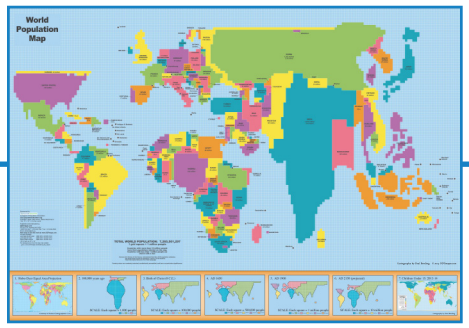
World Population Map Activity Guide

An Introduction for Teachers



World Population Map Activity Guide

Population Education partnered with ODT Maps to bring you a 2015 edition of the **World Population Map** and a set of classroom activities to use the map as a launch pad for student exploration of global demographics and human development. These activities have been designed primarily for the high school social studies classroom but are all interdisciplinary, applying knowledge and skills from mathematics, English language arts, and science.

About the World Population Map

The World Population Map is a population cartogram providing a unique view of the earth – the size of each country is shown in proportion to its population, rather than land mass. The original World Population Map was published in 2005 and included 6,428 squares on the cartogram to represent the global population at that time, 6.4 billion people. Jump ahead a decade and the cartographers had to expand the map by an additional 813 squares to accommodate the larger population for the 2015 edition. A fifth of all the new squares were added to India, whose size (along with China's) seems to dominate the population map. A full description of the cartographers' work in developing the World Population Map can be found at www.odtmaps.com.

Activities for Classroom Exploration

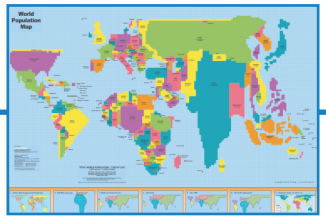
The map is a powerful tool for examining how population data can be visually represented and what trends affect population size and growth in countries worldwide. The following classroom activities help students understand and illustrate complex data and then extend their thinking to what this data means for the lives of people around the globe.

Use the primer reading, **Human Population: An Introduction**, to provide students with background knowledge on the history of human population growth and related social and environmental issues. Then begin your investigation with **Population Squared**, an introductory activity where students think like demographers to comprehend what the cartogram depicts and how this map differs from the traditional land area maps with which they are most familiar. You may wish to have students continue their demographic studies with **Illustrating Birth and Death Rates** (a birth and death rate simulation) and **Exploring the Pyramids** (an analysis of age-sex distribution charts for a variety of countries). Follow this with **Land Use Squared** which introduces concepts of population density, urbanization, and arable land use, while having students construct their own land area and population diagrams. The final two activities, **Development in Motion** and **Life by the Numbers**, expand the exploration to a range of human development indicators (fertility, income, health, education, environmental quality, and more) that give a fuller picture of life in different countries and world regions. More information about each of these activities can be found in the Summary of Activities.

Summary of Activities

Grade Level: All lessons are recommended for high school level students.

Activity Title	Description	Skills	Time Needed	Format
Human Population: An Introduction (Student Reading)	Through a short reading, students gain background information on the history of world population and the contemporary issues related to population growth.	Reading comprehension, content area literacy	N/A	Reading
Population Squared	Using the methods of a demographer, students will analyze, interpret, and evaluate conclusions on population data from the World Population Map.	Critical thinking, calculating ratios, developing questions, making inferences, constructing maps, argumentative writing	1 Class Period	Worksheet; Small group discussion; Class discussion
Illustrating Birth and Death Rates	Through a short demonstration, students observe how birth and death rates influence population growth.	Observing, critical thinking, making inferences	1 Class Period	Hands-on demonstration; Class discussion
Exploring the Pyramids	Students interpret population pyramids for 10 countries, discuss differences in the population growth rates, and infer implications of these differences.	Analyzing graphic data, making inferences, argumentative writing	1 Class Period	Class discussion
Land Use Squared	Students compare the World Population Map with an equal area map to calculate statistics related to arable land, megacities, and urban population.	Mapping skills, converting between scales, calculating percentages and ratios, gathering and evaluating data, using evidence to develop claims, argumentative writing	2-3 Class Periods	Worksheet (in pairs); Class discussion
Development in Motion	Using online software, students construct and interpret dynamic graphs and discuss differences in life expectancy, fertility rates, economics, and total population among several different countries.	Graphing, analyzing graphic data, critical thinking, making inferences, using evidence to develop claims, communicating conclusions	2 Class Periods	Worksheet (using online program); Class discussion
Life by the Numbers	Working in pairs, students research a world region to find demographic, social, environmental, and economic data, then present findings to the class.	Gathering and evaluating data, calculating averages, using evidence to develop claims, communicating conclusions	1-2 Class Periods	Small group research; Presentation



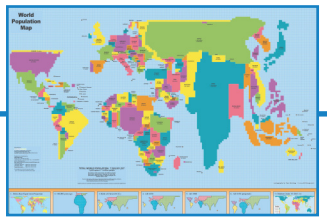
Meeting the Latest Standards

The World Population Map Activity Guide was developed with the C3 Framework for State Social Studies Standards in mind. In particular, the activities apply the Disciplinary Concepts and Tools (Dimension 2) for Geography (Geographic Representations, Human-Environment Interactions, Human Population, and Global Interconnections), while emphasizing skills in developing compelling questions (Dimension 1), developing explanations and making and supporting arguments (Dimension 3), and critiquing and communicating conclusions (Dimension 4). In requiring students to effectively communicate their ideas through writing, discussions, and class presentations, the activities also address a number of the English Language Arts/Literacy Common Core Standards.

Vocabulary

Both the C3 Framework and the CCSS require students to acquire and use academic vocabulary. The following terms are found in the World Population Map Activity Guide.

Age Distribution: the proportion of individuals of different ages within a population.
Arable land: land that can be cultivated for the production of crops.
Birth Rate: number of live births per year per 1,000 people.
Cartogram: a map in which each area is sized proportionally according to some particular characteristic.
Cohort: a group of persons sharing a demographic characteristic, often age.
Death Rate: number of deaths per year per 1,000 people.
Demographer: a person who studies a human population's size, structure, distribution, and changes over time.
Demographic Transition: a model describing changing levels of fertility and mortality, and hence natural increase, over time. The model is based on the experience of the contemporary more developed nations.
Dependency Ratio: the number of people under the age of 15 and over the age of 64, compared to the number of people active in the labor force.
GDP (Gross Domestic Product): an economic indicator which measures the total market value of all goods and services produced by a nation's economy over a given period of time (usually a year).
Improved Sanitation: refers to facilities that ensure the hygienic separation of human waste from human contact.
Infant Mortality Rate: the annual number of deaths of infants under one year of age per 1,000 live births.
Levels of Development: the United Nations classifies countries as **More Developed**, **Less Developed** and **Least Developed** based on a number of measures including GDP, literacy rate, life expectancy, education, etc.
Life Expectancy: the average number of years a newborn infant can expect to live under current mortality levels.



