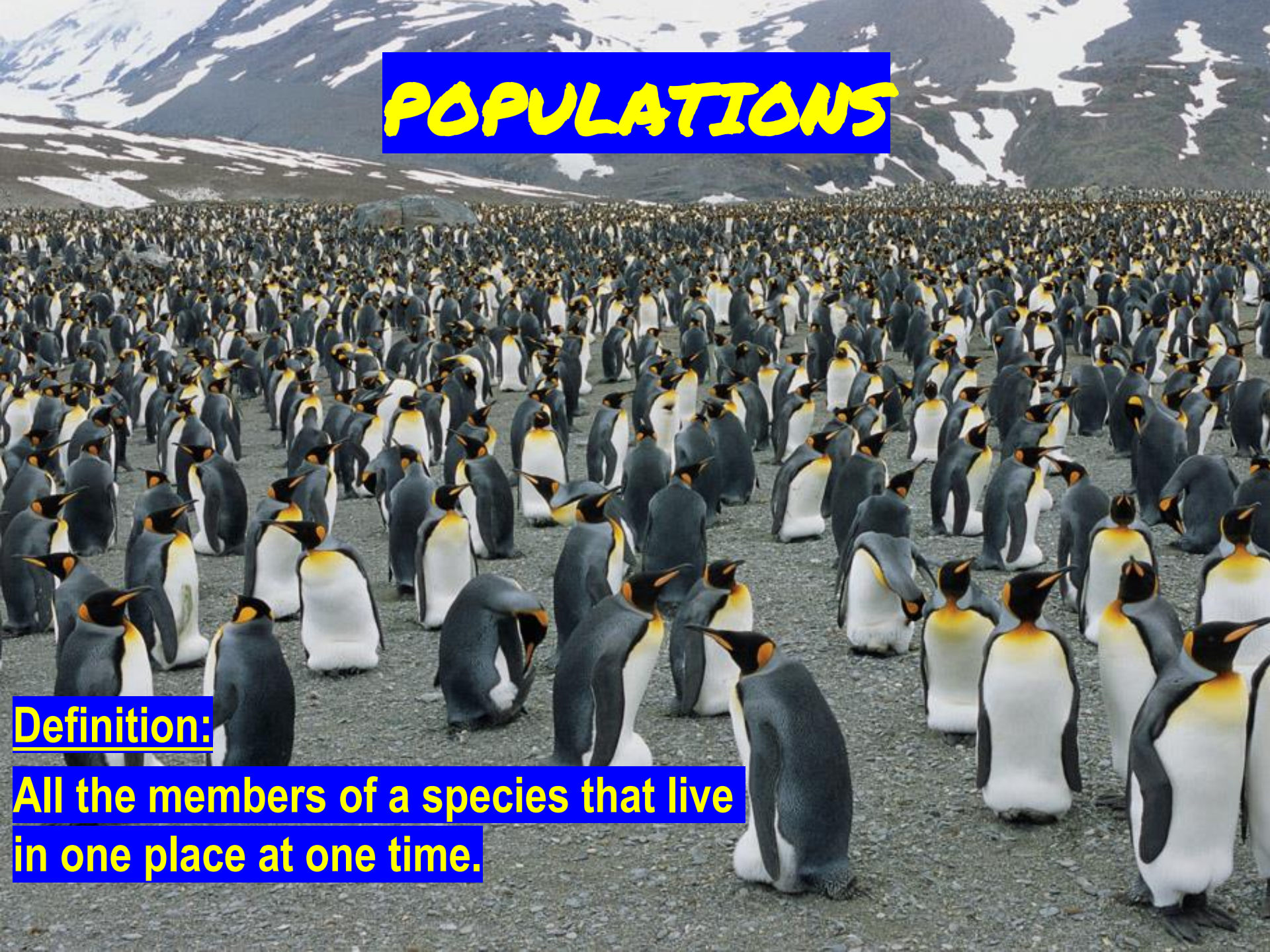


POPULATIONS

Definition:

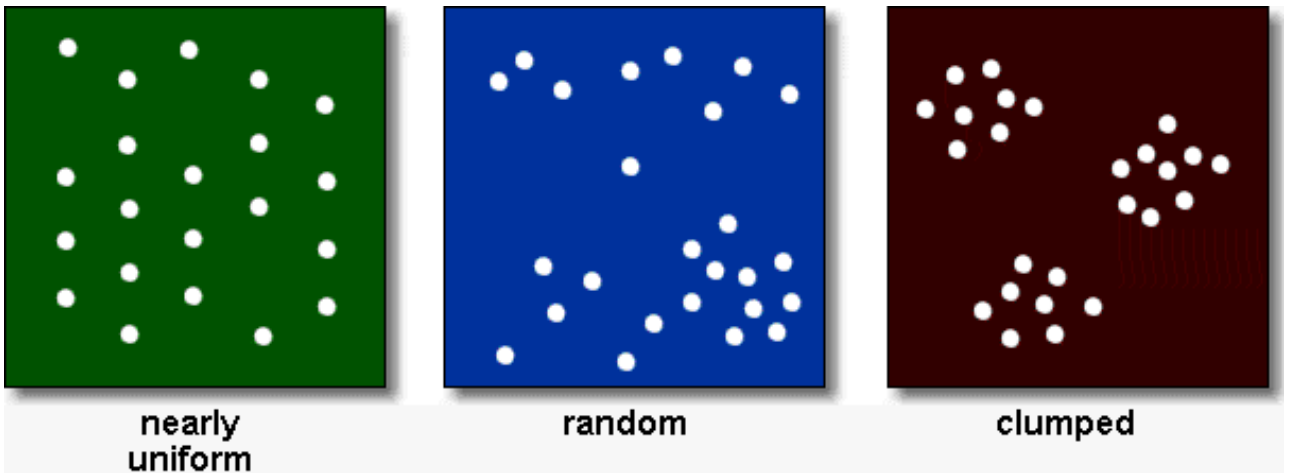
All the members of a species that live in one place at one time.

