Population Dynamics

The Back Page

State population to double by 2040; babies to blame

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Clatchy News Service

SACRAMENTO — In their first attempt at projecting California population in the year 2040, officials Tuesday unveiled a future state with twice as many people

Area Counties

Northern San Joaquin Valley counties with their 1990 populations and projections

S2-1-04 Discuss the carrying capacity of an ecosystem.

S2-1-06 Construct and interpret graphs of population dynamics.

Populations…

A **POPULATION** is a group of organisms that belong to the **SAME SPECIES** that live in a **CERTAIN AREA**.

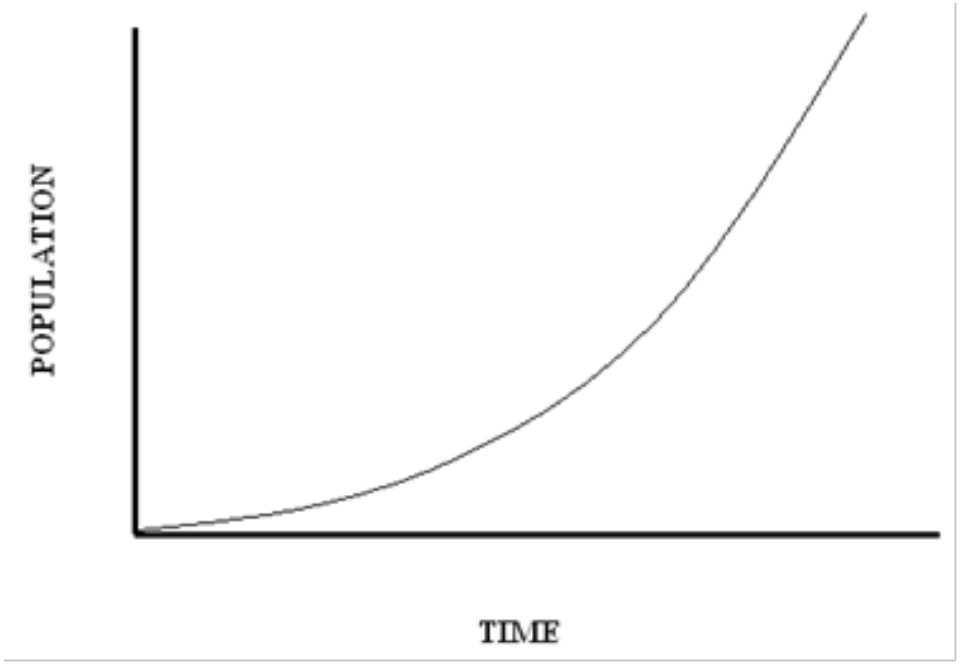
- →For example, all the flies that live in your house are a population, just like all the people that live in Winnipeg.

Exponential Population Growth

- When conditions are **IDEAL** for **GROWTH** and **REPRODUCTION**, a population will experience a **RAPID INCREASE** in size.

