

**ENV SCIENCE 120 - LESSON 18**

**CARRYING CAPACITY**

## Env Science 120

### STUDENT LEARNING TARGET

<b>WHAT AM I GOING TO LEARN?</b>	<b>HOW WILL I SHOW WHAT I KNOW?</b>	<b>HOW WILL I KNOW HOW WELL I AM DOING – WHAT ARE MY LOOK-FORS?</b>
<b>I AM GOING TO LEARN ABOUT:</b> <ol style="list-style-type: none"><li><b>CARRYING CAPACITY</b></li><li><b>WHY:</b></li><li><b>TO HAVE AN UNDERSTANDING OF HOW CARRYING CAPACITY AFFECTS HOW POPULATIONS GROW</b></li></ol>	<b>I WILL USE A PENCIL AND PAPER TO COMPLETE ANSWERS TO THE QUESTIONS ASKED AND /OR RESPOND ORALLY TO THE TEACHER</b>	<ol style="list-style-type: none"><li><b>I HAVE ANSWERED THE QUESTIONS IN ASSIGNMENT 18 - CARRYING CAPACITY</b></li></ol>

## CARRYING CAPACITY

Assume an Apple represents the earth

Slice in 4, three pieces rep the oceans and  $\frac{1}{4}$  is land



Cut quarter in half ..... one piece is land that cannot be used by people (swamps, polar areas, deserts, rocky mountains)

What is left is ?  $\frac{1}{8}$

Slice  $\frac{1}{8}$  piece into four ...3 of them is land for cities, roads, suburbs, places where people live and work, but do not grow food

Remaining fraction of the earth is  $\frac{1}{32}$

Carefully peel the skin of the piece .....this skin represents the tiny portion of earth that can effectively be used to grow food.

This is a fixed resource....cannot get bigger, but it can get smaller

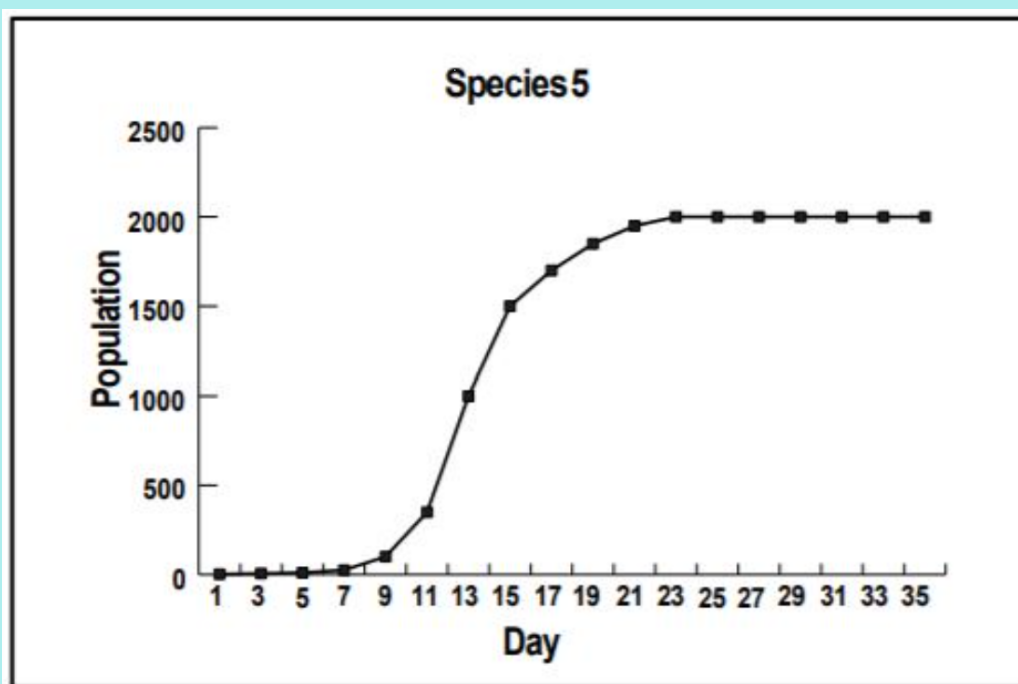
We have an ever-increasing number of humans to feed

**IT IS ESSENTIAL** to protect our fixed resources like land, air, and water.

## CARRYING CAPACITY

- Living things need resources in order to survive.
- However, the amount of available resources dictates the size of a population
- A population will grow when resources are in surplus, decline when resources are scarce, and stabilize when the population is at the maximum level that can be sustained.
- On a school bus or an elevator, the carrying capacity would be the maximum number of people that could safely fit.
- In nature, carrying capacity is defined as the maximum number of a species that can sustainably live in a given area.
- In other words, a population's carrying capacity is the size at which a population can no longer grow due to lack of supporting resources.
- All populations have a carrying capacity, whether bacteria in a bottle or rabbits in a forest.
- Biologists often graph populations to show growth trends. A graph that reveals an "s" shape indicates that the population has hit its carrying capacity.

