

Name:

## Unit 3: Populations

**Topics:**

- I. Abundance and Distribution of Populations (17)
- II. Life History Strategies (19)
- III. Population Growth and Resources Availability (18)
- IV. Human Population Dynamics (22,23,31)
- V. Economic Development, Consumption, and Sustainability (23)

**Textbook: Chapters 17-19, 22, 23, 31**

### Vocabulary

- |   |  |   |
|---|--|---|
| <ul style="list-style-type: none"> <li>• Affluence</li> <li>• Age structure diagram</li> <li>• Biotic potential</li> <li>• Carrying capacity (K)</li> <li>• CBR/CDR</li> <li>• Clumping</li> <li>• Cohort</li> <li>• Community</li> <li>• Corridor</li> <li>• Demographic transition model</li> <li>• Demography</li> <li>• Density-dependent</li> <li>• Density-independent</li> <li>• Developed/Developing country</li> <li>• Dieback</li> <li>• Doubling Time</li> <li>• Exponential growth model</li> <li>• Family planning</li> <li>• Fecundity</li> <li>• Generalist</li> <li>• Gross domestic product (GDP)</li> </ul> | <ul style="list-style-type: none"> <li>• Immigration/Emigration</li> <li>• Inbreeding depression</li> <li>• Industrialization</li> <li>• Infant/Child mortality</li> <li>• Intrinsic growth rate (<math>r</math>)</li> <li>• J-shaped curve</li> <li>• K-selected</li> <li>• Life expectancy</li> <li>• Limiting resource</li> <li>• Logistic growth model</li> <li>• Malthus</li> <li>• Malthusian theory</li> <li>• Metapopulation</li> <li>• Mortality</li> <li>• Net migration rate</li> <li>• <math>N_t = N_0 e^{rt}</math></li> <li>• Overshoot</li> <li>• Parental care</li> <li>• Population density</li> <li>• Population distribution</li> </ul> | <ul style="list-style-type: none"> <li>• Population growth model</li> <li>• Population growth rate</li> <li>• Population momentum</li> <li>• Population pyramid</li> <li>• Population size (N)</li> <li>• Post-industrialization</li> <li>• Pre-industrialization</li> <li>• r-selected</li> <li>• Random dispersion</li> <li>• Replacement level</li> <li>• Resource availability</li> <li>• Rule of 70</li> <li>• S-shaped curve</li> <li>• Sex ratio</li> <li>• Specialist</li> <li>• Survivorship Curve (I, II, III)</li> <li>• Theory of demographic transition</li> <li>• Total Fertility Rate (TFR)</li> <li>• Uniform dispersion</li> </ul> |
|---|--|---|

Today is **July 29, 2019**

[www.worldometers.info](http://www.worldometers.info)

	Prediction	Actual
World population right this second, down to the person		
Net population growth this year (#added)		
Cars produced so far this year		

Computers produced this year		
Worldwide internet users		
Cell phones sold today		
Emails sent today		
Forest loss this year (hectares)		
Tons of CO2 emissions this year		
# undernourished people in world		
# obese people in world		
# People with no access to safe drinking water		
# years left until the end of oil		
Deaths of children under 5 this year		
HIV/AIDS infected people		
Deaths caused by smoking this year		
World spending on illegal drugs this year		

## I. Abundance and Distribution of Populations

*Objectives:*

- Explain how nature exists at several levels of complexity
- Discuss the characteristics of populations
- Contrast the effects of density-dependent and density-independent factors on population growth

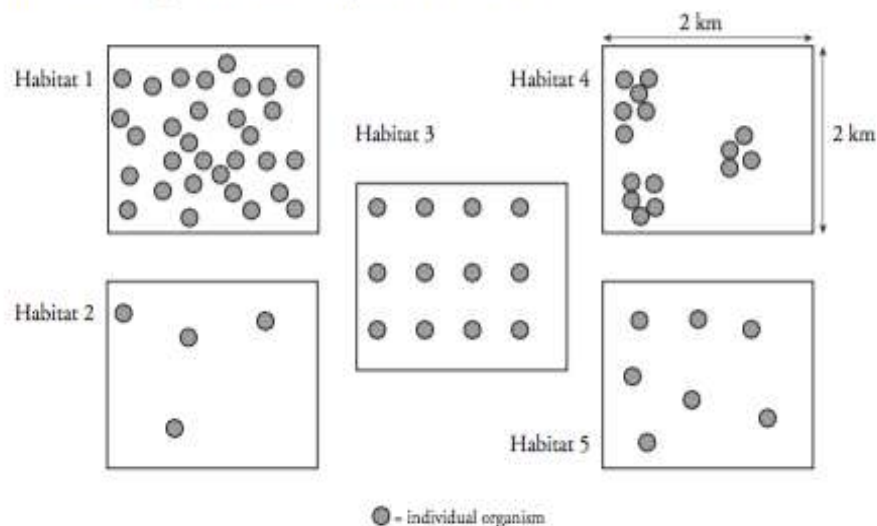
**Four variables that influence population size:**

INCREASE	DECREASE
1.	3.
2.	4.