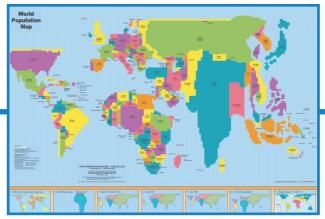
Literacy Rate: according to the World Bank, the percentage of people aged 15 and above who can, with understanding, both read and write a short, simple statement on their everyday life.
Malnutrition: the condition that occurs when a person's body does not receive enough nutrients, often caused by an inadequate or unbalanced diet.
Medical Revolution: the leap of medical knowledge in stage 2 of the demographic transition.
Megacity: a city of 10 million or more residents.
Net Migration: immigration minus emigration.
Overpopulation: too many people in one place for the resources available.
Population Cartogram: a cartogram based on population size.
Population Density: a measurement of the number of people per given unit of land.
Population Explosion: the rapid growth of the world's population during the 20th century, attended by ever-shorter doubling times and accelerating natural increase rates.
Population Pyramid: (age-sex structure) a bar graph displaying population distribution by age and gender.
Poverty: an economic state below the poverty line.
Rate of Natural Increase: the birth rate minus the death rate without regard for migration; a measure of the annual rate of population growth.
Stationary Population Level: the level in which a population has a basically even distribution of age groups and population ceases to grow.
Total Fertility Rate: the average number of children born to a woman during her lifetime.
United Nations: an international body, made up of 192 member states, established at the end of World War II to foster international security and cooperation. The UN has many subsidiaries such as the Security Council, World Health Organization, UN Population Fund, etc.
Urbanization: the process in which an increasing proportion of a population inhabits cities and their suburbs.
Youth bulge: a demographic phenomenon in which a disproportionate percentage of a country's population is between the ages of 15 and 24 years old. This is, however, almost always accompanied by a greater percentage of the population being under 14. This youth bulge can lead to high unemployment and political instability.

Recommended Resources

<u>Reference Sources:</u>
CIA World Factbook – An online database with population information for every country and world region. www.cia.gov/library/publications/the-world-factbook

Population Reference Bureau – Find the most up-to-date population data for all countries. www.prb.org/DataFinder

United Nations Population Information Network – A guide to population information that can be found on the UN website. www.un.org/popin



Background Information and Multimedia Resources:

Los Angeles Times, Beyond 7 Billion – Well researched series of stories, videos, maps, photos and narrated graphics on world population history and current challenges. www.latimes.com/news/nation-world/world/population

Marketplace, Food for 9 Billion – This website accompanies a year-long radio series. The interactive world map and Food through the Ages timeline are great teaching tools. www.marketplace.org/topics/sustainability/food-9-billion

National Geographic, 7 Billion – An expansive collection of resources exploring how we arrived at 7 billion people on the planet and what that means for the future. http://ngm.nationalgeographic.com/2011/01/seven-billion/kunzig-text

National Geographic, "Feeding 9 Billion," Jonathan Foley, May 2013 – An article exploring the challenges of meeting global food demand as our population grows. www.nationalgeographic.com/food-features/feeding-9-billion

Science Magazine, Special Population Issue – Articles, graphics and an educational video about population figures, trends and projections. www.sciencemag.org/site/special/population

The World Bank, Population Growth Rate – An on-line learning module about Population Growth Rate. www.worldbank.org/depweb/english/modules/social/pgr

World of 7 Billion – Created by the Population Education program, a set of globally focused lesson plans and the host site for an annual student video contest. www.Worldof7Billion.org

World Population – A graphic simulation of history of world population growth over 2,000+ years. View this 7-minute video animation at www.populationeducation.org/world-population-video

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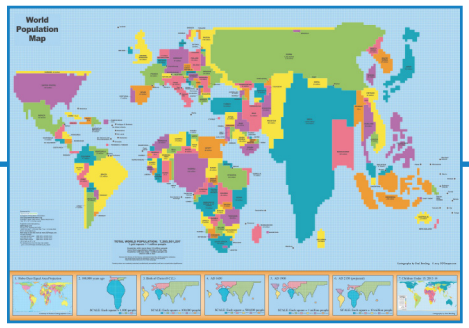
About Population Education:
Population Education, a program of Population Connection, has developed age-appropriate curricula and provided professional development workshops for K-12 educators since 1975. With an emphasis on hands-on learning and critical thinking, the program has earned a reputation for educational excellence. Visit www.PopulationEducation.org to download additional lesson plans, background materials, and classroom resources.

Human Population: An Introduction

Student Reading



World Population Map Activity Guide

Central to so many of the environmental, social, and economic issues facing the planet today are people – our numbers and our behaviors. Human **population** pressures can be seen all around us, from traffic congestion and pollution to loss of biodiversity and climate change, and are threatening the health of our ecosystems and the quality of life for earth's inhabitants.

Consider that in the six seconds it takes to read this sentence, 15 more people will inhabit the globe. In fact, the world's population growth is such that we add a Germany each year and a New York City nearly every month.[1] There are now over seven billion people on the planet and this growth in human numbers has been described as a **population explosion**.

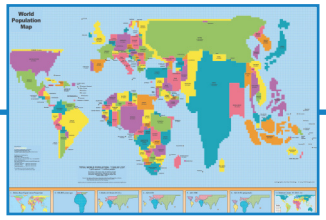
What Ignited the Explosion?

Rapid population increase has been a very recent development in the scope of human history. People lived on earth for about three million years before the world population reached 500 million around 1500. Until then, **birth rates** and **death rates** were in balance, keeping the population stable. Although birth rates were high, death rates – particularly among children – also remained high.
By the 17th century, this balance of birth and death rates began to change as advances in medical care, sanitation, food production, and nutrition increased **life expectancy** for children and adults. Death rates dropped but birth rates remained high, and the population grew steadily. By 1804, at the height of the Industrial Revolution in Northern America and Europe, global population reached one billion.

As industrialization grew throughout the Western world, people exchanged their agrarian lifestyles for homes and jobs in burgeoning cities. Without land to farm, large families became neither necessary nor practical. Slowly, birth rates dropped in rapidly industrializing nations. This pattern – from high birth and death rates (stage 1), to high birth and low death rates (stages 2 and 3), and finally to low birth and death rates (stage 4) – is referred to as the **demographic transition**.

In the less industrialized societies of Africa, Latin America, and Asia, however, birth rates remained high at the same time that death rates dropped due the improved medical technologies of the **Medical Revolution** and new agricultural advancements. Economic conditions in these nations did not always improve as life expectancy increased. This resulted in stagnation in the middle stage of the demographic transition for less developed countries and a pattern of population growth for much of the globe. By 1960, the world population reached three billion. Then just 14 years later in 1974, population soared to four billion, it continued to climb to five billion in 1987, topped six billion in 1999, and reached seven billion in 2011. World population had completely doubled in less than 40 years.

Over the years, some countries caught in the middle stages of the demographic transition were able to develop further and they gradually reached a **stationary population level**. However, many of the **least developed countries** continue to be marked with high birth rates and low death rates, leading to rapid growth. In fact, almost all of the additional 3.7 billion people expected to be added to the planet between now and 2100 will live in developing countries, posing unique challenges for our global community.[2]



Understanding the Numbers

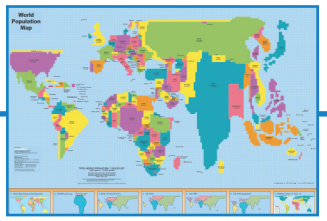
To determine the impacts of human population growth, it is important to make sense of demographic data. One way that **demographers** interpret data is by using population cartograms. A **population cartogram** is a map where country size is based on population rather than land area. It is a valuable tool for determining where people are located around the world, and comparing cartograms from different years can inform how a population has changed over time. However, there are some things that cartograms can't reveal. For instance, a cartogram doesn't indicate how fast or slow a population is currently growing. It also can't reveal what life is like for the people who live in a particular area or what social or environmental challenges a country might face as a result of their population trends. Combining cartogram data with information from other sources gives meaning to the numbers and allows important questions to be addressed: How does the quality of life on earth vary for people around the world? What might change in the future when the population is much larger? How do humans impact the natural world they depend on?

