



Population Dynamics



BIO SOL: 9a

The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems.

Key concepts include:

- **interactions within and among populations including carrying capacities, limiting factors, and growth curves;**
-

Population Dynamics

Population: all the individuals of a species that live together in an area

Demography: the statistical study of populations, make predictions about how a population will change

Population Dynamics

Three Key Features of Populations

- **Size**
 - **Density**
 - **Dispersion**
 - (clumped, even/uniform, random)
-

Three Key Features of Populations

1. Size: number of individuals in an area



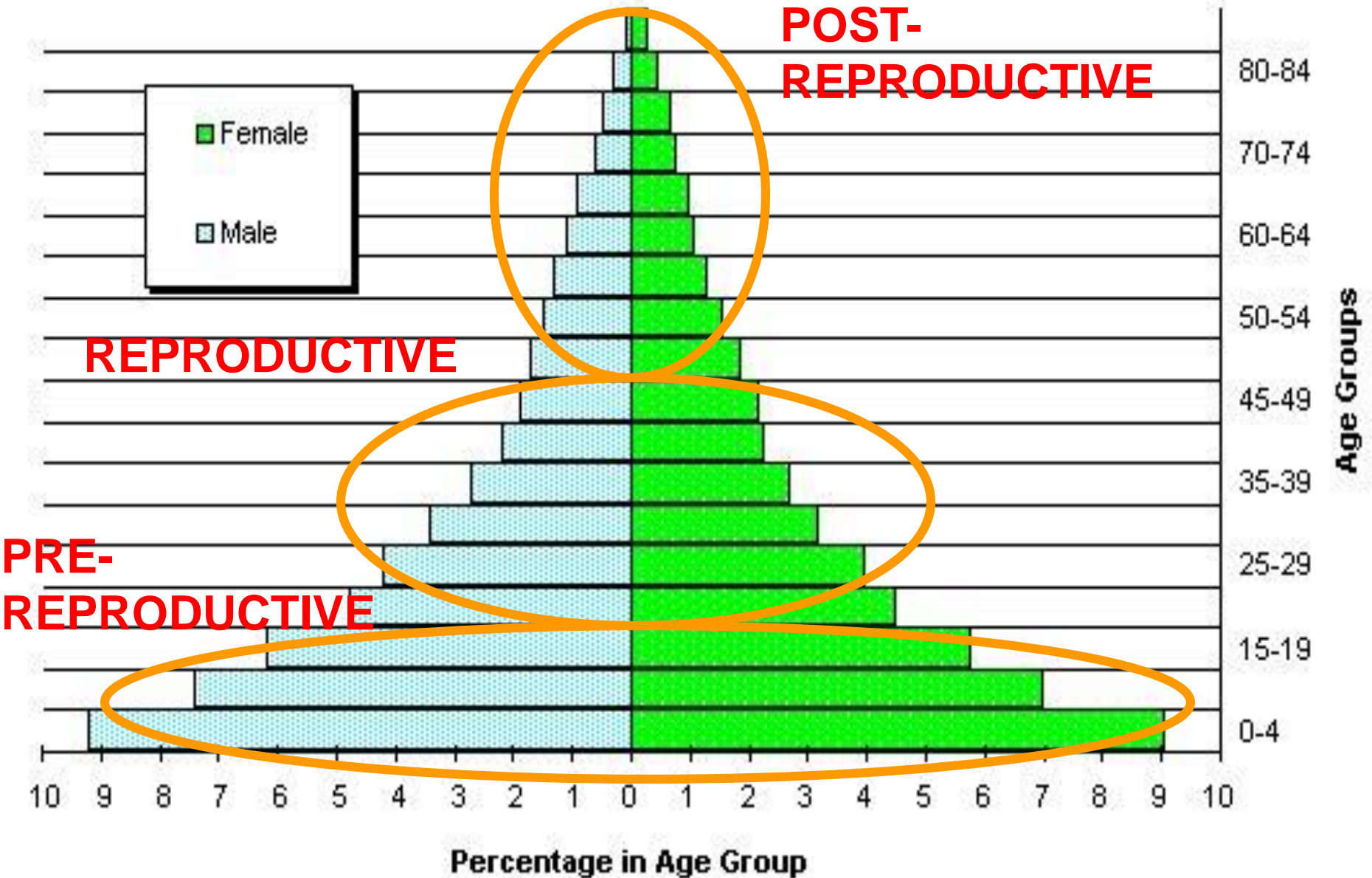
Three Key Features of Populations

**Growth Rate: Birth Rate (natality) -
Death Rate (mortality)**

**How many individuals are born vs. how
many die**

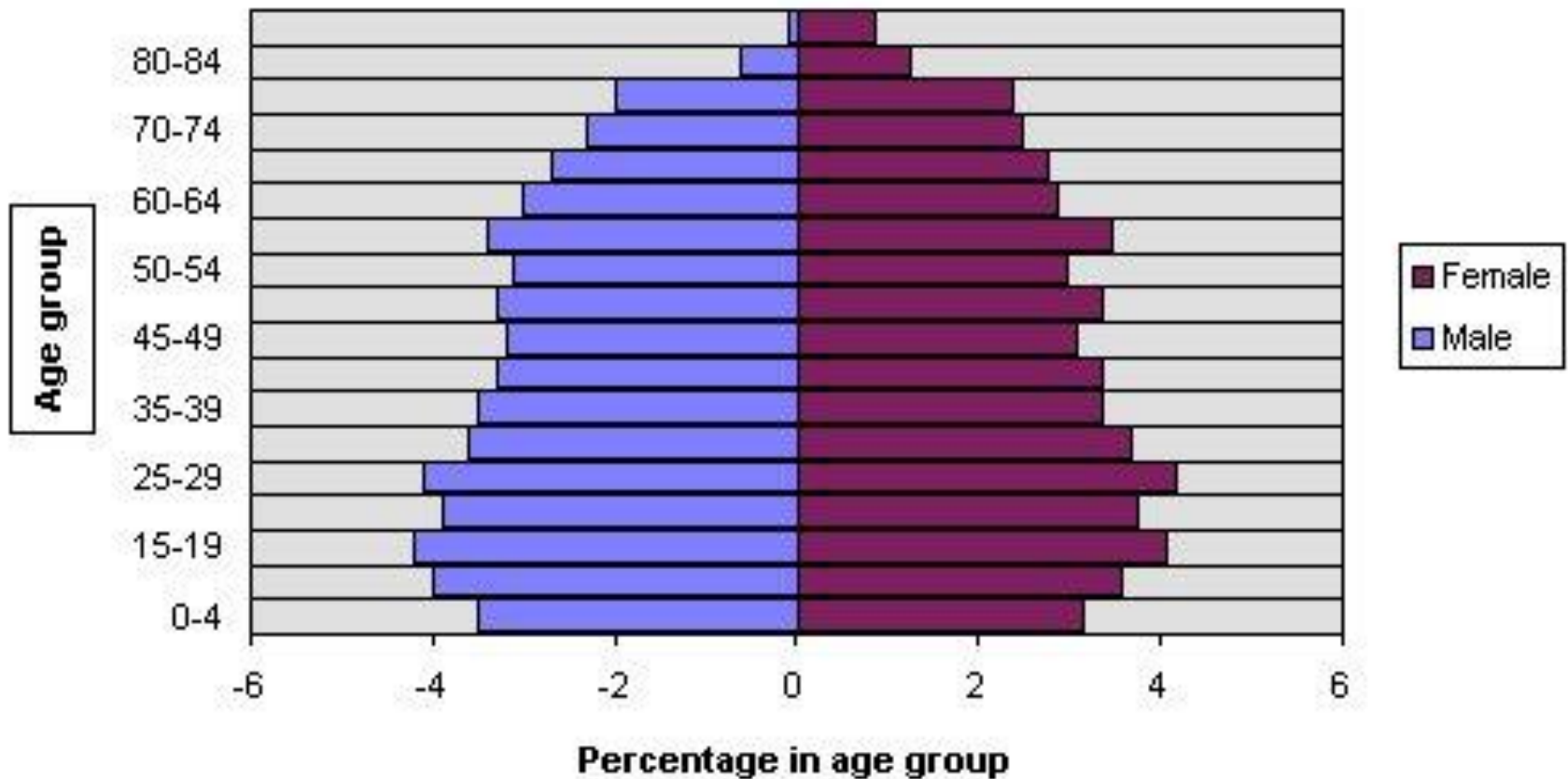
**Birth rate (b) – death rate (d) = rate of
natural increase (r).**