PROPERTIES of Populations

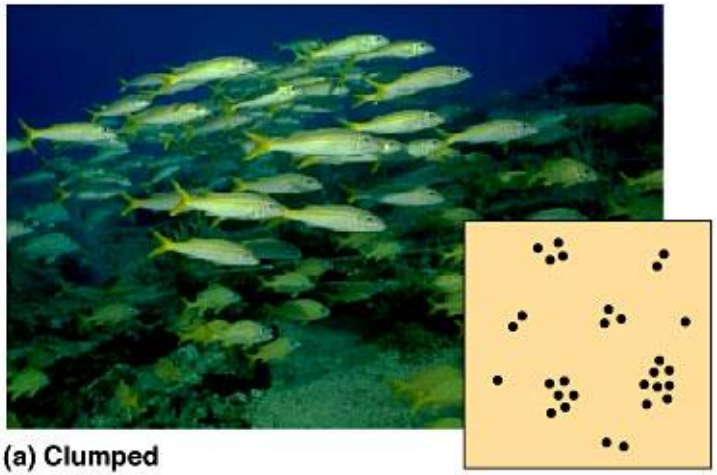
- **DISPERSION**
- Population **SIZE**
  - The number of individuals in a population
- Population **DENSITY**
  - Number of individuals per unit of area

PROPERTIES of Populations

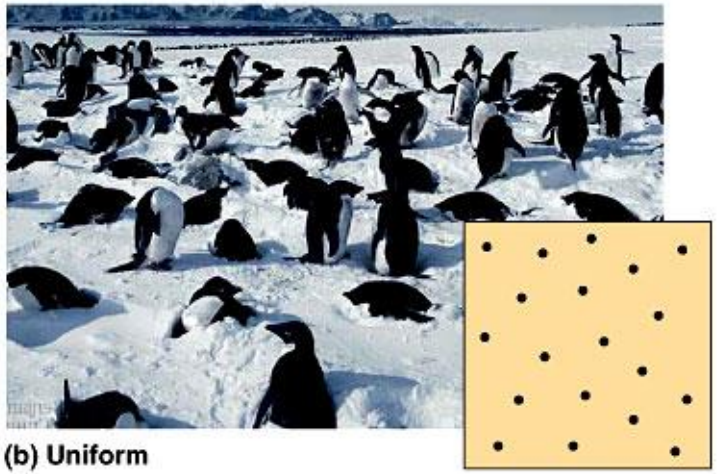
- Population Dispersion:
  - **SPATIAL** distribution of individuals within the population
    - Uniform
    - Random
    - Clumped



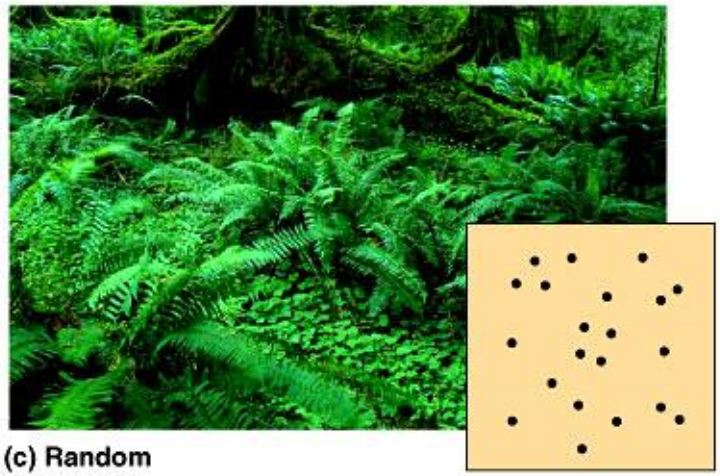
PROPERTIES of Populations



(a) Clumped



(b) Uniform

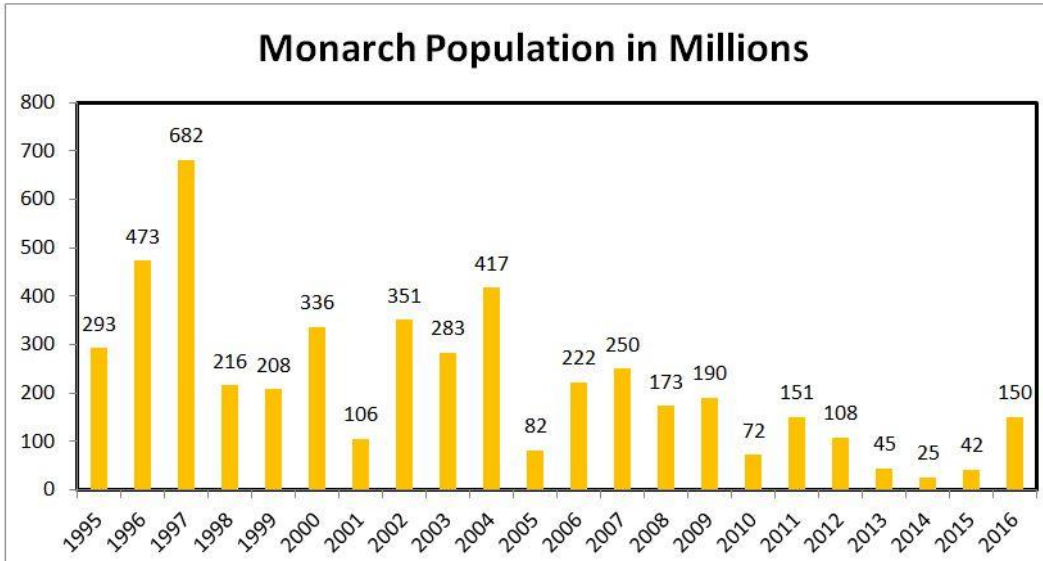


(c) Random

Population Size

Definition

- The number of individuals in a population.