## Why?

Alaska contains over 127 million acres of untouched forest land. It is the largest state in the United States, yet with a population of nearly 700,000 people it has the same total population as Austin, Texas. New Jersey is one of the smallest states and home to a population of nearly 9 million, but almost 1.8 million of its 4.4 million total land acres are untouched natural woodland. What are the reasons for the ways populations organize themselves, and what effect does this organization have on the environment?

## Model 1 – Population Density and Distribution



1. Refer to Model 1.
  - a. What do the dots in the diagrams represent?
  - b. What do the boxes in the diagrams represent?
2. Calculate the area of a single habitat.
3. Consider the arrangements of the dots in Model 1.
  - a. Describe the arrangements of the dots in habitat 3.

b. Describe the arrangement of the dots in habitat 4.

4. Fill in the table below by counting the number of individuals in each habitat in Model 1 and then calculate the area available per individual.


Habitat No.	Area (km <sup>2</sup> )	No. of Individuals	No. of Individuals/Unit area (Density)
1			
2			
3			
4			
5			

5. Refer to the completed table above.
  - a. Which habitat shows a high **population density**?
  - b. Which habitat shows the lowest population density?
6. Draw a vertical line through the middle of each of the boxes in model 1. Label the left side "a" and the right side "b" on each box. Complete the table below for each half of each habitat.

Habitat No.	Area (km <sup>2</sup> )	No. of Individuals	No. of Individuals/Unit area (Density)
1	a		
	b		
2	a		
	b		
3	a		
	b		
4	a		
	b		
5	a		
	b		

7. For which of the habitats in Model 1 is population density very similar between sides a and b?
8. For which of the habitats in Model 1 is the population density quite different between sides a and b?


9. Label each of the diagrams on Model 1 using the terms clumped (clustered), random, and uniform (even) to describe the **population distribution** within the boxes.

 10. Compare and contrast the terms population density and population distribution.

11. Assuming the population size stays constant, propose at least two factors that might cause a population to shift from a low density habitat to a high density habitat?

12. Animals such as lions or wolves often show clumped distribution. Give a reason why this would be advantageous for these animals.

13. Other than social reasons, list any other factors that may lead to clumped distribution patterns in populations.

 14. For each of the organisms listed below state the type of population distribution and population density of their habitat. Give a reason for each answer.

Organism	Distribution	Density	Reason
Tigers			
Bison			
Ants			
Dandelions			
Apple trees in an orchard			

### Model 2 – Factors Affecting Density

Factor	Density Dependent	Density Independent
Food supply	X	
Rainfall		X
Flood		X
Parasites	X	
Acidity		X
Disease	X	
Drought		X
Competition	X	
Predation	X	


15. Refer to Model 2.

a. Which factors are dependent on the population density?

b. Describe how the food supply would be affected by the population density.

c. Describe how the levels or spread of disease would be affected by population density.

16. What do all the density-independent factors have in common?

 17. In your own words, define **density dependent** and **density independent** by completing the sentences below.

Density-dependent factors are

Density-independent factors are

18. Density-independent factors and density-dependent factors may be interrelated. For example, a lack of rainfall that causes a drought will impact the food supply in a habitat. Propose another pairing of a density-independent factor and density-dependent factor that might occur.

- \_\_\_\_\_ : Spatially distinct populations that are connected by occasional movements of individuals among them, using wildlife \_\_\_\_\_
- Small populations can lead to \_\_\_\_\_ : greater likelihood of harmful alleles spreading in a population

## II. Life History Strategies

Objectives:

- Identify differences between K- and r-selected species.
- Explain survivorship curves and relate them to K- and r-selected species.

- \_\_\_\_\_ : series of events from birth through reproduction to death

Life history strategies influence growth rate of a population. They involve “evolutionary choices” in...

- 1.
- 2.
- 3.
- 4.