Population Pyramid for a Developing country



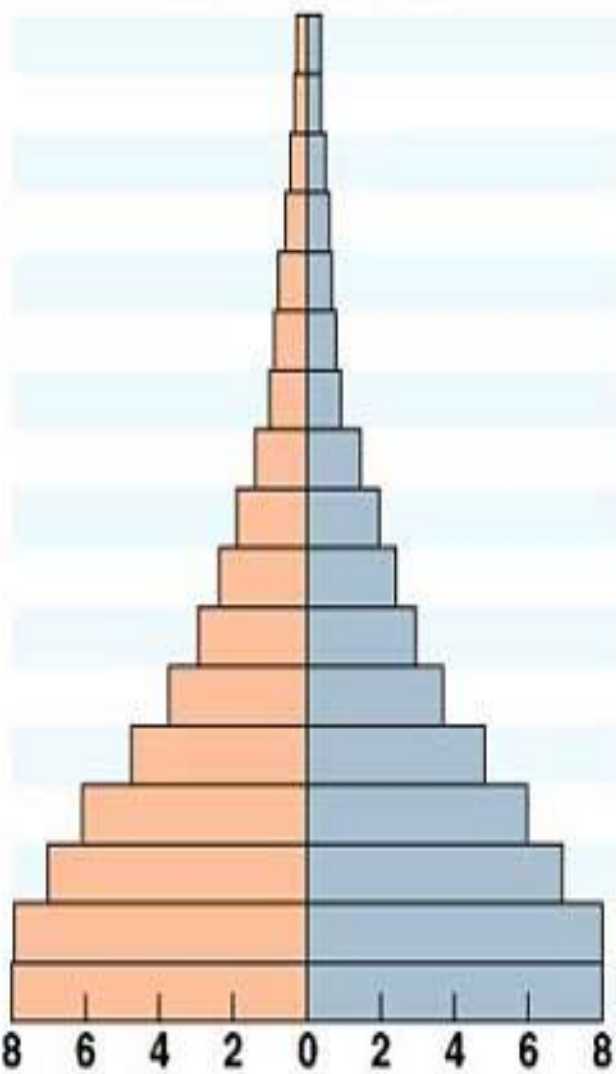
Population of a Stable Country

Population Pyramid for a Developed country



Rapid growth
Kenya

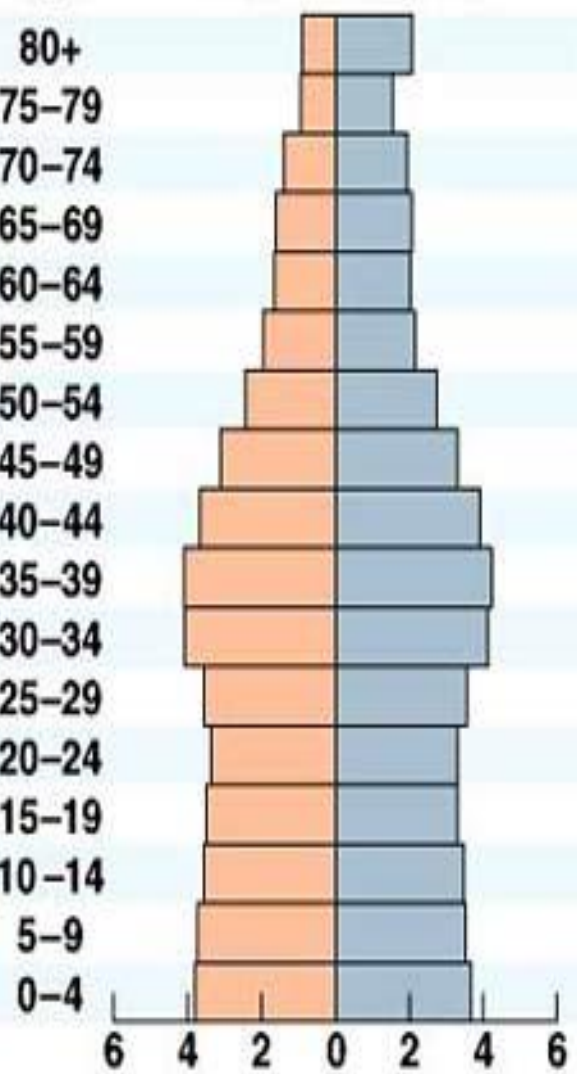
Male Female



Percent of population

Slow growth
United States

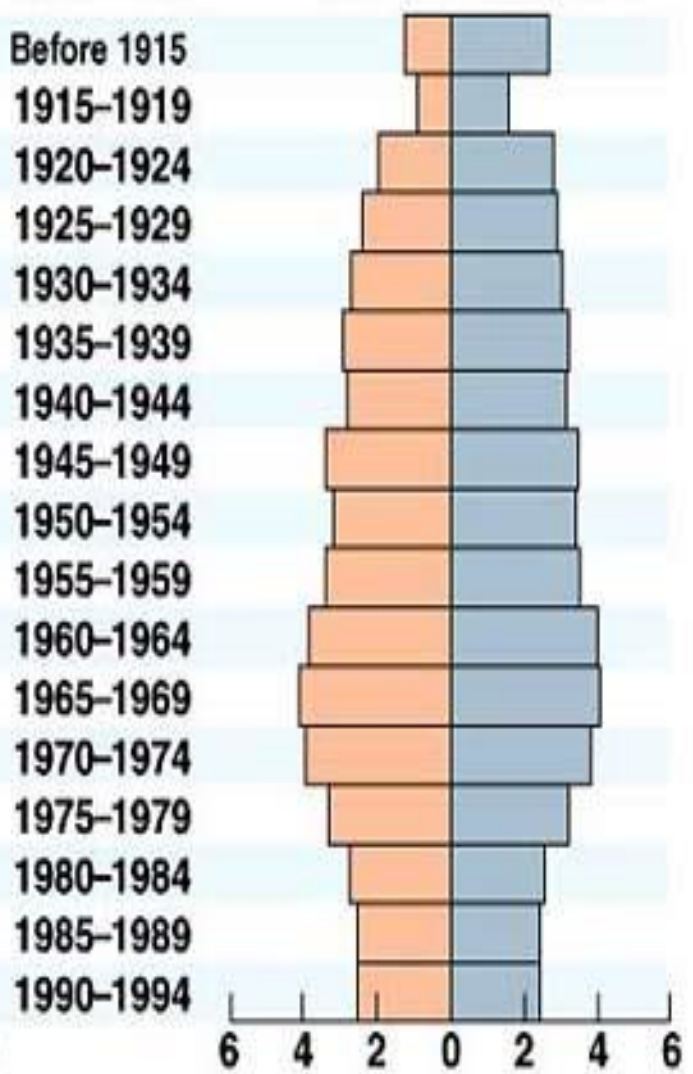
Male Female



Percent of population

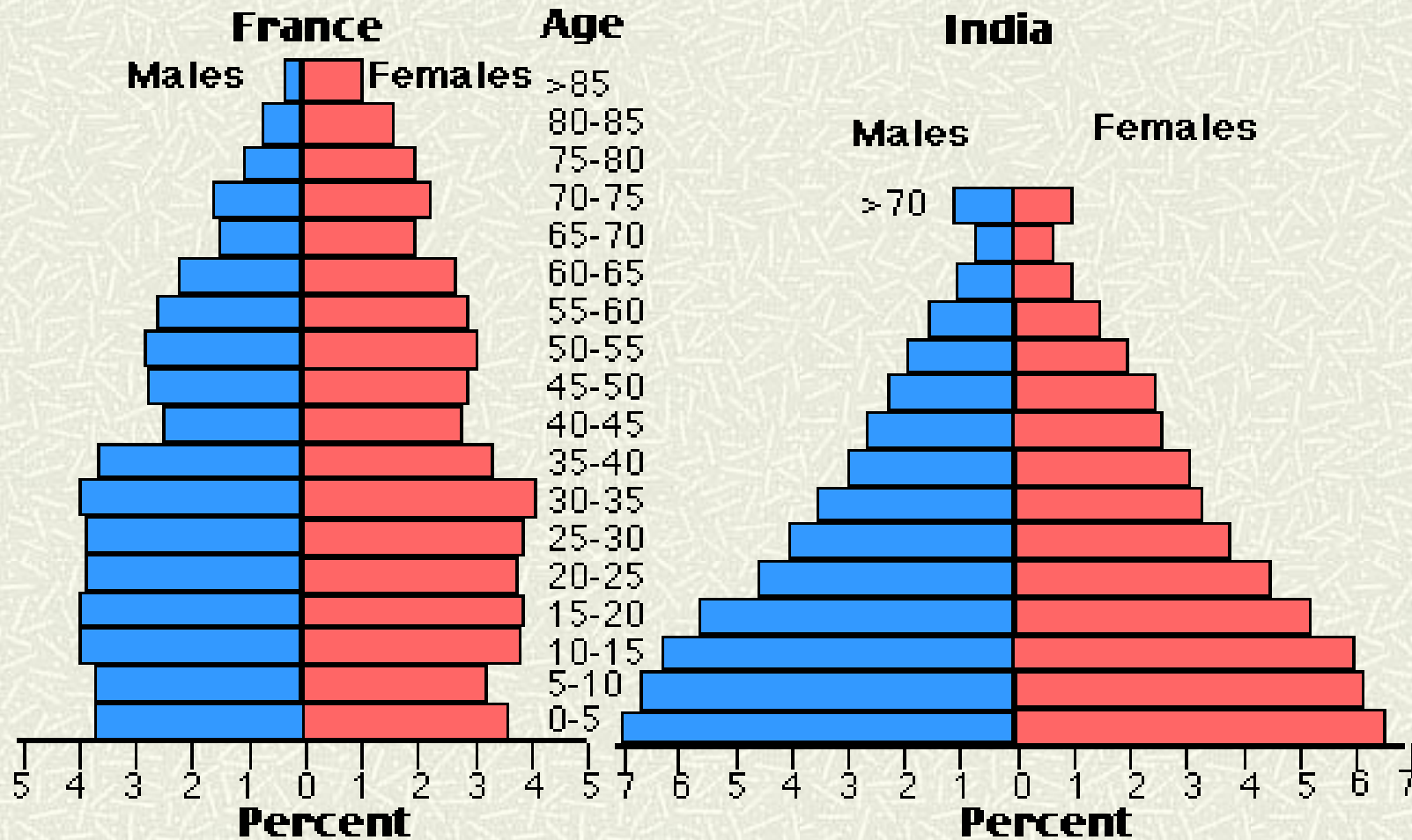
Zero growth/decrease
Italy

Male Female



Percent of population

You decide!



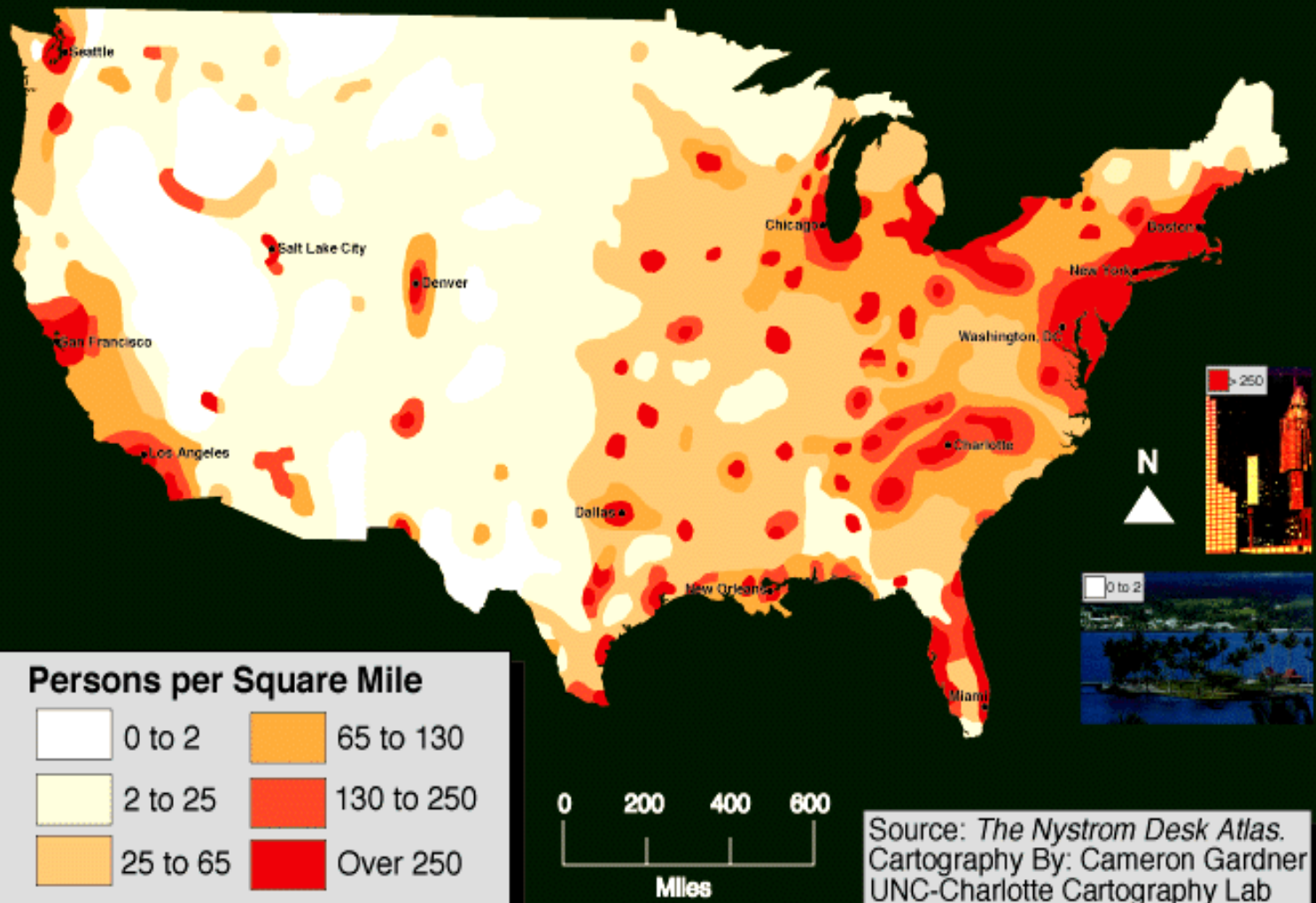
Three Key Features of Populations

2. Density: measurement of population per unit area or unit volume

$$\text{Formula: } D_p = \frac{N}{S}$$

Pop. Density = # of individuals ÷ unit of space

Population Density of the United States



4 Factors that affect density

1. Immigration- movement of individuals into a population

2. Emigration- movement of individuals out of a population

4 Factors that affect density

3. Density-dependent factors- Biotic factors in the environment that have an increasing effect as population size increases

Ex. disease
competition
parasites

4 Factors that affect density

4. Density-independent factors-

Abiotic factors in the environment that affect populations regardless of their density