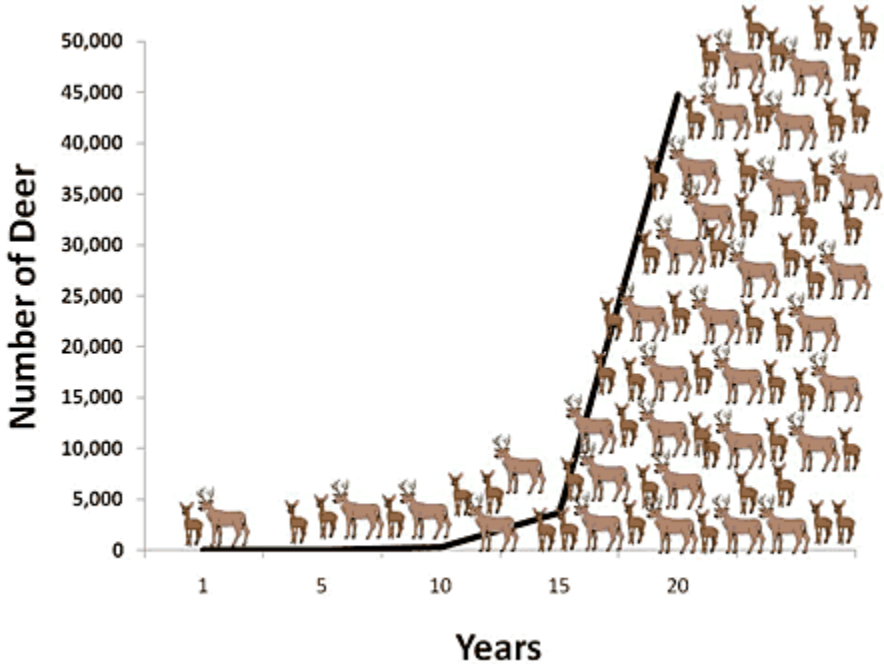
Population Size

- Depends on:
  - Birth +
  - Death -
  - Emigration: movement of individuals **OUT OF** a population -
  - Immigration: movement of individuals **INTO** a population +

Population Growth Rate

Definition

- The amount by which a population's size changes over time.



2 Types of Population Growth

1. Exponential
2. Logistic

EXPONENTIAL Model of Population Growth

- Population increases rapidly with no limit
- What will a graph look like? **"J" shaped curve**
- Rare in nature. Why?

Limit on the amount of resources (food / space)

Time	Number of Cells	
0 minutes	1	$= 2^0$
20	2	$= 2^1$
40	4	$= 2^2$
60	8	$= 2^3$
80	16	$= 2^4$
100	32	$= 2^5$
120 (= 2 hours)	64	$= 2^6$
3 hours	512	$= 2^9$
4 hours	4096	$= 2^{12}$
8 hours	16,777,216	$= 2^{24}$
12 hours	68,719,476,736	$= 2^{36}$