Crowding the Earth

The size of the human population affects virtually every environmental condition facing our planet. In short, the population issue is not one of just numbers, or squares on a cartogram, but also the impact of those numbers. As population grows, demand for resources increases, adding to pollution and waste. More energy is used, escalating the problems of climate change, air pollution, oil spills, and nuclear waste. More land is required for agriculture leading to deforestation and soil erosion. More homes, factories, and roads must be built, occupying habitat once belonging to other species and leading increasingly to their extinction. Simply put, the more people there are to support, the greater the stress on our resources.

However, the environmental impact of each population square on a cartogram is not created equal. For instance, in Northern America, like many other industrialized regions, our affluent lifestyles compound the impact of our numbers. Residents of the US and Canada constitute less than 5 percent of the world population, yet consume 21 percent of the world's energy and produce 19 percent of the world's carbon dioxide emissions.[3] Our consumption habits place a disproportionate strain on the world's resources and exacerbate the challenges of climate change and sea level rise among our global community.

Not only do more people have a greater impact on natural resources, they also require more space to support basic needs like food, housing, and transportation. Consider that the entire world population could fit into the state of Texas, and each person could have an area equal to the floor space of a typical Northern American home. But this ignores the amount of land required to provide each individual with the raw materials for survival (food, water, shelter, clothing, and energy) and all that has become essential to our modern lifestyles (transportation, electronic communication, and consumer goods and services).



Global food supply is an interesting case study on the limits of earth's resources. While the continents are vast, only a small fraction (1/10) of all the land in the world is **arable**.[4] The rest has been built up into cities and towns to support our lifestyles or is inhospitable to growing crops. The lowest authoritative estimate of the minimum amount of arable land required to feed one person without intensive use of synthetic fertilizers is 0.17 acres.[5] As the number of people continues to grow and the small portion of land which must support these people remains the same (or shrinks as cities expand and soil is degraded due to erosion, overuse, or pollution), the number of acres per person dwindles.

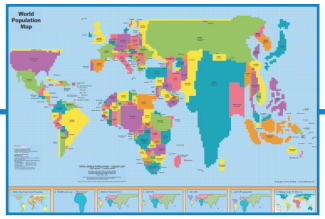
The fact that arable land is not divided evenly around the world adds to the puzzle. Countries face their own unique challenges in maintaining agricultural space to feed their respective populations; they must balance the required space for housing, infrastructure, and development with the need for healthy cropland.

Meeting People's Needs and Wants

The strain on earth's finite natural resources makes it more difficult for people around the world to meet their basic needs. Chronic hunger and **malnutrition** are already the greatest risks to health worldwide. One in eight people do not get enough food to be healthy and lead an active life.[6] As the world population grows, it will be a challenge for food production to keep pace, yet we continue to lose arable land. Almost 25 percent of the world's people now face chronic water shortages[7] even as more water is needed for agriculture, industry, and domestic uses. As developing nations aspire to more affluent lifestyles – protein rich diets, automobiles, and a broader reach of electricity – their historically small eco-footprints will expand. Combined with the intensive resource use among developed countries, this will place an even greater strain on the world's environment than ever before.

In addition, we live in an economically divided world. One-sixth of the world's population enjoys relative wealth in high income countries. One-third resides in rapidly developing middle-income countries, and the remaining half of the world's people struggle to survive on less than $2 USD per day.[8] Most of the world's poor live in Africa, Asia, and Latin America, and women, children, the elderly, and ethnic minorities are the hardest hit. For many, **poverty** is far more than an economic condition. The effects of poverty extend into all aspects of a person's life and can impact one's susceptibility to disease, availability of medical care, access to information and technology, and educational opportunities. Those living in poverty struggle with greater insecurity in the face of changing circumstances, such as food shortages and natural disasters.

Population and poverty are tightly intertwined: low wages, poor education, and high **infant mortality rates**, all symptoms of poverty, are also associated with high fertility rates and growing populations. Conversely, large populations, on both the family and national level, mean resources are spread more thinly making it difficult to invest in the health and education of individuals. The cycle of population growth and poverty can become a trap that is difficult to escape.



What Can Be Done?

If world population continues to expand at the rate we grow today, a population cartogram in 2100, using the same scale of 1 square = 1 million people, would need to include at least 3,700 more squares to represent the 3.7 billion additional people on the planet. Our growing population will intensify the environmental and social issues we face and lead to many daunting challenges. However, there is much that can and has been done toward stabilizing world population and preserving the environment. Small changes in **total fertility rates** can make a big difference in determining when the population will stabilize and how many people there will be when that happens. According to the **United Nations**, a drop in the average number of children per woman by half a child per woman would mean a difference of four billion people in the projected population for 2100.[9]

Recent trends show that the population growth rate has begun to decrease. Programs that expand access to health care and education, as well as family planning services that enable women to choose the timing and number of their children, have raised the status of women worldwide and been proven to lower fertility levels. In 1960, the average woman gave birth to more than five children. Today, the average woman gives birth to two to three children.

Yet these positive indicators do not mean **overpopulation** no longer poses a threat to the world's people, resources, and wildlife. High growth rates in recent decades mean that almost one-third of the world's people are under age 15 and have not yet entered their child-bearing years.[10] The majority of this youth population is located in developing countries. Such an age structure means there is still potential for steady population increases in countries where resources are already strained, and there is a strong need for international cooperation to continue successful programs.

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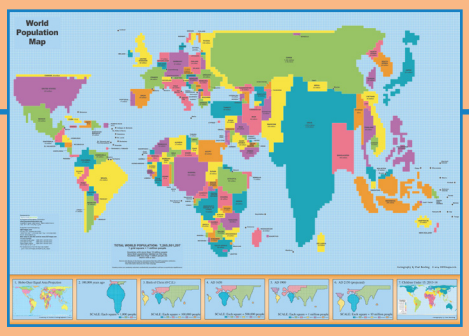
[1] 2013 World Population Data Sheet, Population Reference Bureau, www.prb.org.
[2] United Nations Population Fund, www.unfpa.org/pds/trends.htm.
[3] Energy Information Agency, 2011, www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=44&pid=44&aid=2.
[4] Food and Agriculture Organization of the United Nations, http://faostat.fao.org.
[5] Engelman, Robert, and Pamela LeRoy. Conserving Land: Population and Sustainable Food Production. Population Action International, Washington, DC, 1995. p. 9.
[6] Food and Agriculture Organization of the United Nations (FAO), The State of Food Insecurity in the World, 2012, www.fao.org/docrep/016/i3027e/i3027e00.htm.
[7] United Nation Department of Economic and Social Affairs, www.un.org/waterforlifedecade/scarcity.shtml.
[8] The World Bank, World Development Indicators, 2011, www.worldbank.org.
[9] Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects, 2010 Revision (New York: United Nations, 2011).
[10] 2013 World Population Data Sheet.