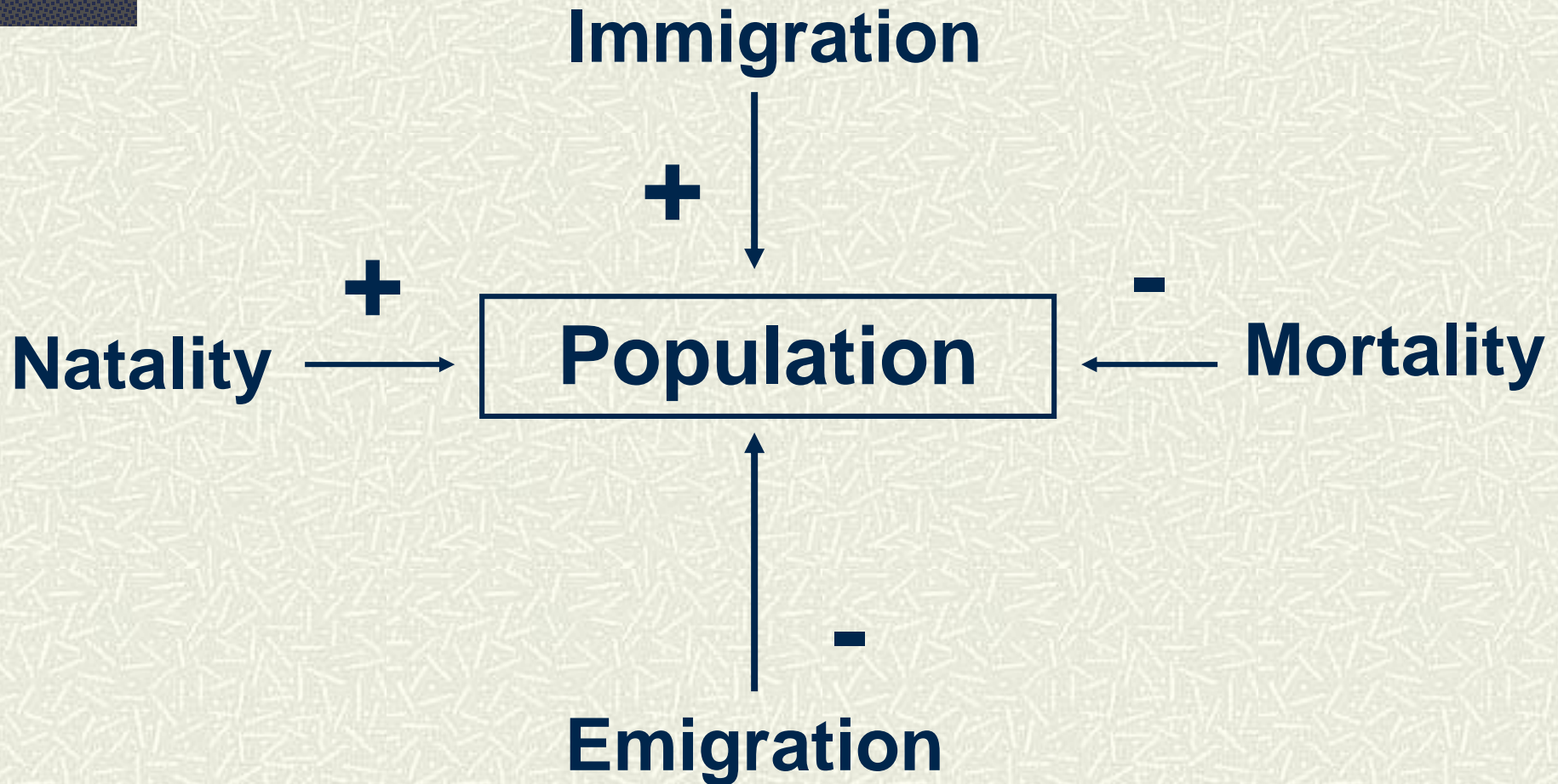
Ex. temperature

storms

habitat destruction

drought

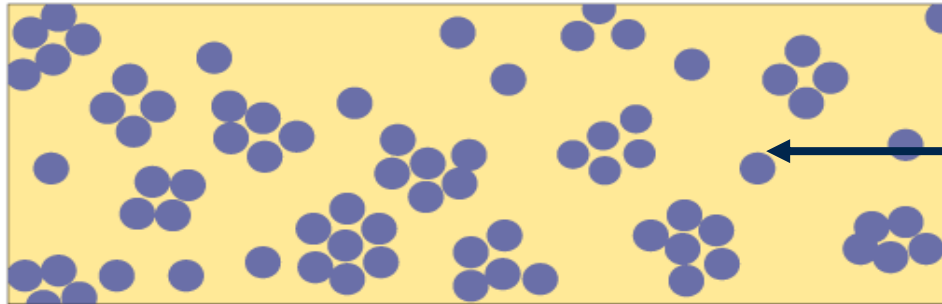
Factors That Affect Future Population Growth



Three Key Features of Populations

3. Dispersion:describes their spacing relative to each other

- **clumped**
 - **even or uniform**
 - **random**
-



(a)

clumped



(b)

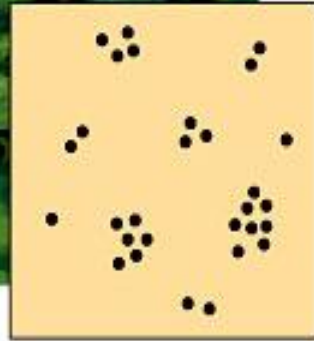
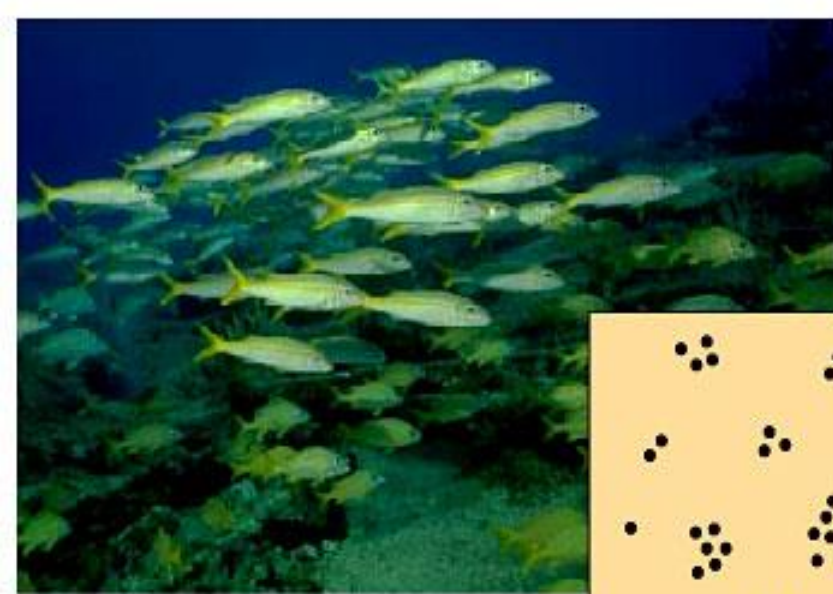
**even
(uniform)**



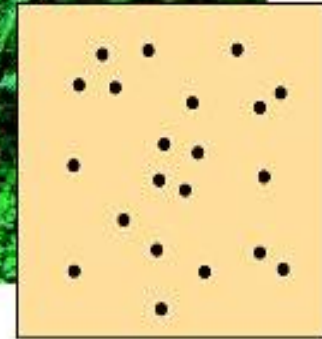
(c)

random

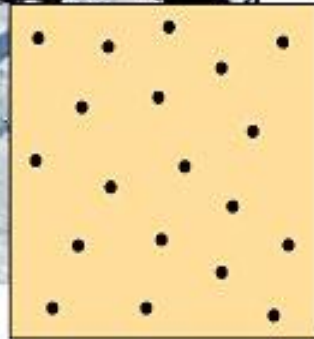
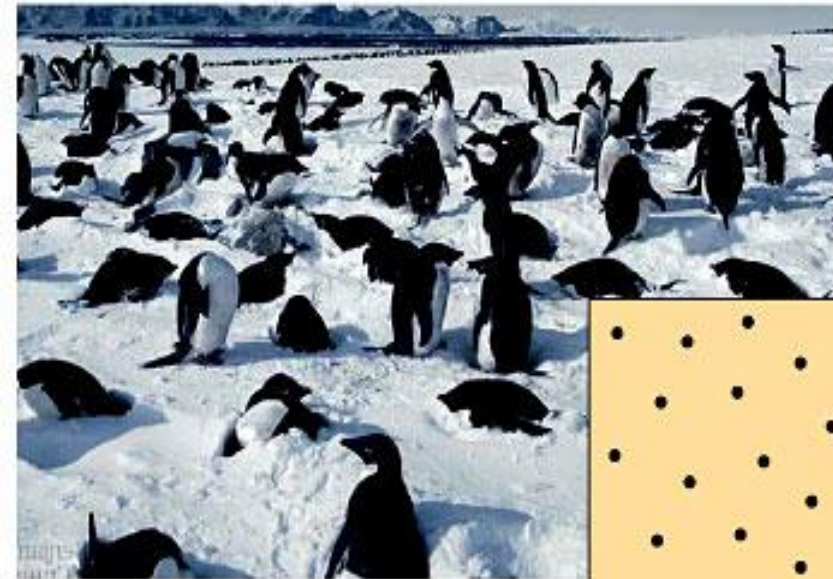
Population Dispersion