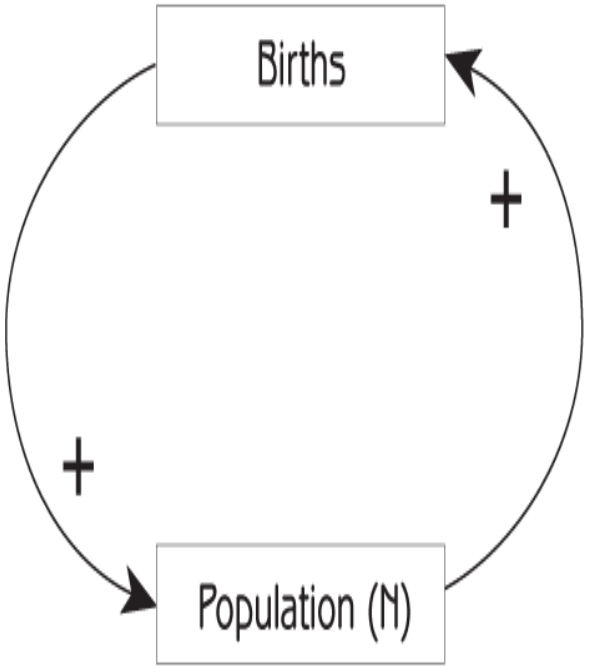
Do the Math

- Fill in the chart with the correct quantities

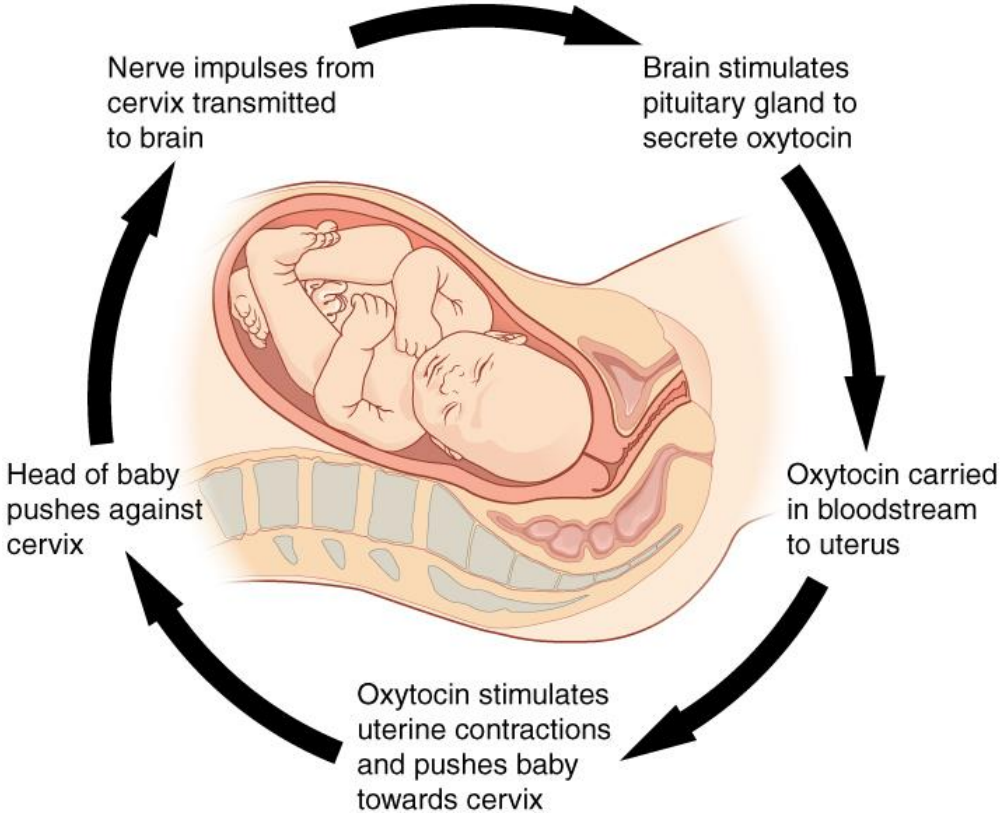
Time (minutes)	Formula	Number of Cells
0	2^0	1
20	2^1	2
40	2^2	4
60	2^3	8
80	2^4	16
100	2^5	32
120	2^6	64
140	2^7	128
160	2^8	256
180	2^9	512
200	2^{10}	1024

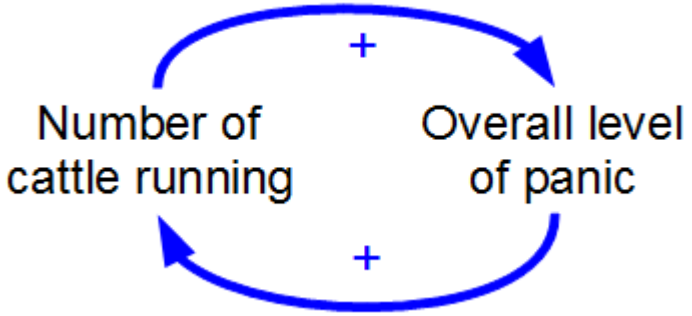
Positive Feedback

- Exponential growth is an example of positive feedback.
  - The more organisms there are, the more babies will be born who, in turn, grow up to have babies themselves and so on.



Positive Feedback





Rare in Nature

Logistic Model of Population Growth

- Exponential growth is not sustainable long term!!!
- Most populations will face limiting factors and thus show a “logistic” growth rate.
- Populations are limited by finite resources in the environment.

Logistic Population Growth

The amount of resources in an environment dictates its carrying capacity.

Definition of Carrying Capacity:

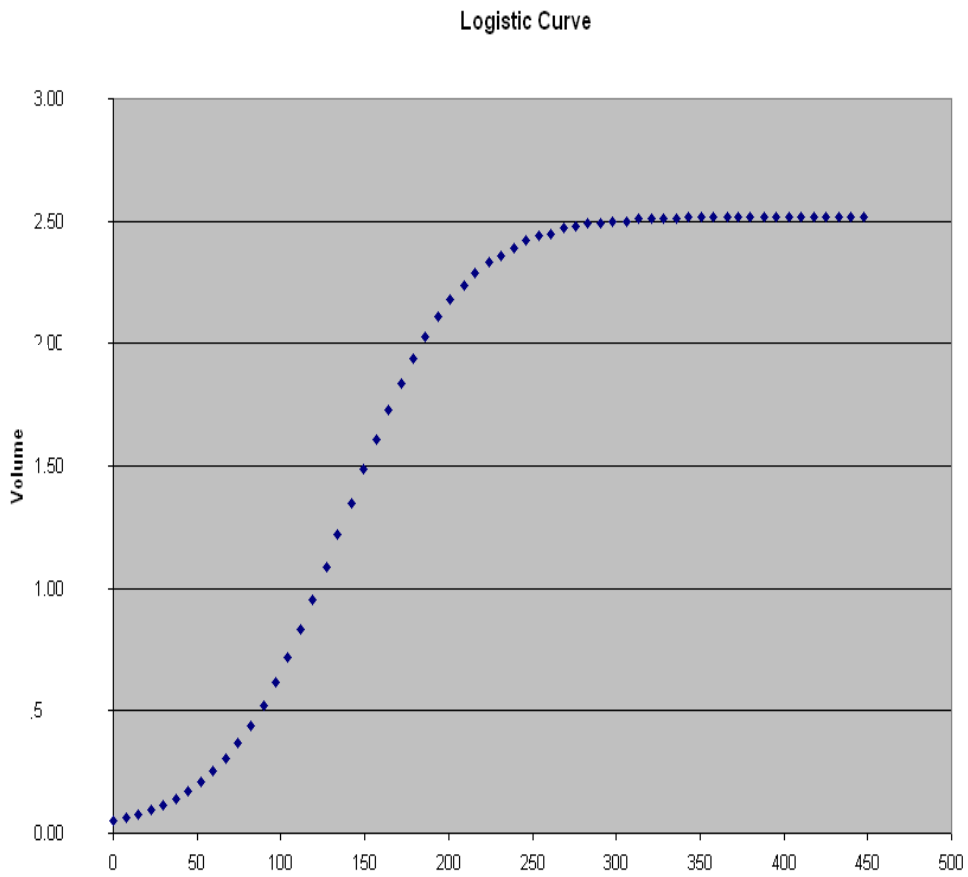
The number of individuals the environment can support over a long period of time.

