IDX G9 Biology S Level
Study Guide S1 Monthly 2
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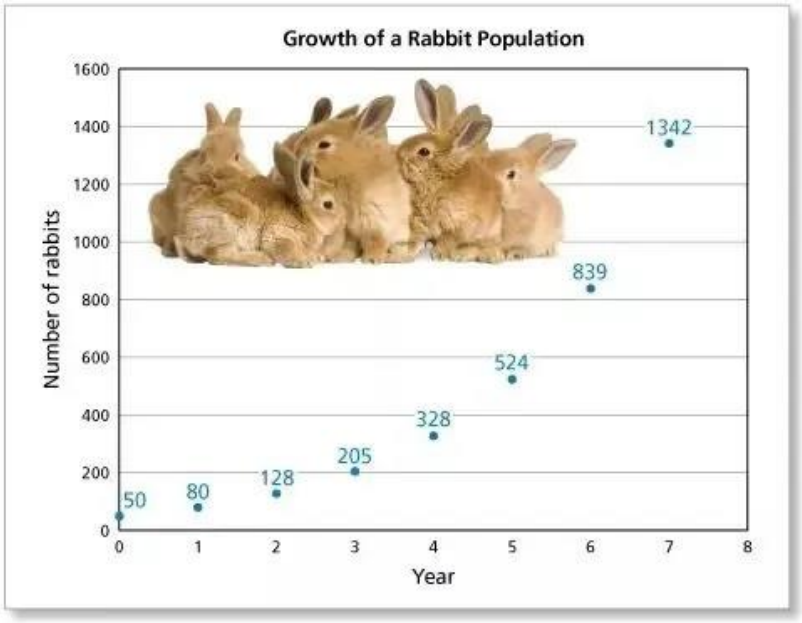
Contents:

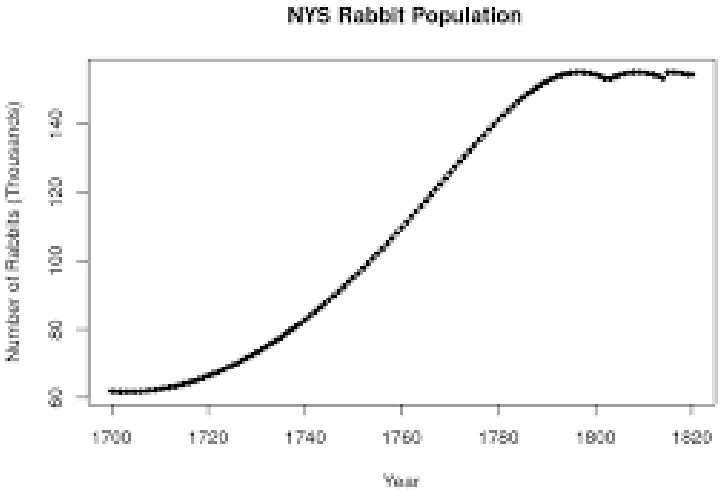
5.1 How did population growth

- Four factors to consider:
    - Geographic range: The area inhabited by a population is called its geographic range. (where things live)
    - Density: the number of individuals per unit area.
        - Distribution is how animals are spread in an area. It can be spread in random, uniform, or concentrated way.
    - Growth rate: The increase and decrease of population of a species.
    - Age structure: the number of males and females of each age a population contains. It is important to know because animals in certain ages cannot reproduce and only females can give birth to offsprings
- Population Growth:
    - Factors that affect population growth are the birthrate, death rate, and the rate at which individuals enter or leave the population.
    - Immigration: move in Emigration: move out
    - Exponential Growth: under **ideal conditions** with **unlimited** resources, a population will grow exponentially. Which means it is almost impossible to happen.

(Sometimes happens when invasive species enter to new environment with enough resources and no predator)



