Populations

Biotic and Abiotic Influence

-
  - Example:
- Changes may affect the numbers of individuals the niche can support, and thus limit the size of populations of organisms

Population Growth

-
  - Malthus stated that more offspring are born than can survive.
- Darwin's idea of natural selection was influenced by Malthus statement (above). If a single species was able to overproduce, eventually the planet would be covered with that single species.
  -

Exponential growth -

  - Every population has the ability to increase exponentially if it has a perfect environment.
  -

Carrying Capacity

- As a population grows, it takes more from its habitat. Resources such as food and living space become scares. Thus, individuals will compete for them. Those that cannot compete will die, and birth rate will decrease due to lack of resources.
  -

Carrying capacity -

  - The growth of a population toward its carrying capacity if called a "S-shaped" curve. The population starts out small and increases rapidly. As the population approaches carrying capacity, the growth rate slows. It will stop growing when it reaches carrying capacity.

Limiting Factors

Limiting Factors -

Two types:

1. Density-dependent limiting factors -
   - Food supply
   - Predation
   - Disease
   - Water availability
   - Living space

A.

2. Density - independent limiting factors -
   - Climate
   - Human disturbance
   - Natural disasters (hurricane & fires)

A.

Yeast Population Density

Problem: How does the population density of a yeast cell culture change over time?

Hypothesis: (create a hypothesis, using an If...then.. statement, after reading the entire activity)

Materials:

- Five empty test tubes and rack
- 100 mL graduated cylinder
- 10% molasses solution + yeast
- pipettes
- five glass microscope slides
- five coverslips
- microscope
- pencil
- graph paper and comp book

Procedures

Day 1:

1. Label each test tube.
2. Add 2 mL of the molasses solution to each of the test tubes.
3. Stir the yeast solution and equal amounts to each test tube
4. Using a pipette, transfer one drop of day 1 solution to glass slide and apply coverslip.
5. Observe the slide under the microscope at high power. Count the number of yeast individuals in four different fields of view.
6. Record data in data table and calculate an average.
7. Empty test tube 1 and store the remaining test tubes in a dark place where they will not be disturbed.

Day 2- 4:

1. Repeat steps 4-7, using the appropriate test tube
2. Return equipment to instructor and clean lab stations.

Data Table (use a ruler)

Population Density:	1st field of view	2nd field of view	3rd field of view	4th field of view	Average
Day 1					
Day 2					
Day 3					
Day 4					

Data Analysis

1. Using graph paper, create a line graph depicting the averages of your group and two other groups. Make sure to include a title, key and label the x and y axis.
2. On each line, label the growth phase, stationary phase and decline phase.
3. What is the carrying capacity of each population?
   Population 1 (your group): _____
   Population 2 (other group): _____
   Population 3 (other group): _____

Conclusion: In a well-formed paragraph, address the following prompts.

- Define population density.
- Briefly describe our lab activity (set-up and goal).
- Describe the limiting factors that influenced the yeast cell population. (using your Populations notes: pg _____)

Modeling a Bald Eagle Population

Lab adapted from Environmental Science

Problem: How does that environment affect an eagle population?

Materials (per pair of students)

-pencil
-150 uncooked rice grains
-One 20-cm by 20-cm piece of paper
-Graph paper
-Several colored pencils

Hypothesize

After reading through the entire activity, hypothesize how a bald eagle population is affected by biotic factors.

Procedure

1. Work in pairs at lab stations. Obtain the graph paper that represents the pond. The grid represents a 4-km^2 lake where the eagles hunt (100cm^2= 1 km^2).
2. Obtain the two small colored squares that represent the eagles, one F for female and the other M for male.
3. Put the lake grid on a flat surface, and scatter the 150 rice grains over it.
4. Hold the F square about 30 cm over the grid and drop it. Remove all of the rice from under the square. Repeat the process with the M square. *Note: This step represents eagles catching fish.*
5. After each hunting expedition, rescatter the remaining rice. Repeat step 4. After each eagle has hunted four times, total the number of fish caught by each eagle on Day 1. Make a data table in your notebook and record your data.
6. Repeat steps 4 and 5 nine times (representing the nine remaining days), recording the data in your notebook.

(Title)

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9
Male									
Female									

7. An eagle will share its food with its mate, but feeds itself first. If an eagle does not eat three fish per day, it becomes too weak to hunt and will die. Be sure to examine the data for each 3-day period. If one eagle dies, continue hunting with only one eagle.
8. Use different colored pencils for the male and the female eagles, and graph the data from your notebook, totaling the number of fish caught by each eagle per day. *Note: On the graph, record the days on the horizontal axis and the number of fish caught on the vertical axis.*

Analysis

1. How might the fish population in the pond be affected by the eagles' hunting over time?
2. What effect might a small decrease in the fish population have on the eagle population?
3. After reading the article Endangered Species: Bald Eagle, describe all factors that can affect a population's size.
4. Thoroughly explain the reasons for the decline in the bald eagle population.

Endangered Species: Bald Eagle

(Haliaeetus leucocephalus)

DESCRIPTION:

The plumage of an adult bald eagle is brown with a white head and tail. Immature eagles are irregularly mottled with white until the fourth year. Their legs are feathered half way down the tarsus, and the beak, feet, and eyes are bright yellow. Bald eagles have massive tarsi, short and powerful grasping toes, and long talons. The talon of the hind toe highly developed in both species, and it is used to pierce vital areas while the prey is held immobile by the front toes. The wing span of an eagle can reach seven and a half feet.