### → 2 Patterns of Reproduction:

<b>r-Selection</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> </ul>	<b>K-selection</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> </ul>
<b>Characteristics:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> </ul>	<b>Characteristics:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> </ul>
<b>Examples:</b>	<b>Examples:</b>

## Survivorship Curves

### III. Population Growth and Resource Availability

*Objectives:*

- Describe carrying capacity and its impact on carrying capacity on ecosystems.
- Explain how resource availability affects population growth.
- Explain exponential and logistic growth models of populations, relating them to life history strategies.

No population can grow indefinitely due to \_\_\_\_\_ such as:

\_\_\_\_\_ : Rate of population growth with unlimited resources

**4 characteristics of rapidly growing populations:**

Timing of reproduction?	1.
Amount of time between generations?	2.
Length of reproductive lives?	3.
# of offspring? (THIS IS: _____ )	4.

\_\_\_\_\_ : determined by

→ \_\_\_\_\_ --maximum reproductive rate of a population in ideal conditions (capacity for growth)

→ \_\_\_\_\_ (factors that limit growth)

- As a population reaches carrying capacity, growth rate \_\_\_\_\_ because resources become more scarce
  - Mortality (increases/decreases)
  - Fecundity (increases/decreases)

**Population Growth Curves:**



### Exponential Growth Equation

$N_0 =$ _____
$r =$ _____
$e =$ _____
$t =$ _____
$N_t =$ _____

Consider a population of mice that has an initial population size of 20 individuals. The intrinsic rate of growth for mice is  $r=0.2$  (or 20%), meaning each mouse produces a net increase of 0.2 mice each year. Predict the size of the mouse population 5 years from now.

10 years from now?

20 years from now?

Density-Dependent Factors

Density-Independent Factors

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→Video: Texas Mosquito Mystery Crash Course #2 (11:52) [www.youtube.com/watch?v=RBOsqmBQBQk](http://www.youtube.com/watch?v=RBOsqmBQBQk)

What is the central question being investigated?
What does a mosquito need to live and breathe? (Potential <b>limiting factors</b> ) 1. 2. 3. 4.
When density-dependent limitations kick in, what does that mean for a population?

Draw what kind of curve the mosquitoes initially had:



Draw what kind of curve the mosquitoes would eventually have:



<b>Four types of population fluctuations in nature:</b>	Examples:
1. _____ : fluctuates slightly above and below carrying capacity	
2. _____ : Usually stable, but sometimes explodes and then crashes	
3. _____ : Rise and fall in predictable pattern	
4. _____ : no recurring pattern ■ Chaos in the system, or just not yet understood?	



## IV. Human Population Dynamics

*Objectives:*

- Explain how human populations experience growth and decline.
- Interpret age structure diagrams.
- Explain factors that affect total fertility rate in human populations.

**7 Billion People** <https://www.youtube.com/watch?v=sc4HxPxNrZo>

Trends?

Earth's Most Typical Person <https://www.youtube.com/watch?v=4B2xOvKFFz4>

The world's most typical person...	Prediction	Actual
Makes how much money a year?		
Has a cell phone?		
Has a bank account?		
Is male or female?		
Is how old?		
Is what ethnicity?		
How many of these "typical" humans are there in the world?		

**Human Population Through Time**—AMNH (6:24) [https://www.youtube.com/watch?time\\_continue=311&v=PUwmA3Qo\\_OE](https://www.youtube.com/watch?time_continue=311&v=PUwmA3Qo_OE)

- 1 million people are added to the earth's population every \_\_\_\_\_.
- Population began to explode \_\_\_\_\_ years ago.

WHY? →

Will we soon exceed Earth's carrying capacity?	
YES. (Malthus)	NO.

What factors influence human populations?

New York Times: *The Unrealized Horrors of Population Explosion*

<http://www.nytimes.com/2015/06/01/us/the-unrealized-horrors-of-population-explosion.html>

Summarize the premise of Paul Ehrlich's 1968 book.

Why did his dire predictions not come to pass?

What is writer Fred Pearce's opinion on the situation?

\_\_\_\_\_ : The proportions of individuals at various ages

Three Stages:

- 1.
- 2.
- 3.

Which stage of the three being the biggest indicates population growth in the future?

Which stage being the biggest indicates a future population decline?

**Scishow: The Science of Overpopulation** <https://www.youtube.com/watch?t=111&v=dD-yN2G5BY0> (10:17)

Our population grows \_\_\_\_\_, but our ability to feed everybody grows \_\_\_\_\_.