- Based on the amount of resources in that environment.

Exponential Growth Curve

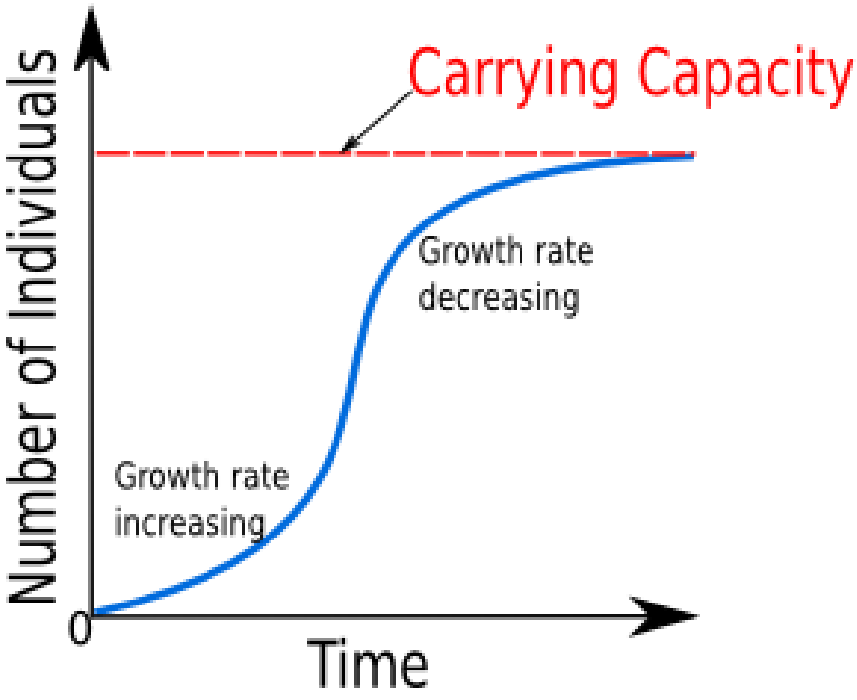
- Trace the trend line for the exponential growth curve and
- label the x and y axes with appropriate terms and
- Add a title

Logistic Growth Curve



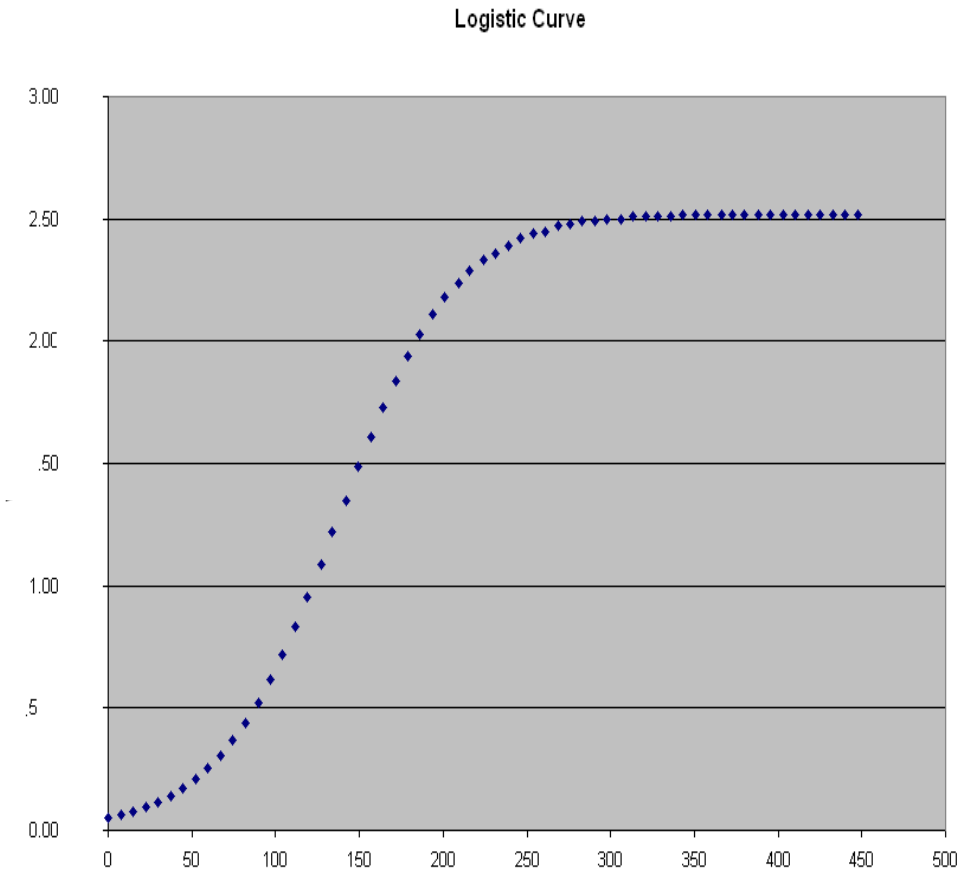
- On your notes trace the trend line
- Label the x and y axis
- Add a title
- Label the phrases
  - Birth rate increases
  - Death rate increases
  - Carrying capacity

Logistic Growth Curve



- On your notes trace the trend line
- Label the x and y axis
- Add a title
- Label the phrases
  - Birth rate increases
  - Death rate increases
  - Carrying capacity