Population Squared



World Population Map Activity Guide

Introduction:

A **cartogram** is a map in which each area is sized proportionally according to some particular characteristic. Demographers use cartograms, like the World Population Map, to visually represent **population** data and show the relative size of different country populations on a world map according to a set scale. In this activity, students will perform the role of demographers to understand and interpret world population presented in the form of a cartogram. The Student Worksheet will provide students with a working knowledge of cartograms by challenging them to first identify the main characteristics of **population cartograms** and then evaluate the role of cartograms through the construction of their own world population map.

Materials:

World Population Map
Student Worksheet

Procedure:

1. Display the World Population Map and distribute the Student Worksheet.
2. Provide a working definition of **demographer** and have students note the definition.
   (demographer: a person who studies a human population's size, structure, distribution, and changes over time)
3. Have students independently compose ideas to the Pre-Think prompt and then discuss their ideas as a class.
4. Have students work through Section A, "World View," of the worksheet and then share observations from questions 1 and 2. Make a list of responses.
5. Guide students through Section B, "Gathering the Facts," a map orientation to gather specifics from the World Population Map.
6. Divide students into small groups to work through Section C, "Cartography in Action." Be sure that each group spends time answering the Small Group Discussion Questions.
7. Guide students through the class-wide Discussion Questions.

Discussion Questions:

1. How do each of the groups' cartograms compare?
2. How do the different representations of the world's regions impact how you imagine population numbers?
3. What are the benefits of a cartogram in understanding population data?
4. What are the limitations of a cartogram in understanding population data?

Concept:

Cartograms are maps used to visualize different kinds of data. Demographers use cartograms to map the world's population.

Objectives:

Students will be able to:

- Define and explain how a demographer represents population data.
- Identify, construct, and interpret a cartogram.
- Describe the ways different map types represent population data.
- Evaluate how population cartograms influence perspective of geographic regions.

Skills:

Critical thinking, calculating ratios, developing questions, making inferences, constructing maps, argumentative writing

Method:

Using the methods of a demographer, students will analyze, interpret, and evaluate conclusions on population data from the World Population Map.

5. What variables, other than population, could be used to create a cartogram?

Student Worksheet Answers:
Section B - "Gathering the Facts"

1. *Cartogram – A map that changes the geographical area or form, in this case country size/form, through a chosen variable.*
2. *Countries, Nation-states*
3. *Population*
4. *A country's size depends on its population – the greater the population the larger the country size; the lesser the population the smaller the country size.*
5. *Answers may vary. Examples: Increase – Pakistan, United Kingdom, Vietnam; Decrease – Canada, Mongolia, Saudi Arabia*
6. *Population has been scaled to have 1 grid square = 1 million people.*
7. *At least 10 million people*
8. *A star*
9. *Over time, as population increases, the scale increases so that 1 grid square represents a larger and larger number of people.*
10. *US Bureau of the Census; International Data Base 2015 population estimates; The South Sudan Center for Statistics, Census, and Evaluation; Tibet Information Network; Free Tibet Campaign*

Section C - "Cartography in Action"
Grid Square totals: Africa (44); Asia (172); Europe (30); Latin America (24); Northern America (14); Oceania (1.5)

Measuring Learning:

Have students construct written arguments in support of their claims to the following questions:

a. How do population cartograms influence our understanding of the world?

b. What role do demographers play in providing an understanding of population data?

c. How has the use of a cartogram influenced how you understand world population as a whole and by region? Provide at least three examples from the World Population Map.

Extension:

Have students create cartograms of the world's regional groupings for different years -- both in the past (1980) and future (2050 and 2100). Have each square represent 25 million as on the Student Worksheet so students can compare charts from year to year.

Region	1980 Population	# Grid Squares	2050 Population	# Grid Squares	2100 Population	# Grid Squares
Africa	478 Million	29	2.5 Billion	100	4.4 Billion	176
Asia	2.6 Billion	104	5.3 Billion	212	4.9 Billion	196
Europe	694 Million	28	707 Million	28	646 Million	26
Latin America	365 Million	15	784 Million	31	721 Million	29
North America	254 Million	10	433 Million	17	500 Million	20
Oceania	23 Million	1	56 Million	2	71 Million	3

Name:_____ Date:_____

Student Worksheet

In October of 2011, world population reached seven billion people. Every second that number increases, but what does that number really mean? Through the questioning and analysis of population data, we as global citizens can better understand how we live and interact with our world. To help with this understanding we ask for help from **demographers** (write in the definition): _____

_____

PRE-THINK: How might a demographer's work be useful?

Today, the demographer we need help from is you! Your task is to take the following world population information and play the role of demographer as you make sense of the data.

A. World View

1. What do you see when you look at the World Population Map? Write down all observations.

_____

_____

_____

2. How does this map compare to the Hobo-Dyer Equal Area Projection (found in the bottom left corner of the map poster)?

What looks the same?	What looks different?
What do these similarities mean?	What do these differences mean?

3. What do you find most interesting when you compare the World Population Map to the Hobo-Dyer Equal Area Projection?

_____

_____

_____

4. If you had to select one map to represent the world, which map would you choose? The World Population Map or the Hobo-Dyer Equal Area Projection? Explain your choice.

_____

_____

_____

5. Like all good demographers, questioning is essential! What questions do you have about the World Population Map?

_____

_____

_____

B. Gathering the Facts

1. What type of map is the World Population Map? _____

2. What geographical area is being changed? _____

3. What variable is causing this change? _____

4. How does the change in population affect how a country is represented on the map?

_____

5. Compared to the equal area map, identify three countries whose relative size is larger on the World Population Map and three countries whose relative size is smaller on the World Population Map.

   Larger: _____

   Smaller: _____

6. On what scale is population measured on the World Population Map? _____

7. How large must a country's population total for it to be labeled on the World Population Map?

_____

8. How are countries labeled if their population does not exceed one million people? _____

9. Looking at the cartograms at the bottom of the poster (#2-6), how has the scale changed over time?

_____

10. From what sources were the country population totals gathered?

_____

C. Cartography in Action

Construct a cartogram of the world's population by regional grouping.

1. Use the scale: 1 grid square = 25 million people. Calculate the number of grid squares for each region.

WORLD POPULATION TABLE

Regional Grouping Name	Total Population	# of Grid Squares
Africa	1.1 billion people	
Asia	4.3 billion people	
Europe	740 million people	
Latin America	606 million people	
Northern America	352 million people	
Oceania	38 million people	

2. Plot the grid squares on the graph below. Use a different color or pattern to identify each group.
3. Include: Title, Orientation, Date, Author, Legend/Key (Region Labels), Scale, and Source
4. After completing the map, answer the Small Group Discussion Questions (on back).

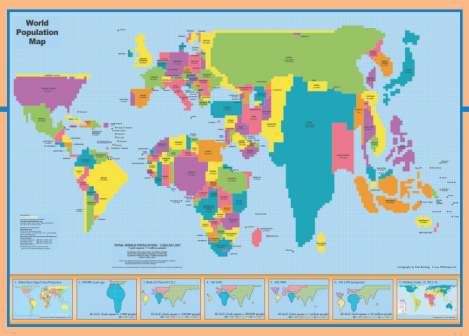
Small Group Discussion

1. Describe the process of your cartogram construction. What factors did you have to keep in mind while you built the map?