Discuss Malthus's quote with your neighbor. What is he saying? Restate so a 10 year old could understand.

What came after Malthus, and helped us cram more people onto the earth than he had predicted? How so?

What are some different needs that poor people and rich people have?

We **COULD** feed \_\_\_\_\_ people. \_\_\_\_\_ people are not getting food. Where is the extra food going?

We consume as much stuff as \_\_\_\_\_ Kenyans.

How is population growth rate different in developed and developing countries?

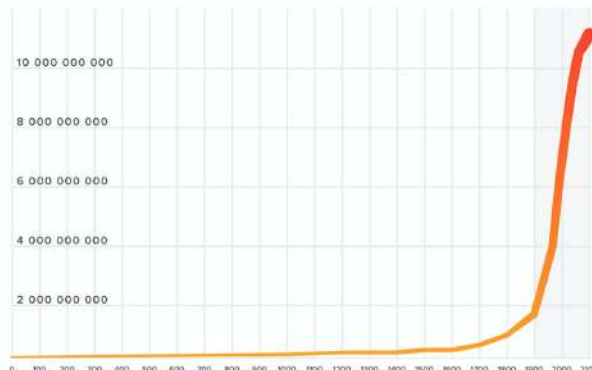
What's the problem with having "youth bulges"?

What is the number one threat to biodiversity, due to overpopulation of humans?



## WORLD POPULATION

Past, Present and Future



# Human Population Timeline

1700

1750

1800

1850

1900

1950

2000

\_\_\_\_\_ (CBR)  
= # births per 1000 individuals per year

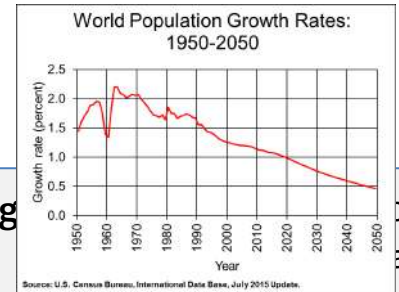
\_\_\_\_\_ (CDR)  
= # deaths per 1000 individuals per year

**Population Density** = Population/area

**National growth rate** =  
$$\frac{(\text{CBR} + \text{immi}) - (\text{CDR} + \text{emi})}{10}$$

**Global growth rate** (no immigration or emigration) (also "rate of natural increase" or RNI)  
$$r = (\text{CBR} - \text{CDR})/10$$

**Rule of 70: Doubling**



ate (%)

**FINDING FUTURE POPULATION FROM GROWTH RATE:**

$$(\text{initial population}) \times (\text{growth rate})^{\text{years}} = \text{Final Population}$$

**NOTE: a growth rate of 3% is expressed as 1.03; a growth rate of 0.25% is 1.0025**

**for example: ( 468,843 people ) X ( 1.03 )<sup>10</sup> years = 630,085 people**

**Population Problems – SHOW ALL WORK!!**

Given the following information, answer questions 1-4. *Thalerville* is a utopic island of **5000 square kilometers** off the coast of *Yomamma*. There are currently **250,000 inhabitants** of the island. Last year, there were **12,000 new children born** and **10,000 people** were recorded as deceased.

1. What is the current population density?
2. What are the birth and death rates?
3. What is the population growth rate (r)?
4. In how many years will the population of *Thalerville* double?

Given the following information, answer questions 5-8. *The country of Transylvania contains **2.3 million people** (vampires not included) and covers **800,000 square kilometers**. In the year after the last census, there were **109,000 new children born** and **111,000 people died**.*

5. What is the current population density?
6. What are the birth and death rates?
7. What is the population growth rate (r)?
8. In how many years will the population of Transylvania double?
9. Given a 2010 world population growth rate of about 1.3% per year, how long would it take the world's population to double?  How old will you be when this doubling occurs?
10. If a country doubles its population in 56 years, what has its population growth rate during that time?

11. Calculate the growth rates and doubling times for the countries listed below.

Country	Birth Rate (2011)	Death Rate (2011)	Growth Rate (r)	Doubling Time
United States	13	8		
Mexico	19	5		
Japan	8	9		
United Kingdom	13	9		
China	12	7		
India	23	7		
Nigeria	41	16		
South Africa	21	14		
Canada	11	7		
Italy	9	10		

12. In April of 2010 the U.S. population was 308,745,538 and it is growing by about .97%. Assuming a constant growth rate, what will the population be in 2020?

... in 2050?