LIFE CYCLE:

The bald eagle breeds from central Alaska across Canada to Labrador and Newfoundland and south to southern mainland Alaska and the Aleutian Islands. It also breeds in Baja California, central Arizona, southwestern and central New Mexico, and along the Gulf Coast from Texas to Florida. The bald eagle occurs only locally throughout much of the Great Basin and Great Plains. Bald eagles winter in most of their breeding range, from southern Alaska and Canada southward. Resident populations are found along the Atlantic, Pacific, and Gulf Coasts.

DISTRIBUTION:

The bald eagle is native to North America and originally bred from central Alaska and northern Canada south to Baja California, central Arizona, and the Gulf of Mexico. It now has been extirpated in many southern areas of this range.

REASON FOR DECLINE:

Over the years, the Bald Eagle population has suffered from excessive hunting and pollution. In the early part of the century, hunting eagles was a popular sport. Eagles were shot not only for their feathers, but also because they posed a "threat" to livestock (e.g. sheep) and hampered the fishing industry. In recent years, however, pollution has greatly contributed to the demise of the species. As a result of land and water pollution, a significant amount of the Bald Eagle food supply has been killed. In particular, the use of pesticides such as DDT had been the greatest threat to the species. Pesticides are often found in fish, the major food supply for eagles. DDT in a female's body disturbs the shell-making process, causing her to produce very weak shells or no shells at all. Eagles once numbered around 50,000 in the contiguous United States, but by the time the U.S had restricted the use of DDT in1972, only about 800 breeding pairs remained. Under the Endangered Species Act of 1973, however, the eagles have made a steady recovery. Breeding pairs now number close to 3000, and there has been an increase in the number of hatchlings per nest. Only in Canada and Alaska, however, are eagles found in abundance.

A tremendous effort had been made to protect and restore the bald eagle population. Some states now support effective nest-monitoring and programs to release young birds into the wild. Federal protection has involved monitoring populations, improving protection, setting up captive breeding programs, relocating wild birds, and establishing a wide-ranging public information program.

SOURCE: http://www.ca.blm.gov/bakersfield/untitled1.html

Population Dynamics Poster

Objective: Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept: (1) *Students know* how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size (2) *Students know* how fluctuations in population size in an ecosystem are deter-mined by the relative rates of birth, immigration, emigration, and death.

Directions:

1. Design and create a poster that depicts how populations increase or decrease and factors that influence population growth. The poster should diagram how populations grow through natality and immigration and how populations decrease due to mortality and emigration. Each diagram should be accompanied by a definition of the word and a description.
2. The second part of your poster should incorporate two limiting factors: one density independent and one density dependent. Diagram these two limiting factors and express how they will influence your population.
3. Your colorful poster should incorporate a title that describes your work.
4. Cut rubric and glue on back of poster, turn in your work to the indicated area. (Clean lab station if used)

Population Dynamics Poster Scoring Rubric

Names of Group Member: _____

_____

_____

Period: _____

Poster Attribute	Outstanding (3)	Average (2)	Satisfactory (1)
Title	Title is quite creative and describes content well.	Title describes content well.	The title is too small and/or does not describe the content of the poster well.
Visual display (color) and Legibility	Visual display is above and beyond required elements. Poster is legible.	Visually display is appealing. Poster is legible.	Visual display is satisfactory. Poster may not be legible.
Participation	All group members participated fully in production of poster	Some group members participated	Not all group members participated fully.
Graphics of natality, mortality, immigration and emigration- Originality	Several of the graphics used on the poster reflect an exceptional degree of student creativity in their creation and/or display.	One or two of the graphics used on the poster reflect student creativity in their creation and/or display.	The graphics are made by the student, but are based on the designs or ideas of others.
Labels	All items of importance on the poster are clearly labeled with labels that can be read from at least 3 ft. away.	Almost all items of importance on the poster are clearly labeled with labels that can be read from at least 3 ft. away.	Several items of importance on the poster are clearly labeled with labels that can be read from at least 3 ft. away.
Definitions	Definitions are very thorough and a description is provided, both are easy to read.	Definitions are provided, but not thorough. Description may or may not be provided.	Definitions are vague.
Density independent limiting factor	Poster depicts one density independent limiting factor and describes how that limiting factor would influence the population.	Poster somewhat depicts one density independent limiting factor and describes how that limiting factor would influence the population.	Poster vaguely depicts one density independent limiting factor and describes how that limiting factor would influence the population.
Density dependent limiting factor	Poster depicts one density dependent limiting factor and describes how that limiting factor would influence the population.	Poster somewhat depicts one density dependent limiting factor and describes how that limiting factor would influence the population.	Poster vaguely depicts one density dependent limiting factor and describes how that limiting factor would influence the population.

Total Points: _____ x 2 = _____

Patterns of Population Growth and Management
Video Questions

1. Define lag time and stationary phase.

2. Diagram the exponential growth

3. Characteristics of a R-selected population:

4. What does "K" represented?_____
5. What are the three characteristics of K-selected populations?

6. What organisms have been successfully re-introduced into the Great Plains?
   _____

7. Survivorship A curve represents _____ - selected populations.
8. Survivorship B curve represents _____-selected populations.

9. Describe how mosquito populations are controlled.

Hormone	Bacteria	Organic Chemical

10. Name at least five reasons why the Burrowing Owl Population decreased?

11. How are the owls interdependent on the squirrels and badger?

12. What are three perimeters of biodiversity?

13. Name two biological agents used to control populations.

Thomas Malthus

Thomas Robert Malthus (February 14, 1766 - 1834) was an English economist known particularly for his views on population growth.