2. Is your map useful for understanding world population? Why or why not?

3. How does your cartogram compare to the World Population Map? Does your view of world population differ from one map to the other?

Illustrating Birth & Death Rates



World Population Map Activity Guide

Introduction:

The **rate of natural increase** is calculated by subtracting the death rate from the birth rate. A population grows when a species' **birth rate** exceeds its **death rate**. Worldwide, the human birth rate is about 2.5 times the death rate (20 births to 8 deaths). In this activity, students will observe a visual demonstration of the relationship between the global birth and death rate. Then the class will explore the birth and death rates from three different countries and discuss their implications on future population growth and related issues.

Materials:

Clear bowl
"Birth Rate" and "Death Rate" tags (included)
Masking tape
Opaque bowl of water
Food coloring
Set of standard measuring cups

Part 1: Demonstration of World Statistics

Procedure:

1. Fill the opaque container with water and add food coloring. Fill the clear container so it is roughly 1/4 full.
2. Ask for two volunteers and designate one the "Birth Rate" and the other the "Death Rate." Each student should tape the appropriate name tag to him/herself.
3. Hold up the clear container and explain that it represents the world and the water represents our human population.
4. The Birth Rate volunteer will add water to the clear container to represent people being born, or "added" to the earth. The Death Rate volunteer will remove water from the clear container to represent people passing away, or being "removed" from the earth.
5. In 2014, the global birth rate is 20 per 1,000 and the death rate is 8 per 1,000. Have the students determine which volunteer should receive the larger measuring cup. (Birth Rate should receive the 1 cup dipper and Death Rate the 1/3 cup dipper.)
6. Have the students conduct the demonstration: the Birth and Death Rate volunteers move the water between the opaque container and clear container in a one-to-one fashion – the Birth Rate adding a scoop to the clear container while the Death Rate removes a scoop. Those not participating in the demonstration should observe what happens to the level of the water.
7. Go over the Discussion Questions as a class.

Concept:

Population growth occurs when a species' birth rate exceeds its death rate.

Objectives:

Students will be able to:

- Define birth rate and death rate and describe how they relate to population growth.
- Explain why death rates have dropped in recent history.
- Identify why it is important to know the birth and death rate of a country when planning for the future.

Skills:

Observing, critical thinking, making inferences

Method:

Through a short demonstration, students observe how birth and death rates influence population growth.

Discussion Questions:

1. Why did the water level rise steadily? What does this show us about the relationship between birth and death rates as it relates to the rate of natural increase?
   The water level rose because more water was being added to the bowl than removed. When the birth rate is greater than the death rate, a population grows; the rate of natural increase is positive.

2. What size would the Death Rate's dipper need to be for the water level to stay the same? What size would the Death Rate's dipper need to be for the water level to decrease?
   To stay the same, the same size as the Birth Rate's dipper; in this case, one cup. To decrease, the Death Rate's dipper would need to be larger than the Birth Rate's dipper; in this case, larger than one cup.

3. Throughout history, the birth rate and death rate were very close; the Birth rate's dipper and Death Rate's dippers were about the same size. But over the past 200 years, the Death Rate's dipper has become much smaller than the Birth Rate's. Why has the death rate decreased in recent years?
   Answers might include: Advances in medicine: New scientific discoveries meant doctors became better at healing people. Increased contact between countries allowed them to learn from each other. Better sanitation: People invented safer ways of disposing of garbage and human waste so their surroundings were cleaner and didn't breed as much disease. Better nutrition: Advances in farming made it possible to grow better food in greater quantities. There was a greater awareness of the importance of eating a variety of foods.

   *All of these things worked to allow more people to survive infancy and childhood and extended the average **life expectancy**. People used to only live to be about 40 or maybe 50, whereas now many people survive much longer.*

Part 2: Exploration of Growing, Stable, and Decreasing Populations

Procedure:

1. Explain that you are going to examine three countries with different birth and death rates. Share the information for Poland, Nigeria, and Hungary.
2. Once students have had a moment to contemplate the birth and death rates of each, go through the Discussion Questions.

Country	Birth rate	Death rate	Measuring Cup
Poland	10	10	1:1 cup
Nigeria	42	13	3:1 cup
Hungary	9	13	2/3:1 cup

Discussion Questions:

1. Based on these three countries' birth and death rates, which country's population is growing the fastest, which is not growing, and which population is experiencing a slow decline?
   Nigeria's population is growing the fastest; the birth rate is triple the death rate. Poland's population is stable; the birth rate is equal to the death rate. Hungary's population will shrink over time because the death rate is slightly larger than the birth rate.

2. Why is it useful to know the birth and death rate of a country?
   Knowing the birth and death rate of a country helps plan for the future. A population with a high birth rate and a low death rate indicates a growing population – young populations will need social structures and

facilities like schools and future job options. A growing population will require more resources (food, water, energy, etc.) to support more people. A population with a higher death rate than birth rate indicates an aging population, which will need other social structures like a retirement system and healthcare.

3. Thinking specifically about each of the three countries' birth and death rates, what challenges might each face in the future related to the changes in their population? Explain.
   Hungary: Hungary's birth rate is 9 and the death rate is 13, indicating that their population will slowly decrease. They will have a large elderly population and will need the social structures to care of them (retirement, medical care, etc.). And while economic opportunities for the elderly population will be important, so will opportunities for the youth population to ensure future economic support.

   Poland: Because both Poland's birth rate and death rate stand at 10, it indicates that their population will remain stationary. Because stationary populations are predictable, they are easier to plan for and face fewer demographic-related challenges.

   Nigeria: Nigeria's birth rate is much greater than its death rate, indicating a rapidly growing population. In the future, Nigeria may face challenges related to: land use – arable land for crops and open spaces; ensuring the availability of resources (food, water, energy, etc.); developing the social resources and structures (schools, advanced education, job opportunities, etc.) necessary to support a young population.

Measuring Learning:

Students must answer the following queries on an exit slip and hand in before exiting class.

a. Make up a birth rate and death rate for a country that has a growing population.

b. Make up a birth rate and death rate for a country that has a stable population.

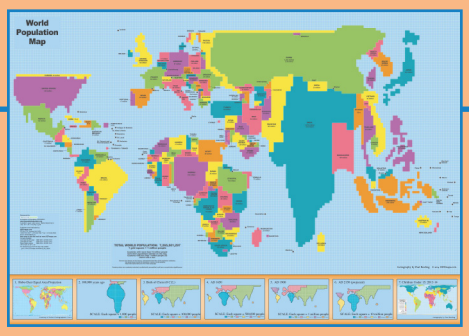
c. Explain one reason that death rates have dropped in recent history.

d. Why is it important to know a country's birth rate and death rate?

Birth Rate

Death Rate

Exploring the Pyramids



World Population Map Activity Guide

Introduction:

To help them make population projections for different countries, demographers look at the profile of the countries' residents. What are the ages of the people? How many are men? How many are women? Taking this information, they analyze population pyramids like the ones students will see in this activity. These graphs depict the configuration of a country's population as impacted by 70 to 80 years of economic, political, and natural events. These graphs can also help predict future population trends.

Note: To help ensure thoughtful analysis of the presented data, it's recommended that students have prior knowledge of population pyramids before beginning this lesson.