(a) Clumped



(c) Random



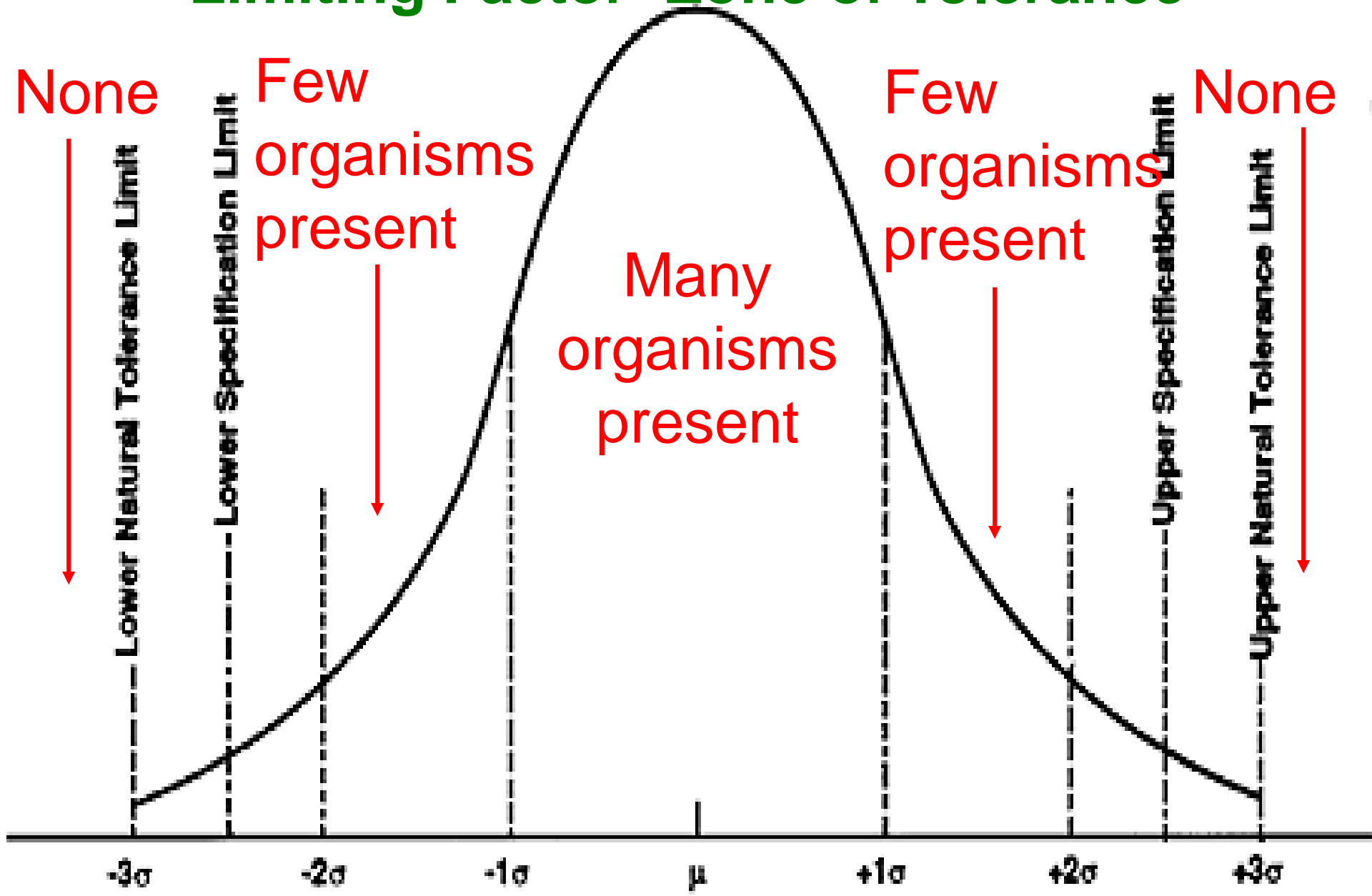
(b) Uniform

Other factors that affect population growth

Limiting factor- any biotic or abiotic factor that restricts the existence of organisms in a specific environment.