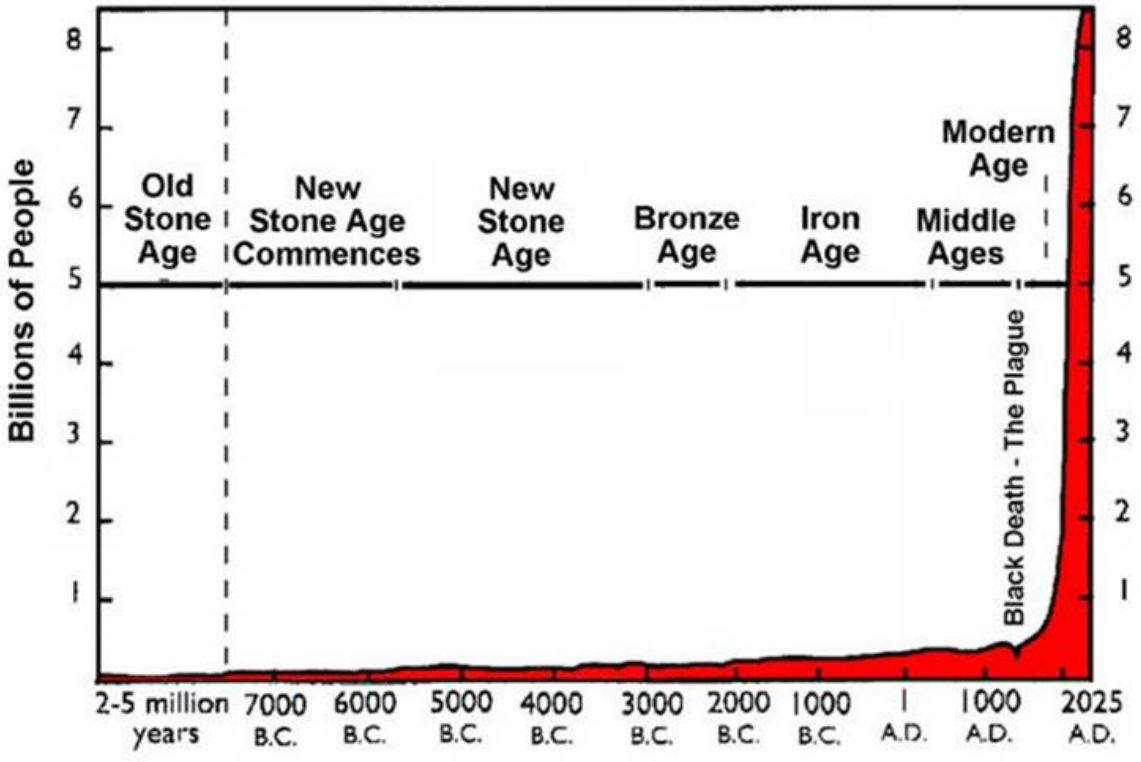
- Initially the population grows **SLOWLY**, but the **LARGER** the population gets, the **FASTER** it **GROWS**.

  →As more offspring survive and reproduce, even **MORE** offspring are born.



Exponential Population Growth

- The graph below shows the human population growth curve. This type of population growth is called **EXPONENTIAL** and occurs under **IDEAL CONDITIONS**.



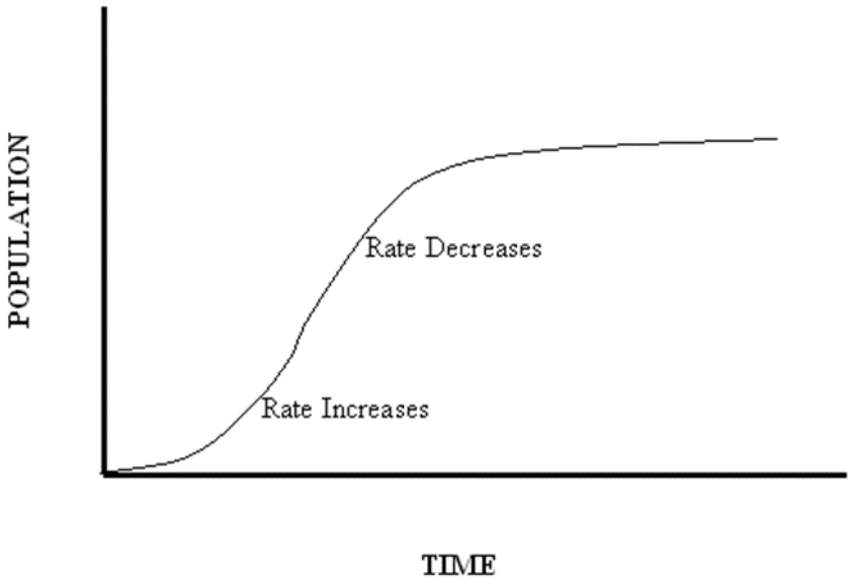
- Can a population continue to grow at this rate forever?

→The answer of course, is **NO**.

Logistic Growth Curve

- The **ENVIRONMENT** begins to **LIMIT** population **GROWTH**. Resources such as **FOOD**, **WATER**, and **SPACE** become **SCARCER** and the rate of population **INCREASE** begins to **SLOW**.

