run out of some limiting resource

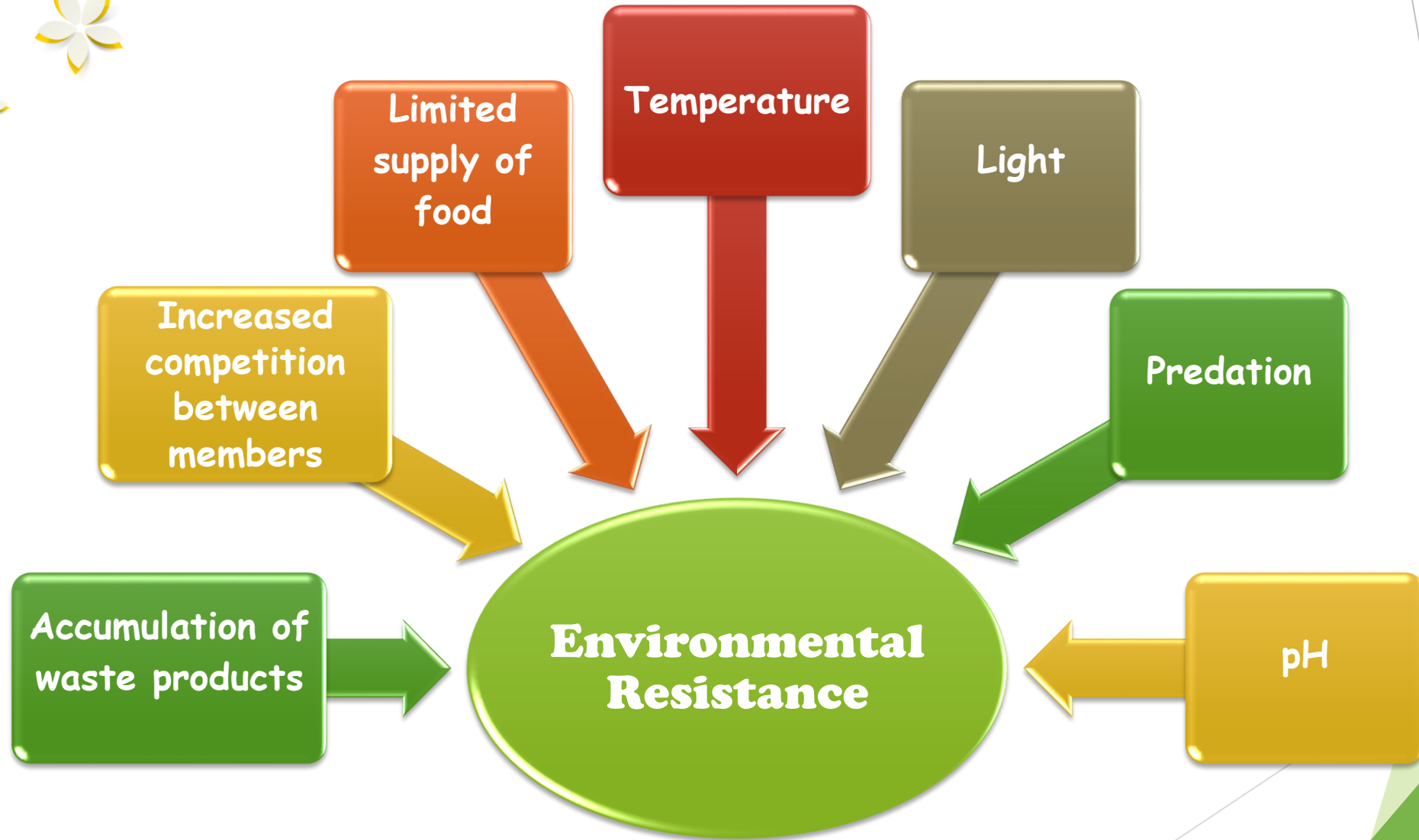
As a result,

- Growth slows
- Population size tends to stabilize



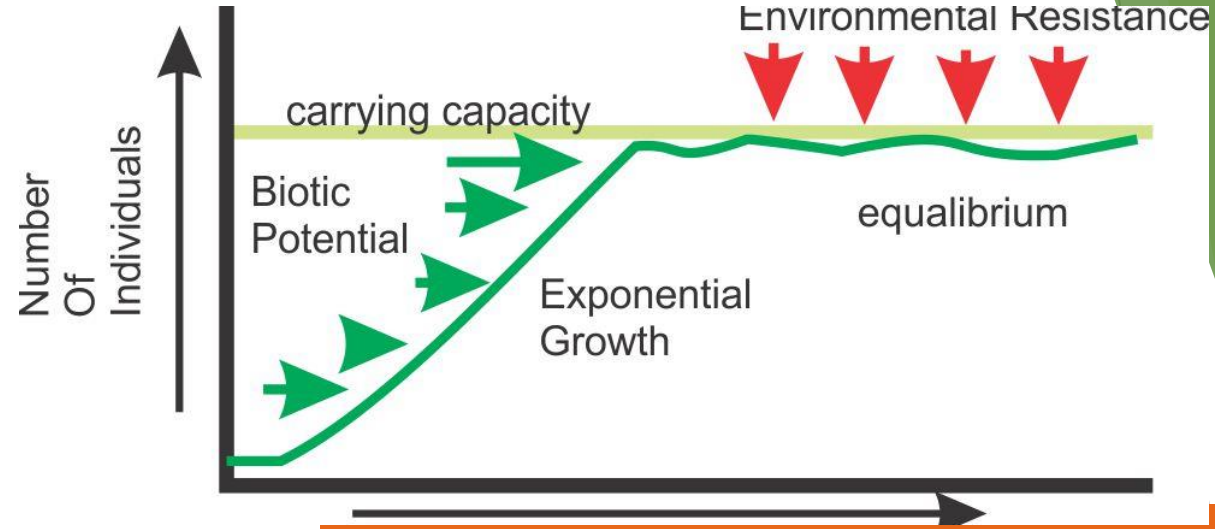