## CARRYING CAPACITY



## CARRYING CAPACITY

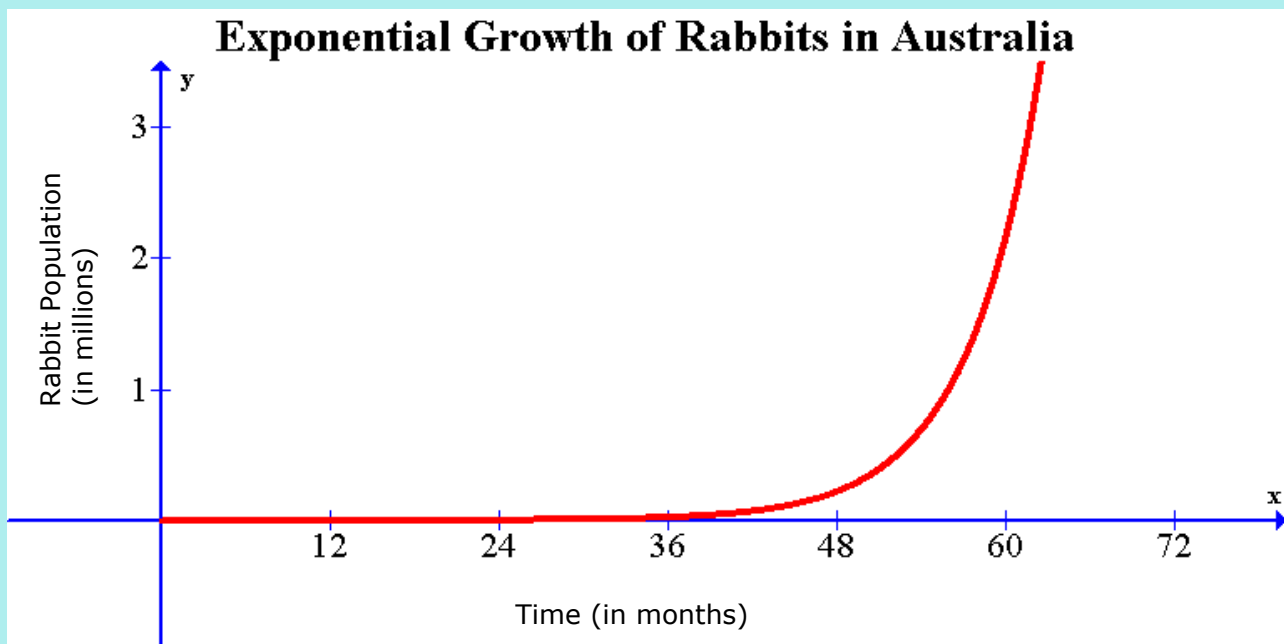
- **Carrying Capacity** - the maximum number of individuals of a given species that an environment can support