- The graph below illustrates a curve of this nature called a **LOGISTIC** population growth curve. This curve has the shape of the letter "**S**".



Closed Populations

- A **CLOSED** population occurs when **NEW INDIVIDUALS** cannot enter (**IMMIGRATE**) an existing population, and **EXISTING INDIVIDUALS** cannot leave (**EMIGRATE**).
- In a closed population only **BIRTHS** or **NATALITY INCREASE** the population and only **DEATHS** or **MORTALITY DECREASE** the population of a certain organism in an ecosystem.

Example – Closed Population:

A deer population living on an isolated island. No deer can enter or leave the island.

- The population of the deer will increase only if deer are born and decrease only if deer die.
- If 45 deer now live on the island and 25 deer are born and 20 deer die during the next year, then, the population growth for the year will be found as follows:

Population Growth = births – deaths

= 25 - 20

= 5

→The population grows by **5** from **45** to **50** deer.

Open Populations

- Deer found in the forests of Manitoba are considered to be part of **OPEN POPULATIONS**. In this kind of population, besides being born or dying, deer can **LEAVE** the population and move to another area or **EMIGRATE**. Deer from other areas can travel **INTO** the ecosystem or **IMMIGRATE**.
    - **IMMIGRATION** and **BIRTHS** **INCREASE** the population.
    - **EMIGRATION** and **DEATHS** **DECREASE** the population.

- The formula for determining population growth in an open system is as follows:

POPULATION GROWTH = (BIRTHS + IMMIGRANTS) – (DEATHS + EMIGRANTS)

- If population growth is **LESS THAN ZERO**, there are **MORE** **DEATHS** and **EMIGRANTS** in the population **THAN** there are **BIRTHS** and **IMMIGRANTS**. The size of the population begins to decline.

Examples-Open Populations

It has been a cold year and a population of coyotes is feeling the effects. During the year 12 pups were born, but 5 died. 9 coyotes left the population to find more food, however, the pack welcomed 2 from the pack across the river. What was the population growth?

PG = (B+I) – (D+E)
PG = (12+2) – (5+9)
PG = (14) – (14)
PG = 0

Try this one…

Biologists want to study population growth of ladybugs in two weeks. In a small ecosystem 137 ladybugs die and 213 are born. 187 leave the population and 98 immigrate in. What is the change in population?

PG = (B + I) − (D + E)
= (213 + 98) − (137 + 187)
= 311 − 324
= -13

Carrying Capacity

- The **LARGEST** population of a species that a **PARTICULAR ENVIRONMENT** can **SUPPORT** is known as the **CARRYING CAPACITY**.