Logistic Growth Curve

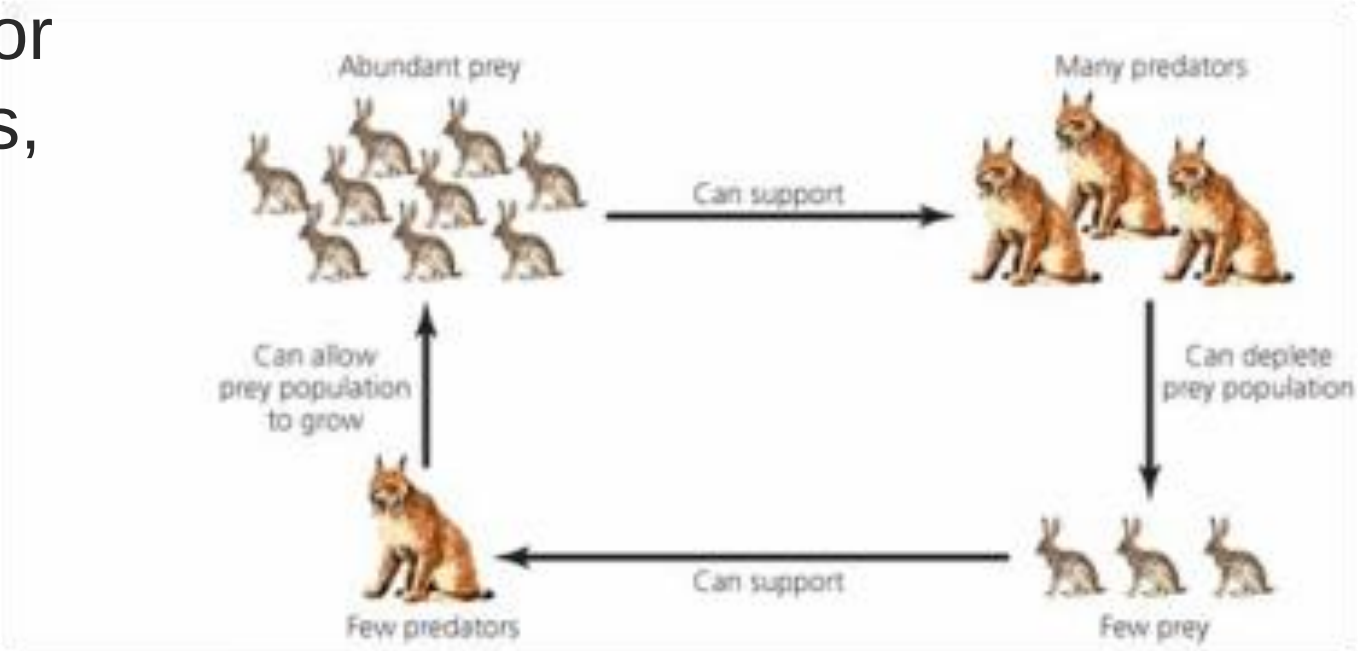


- According to the graph, how many individuals will this environment "carry" for the long term?
  - 2.50 million

Negative Feedback

Logistic growth is an example of negative feedback.

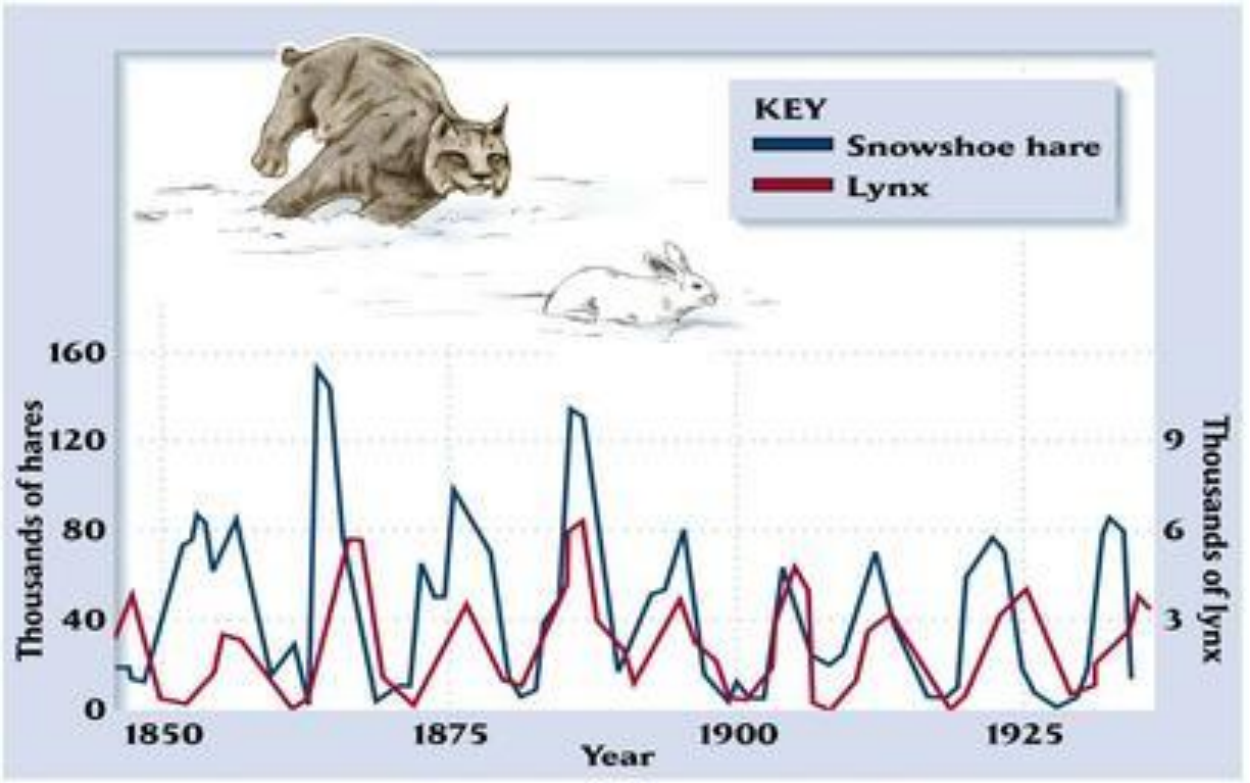
- Since resources are limited, there is competition for these resources, therefore death rates rise, causing the population to stabilize.