Materials:

Population Pyramids Worksheet
World Population Map

Procedure:

1. Display the world population pyramid and explain that it is a graph used by demographers to study the gender and **age distribution** of a population. Sex is shown on the left/right sides, age on the y-axis, and the percentage of population on the x-axis. Each grouping (ex: males aged 0-4) is called a **cohort**.
2. Ask students where they are represented on the world pyramid graph. *(If you are between 15 and 19 years old in 2014, you and your cohort are represented by the fourth bar from the bottom, males on the left, females on the right.)*
3. Pass out the Population Pyramids Worksheet and let students examine the 10 pyramids.
4. Go over the Discussion Questions as a class.

Discussion Questions:

1. Can you tell from the pyramids if there are more males or females aged 0-4 in each country?
   Yes, there are more males in the youngest cohorts. There is a slightly greater probability of giving birth to male children. For every 100 girls born, about 105 boys are born.

2. Are there more elderly women or men in each country? Explain.
   There are more elderly women. Throughout the world, life expectancy for women is higher than for men. This is due to a number of genetic and social factors. In general, men are more predisposed to certain health risks than women and have, historically, worked in the more dangerous fields. Also, men make up the vast majority of military members and are more likely to die during wars.

Concept:

The age-sex distribution of a population affects its growth rate and provides information on its past, present, and future growth patterns.

Objectives:

Students will be able to:

- Discuss connections between the shapes of population pyramids and the growth patterns of different countries.
- Explain why a country with a large percentage of population under 15 years of age is experiencing rapid population growth.
- Analyze current population pyramids to predict future population trends.

Skills:

Analyzing graphic data, making inferences, argumentative writing

Method:

Students interpret population pyramids for 10 countries, discuss differences in the population growth rates, and infer implications of these differences.

3. Looking at the 10 country pyramids, can you tell which country has the largest population? Why or why not?
   No. The graphs represent 100 percent of the population of each country and do not provide the actual population numbers. Demographers use the percentage data instead of the raw data so that each graph fits on the same size paper and can be compared to the graphs of other countries.

4. Looking at the pyramids, can you determine which countries have a slow or fast population growth rate? How can you tell?
   The slower a population is growing, the more rectangular the graph shape. The rectangle shape indicates a more uniform population size across the age groups, or a ***stationary population level****. Italy and Japan are growing the slowest. Japan's birth rate and death rate are roughly equal. The graphs that are more pyramid-shaped – a wide base and narrow top – have a faster rate of population growth. This indicates a young population, with more people in the lowest bars who will soon enter their childbearing years. Nigeria, Uganda, and India are growing the fastest.*

Now, display the World Population Map and have students refer to their Population Pyramids Worksheet. Answer the following questions as a class:

5. The tile in the bottom right of the poster, titled "Children Under 15: 2013-2014," shows the relative youth of countries, just as the age distribution bars do on the pyramid graphs. How does the information on this tile indicate what a future population cartogram might look like? What information can you gather from the map tile that you can't by seeing the 10 pyramids? What do the pyramids tell you that the map tile doesn't?
   The information on the tile displays countries by their percent youth populations. Countries with a high youth percentage are indicative of faster-growing populations; countries with a low percent youth population indicate a slower-growing population. Countries with high percent youth populations will occupy more space on a future cartogram – their population is increasing and thus will be larger in the future. The cartogram shows all countries, so you can see how the youth population differs among countries and regions. The pyramids tell you about the entire age structure of a country's population, not just those under the age of 15.

6. What are some challenges that countries with a large youth population could encounter? How might this change in the future?
   When a population grows quickly, community programs and facilities can't always keep up and poverty and a slowed economy can result. Countries with a ***youth bulge****, or a large population between the ages of 14 and 24, risk social and political instability, especially if working-age populations are unable to find work and a large sector of the population is faced with high unemployment, low economic opportunity, and the in ability to provide for a family. However, this can be changed over time – as countries invest in community and social infrastructure, and increase educational and economic opportunities, results can include: improved economies, political stability, etc.*

7. What are some challenges that countries with large elderly populations face? Looking at the pyramids, can you predict which countries will have a larger elderly population than youth population in the future?
   Countries with large elderly populations face different challenges than those with large youth populations. Different needs must be met when a greater part of a population is dependent on social programs like retirement/pension/social security, and medical care. When a country's population growth has slowed or become stationary, the elderly population will become larger than the working-age population, resulting in an imbalanced ***dependency ratio****. When this occurs, some economic uncertainty emerges because there must be enough people of working age employed to provide for the elderly populations, or "dependents." The pyramids of China and India indicate that eventually the older population will be larger than the*

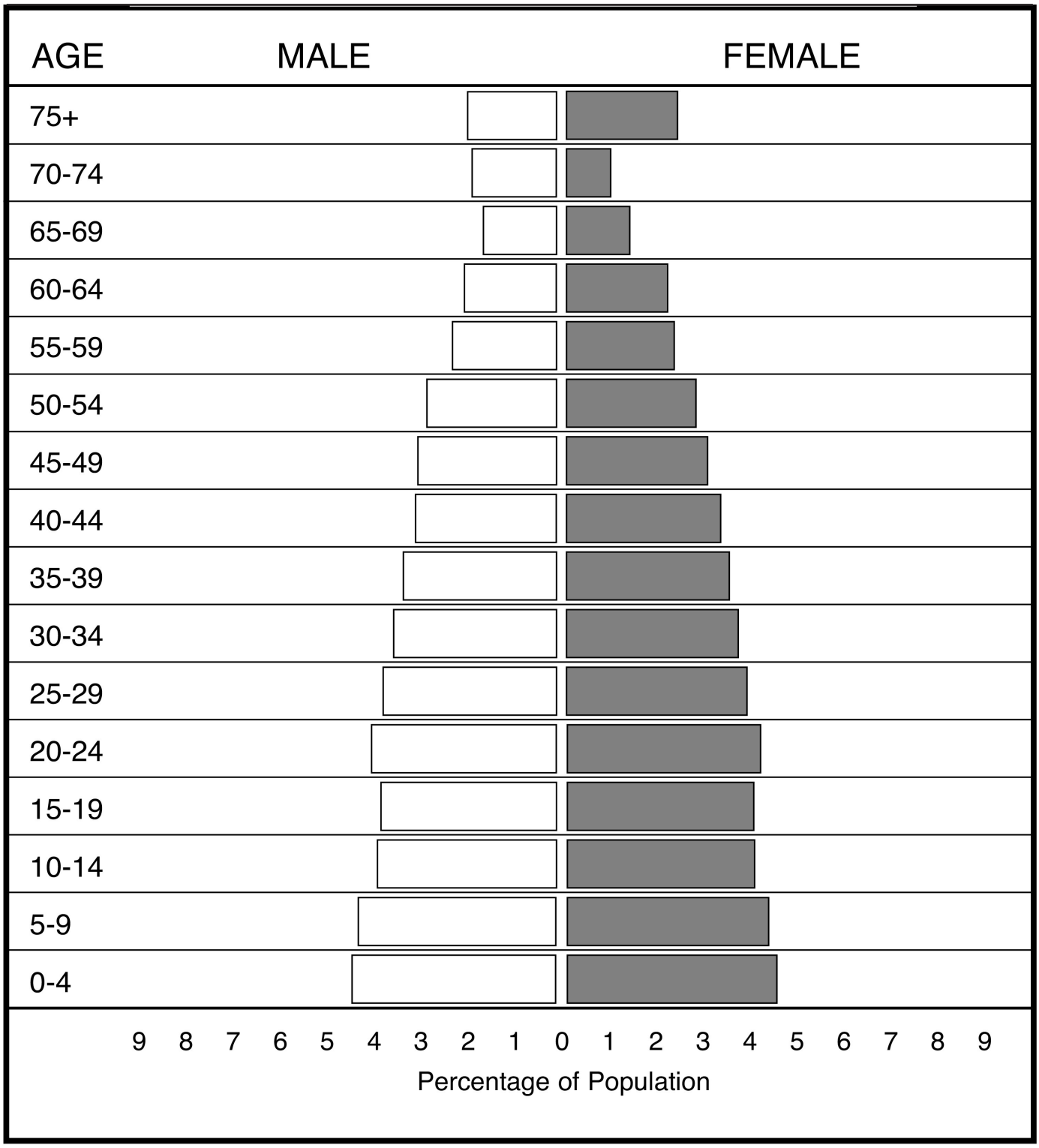
younger population (the largest percentage of both countries' populations are approaching retirement age). Knowing this will help them plan for the future in terms of social programs, retirement systems, and medical care.