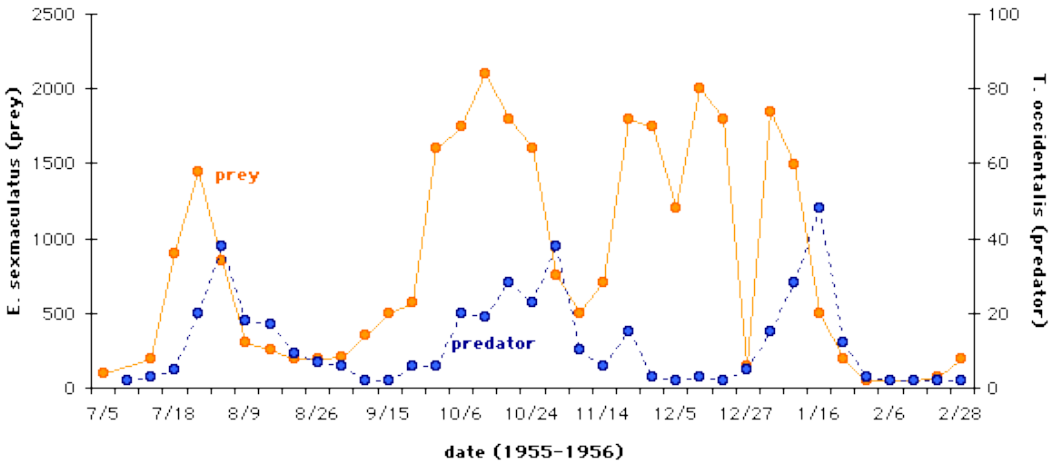
- Like when to draw 2^x graph, the shape of exponential growth is a shape of exponential graph.
- Logistic growth: is when population slows down and eventually stops, it comes after exponential growth.



- **Carrying capacity** is the maximum number of individuals of certain species that an environment can support.

5.2 Limits to Growth

- Limiting Factor: Is what controlling the growth of population. So, it also determines the carrying capacity of an environment for a species.
- Density-dependent limiting factors: competition, predation, herbivory, parasitism, disease, and stress from overcrowding.
    - Competition: it is a density-dependent limiting factor because competitions happens when many individuals live in one area and competes for resources.
    - Predation and herbivory: Predator and prey relationship is affected by the number of predator and prey in each environment. When the population of prey drops, predator species' population drops, but as soon as predators are gone, prey population will increase again, so as the predator population.

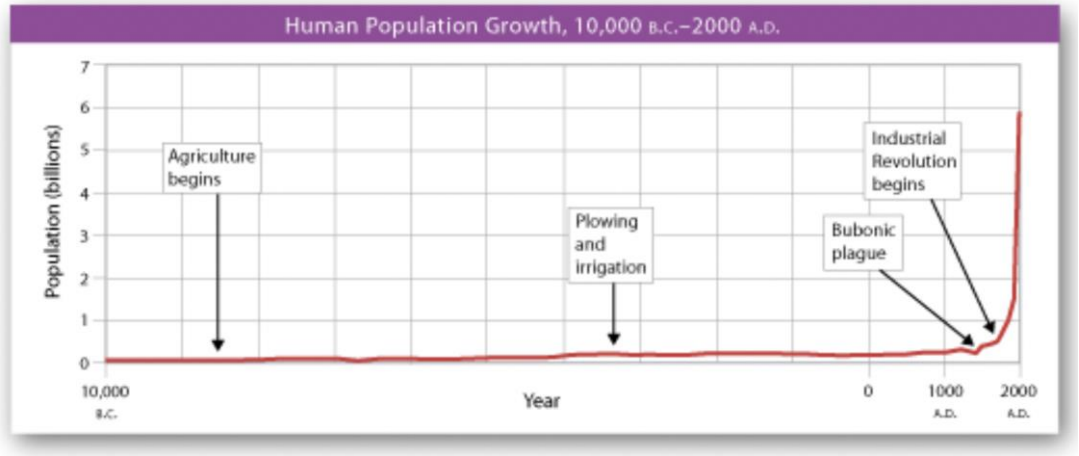


The relationship between herbivores and plants is just like predator-prey model

    - Parasitism and diseases: When an individual is infected by parasite or disease, the disease is spread through between same species by the infected one. Therefore, it is a density-dependent factor that is affected by the number of populations that is available to infect.
    - Stress from overcrowding: Increase of population causes more intense competition for limited resources in the community. The high level of stress can cause emigration and decrease the population.
- Density independent factors: Natural disasters such as hurricanes, droughts, floods, wildfires…ect that happens regardless of population size and population density.