Malthus studied mathematics and philosophy at St John's College, Cambridge, where he went on to become a fellow. Later he became Professor of History and Political Economy at Hailingbury College. He was also ordained and became a country parson.

In *An Essay on the Principle of Population*, written in 1798, Thomas Malthus predicted that the demand for food would inevitably surpass its supply. This prediction was based on the idea that population increases at a geometric rate while the food supply grows at the slower arithmetic rate. The difference between the two would eventually lead to what is now known as the Malthusian catastrophe in which population growth exceeded the capacity of the world to sustain that population.

Malthus' observation that population growth is limited by resource availability may have influenced Charles Darwin while he was developing his theory of evolution by natural selection. Darwin himself, in his book *Origin of Species*, called his theory an application of the doctrines of Malthus in an area without the complicating factor of human intelligence.

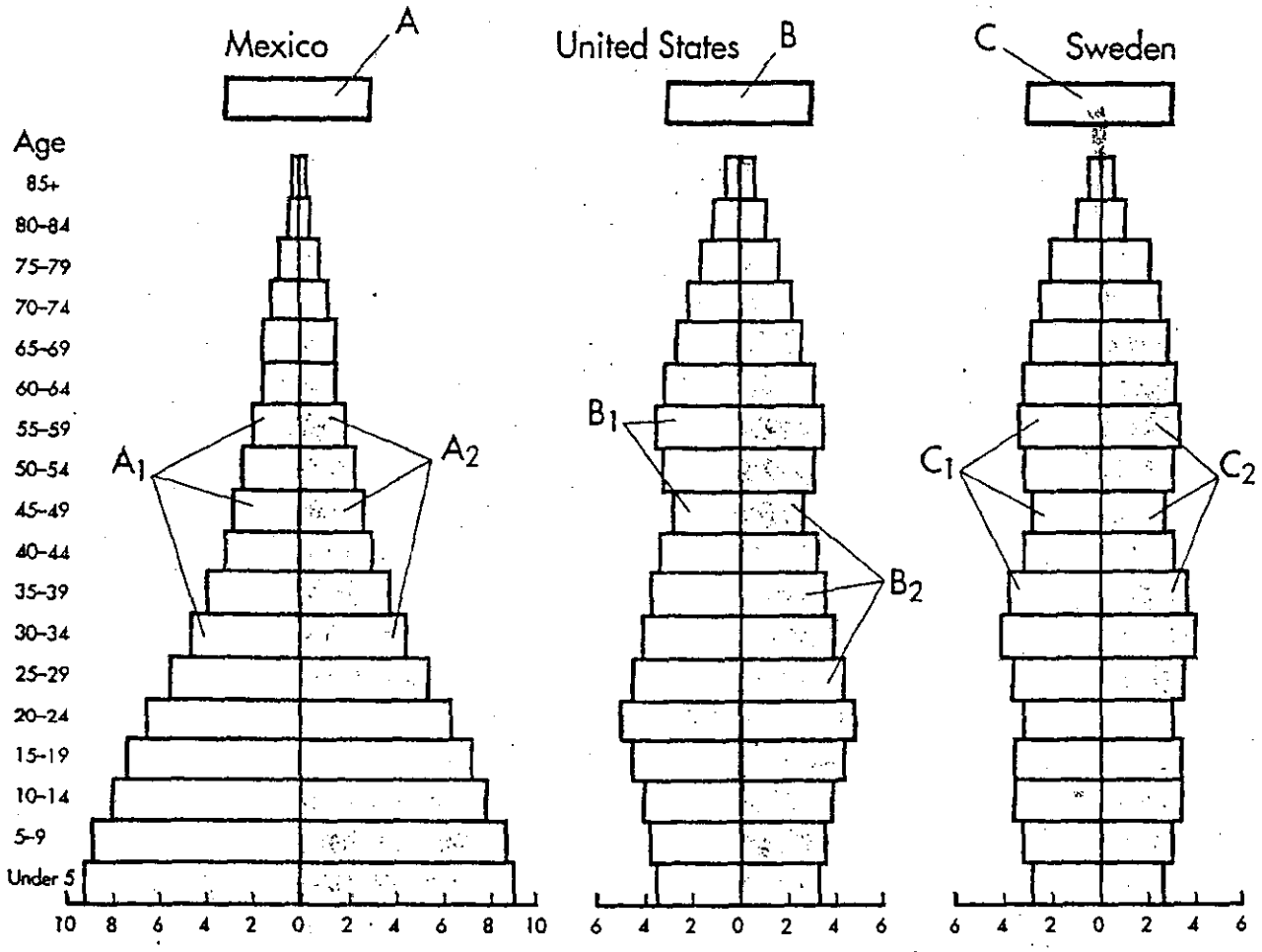
Questions:

1. **Who is Thomas Malthus?**
2. **What did Thomas Malthus hypothesize?**
3. **Who did Malthus influence?**
4. **What factors did Malthus not account for in his hypothesis?**

Population Age Structure

Directions:

1. Cut out the three population age structures and the key. Color it appropriately. Paste the diagrams and key in your comp book (homework).
2. Write the following title on your page: Population age structures



Human Population Ecology

- Mexico .....A
- Mexican Males .....A_1
- Mexican Females .....A_2
- United States of America.....B
- American Males.....B_1
- American Females.....B_2
- Sweden C
- Swedish Males .....C_1
- Swedish Females .....C_2

3. Under the diagrams, write and answer the following questions. Highlight and underline your answers.
   - A. A developing country is broad at the base and narrow at the top. Which country is developing? _____
   - B. Which country shows the smallest amount of prereproductive aged people? _____
   - C. Which country shows prereproductive individuals nearly balancing the number of postreproductive individuals? _____ This demonstrates a stable population.