8. Thinking about the future, how might each country's pyramids change by the year 2050 if current population trends continue? How would this change be represented on the World Population Map?
   If current population trends continue, Japan and Italy's population will remain the same, or decrease very slightly, and so their population pyramids would remain rectangular; they may lose squares on the World Population Map. Nigeria and Uganda will see dramatic increases in their populations; their pyramids will remain triangular in shape and they will gain squares on the map. Pakistan and India will also see an increase in their population – not as quickly as Nigeria and Uganda – but a significant increase nonetheless. Their population pyramids will retain the triangle shape at the top but the base of the pyramids will start to come in and look rectangular. They will add significant squares on the World Population Map. The US, China, Brazil, and Indonesia will all continue to increase but much slower than Nigeria or Uganda; their pyramids won't change shape and they will gain a few squares on the map.

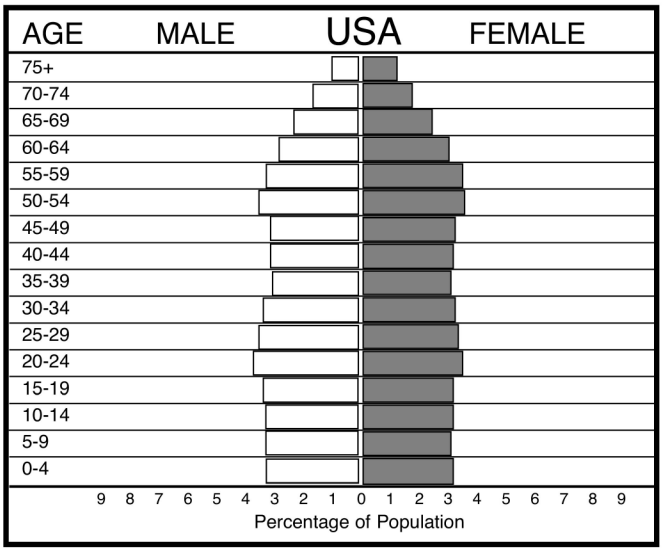
Measuring Learning:

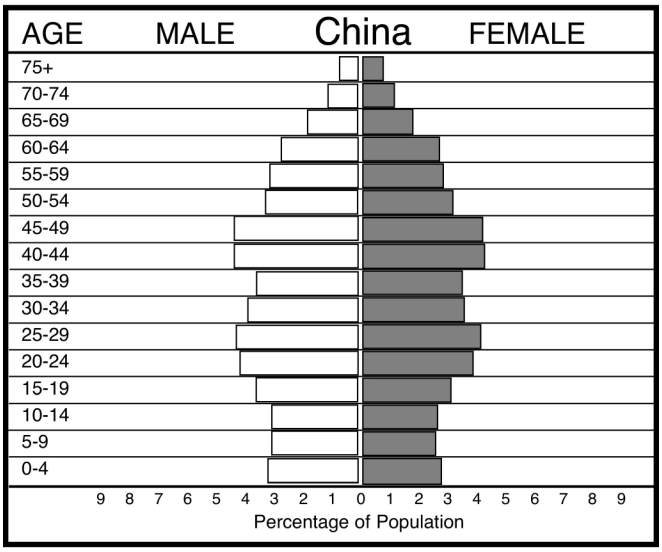
Population pyramids can be accessed and printed from the "Pyramids" section of the International Data Base at the US Census Bureau website. Have students visit the website and print off the 2014 population pyramid for Mexico. Looking at the pyramid, have students write a paragraph explaining what the pyramid shows, what sort of population growth pattern they expect to see the future, and what sort of concerns the government might have based on the population information.