Negative Feedback

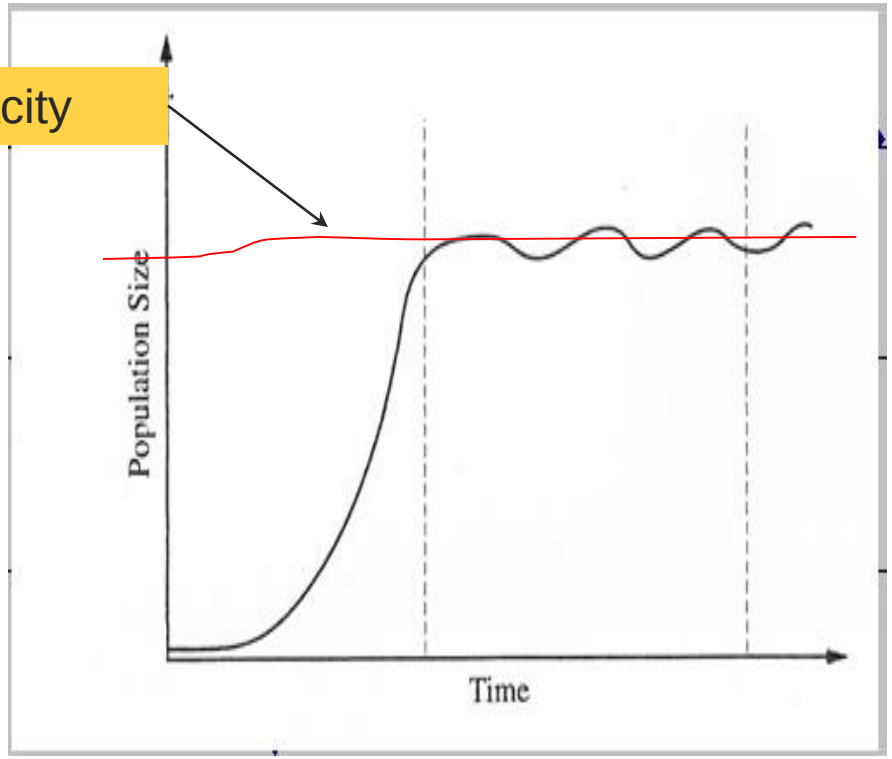
- Logistical Growth is an example of negative feedback.

- As a rabbit population increases, more predators will eat them and the population will decrease. This will cause the predators to decrease and then the rabbits will increase.



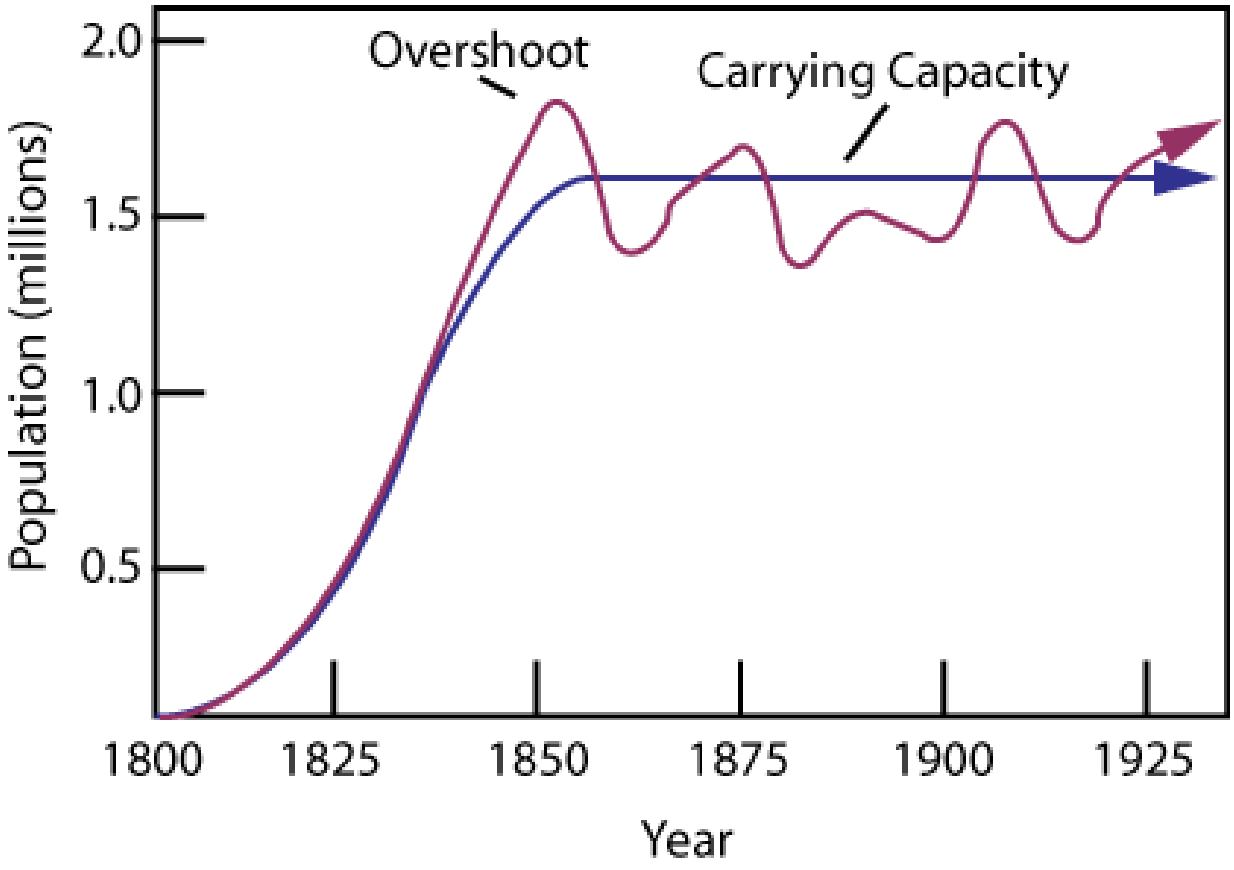
Logistic Growth Curve

- Often the population oscillates up and down, but there is an overall equilibrium to the population.
- Draw in the carrying capacity line in your notes