- **EX.-** Amount of water
Amount of food
Temperature
-

Limiting Factor- Zone of Tolerance

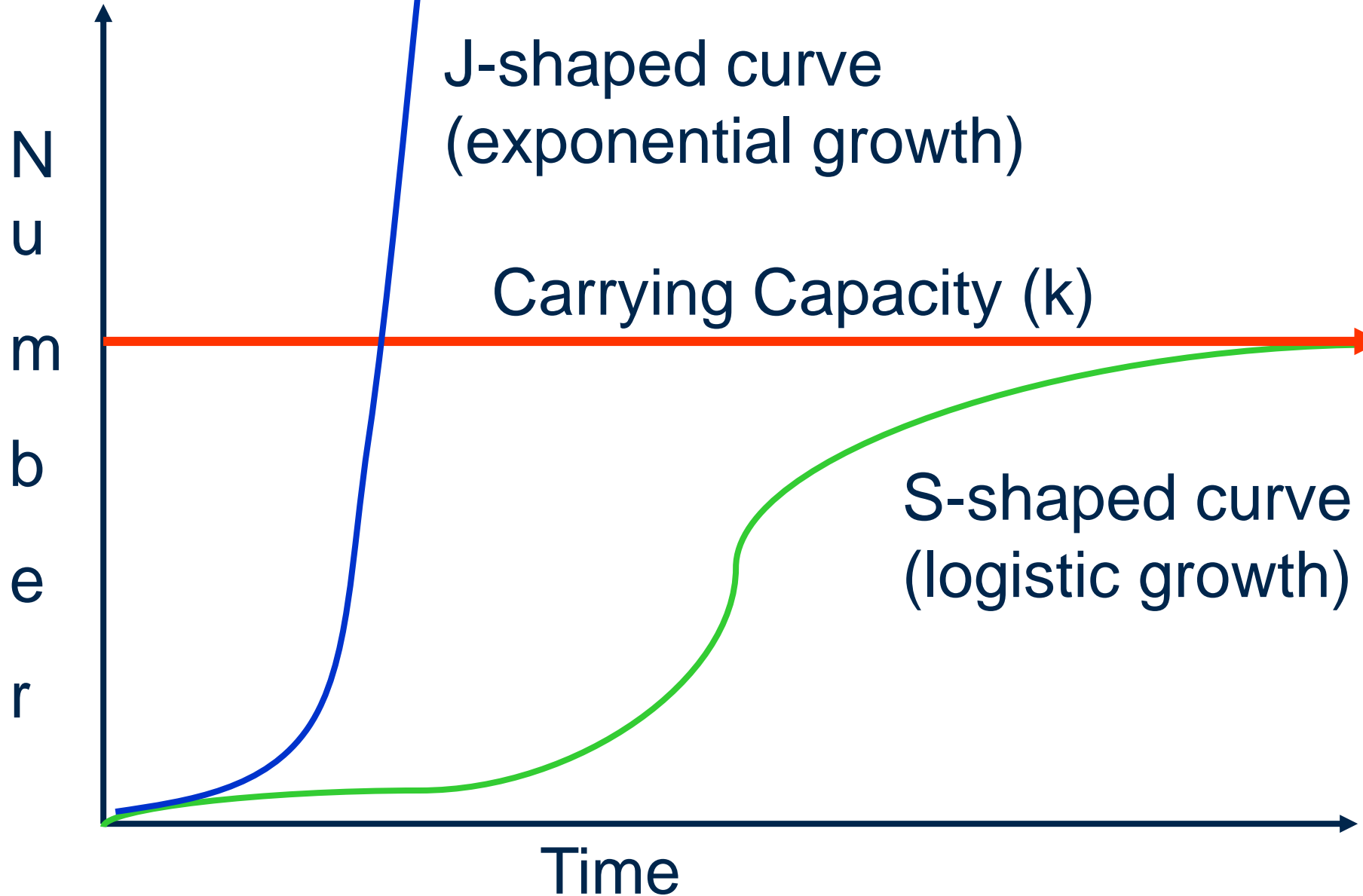


Other factors that affect population growth

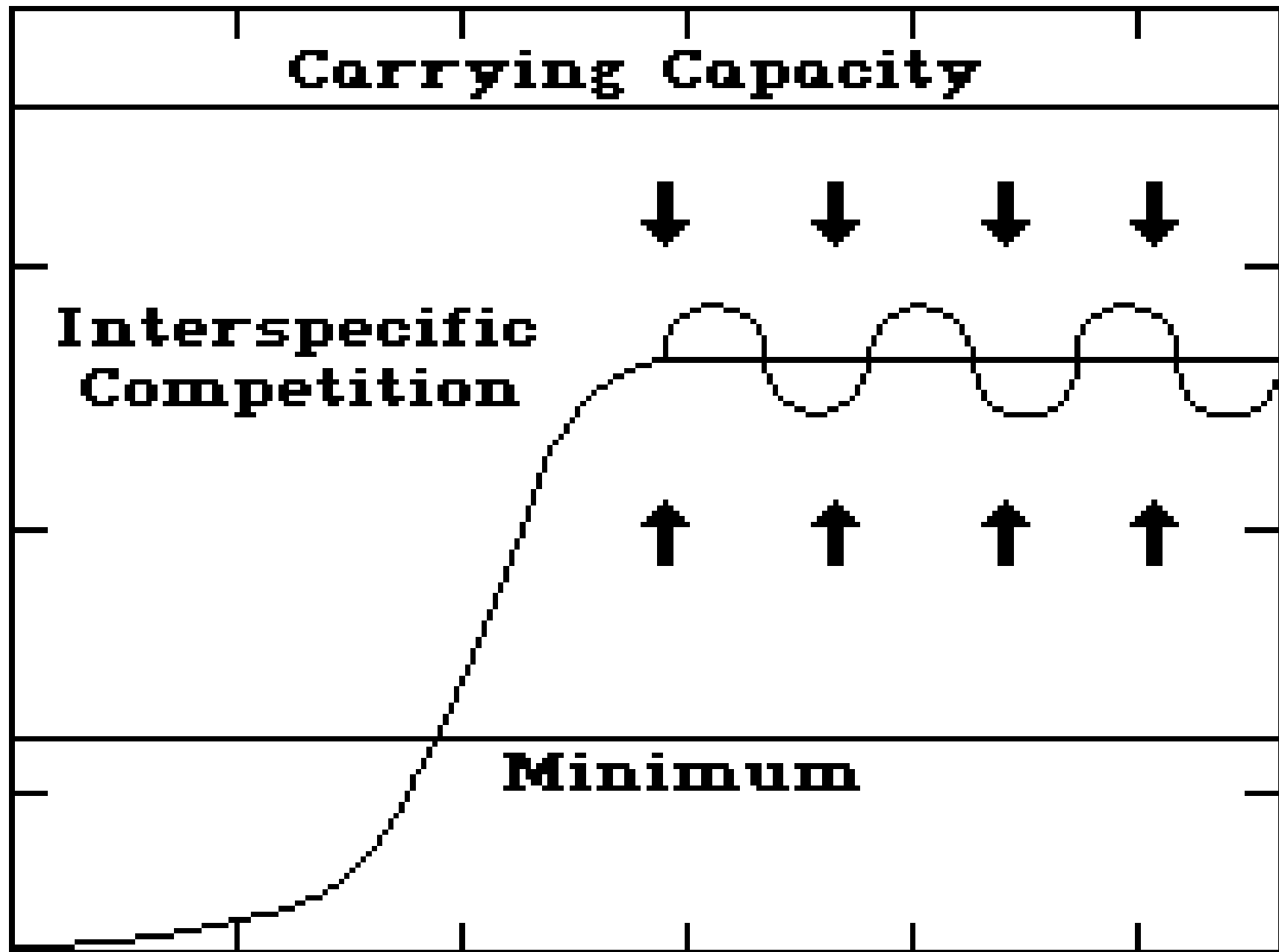
Carrying Capacity- the maximum population size that can be supported by the available resources