People Count: Facing the Population Challenge

What's Going on in the World Today? A Tale of Five Teens

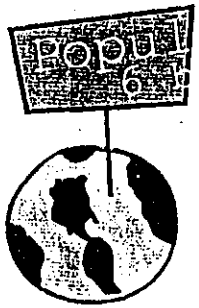
In the morning in China, 17-year old Chao is biking to school with her friends Lee and Vu. On the crowded streets of Shanghai, thousands of people bike to school and work each day. Chao, Lee, and Vu are as close as sisters, but none of them actually has any siblings because of China's strict population policies which discourage couples from having more than one child.

Half a world away, 15-year old Roland prepares for his after-school job as a lifeguard on one of Barbados' many beautiful beaches. From talking to tourists, he has learned that life in other parts of the world is very different from his peaceful and prosperous island nation. Roland sometimes wonders what it might be like to live in those other places, but he loves his home and hopes that Barbados will stay beautiful forever.

Nisa's day begins early in her Kenyan village. She wakes at dawn to get a fire started to prepare breakfast for her family. Yesterday, she spent three hours searching for firewood, as the forests in her area are slowly disappearing. Her husband has gone to the city to look for work. Although only 18 years old, Nisa has been married for four years and has had three children, with another child on the way. Sometimes she wonders if she will be able to afford to send her children to school.

In California's San Fernando Valley, Ricky and his friends have been sitting in a traffic jam for two hours. Although they are eager to get to the beach, they understand that traffic is a fact of life in Los Angeles. Ricky remembers his grandmother once telling him that when she moved from Mexico to California, there were clear skies and orange groves as far as the eye could see. Driving through southern California today, Ricky barely recognizes the place she described.

Today is an exciting day in the shantytown that Luz lives in on the edge of Lima, the capital of Peru. A community organization is installing a water pump for local residents. This is especially good news for Luz, who walks 30 minutes each way to fill her family's heavy water jugs each morning. Luz's family moved here two years ago when she was 12 and she still looks forward to the trips they make back to her home village twice a year. Sometimes she wishes that they could move back to that beautiful highland village, but she knows that there is no work for her parents there. They have been lucky that her father has found work driving a bus, and that her younger brother and sister can go to school.

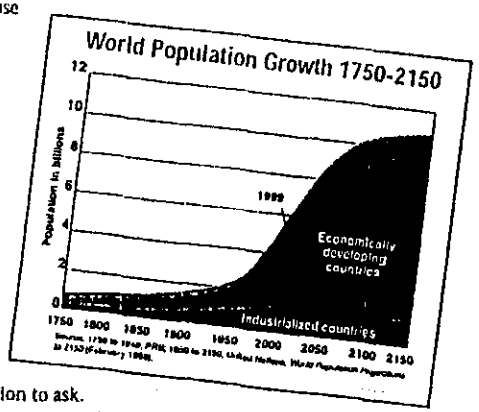


On the surface, Chao, Roland, Nisa, Ricky, and Luz have nothing in common. But although their lives are very different, they all live in the same world — a world of 6 billion people! And as teens growing up today, they do share many of the same concerns. They are all wondering about the future, and thinking about how to take care of themselves, their families, and their communities. How can we examine what these five teens have in common? By taking a closer look at *population*—the number of people, and how those people work, live, and use resources—we can get a closer look at our changing world and discover our place in it!

My How We Have Grown!
A Quick History of Population Growth

World population reached 6 billion in 1999, and we are adding another billion people to the planet about every 12 years. Such rapid population growth is relatively new in the scope of human history. People lived on Earth for about 3 million years before the world population reached 500 million around the year 1600. Until then, birth rates and death rates were about the same, keeping the population stable. People had large families, but many children died before the age of five from common diseases. But by the late 1700s and 1800s, more children survived and adults lived longer too, thanks to improved medicine, sanitation, nutrition, and farming techniques. In 1810 world population reached 1 billion and things really began to take off!

Take a look at the graph in the box. You can see that until about 1800, world population was either fairly constant or growing slowly. But after 1800, population shoots up rapidly, reaching 2 billion in 1930, 3 billion in 1960, 4 billion in 1975, 5 billion in 1987, and 6 billion in 1999. This rapid increase in population is sometimes called the ***population explosion***, and we are currently adding about 78 million people to the planet each year—twice the current population of Spain!

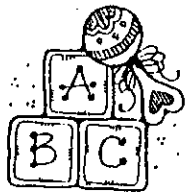


All of these people require food, fuel and homes, straining our planet's natural resource supply. But our planet is a finite system and can only sustain so many people. How many people can the earth support? No one knows for sure. But some people think that's not the right question to ask. Instead, maybe we should ask, how many people can the earth provide with a *good quality of life*? Of course, *quality of life* is not just a question of numbers, but as the number of people increases, competition for resources also increases.

Questions:

- Summarize the article
- Define population and population explosion.
- explain this history of world population
- predict what will occur as population increases

FII



Controlling Population Size

Copied from Environmental Science (3rd edition)

It may seem obvious that controlling the birth rate is the answer to the problems of overpopulation. However, empowering people to control the number of children they have is not easy; convincing them that they should have fewer children is even more difficult. Forcing people to limit the size of their families is a step that most people find unethical and unacceptable.