Exponential growth cannot continue for long because of environmental resistance

Environmental Resistance



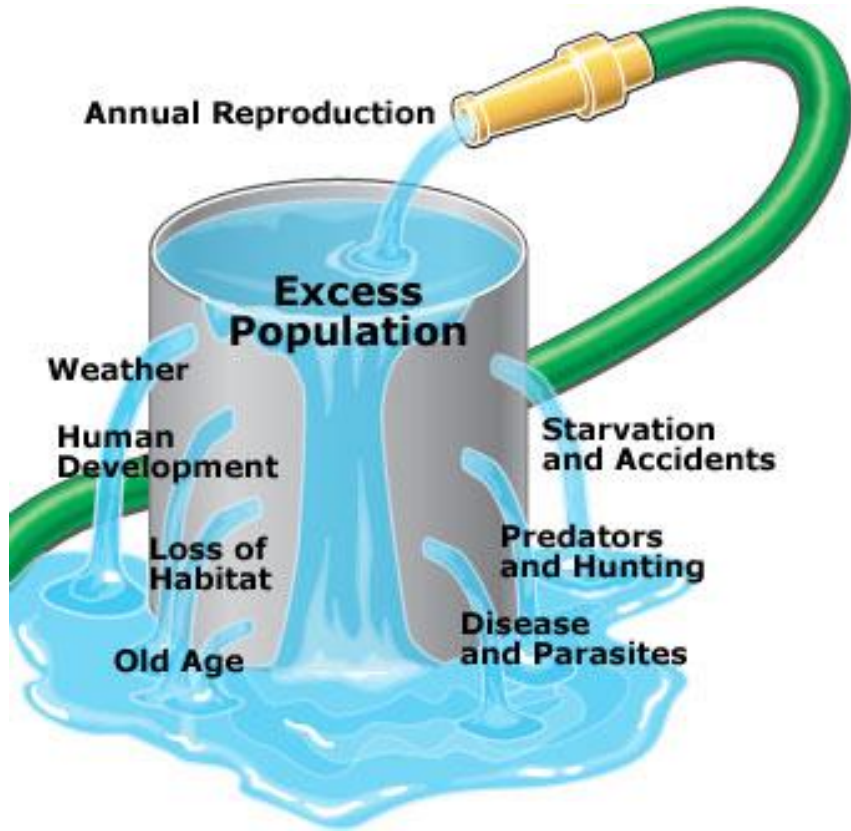
b. Explain carrying capacity and its importance.