There can only be as many organisms as the environmental resources can support

Carrying Capacity

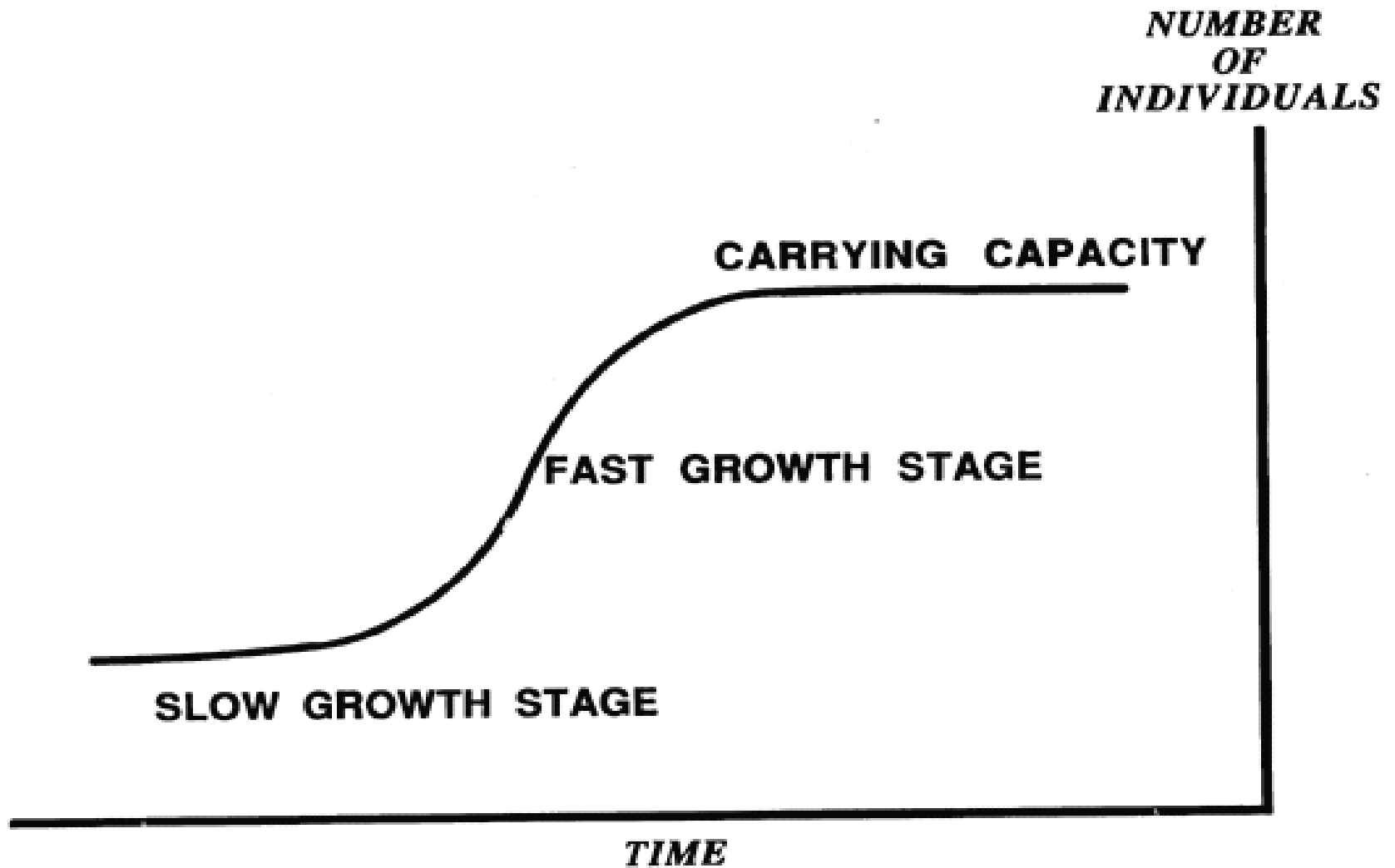


Population Size

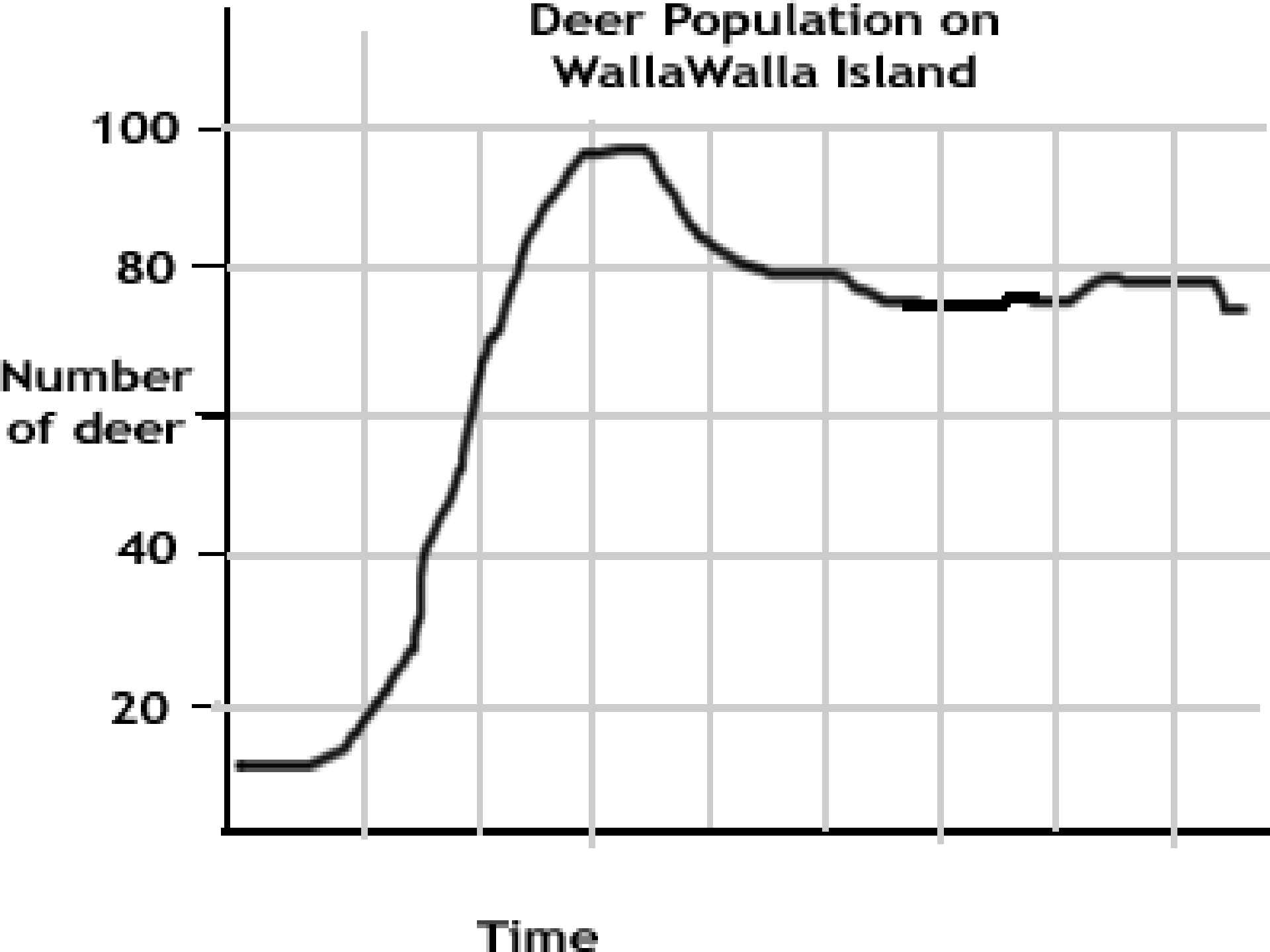


Time

CARRYING CAPACITY



Deer Population on WallaWalla Island



2 Life History Patterns

1. R Strategists

- short life span
- small body size
- reproduce quickly
- have many young
- little parental care
- Ex: cockroaches, weeds, bacteria



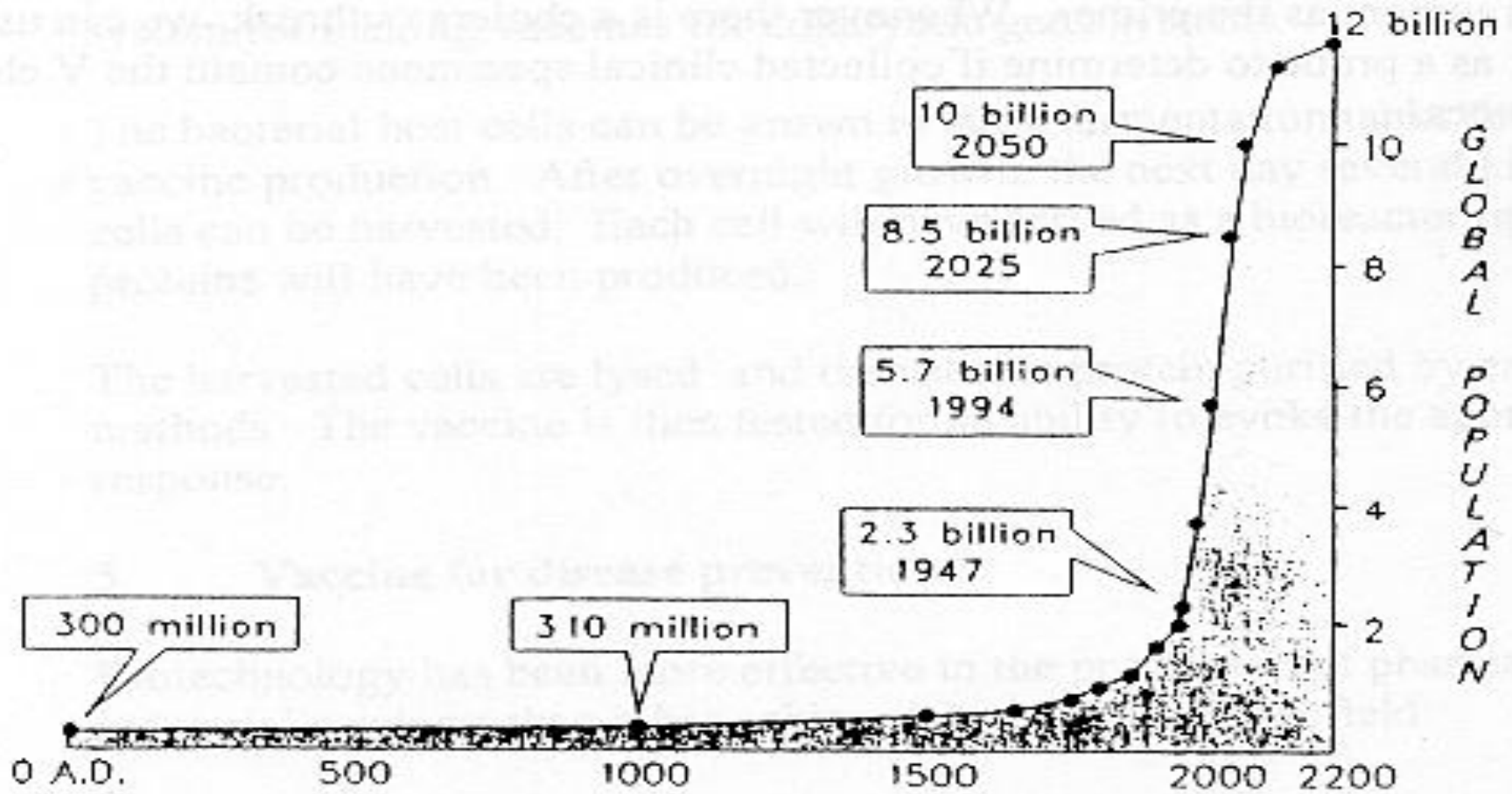
2 Life History Patterns

2. K Strategists

- long life span
- large body size
- reproduce slowly
- have few young
- provides parental care
- Ex: humans, elephants