Logistic Growth Curve

- The carrying capacity is around 1.5 million individuals



Limiting Factors

Limiting factors are things that limit population growth. Limiting factors cause negative feedback loops. There are 2 types of limiting factors:

1. Abiotic

- Examples of abiotic limiting factors
  - Temperature
  - Space

Limiting Factors

2. Biotic factors

- Examples of biotic limiting factors
  - Food
  - Disease
  - Predators

Population **DENSITY**

- Definition:

Number of individuals per unit of area

Low density

High density

Do the math

- In a 3 km^2 area there are 7 deer. What is the density of the deer population?
  - Answer:

7 deer / 3km^2

or

2.3 deer/ km^2

Population Size **REGULATION**

1. **Density Independent Factors**: reduce population regardless of population size

   Examples:

   - Weather
   - Fires
   - Floods

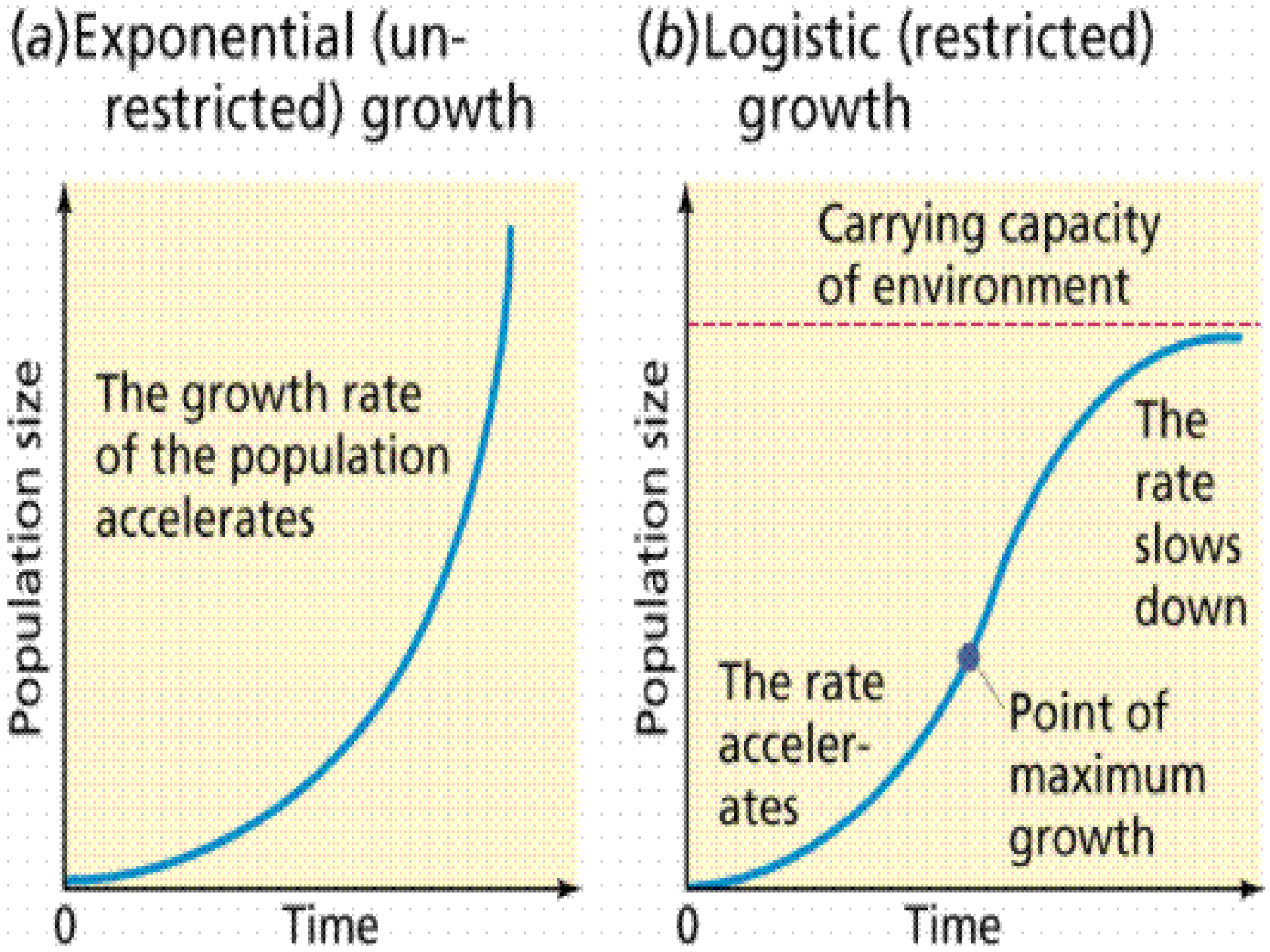
Population Size **REGULATION**

2. Density Dependent Factors:

triggered by increasing population density

Examples

- Food shortages
- Space limitations
- Waste accumulation


(a) Exponential (un-restricted) growth
(b) Logistic (restricted) growth
Population size
The growth rate of the population accelerates
0
Time
Carrying capacity of environment
Population size
The rate slows down
The rate acceler-ates
Point of maximum growth
0
Time