Carrying Capacity (K)



“The maximum population size that can be supported by the available resources.”

Campbell 11th ed.

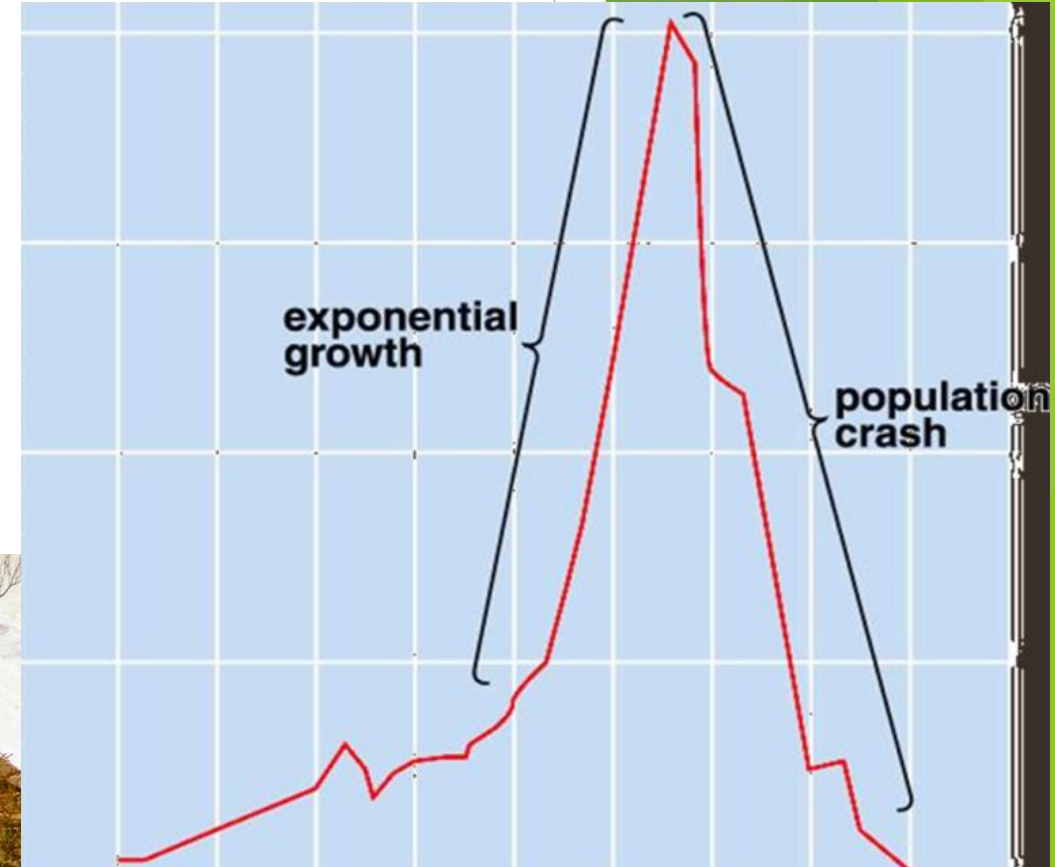


- Determined by both biotic potential and environmental resistance
- Changes in response to environmental changes

b. Explain carrying capacity and its importance.

The Importance of Carrying Capacity(K)

- Important limit on populations to prevent population crash
- Measured relative to a particular species and a particular habitat
- A population below carrying capacity need not deplete any natural capital.



c. Describe natality and mortality and their effects on the rate of population growth.