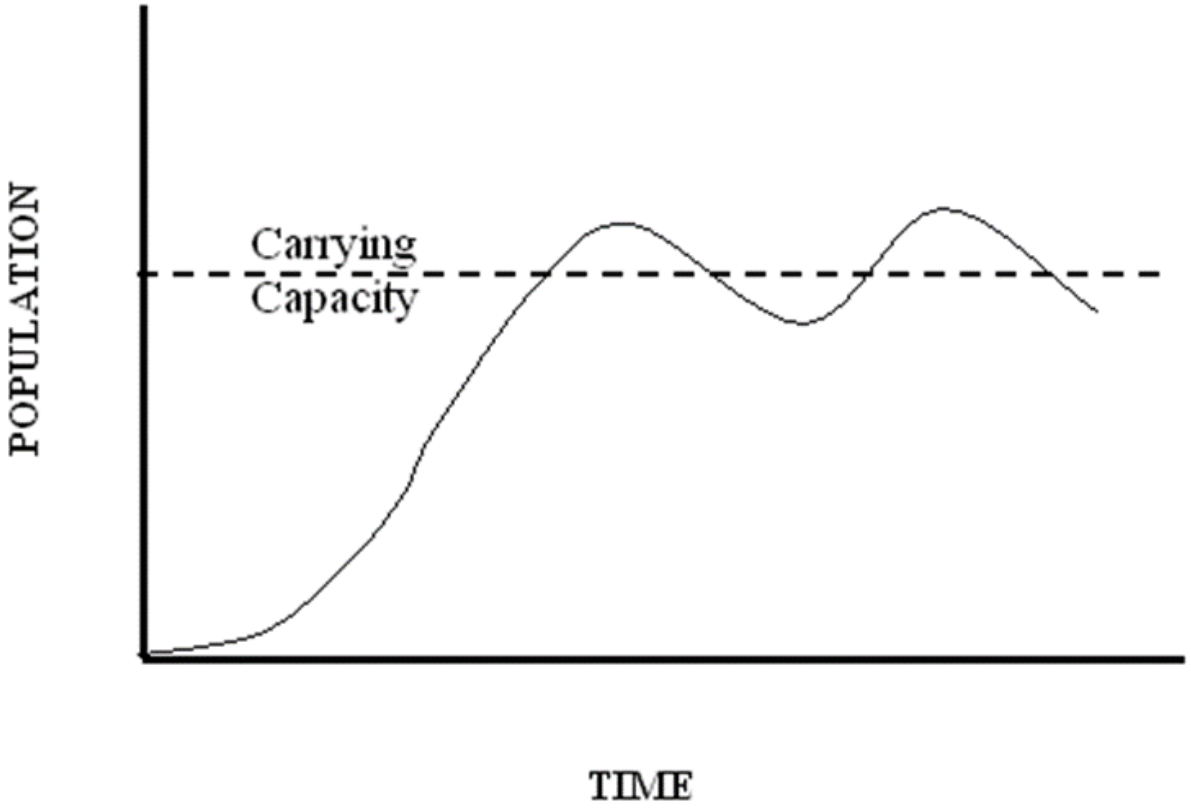
- The **CARRYING CAPACITY** of the environment is different at **DIFFERENT TIMES** since it is **AFFECTED** by many **FACTORS** such as **RESOURCES** (food, water) and **WEATHER**.

- The population **FLUCTUATES** **OVER TIME**, but the **CARRYING CAPACITY** represents an **AVERAGE** of a series of **UPS** and **DOWNS**.

- If you **DRAW A LINE** through the **MIDDLE** of the population **FLUCTUATIONS**, that line represents the **CARRYING CAPACITY** of that environment for that species.

Carrying Capacity

POPULATION GROWTH CURVE: CARRYING CAPACITY



The population of a species in an ecosystem will grow **RAPIDLY AT FIRST**. Once the population has reached the level that the ecosystem can support, the population varies **UP** and **DOWN** around the **CARRYING CAPACITY**.

Population Histograms

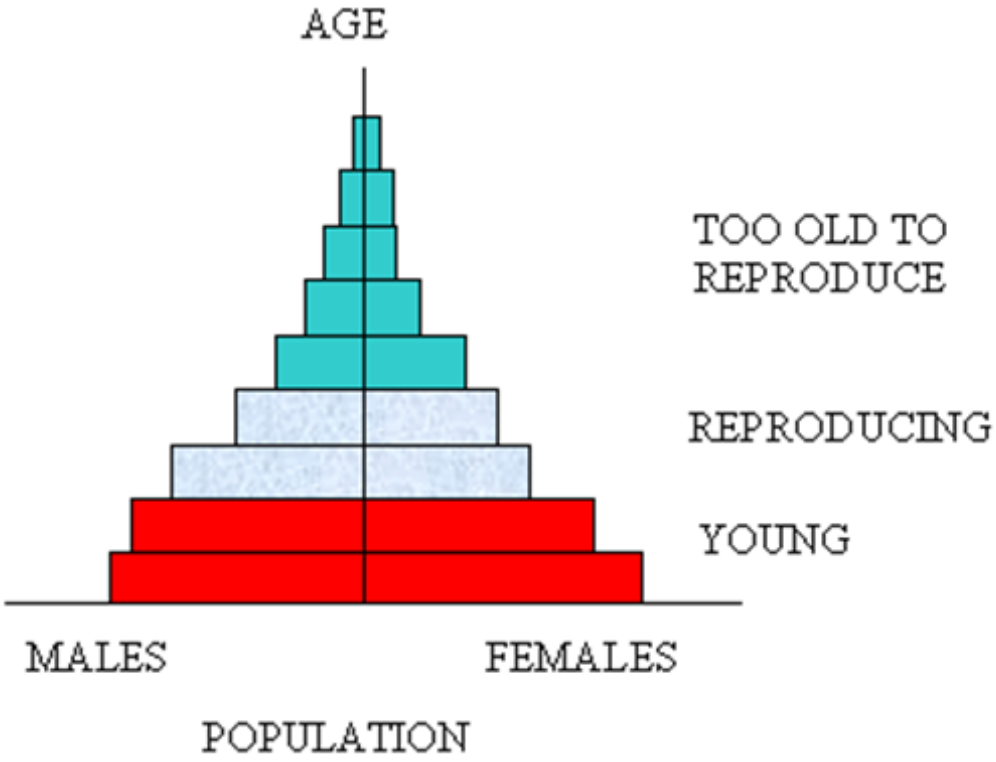
Population Distributions According to Age