... in 2100?

13. What would happen to the population growth rate of a country that maintains a high crude birth rate of 32 but was able to reduce their crude death rate from 28 to 12?

What would happen to the doubling time of this country?

14. We are currently adding 84 million people to the world's population each year. That is about 229,000 each day. Below is a listing of some of the world's worst disasters, along with an approximate death toll. At today's growth rate, determine how many minutes, hours, days, weeks, or months it would take to replace those lost.

Past disasters	Approximate # of deaths	Replaced this # in what time span?
Hurricane Katrina	1836	
September 11, 2001 attacks	2996	
U.S. accidental deaths in 2007	123,700	
Sumatra tsunami on 12/26/04	225,000	
American deaths in all wars as of 2010	655,000	
Total U.S. auto deaths through 2007	3,000,000	
Influenza epidemic, 1918	21,000,000	
Total AIDS deaths through 2005	25,000,000	
The Black Plague, 1347-51	75,000,000	

\_\_\_\_\_ : Average number of children a woman produces in a population throughout her life

US =	Niger (highest) =
World =	South Korea (lowest) =

\_\_\_\_\_ : TFR required to offset the average number of deaths in a population to keep population size stable

Developed countries:

Developing countries:

**New York Times: China Ends One-Child Policy**

<http://www.nytimes.com/2015/10/30/world/asia/china-end-one-child-policy.html>

Provide three reasons why China decided to end its one-child policy.

Do they expect many people to take them up on the relaxed restrictions and have a second child? Why or why not?

### My Family in 100 Years

What do you predict has a greater impact on the final population size of a family: the number of children in each generation, or the time between generations?

Complete the table. Use a calculator where needed (round to nearest tenth).

Family		A	B	C	D
		Generation Time (t)	Number of Children born each generation	Generations/ 100 years (100/t)	# descendants after 100 years (Column B) <sup>Column C</sup>
1	Thomas	15	1		
2	Oskowski	25	1		
3	Johnson	35	1		
4	Smith	15	2		
5	Asano	25	2	4	16
6	Ortiz	35	2		
7	Ruppert	15	3		
8	Norako	25	3		
9	Brown	35	3		



Create a line graph of the growth of the 9 families over 100 years. Remember axes, title, intervals. Label the lines with the number of the family. Use colors if possible.



What has a greater impact on the final population size of a family: the number of children in each generation, or the time between generations? Defend your claim with evidence from above. Remember to refer to actual data, but not every single data point, just examples of ones that support the claim.

Do teenage pregnancy rates have a large impact on population growth rates? Do you think children of teenage mothers are statistically more likely to be teenage mothers themselves? Provide **4 solutions** to the problem of high teenage pregnancy rates in bulletpoint form.

The Age That Women Have Babies: How a Gap Divides America  
<https://www.nytimes.com/interactive/2018/08/04/upshot/up-birth-age-gap.html>

Examine the graphic. Draw the shape of the graphs (the curve, not the individual bars).



There are **two main differences** you see between the two graphs:

1. What has happened to the average age of a first-time mother?
2. How do the shapes of the graphs compare? What does that tell you?

Examine the map. You can zoom if you wish and move it around. The average age of all first-time mothers in the US in 2016 was: \_\_\_\_\_ Now look at some specific counties in the US. You can **SEARCH** for these counties—you don't need to move the map around and look for them.

Santa Clara, CA: \_\_\_\_\_ New York, NY: \_\_\_\_\_ Miami-Dade, FL: \_\_\_\_\_

Culberson, TX: \_\_\_\_\_ Oglala Dakota, SD: \_\_\_\_\_ Webster, WV: \_\_\_\_\_

Consider the overall trends on the map. How does geography correlate with average age?