Population growth is affected by:

Natality (birth rate)

- The rate at which a particular species or population produces offspring



c. Describe natality and mortality and their effects on the rate of population growth.

Population growth is affected by:

Mortality (death rate)

- The rate at which a particular species or population dies, whatever the cause.



Ignoring immigration and emigration, population growth is primarily affected by **birth and death rates**.

BIRTH



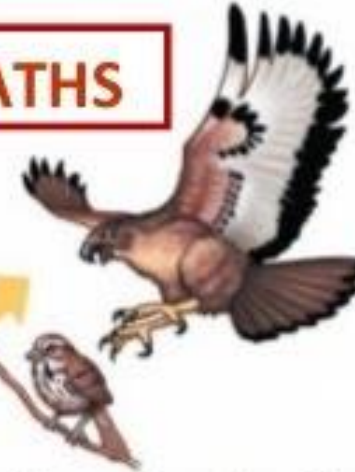
Births and immigration
add individuals to
a population.



Immigration



DEATHS



Deaths and emigration
remove individuals
from a population.



Emigration

2.5 Population Ecology

At the end of this topic, students should be able to:

- d. Explain population growth curves (state the basic forms of growth curves):
 - i. Exponential growth curve (human)
 - ii. Logistic growth curve (*Paramecium* sp.)

- e. Explain the limiting factors affecting the population size:
 - i. Density dependent factors
 - ii. Density independent factors

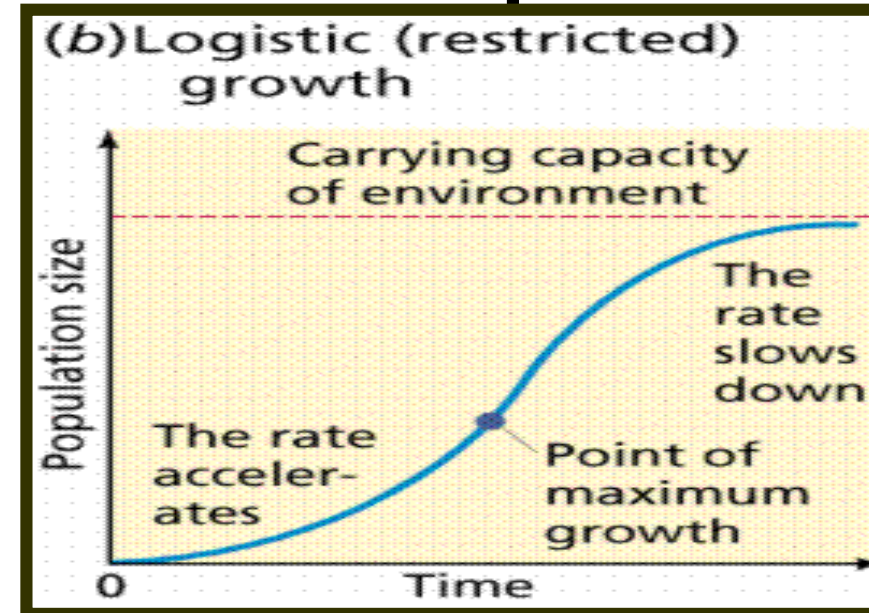
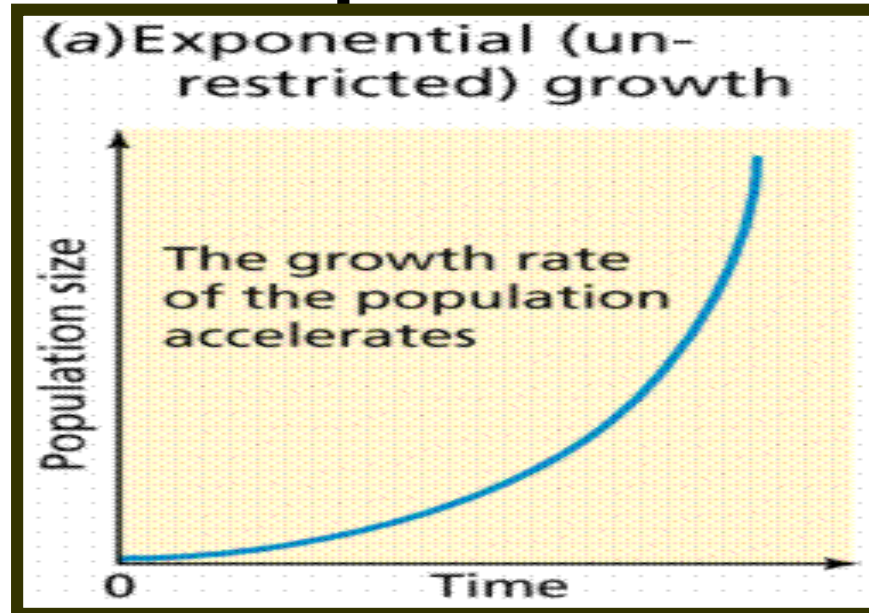