# CARRYING CAPACITY

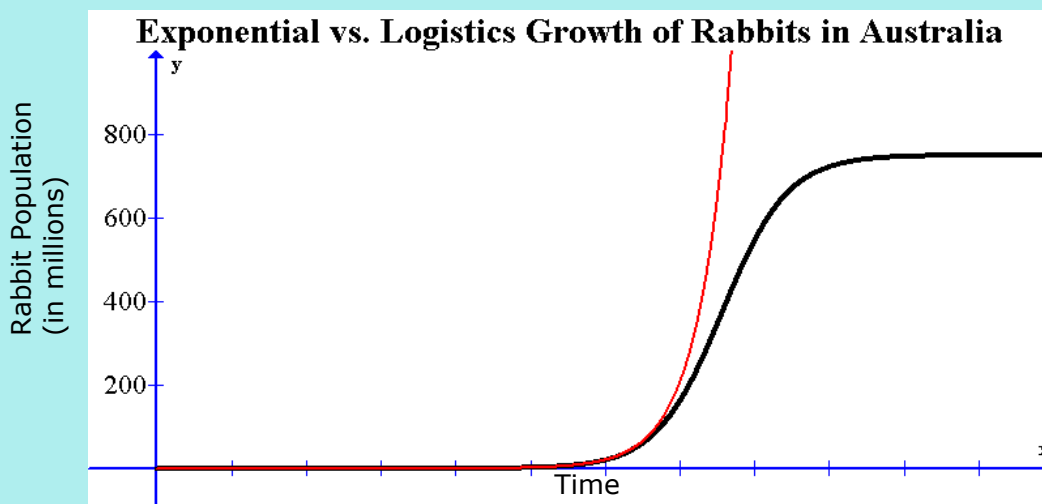
## Exponential Population Growth of Rabbits in Australia

- In 1859, a southern Australian farmer homesick for England imported two dozen (24) wild English rabbits and set them free on his land.
- Within six years (72 months), Thomas Austin's 24 rabbits had multiplied to 22 million!
- The rabbits had no natural predator in Australia.



## CARRYING CAPACITY

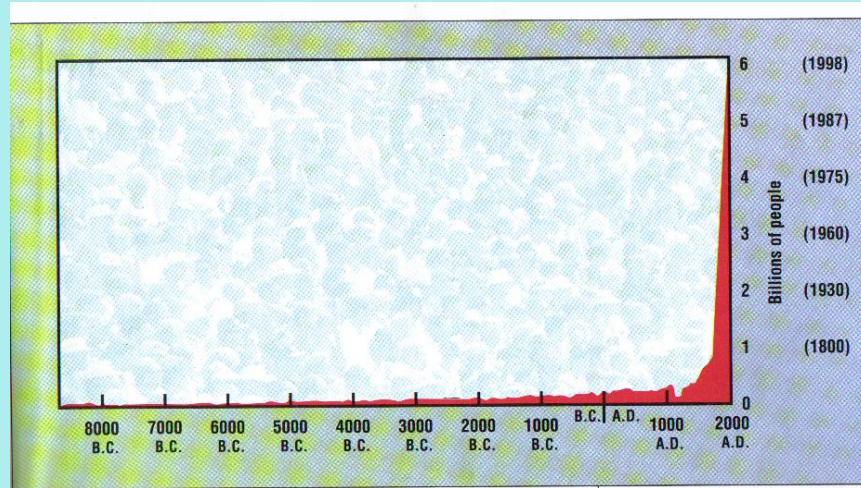
- Rabbits spread across Australia at a rate of 70 miles a year, reaching every corner of the continent by 1907.
- By the 1930s, the rabbit population in Australia was estimated at 750 million.
- After the initial release of the 24 rabbits, the rabbit population increased exponentially.
- However, after a period of time, the population growth rate decreased and eventually the population leveled out.
- More rabbits than there were resources to support them, i.e. pop. exceeded carrying capacity



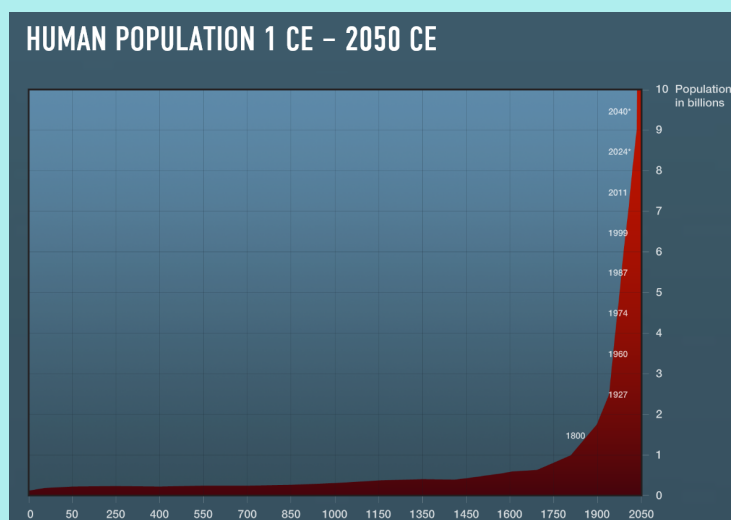
- Rabbits became a plague, eating the best grass, fouling water holes, devouring crops, gnawing young trees...
- Seven rabbits eat as much as one sheep.
- It was estimated that half of each dollar spent by Australian farmers on machinery, fertilizer, or seeds actually went to feed rabbits.
- In the early 1950s, the Australians introduced Myxomatosis , a disease fatal to European rabbits, reducing the rabbit population by 90 percent.
- Wool production immediately increased by 70 million pounds (clip weight of wool).