(Next map graphic) Average age of first-time mothers in **Santa Clara, CA...**

Without a college degree: \_\_\_\_\_ For unmarried women: \_\_\_\_\_

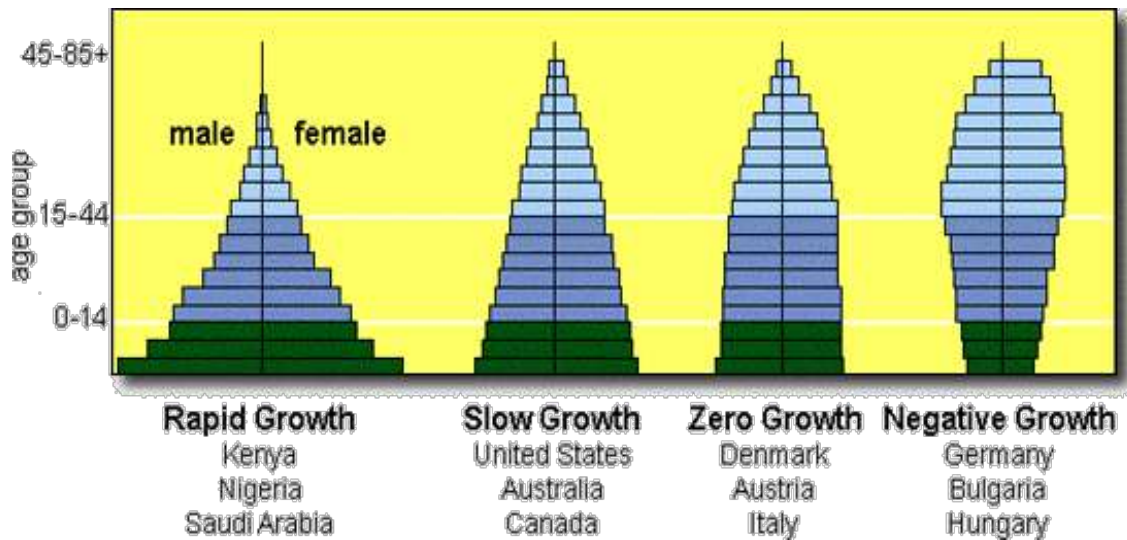
With a college degree: \_\_\_\_\_ For married women: \_\_\_\_\_

What does the average age of first-time motherhood tell us about women's equality in that country, or region of a country? Why?

Of geography, home prices, and education level, which is the strongest factor predicting age of first birth?	
In terms of politics and values, what tends to correlate with being a younger mother vs. older mother?	
Why do some women not worry about health issues in having babies at an older age anymore? Which types of women do you think this would apply to and why?	
Benefits to having babies older:	Cons to having babies older:
Benefits to having babies younger:	Cons to having babies younger:

Why do females have a greater <b>life expectancy</b> than males?	
List three countries with life expectancy over 75 years:	List three countries with life expectancy under 50 years:
<p>_____ : # of deaths of children &lt;1 year per 1000 births</p> <p>_____ : # of deaths of children 5 years per 1000 births</p>	
What are the factors that affect <b>life expectancy</b> , <b>infant mortality rate</b> and <b>child mortality rate</b> in a country ?	

\_\_\_\_\_ = Population pyramids that display the number of individuals within specific age groups (**cohorts**) for a country, divided by gender



How we arrived at a Childless Future: <https://www.axios.com/how-we-arrived-at-a-childless-future-5e72abef-87d8-45b4-aaca-69bf8f994bod.html>

Animated pyramids: <http://www.swissinfo.ch/blob/42152854/6f002b6af069e92ecbb1bd7a3b3e9f2c/int-populationstrucutres-en-data.gif>; <https://www.census.gov/dataviz/visualizations/055/>

## Power of the Pyramids

Each group will choose a different country from the list. Other countries will be considered, but countries are assigned on a first come, first served basis.

My country is: \_\_\_\_\_ I will be working with \_\_\_\_\_

### Procedure, Part 1:

Use the following link to answer the questions below with regards to the country you chose. Go to [www.census.gov](http://www.census.gov) and type in the search bar **International Database**. Select your country.

1. Where is your country located?	5. What is its rate of natural increase?
2. Is your country a developing or developed nation?	6. What is the life expectancy?
3. What is its crude birth rate (CBR)?	7. What is the infant mortality rate?
4. What is its crude death rate (CDR)?	8. What is the total fertility rate (TFR)?

9. How has the growth rate changed since 1995?

10. What was/is the growth rate:

1995 \_\_\_\_\_ 2016 \_\_\_\_\_ 2025 (predicted) \_\_\_\_\_

**Part 2:** Look at the age-sex pyramid (population pyramid) for your country. Find this by going back to the International Database page and changing the **Select Report** dropdown menu choice from **Demographic Overview** to **Population Pyramid Graph**. Print out your pyramid and paste/tape below.



1. Which gender has the higher population in the youngest age groups on your pyramid? Can you account for this?

2. Which gender has the higher population in the oldest age group? Can you account for this?

3. Does your country look like a pyramid? If not, what does it look like? Describe.

4. What can you tell about your country's growth rate by looking at your graph?

5. If birth and death rates remain the same, what will your pyramid look like in 25 years?

6. What are some factors that could change the shape of your pyramid?

7. Determine the percentage of the population that has yet to reach childbearing age. What do these numbers say about the prospects for future growth?