- d. Explain population growth curves (state the basic forms of growth curves)

Population Growth Curves

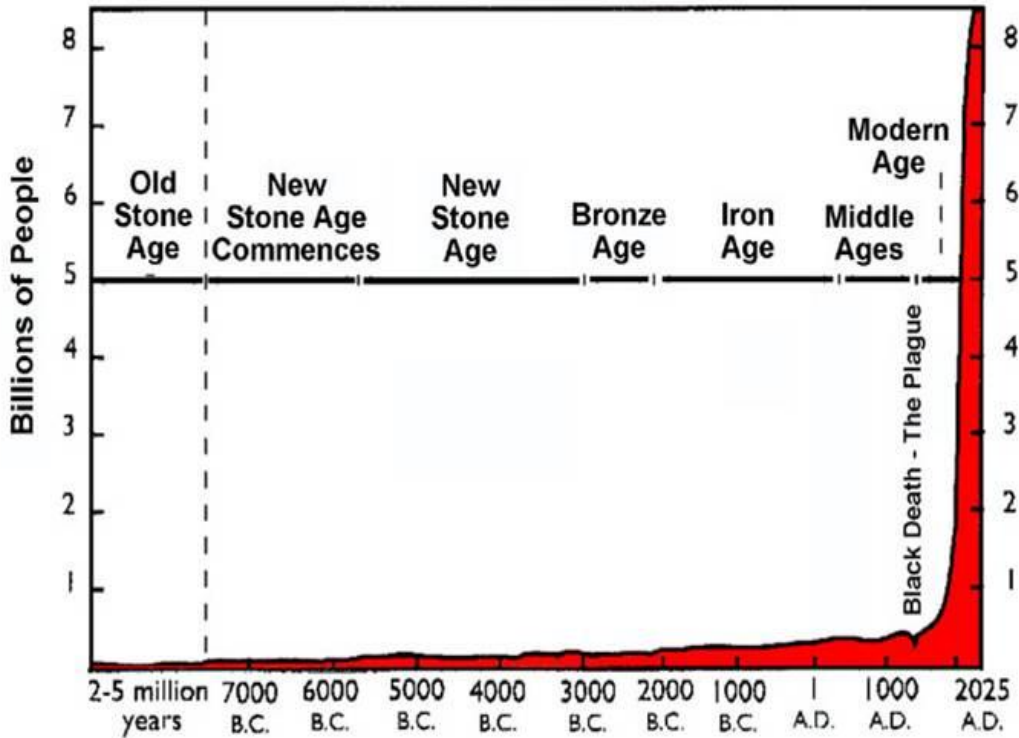
Exponential Growth Curve

Logistic Growth Curve



Exponential Growth Curve

World Population Growth Through History



From "World Population: Toward the Next Century," copyright 1994 by the Population Reference Bureau