- It is also useful to consider **HOW MANY** organisms there are of a **CERTAIN AGE** within a population.
  - This information can tell us how the population will likely **CHANGE** in the **FUTURE**

- Population-age distributions are drawn as **HISTOGRAMS** with **POPULATION** along the **HORIZONTAL** axis and **AGE** along the **VERTICAL** axis. The graph is drawn with horizontal bars. Each bar represents the number of organisms of a certain **AGE GROUP**. There are as many bars as age groups. There is **ONE** side for **MALES** and one side for **FEMALES**.

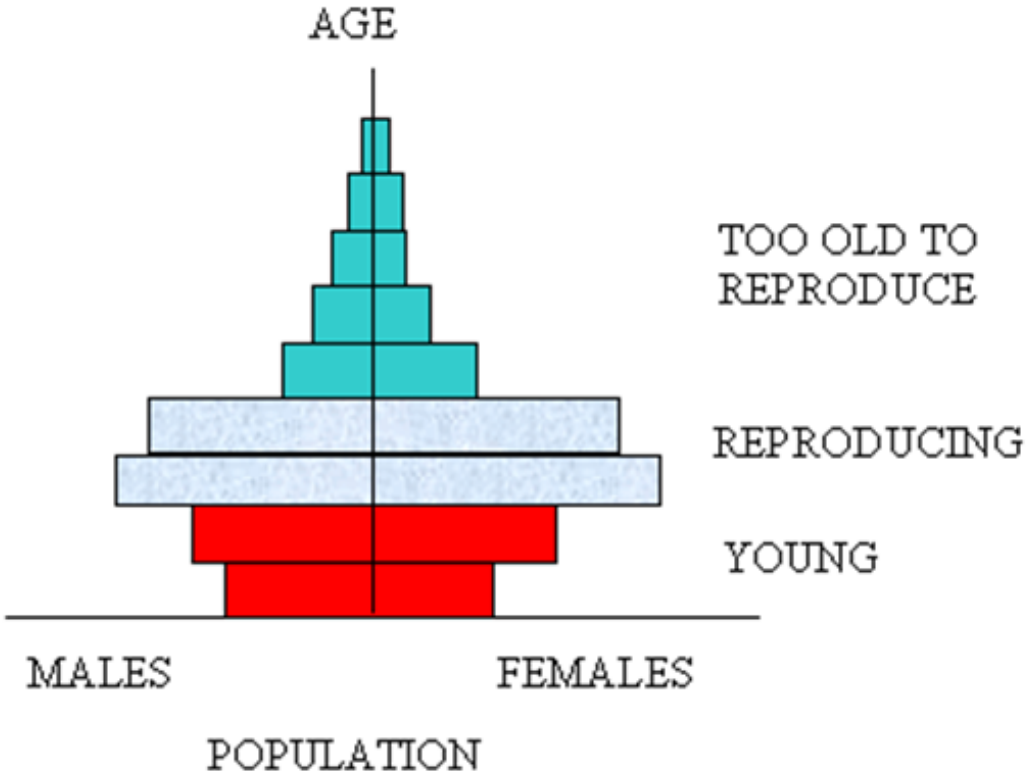
- An age-population histogram shows a **SNAPSHOT** of the organisms, both male and female, that fall into categories of age. While the data represented is for only a particular **INSTANT** in **TIME**, the **SHAPE** of the **DISTRIBUTION** allows us to **PREDICT** if the population is increasing, decreasing or steady.