Large-scale efforts are underway in many underdeveloped and developing countries to educate people and provide effective methods of birth control There are many factors, however, that contribute to people's continuing desire to have children. In many religions, any effort to prevent pregnancy, other than avoiding sexual activity, is considered unacceptable. Also, many people feel that children are a source of pride and joy, and without them their lives would have little meaning. In many societies, a large number of children is considered important for helping to work the family farm or care for aging parents. Such basic cultural beliefs are very difficult to change, even if the change seems to be warranted for the common good.

In several nations, such as Bulgaria, Hungary, and Latvia, the birth rate has fallen below the death rate. Such nations face special challenges due to an aging and declining population. Decreasing numbers of soldiers and working taxpayers threatened to weaken the military and economic strength of these nations. The governments of some nations with a shrinking population offer financial support and tax advantages to encourage couples to have more children. On a global scale the human population continues to increase, but it is also aging. There will be a much higher proportion of middle-aged and elderly adults in the year 2050 than there are today.

Think About It!

1. How do you think people in the United States would feel about the government limiting the number of children a family could have?
2. Would people feel differently if the limit was one child, two children, or ten children? Explain your answer.
3. Explain how the percentage of each functional age class found in a population determines the health of most populations?

Study the Table

Use the table to answer the questions that follow.

Birthrates and Death Rates Around the World (mid-1996)			
	Birthrates (per 1000 people)	**Death Rates (per 1000 people)**	**Growth Rate (per 1000 people)**
Rapidly Growing Countries			
Jordan	39	4	33
Iraq	43	7	36
Uganda	46	21	25
Slowly Growing Countries			
Poland	12	10	2
Italy	10	10	0
Ireland	13	9	4

The numbers in this table are based on numbers of births and deaths for every 1000 people in each country. The death rate is subtracted from the birthrate to find the growth rate.

1. What was the birthrate of Uganda?

   _____

2. What was the death rate of Iraq?

   _____

3. What was the population growth rate of Ireland?

   _____

4. Which country had the fastest growing population?

   _____

5. Why did Italy have a growth rate of zero?

   _____

   _____

Review the Vocabulary

Use the Chapter 4 vocabulary words in the box to fill in the puzzle.

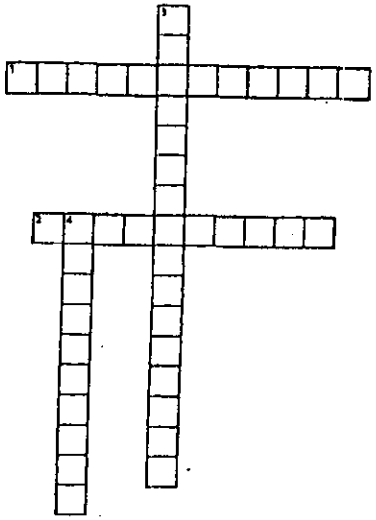
emigration	age structure
demography	carrying capacity

Across

1. proportions of a population that are at different age levels
2. study of population growth characteristics

Down

3. number of organisms of one species that an environment can support
4. movement of individuals out of a population



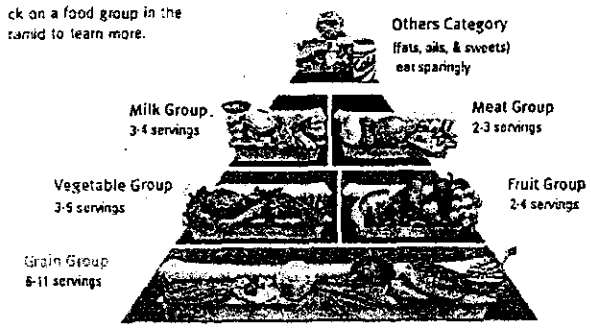
Use the vocabulary words in the box to complete the sentences.

density-dependent factors	density-independent factors
exponential growth	immigration

5. Limiting factors that affect populations more as the populations grow are called _____.
6. A growth rate that increases with time results in _____.
7. Limiting factors that affect populations the same way regardless of their size are called _____.
8. _____ is the movement of individuals into a population.

World Food Supply

I. Human Nutrition - despite having different dietary habits, all humans have the same basic nutritional needs



- a. Carbohydrates -
- b. Protein - polymer of amino acids
- c. Lipids -

2. **Micronutrients** - chemicals (vitamins and minerals) needed in biochemical reactions

II. Nutritional Deficiency

Malnutrition -

a. Scurvy -
b. Beri beri -
c. Rickets -
d. Goiter -
e. Kwasiorkor -

III. World Food Supply

1. **Green Revolution** - (mid-1960's)

a. Better resistance to disease
b.
c. Survive a wide variety of climates
d.