## CARRYING CAPACITY



- > **HUMAN POPULATION IS GROWING EXPONENTIALLY**
- « **FOR 2 MILLION YEARS HUMAN POP. IN MILLIONS**
- « **AT ABOUT 1850 POP. SURPASSED 1 BILLION**
- « **BY 1930 POP. CLIMBED TO 2 BILLION**
- « **CURRENT POPULATION IS ABOUT 7.3 BILLION**
- « **PROJECTED TO 9.7 BILLION BY 2050**
- « **EXPECTED TO BE 12 BILLION BY THE YEAR 2150**



## **CARRYING CAPACITY**

**MOST OF CURRENT GROWTH IS IN DEVELOPING COUNTRIES**

**GROWTH RATES :**

- « **CANADA AND U.S. IS UNDER 1%/YEAR**
- « **EUROPE IS 0.5 % /YEAR**
- « **AFRICA IS 3%/YEAR**
- « **LATIN AMERICA IS 2%/YEAR**
- « **ASIA IS 1.8%/YEAR**

# CARRYING CAPACITY

**EXPONENTIAL GROWTH DOES NOT CONTINUE INDEFINITELY**

- « **LIMIT IS BASED ON CARRYING CAPACITY OF SYSTEM**
- « **BASED ON AMOUNT OF RESOURCES AVAILABLE**
- « **COMPETITION EXISTS FOR LIMITED RESOURCES**
- « **FINAL POP. REFLECTS HOW SUCCESSFUL SPECIES HAS BEEN**

**– CARRYING CAPACITY OF EARTH FOR HUMANS IS DIFFICULT TO DETERMINE**

- « **HUMANS USE TECHNOLOGY TO REMOVE NATURAL CONSTRAINTS:**

- **IMPORT FOOD**
- **IRRIGATE PLANTS**
- **LIVE IN CLIMATE CONTROLLED ENVIRONMENTS**

**– WE ARE CLOSE TO EXCEEDING HUMAN CARRYING CAPACITY**

- « **DEVELOPING COUNTRIES OCCUPY 56% OF LAND SURFACE**
- « **DEVELOPING COUNTRIES CONTAIN 80% OF POP.**
- « **POP. DENSITY IN CANADA IS 0.03 PEOPLE /HECTARE**
- « **DEVELOPING COUNTRIES HAVE POP. DENSITY AS HIGH AS 8%**
- « **8% POP. DENSITY IN CANADA = 8 BILLION PEOPLE**

# **CARRYING CAPACITY**

**DEVELOPED COUNTRIES MAY EXCEED CARRYING CAPACITY  
BECAUSE OF:**

- **OVERCONSUMPTION**
- **UNCONTROLLED INDUSTRIAL EXPANSION**
- **EXCESSIVE USE OF CHEMICALS ON AGRICULTURE**
- **DEPLETION AND CONTAMINATION OF WATER  
RESOURCES**

## **Env Sc 120 Assignment 18 - CARRYING CAPACITY**

- Answer the following questions in complete sentences on looseleaf .
  - Ensure the title of this assignment (Assignment 18 - CARRYING CAPACITY" is on your answer sheet.
1. What portion of the Earth can effectively grow food?
  2. The amount of \_\_\_\_\_ dictates the size of a population.
  3. Define "carrying capacity".
  4. A graph that reveals a \_\_\_\_\_ shape indicates that the population has hit its carrying capacity.
  5. TRUE or False. Only rabbit and bacteria populations have a carrying capacity.
  6. Why did rabbits that were introduced to Australia in 1859 reproduce so fast?
  7. What was the carrying capacity of the rabbits the were introduced to Australia?
  8. How did the Australians reduce the rabbit population?
  9. What is the current population of humans on the Earth?
  10. Why is the carrying capacity of Earth for humans difficult to determine?
  11. Give 4 reasons why developed countries like Canada may exceed carrying capacity.

## Attachments

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World Population Clock