Increasing Population Histogram



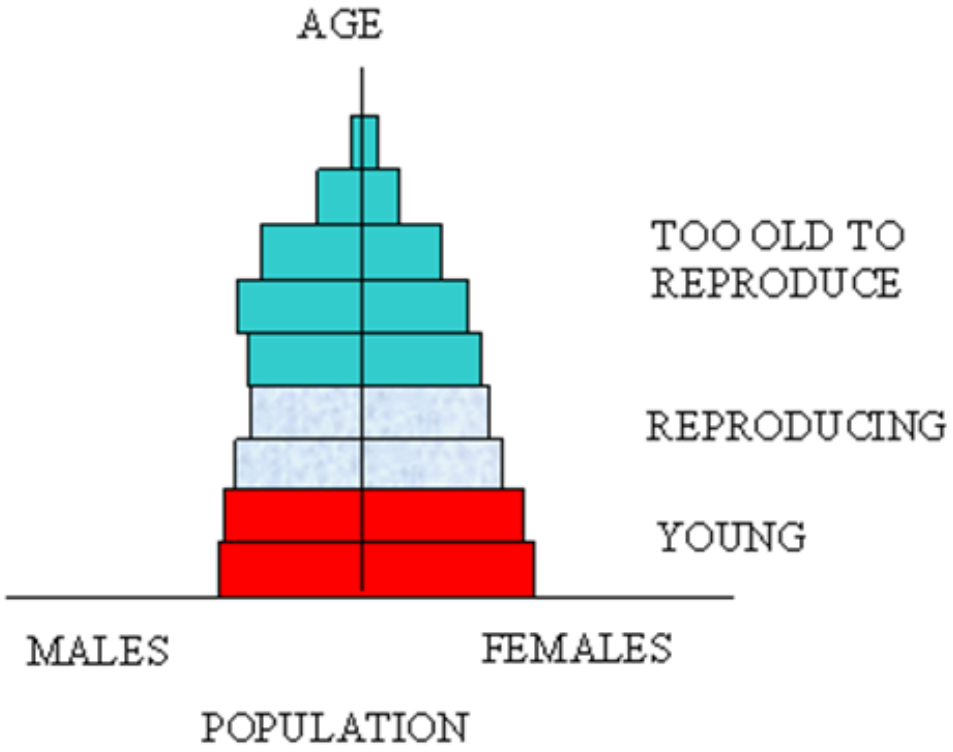
This histogram has the shape of a **PYRAMID** with a wide base. The wide base means there are **LOTS OF YOUNG ORGANISMS** to **REPLACE** the **OLDER ONES WHO DIE OFF**. The population **INCREASES** since there are **FEWER** older organisms dying and many **MORE** organisms being born.

Decreasing Population Histogram



This histogram has the **WIDEST** part in the **MIDDLE** section. In this age-population distribution, there are **FEW YOUNG ORGANISMS** to **REPLACE** the **OLDER ORGANISMS** as they die off. Also, in **LATER YEARS**, there will be **FEWER** organisms to **REPRODUCE** and supply the **OFFSPRING** needed to replace those which are now the young. The population **DECREASES**.

Steady Population Histogram



In this distribution the **REPRODUCING ORGANISMS** are simply **REPLACING THEMSELVES**. Since there are as many organisms being **BORN** as are **DYING**, the population remains **STEADY**.