2. **Cash crop** -

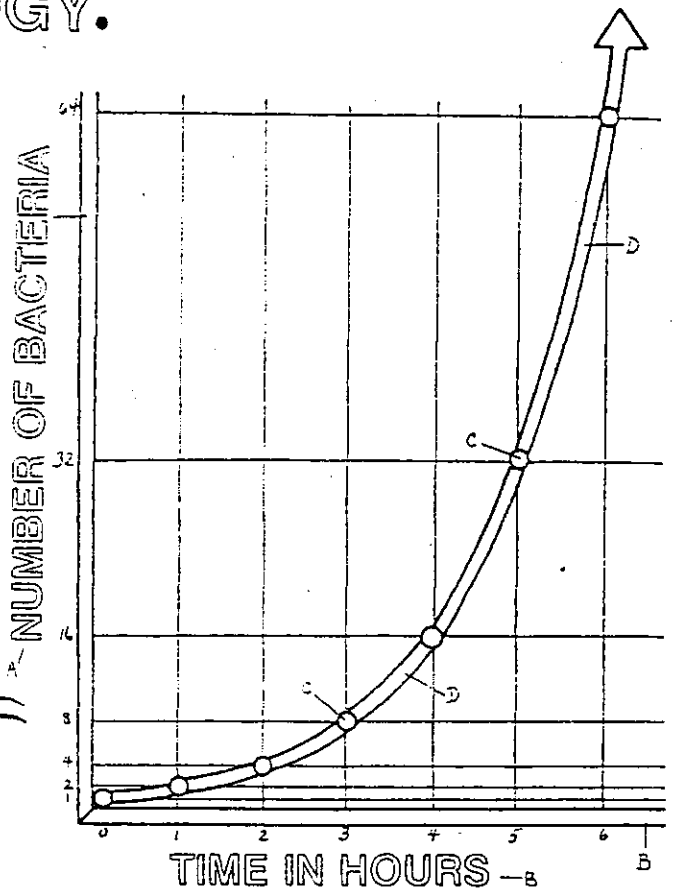
Aquaculture -

a. 80% of fish from aquaculture farms are produced in Asia

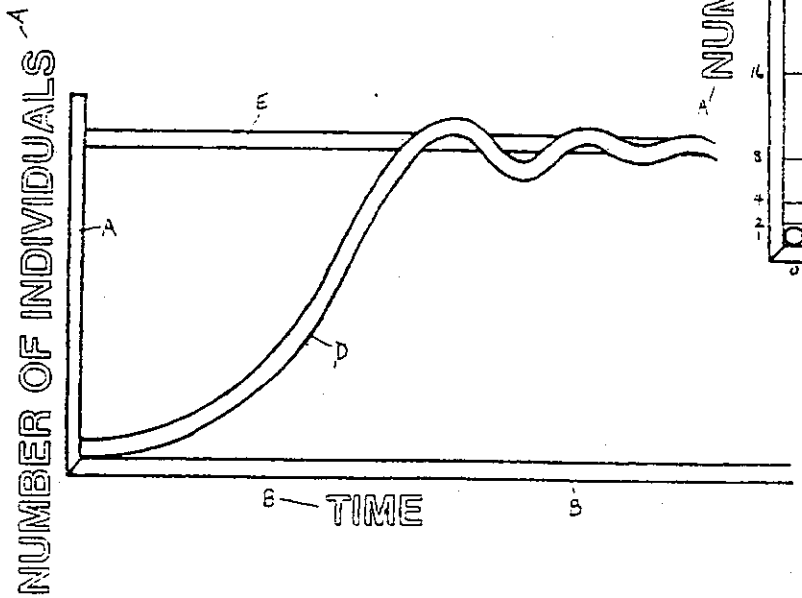
POPULATION ECOLOGY.