8. If your country is not increasing in population growth rate, what are some socio/economic problems that might occur?

9. Does your country have a baby boom in it? (a bulge somewhere in the middle) What could account for this?

10. If you had a business and you wanted to capitalize on your information about the population age distribution, what would you sell?

11. What percentage of the population is above age 65?

12. From the information on your graph/histogram, briefly discuss whether the country is increasing in population size, decreasing or at/close to zero population growth (ZPG).

13. From your data and graph/histogram, would you place the country in the category of developing or developed country? Explain.

Article: *Not Even a Global Catastrophe can Stop the Growth of Human Population*  
<http://www.alternet.org/environment/not-even-global-catastrophe-can-stop-growth-human-population>  
What do you think “demographic momentum” means?

What percent of all humans who have ever lived are still alive today?

What are some solutions that are necessary to reduce population growth for future generations?

## V. Economic Development, Consumption, and Sustainability: The Demographic Transition Model

- Objectives:*
- Describe how demographic transition follows economic development.
  - Explain how relationships among population size, economic development, and resource consumption influence the environment.
  - Describe why sustainable development is a common but elusive goal.

Hans Rosling: 200 Countries, 200 Years, 4 minutes <https://www.youtube.com/watch?v=jbkSRLYSojo>

What measures are on the x- and y-axes of his graph?

Summarize some of the trends you saw in this video.

\_\_\_\_\_ : As a country moves from a subsistence economy to industrialization and increased affluence, it undergoes a predictable shift in population growth.

## Demographic Transition Activity

**Background:** In 1945 demographer Frank Notestein recognized four demographic stages based on his observations of Europe as it became industrialized and urbanized. During these stages Europe converted from relatively high to relatively low birth rate and death rates. Demographers generally assume that the same demographic transition will occur in less developed countries as they become industrialized.

### Directions

On the graph provided (p. 25), plot the crude birth rate, crude death rate and population totals for a hypothetical country as it moves through demographic transitions.

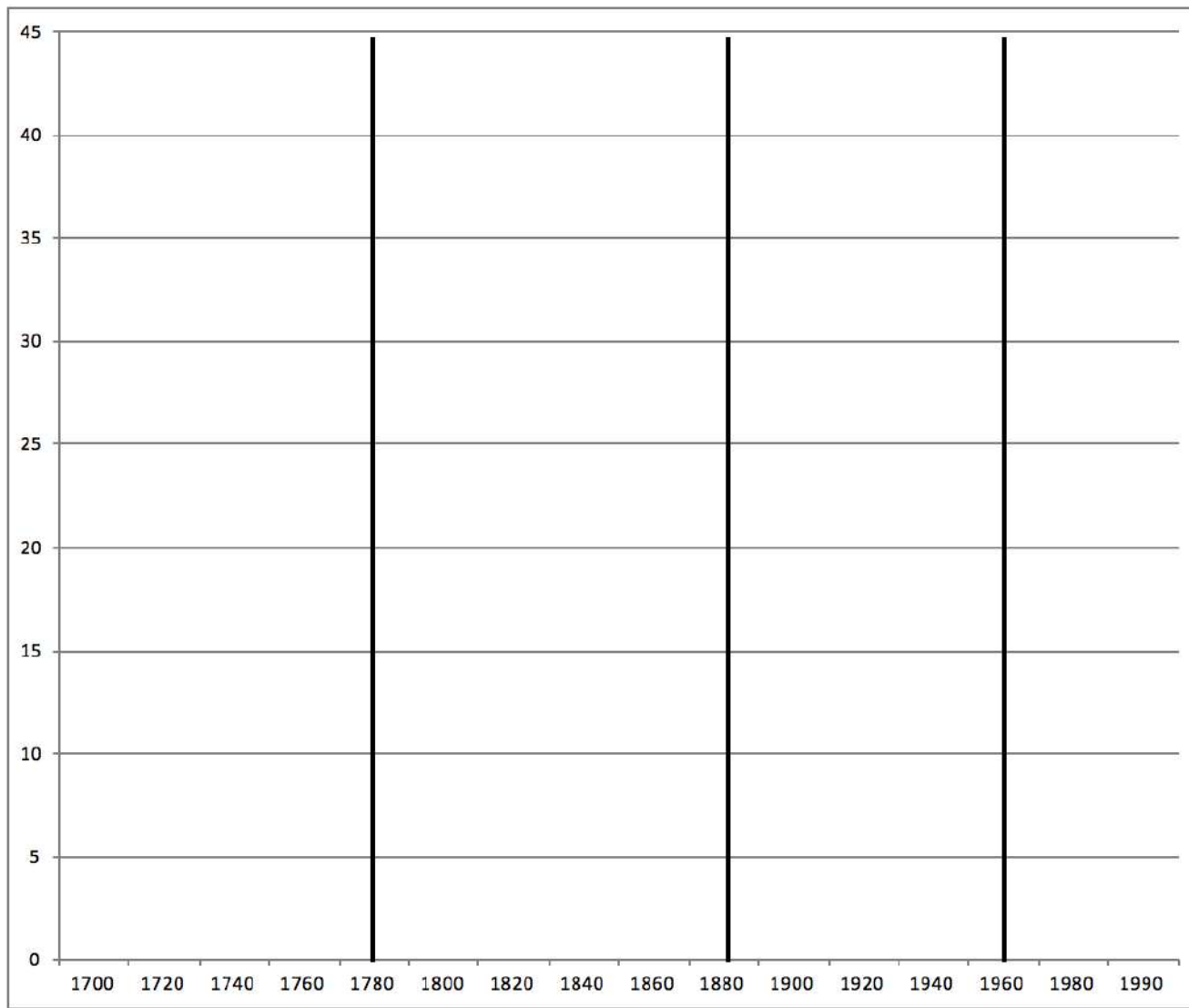
- Create a line graph- birth rates in **green**, death rates in **red** and population totals in **blue**.
- Anytime there is a difference between death rate and birth rate shade the space in between the birth rate and death rate **yellow**.
- On the chart provided you and a partner will determine which descriptions belong under the four stages of the demographic transition. Move the cards around until you are satisfied. When you have completed it,