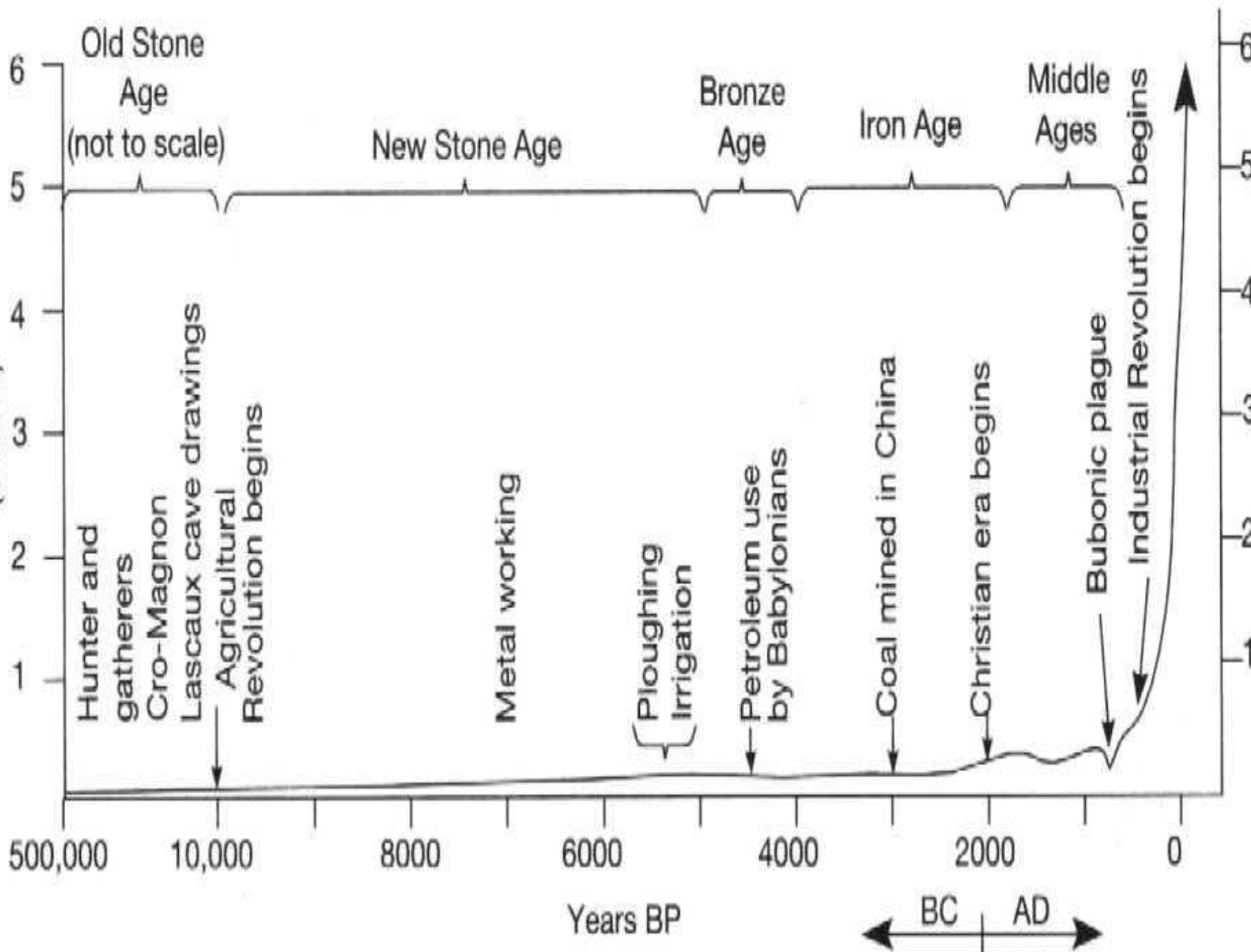
Human Population Growth



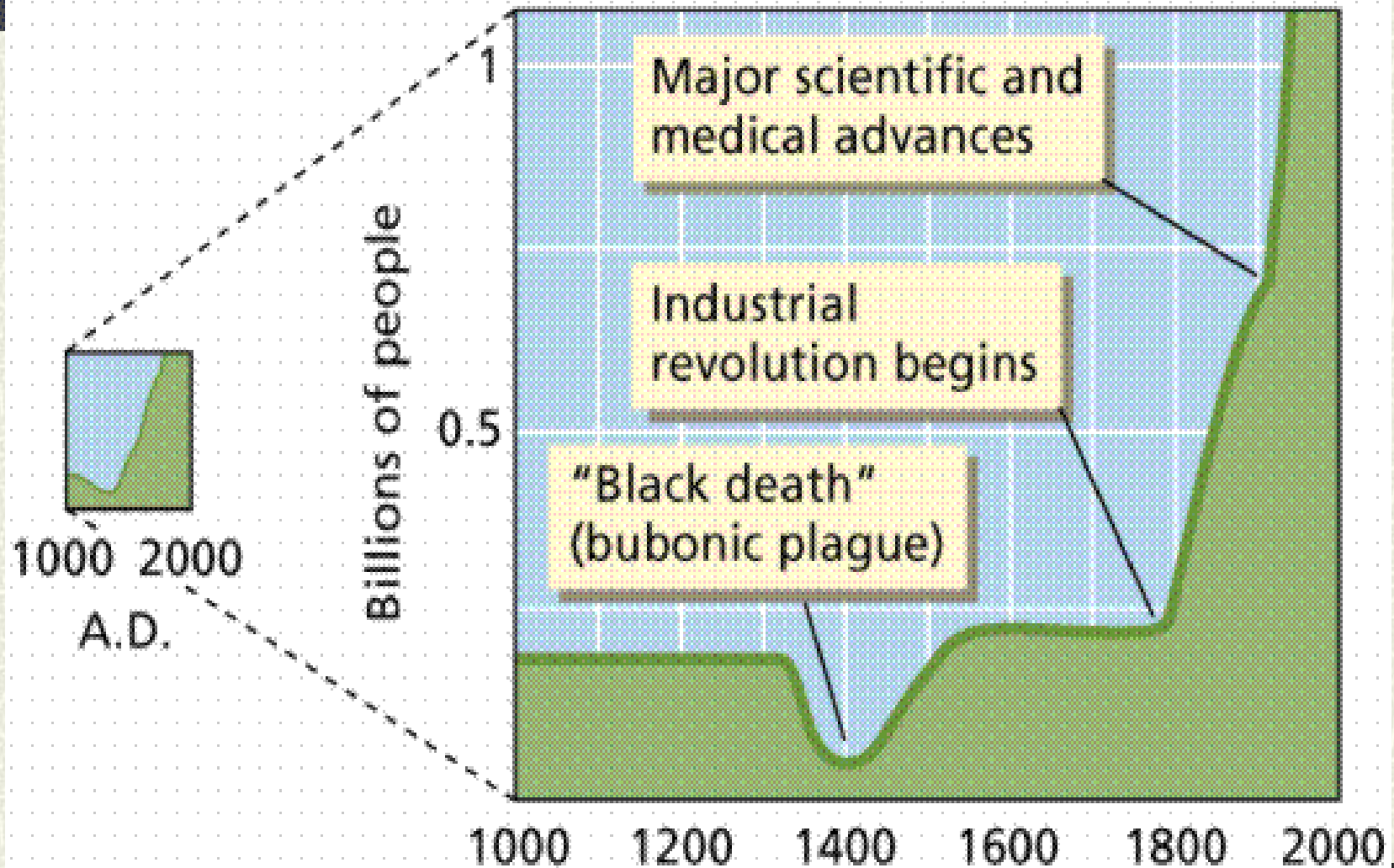
Note: Medium variant projection that assumes declining future fertility rate

Source: United Nations Population Fund, 1994

Human population (billions)



Human Population Growth



Time unit	Births	Deaths	Natural increase
Year	130,013,274	56,130,242	73,883,032
Month	10,834,440	4,677,520	6,156,919
Day	356,201	153,781	202,419
Hour	14,842	6,408	8,434
Minute	247	107	141
Second	4.1	1.8	2.3