VERTICAL AXIS$_A$
HORIZONTAL AXIS$_B$
DATUM POINT$_C$
GROWTH CURVE$_D$

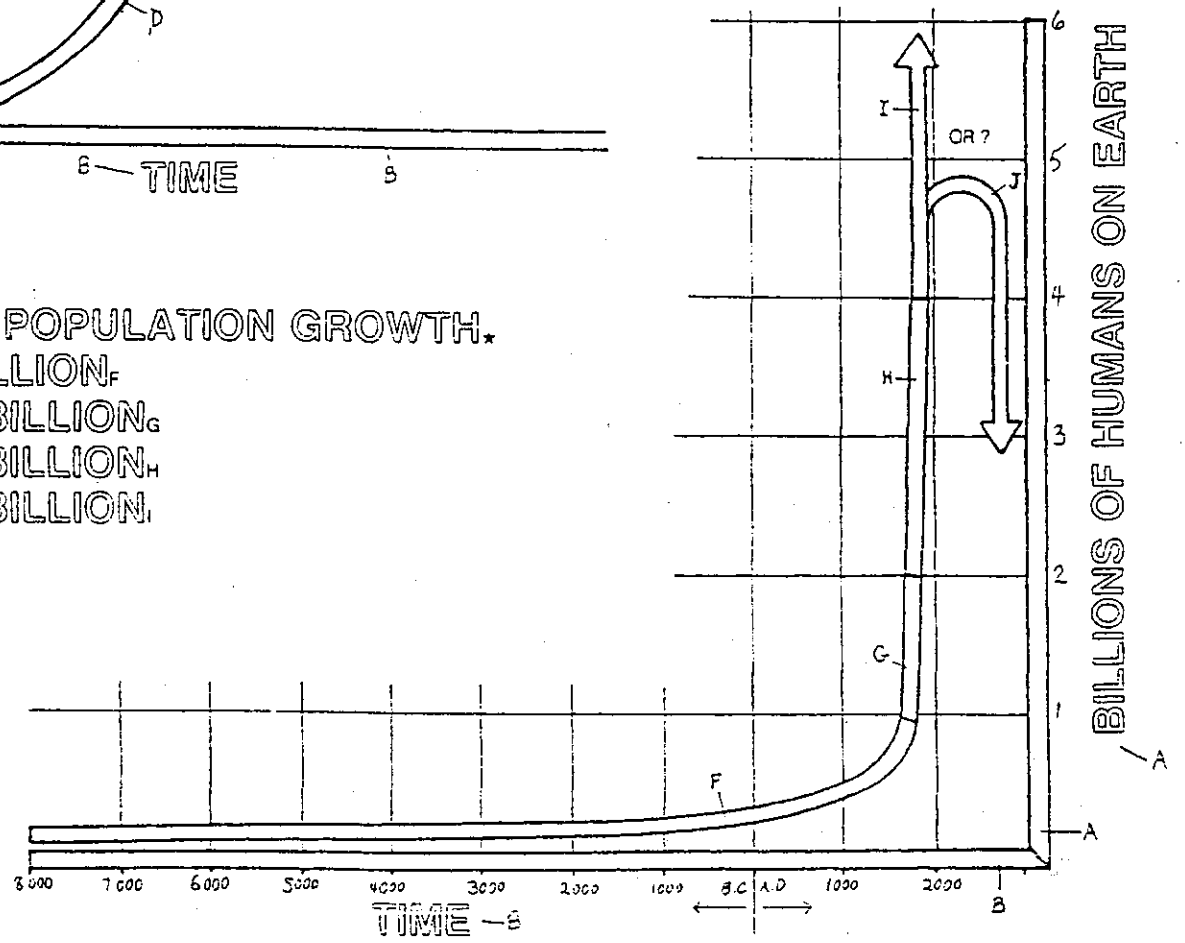
EXPONENTIAL GROWTH*



LOGISTIC GROWTH*
CARRYING CAPACITY$_E$



HUMAN POPULATION GROWTH*
TO 1 BILLION$_F$
1 TO 2 BILLION$_G$
2 TO 4 BILLION$_H$
4 TO 8 BILLION$_I$
CRASH$_J$



Population Dynamics

Population is the number of individuals of a particular species in an area. Animal and plant populations depend on many things for survival. Limiting factors like the availability of food, water and shelter can impact an organism's population. In nature, populations of animals and plants are linked together like a puzzle. The pieces of the plant and animal puzzle depend on each other to form a complete picture. If something is wrong with any of the pieces, it affects the whole puzzle. (http://www.nhptv.org/natureworks/nwep12.htm)

1. Name some limiting factors:

The phrase exponential growth is often used in nontechnical contexts to mean merely surprisingly fast growth. In a strictly mathematical sense, though, exponential growth has a precise meaning and does not necessarily mean that growth will happen quickly. In fact, a population can grow exponentially but at a very slow absolute rate (as when money in a bank account earns a very low interest rate, for instance), and can grow surprisingly fast without growing exponentially.

2. Define exponential growth.

A logistic function or logistic curve models the S-curve of growth of some set P. The initial stage of growth is approximately exponential; then, as competition arises, the growth slows, and at maturity, growth stops. Carrying capacity is the population level that can be supported for an organism, given the quantity of food, habitat, water and other life infrastructure present. For the human population other variables such as sanitation and medical care are sometimes considered as infrastructure. As population density increases, birth rates often decrease and death rates typically increase. Carrying capacity is the point at which these two rates are equal. Carrying capacity is thus the number of individuals an environment can support without significant negative impacts. A factor that keeps population size at equilibrium is known as a regulating factor.

3. Describe carrying capacity.

4. How is a S-shaped curve related to the carrying capacity?

5. What happens as our population increases?

Below carrying capacity, populations often increase, while above, they can decrease. Population size decreases above carrying capacity due to a range of factors depending on the species concerned, but can include insufficient space, food supply, or sunlight. The carrying capacity of an environment can vary for different species, and can change over time due to a variety of factors including: food availability; water supply; environmental conditions; and space. It is possible for a species to exceed its carrying capacity temporarily, until mass fatalities occur as shortages in food and water take effect. This outcome is more devastating for a population compared to gradual population corrections within the carrying capacity, since it produces mass killings as well as stress for the entire species; moreover, the population can then fall far below the carrying capacity in overcorrection. The moose and wolf population of Isle Royale National Park in Lake Superior is one of the world's best studied predator-prey relationships. Without the wolves, the moose would overgraze the island's plants. Without the moose, the wolves would die. It seemed to the first scientists that studied the problem that the wolves would eventually overpopulate, kill all the moose calves and then die from famine. However, this has not occurred, and, in fact, the wolves appear to be "limiting their own population". (http://en.wikipedia.org/wiki)

6. How can a carrying capacity change?

7. Describe the relationship between the moose and the wolf population.

Size It Up

Standard maps of the United States make it easy to compare the relative land area of each state. Using these maps, it's clear that Montana is much larger than Connecticut. These maps don't tell you anything about population, however. To find that information, you need to look at a special purpose map that uses census data.

The We Count! wall map is one example. It uses color and numbers to show population data from the 1990 Census while maintaining geographical accuracy.

The cartogram at the top of the next page is another kind of special purpose map. In a cartogram, the size of each state is not related to the size of the land area. The mapmaker isn't concerned with the accuracy of boundaries or land areas, but does preserve the shapes and positions of geographic locations. This cartogram was specially drawn so that the size of each state is proportional to the number of people who live there. At a glance, you can easily see the relative size of each state's population.

Montana, due to its small population, is shown much smaller than it appears on a standard map. The small state of Connecticut looks much larger. Texas, which has both a large land area and a large population, is shown more or less the same size as it would be on a standard map. Using the cartogram and the standard map, you can draw conclusions about state population density.

Use the two maps on page 5 (the U.S. Population Cartogram and the Standard U.S. Map) to answer the following questions:

1. Which state has the largest population?

   _____

2. Which state has a larger population, West Virginia or Pennsylvania?

   _____

   How can you tell?

   _____

   _____

3. Rank these states according to the size of their populations, from highest to lowest: South Dakota, Illinois, New York, Kansas.