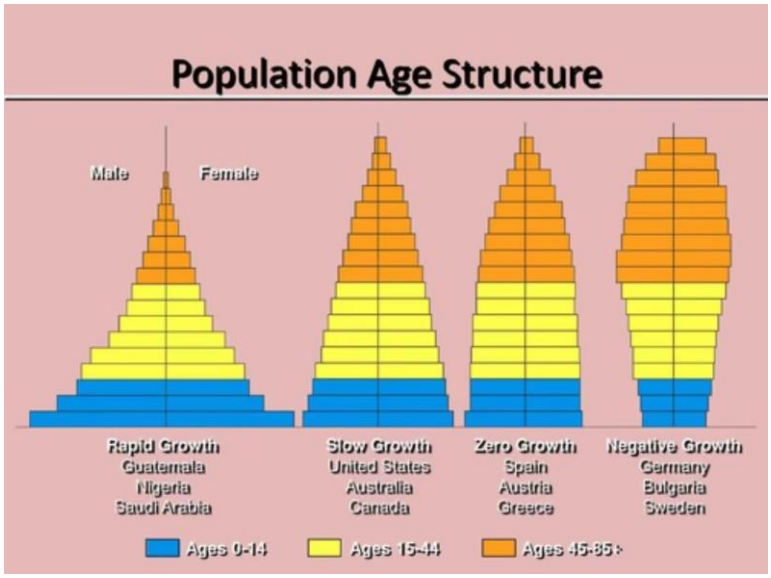
5.3 Human population growth

- Key Concepts & Main Points-
    - For most of human history, populations grew very slowly: high birthrates were balanced by high death rates (due to disease, lack of medicine, poor sanitation, limited food, etc.).
    - As living conditions improved (better sanitation, medicine, food supply, urbanization, technology), death rates dropped but birthrates remained high — that caused a dramatic, rapid increase in human population.
    - This period of accelerated growth is similar to "exponential growth" seen in ecology: when conditions are favorable and resources sufficient, populations can grow fast.



    - Demographic Transition — why growth slows down in developed countries
    - Demographic transition describes the shift societies go through: from high birth & death rates to low birth & death rates.
        - Stage I — pre-industrial: high birth, high death, slow growth.
        - Stage II — death rate falls (due to better medicine, sanitation), but birthrate stays high for a while → population grows rapidly.
        - Stage III — birthrates decline (often as living standards rise, more access to education, contraception, changed social norms), so growth slows and population stabilizes.
- Many developed countries have completed the demographic transition; others — especially developing countries — may still be in Stage II or transitioning.
- Age-structure & population growth predictions

- The age structure (how many people in different age groups) helps predict population growth trends for a country.



- Countries with many young people (a "youth-heavy" age pyramid) tend to have high growth potential (because many people will reach reproductive age).
- Countries with more balanced or older age distributions tend to have slower growth or stable population.

- Why human population growth matters & its implications
  - Human populations — unlike many other species — can actively modify their environment (through technology, agriculture, urbanization), which can increase the environment's carrying capacity, but also cause environmental stress/damage.
  - Rapid population growth raises concerns about sustainability, resource use (food, water, land), environmental impact (pollution, habitat destruction), and social issues (crowding, inequality, public health).

Video: "Don't Panic!" TED talk by Hans Rosling

- Main Points & Key Facts
  - In ancient times (around when agriculture began), the global population was extremely small — only a few tens of millions.
  - The world didn't reach the first billion people until the 1800s — the rise of the first billion coincided with the Industrial Revolution.
  - After the Industrial Revolution, population growth accelerated dramatically.

- A major cause for population growth slowing down (or fertility rates dropping) is improved health, longer life expectancies, and lower child mortality — i.e. more children survive to adulthood, so families tend to have fewer children overall.
- Education — especially of women — and better economic conditions tend to correlate with lower fertility rates.
- There is a global inequality dimension: many regions (especially less developed nations) still have high fertility rates and lower life expectancy; these are often the places where most of future population growth is expected.
- As of now, global population growth remains real, but the "fast growth" phase is expected to slow or end — meaning population growth will level off. Some forecasts suggest the global population could peak later this century.

- **Term/ Concept**
  - Fertility rate:
    - The average number of children a woman has in her lifetime — a key metric to track population growth.
  - Child mortality / life expectancy:
    - When child mortality drops (fewer kids die), families often choose to have fewer children. This changes population growth dynamics.
  - Industrial Revolution:
    - The historical period that triggered major population growth worldwide — due to advances in medicine, agriculture, sanitation, living standards.
  - Demographic transition: A shift many countries undergo:
    - from high fertility & high mortality → to low fertility & low mortality — leading eventually to slower population growth (or stabilization). The video illustrates this transition globally.