Paste or Tape Table Answer Key Here

ask me for a copy of the answers to paste below.



Population



Year	Crude Birth Rate	Crude Death Rate	Popu To
1700	36	38	0
1715	38	36	0
1720	36	38	0
1740	37	36	0
1780	37	34	0
1820	37	21	1
1860	37	14	1
1900	28	12	2
1940	14	11	3
1980	13	11	4
1990	12	12	4

→ Ted Talk: How Mr. Condom made Thailand a Better Place

[https://www.ted.com/talks/mechai\\_viravaidya\\_how\\_mr\\_condom\\_made\\_thailand\\_a\\_better\\_place/](https://www.ted.com/talks/mechai_viravaidya_how_mr_condom_made_thailand_a_better_place/)

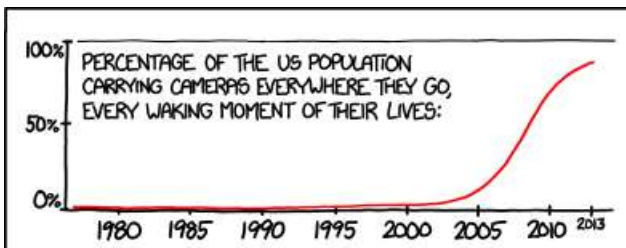
In 15 years, Thailand went from 3.2% growth rate with an average family of 6.4 children (1971) to 1.6% growth rate with an average family of 1.7 children.

To what does Thailand owe its initiative's success?

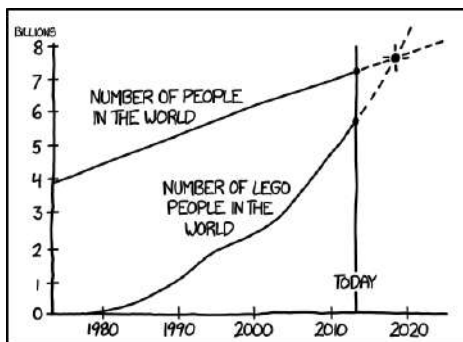
IPAT Equation

Does **Affluence** always lead to a greater impact? **GDP = Gross Domestic Product**

Does **Technology** always lead to a greater impact? *Destructive vs. Beneficial*



IN THE LAST FEW YEARS, WITH VERY LITTLE FANFARE, WE'VE CONCLUSIVELY SETTLED THE QUESTIONS OF FLYING SAUCERS, LAKE MONSTERS, GHOSTS, AND BIGFOOT.



BY 2019, HUMANS WILL BE OUTNUMBERED.