   1. _____
   2. _____
   3. _____
   4. _____

4. List a state that is much larger on the cartogram than on the regular map.

   _____

5. Find your own state on the cartogram. Does it appear smaller or larger relative to its size on the standard map?

   _____

6. Find a densely populated state by comparing the cartogram to the standard U.S. map.

   _____

7. Name a sparsely populated state other than Montana.

   _____

8. Based on the cartogram, which three states would you conclude have the most U.S. representatives?

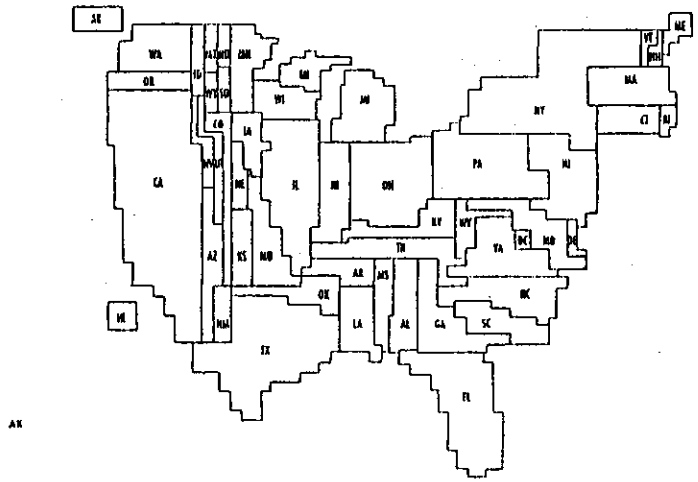
   _____

   _____

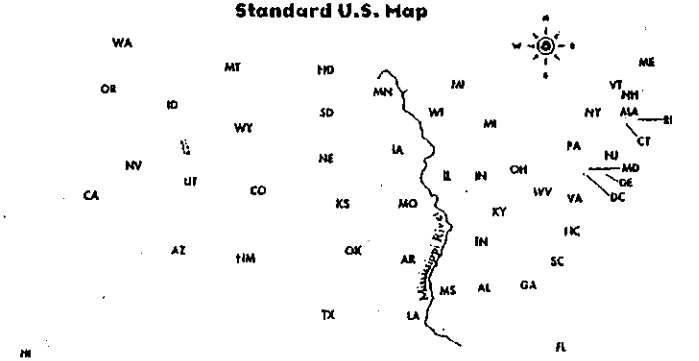
   _____

Size It Up (continued)

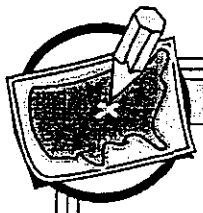
U.S. Population Cartogram



Standard U.S. Map



Source: U.S. Census Bureau



Make Your **Own Map**

The We Count! wall map in your classroom is a thematic map. This map is designed to show state populations based on 1990 Census data. In addition to the state population totals, the states are color-coded according to population ranges. This color-coding makes relationships between state populations easier to see. For example, what does the color-coding tell you about the Northeast? The South? The Midwest? The West?

Below, you will find some census information about each state. The percent of college graduates includes those 25 and older who have a bachelor's degree. Per capita income is the total amount of income earned by everyone in the state, divided by the state population.

Your job is to make a map that shows both sets of data from this table. Follow the steps below.

1. Decide how you want to represent the data sets. Remember, you are putting the data on a map to create a visual message. If you just write the corresponding numbers from the table in each state, are you making good use of the map? Will the reader be able to see the patterns in the map?
2. How can you use colors, patterns, or symbols to represent the data sets? You will need to divide the data into ranges. To do this, arrange each set from least to greatest, and divide it according to the number of ranges you would like to use. Make sure each range or category contains data. Then, color the map.
3. Once you have represented the data on your map, fill in the map key. Include the ranges for the colors, patterns and/or symbols you have used.

State	% of College Graduates	Per Capita Income
Alabama	16%	$11,486
Alaska	23%	$17,610
Arizona	20%	$13,461
Arkansas	13%	$10,520
California	23%	$16,409
Colorado	27%	$14,821
Connecticut	27%	$20,189
Delaware	21%	$15,854
D.C.	33%	$18,881
Florida	18%	$14,698
Georgia	19%	$13,631
Hawaii	23%	$15,770
Idaho	18%	$11,457
Illinois	21%	$15,201
Indiana	16%	$13,149
Iowa	17%	$12,422
Kansas	21%	$13,330
Kentucky	14%	$11,153
Louisiana	16%	$10,635
Maine	19%	$12,957
Maryland	27%	$17,730
Massachusetts	27%	$17,224
Michigan	17%	$14,154
Minnesota	22%	$14,389
Mississippi	15%	$9,648
Missouri	18%	$12,989
Montana	20%	$11,213
Nebraska	19%	$12,452
Nevada	15%	$15,214
New Hampshire	24%	$15,959
New Jersey	25%	$18,714
New Mexico	20%	$11,246
New York	23%	$16,501
North Carolina	17%	$12,885
North Dakota	18%	$11,051
Ohio	17%	$13,461
Oklahoma	18%	$11,893
Oregon	21%	$13,418
Pennsylvania	18%	$14,068
Rhode Island	21%	$14,981
South Carolina	17%	$11,897
South Dakota	17%	$10,661
Tennessee	16%	$12,255
Texas	20%	$12,904
Utah	22%	$11,029
Vermont	24%	$13,527
Virginia	25%	$15,713
Washington	23%	$14,923
West Virginia	12%	$10,520
Wisconsin	18%	$13,276
Wyoming	19%	$12,311

Source: U.S. Census Bureau

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