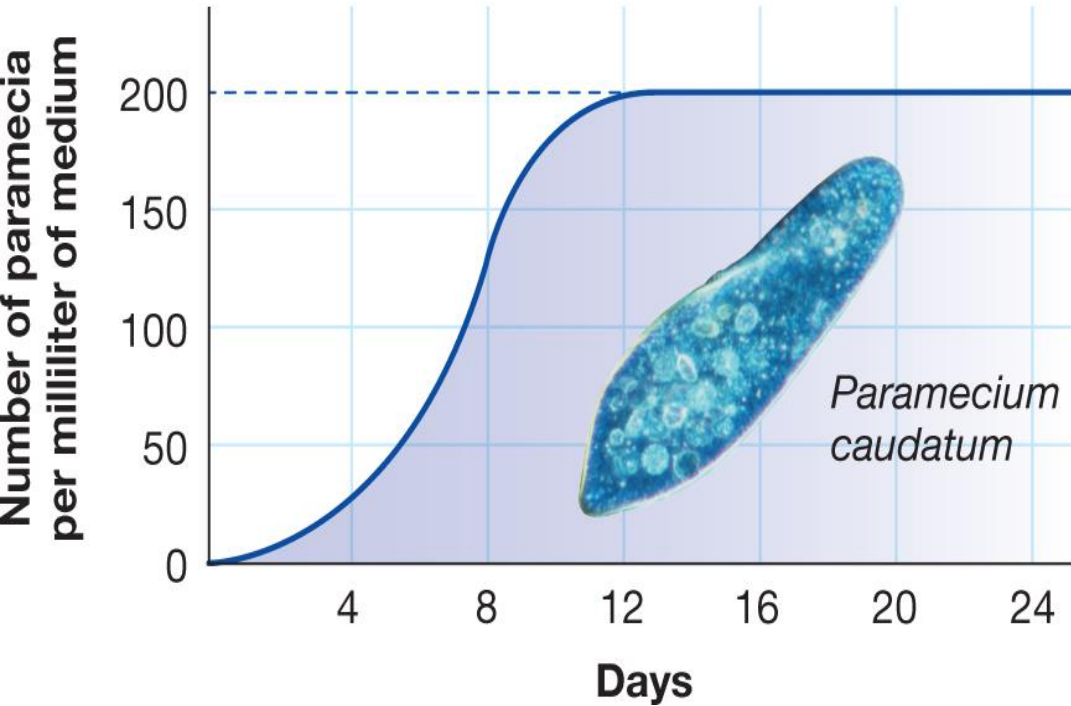
Shows how the increase of individuals added each generation

- Exponential growth refers to **unlimited growth** of a population
- Occurs when **environmental conditions are not limiting**
- Reproduce at **maximum biotic potential**
- Cause a large population growth
- Eg. Human population



Logistic Growth Curve

The maximum population size that can be supported indefinitely by the environment is 200 cells per milliliter of growth medium.



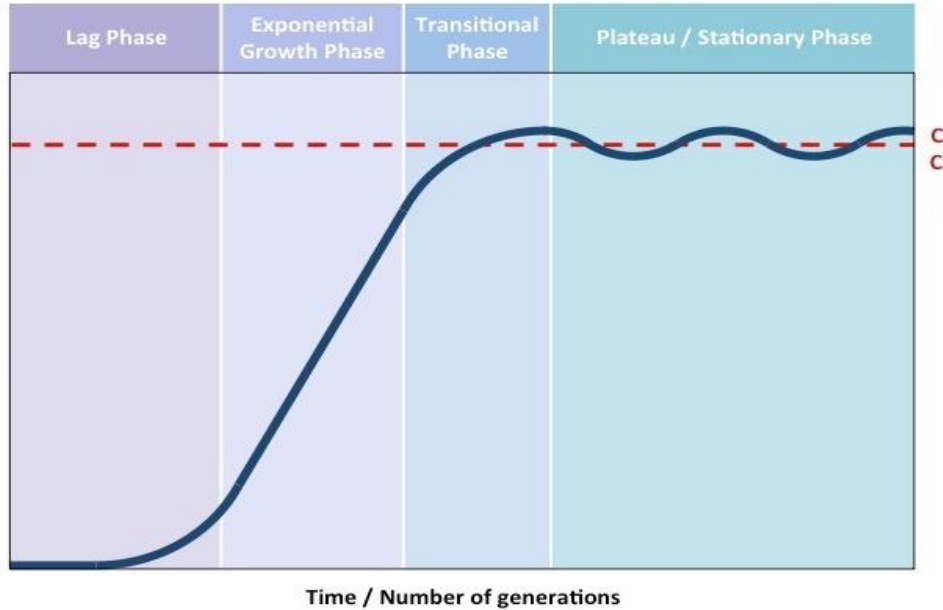
Population growth is stabilized by environmental resistance

- S-shaped curve
- As a result of environmental resistance
- Which increases in intensity as the population density increases
- Until it reaches a steady level
- Achieve its maximum carrying capacity
- Eg : *Paramecium* sp.





Logistic Growth Curve of *Paramecium* sp.



Time / Number of generations



1. Lag phase

Paramecium prepares to grow, cell division and differentiation of tissues



2. Log / Exponential phase

Paramecium are growing, producing new organisms and dividing rapidly to take advantage of fresh medium.



3. Transitional phase

Growth slows down because of limited nutrients.



4. Stationary phase

Birth of new organism and death of old ones is in equilibrium. (natality = mortality)

e. Explain the limiting factors affecting the population size.

Density Dependent Factors

Refers to any characteristic that varies with population density

Campbell 11th edition

Density Independent Factors



Density Independent Factors

Refers to any characteristic that is not affected by population density

Campbell 11th edition

Density Dependent Factors





Predation



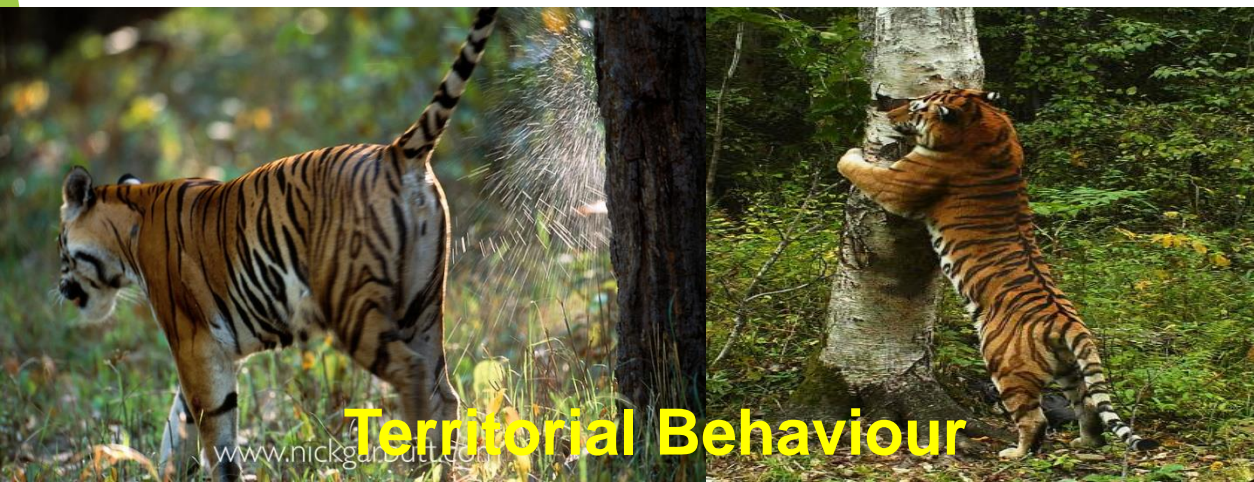
Competition



Density Dependent Factors

Population growth rates are affected by population size.

Usually caused by **BIOTIC FACTORS**.



Territorial Behaviour



Parasitism



Unusual
Weather



Natural
Disasters



Human
Activities



Density
Independent
Factors

- Affect all populations in similar ways, regardless of the population size.
- Usually caused by abiotic factors



NEXT

LECTURE

**3.0 SPECIATION &
SELECTION**