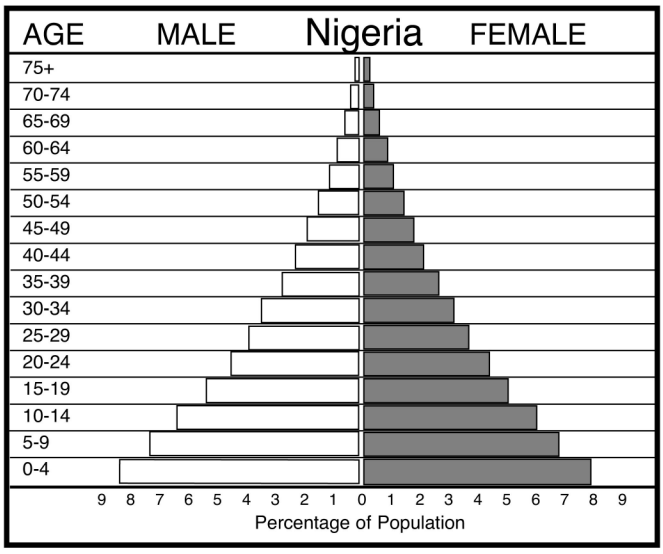
World Population Pyramid

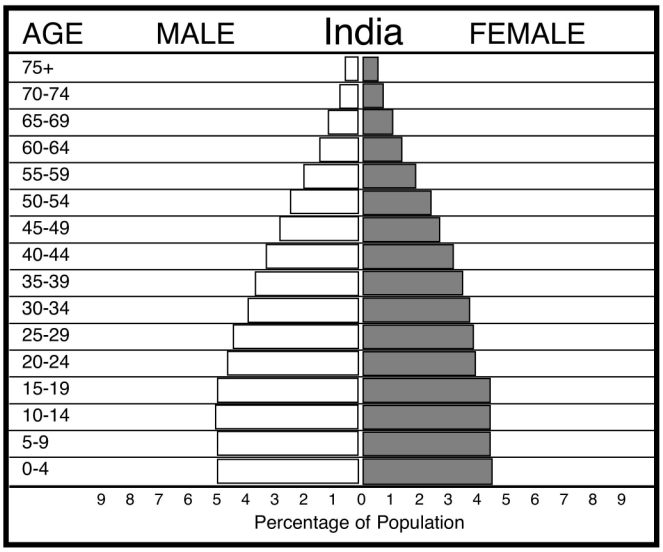


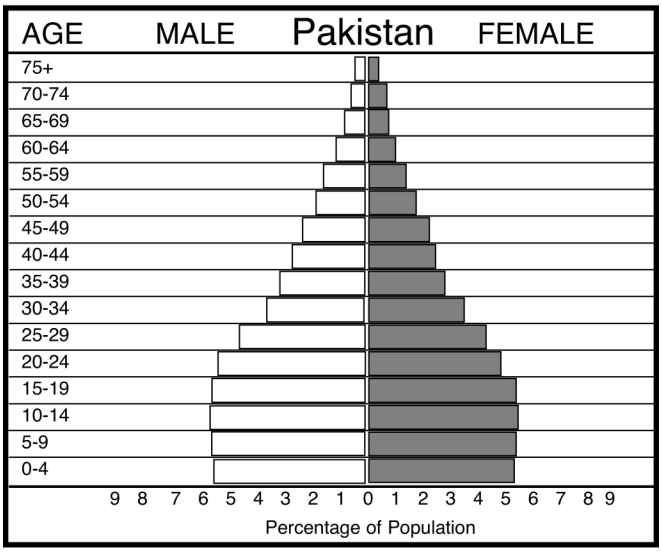
Population Pyramid Worksheet



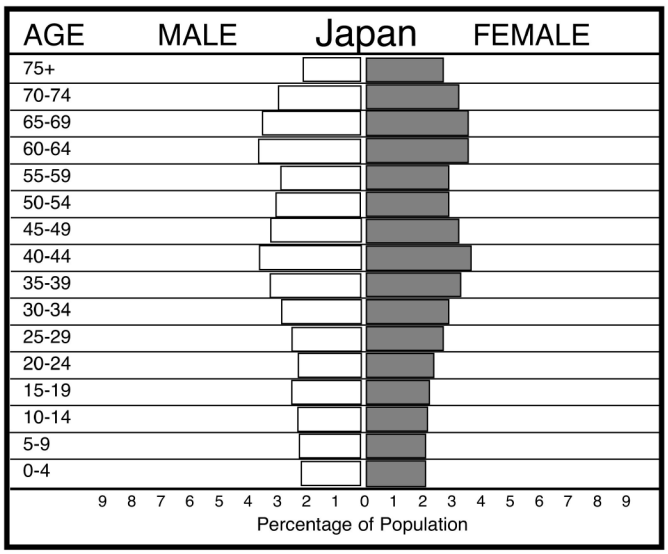


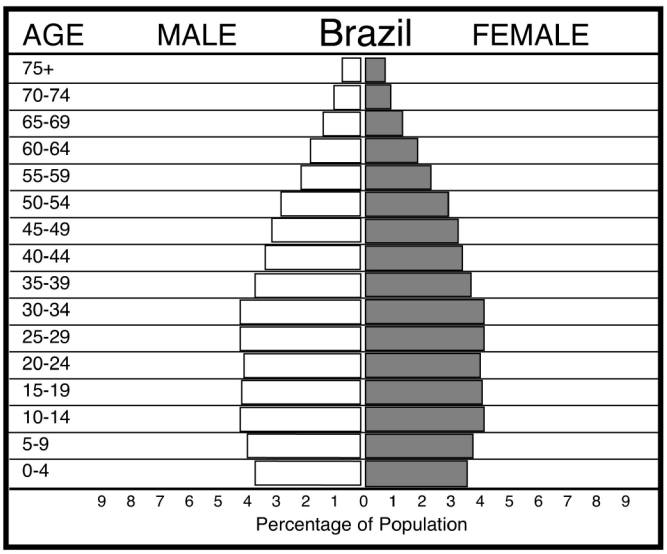


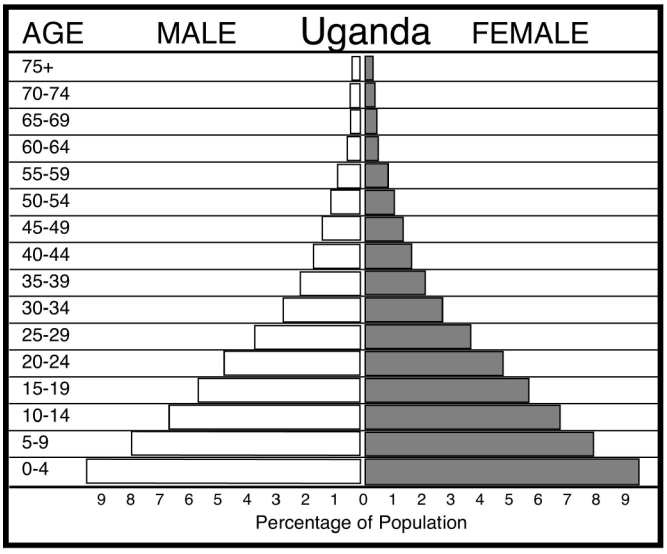


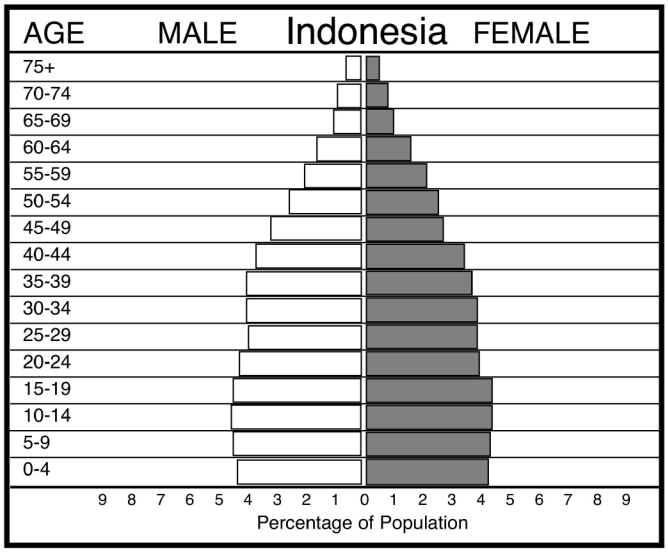


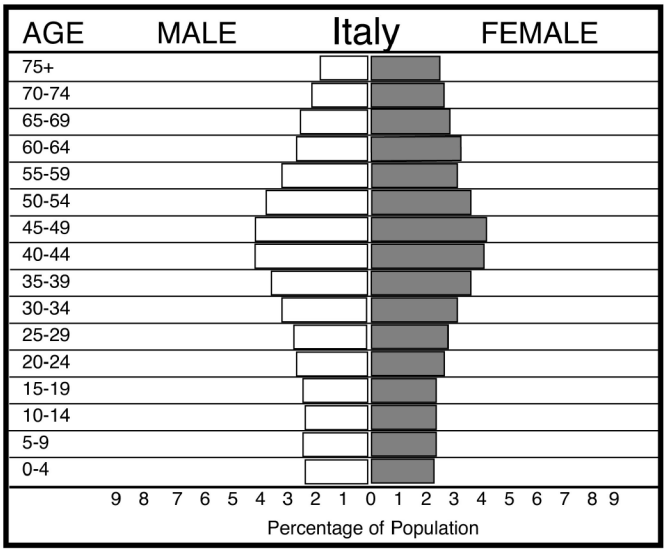
Population Pyramid Worksheet



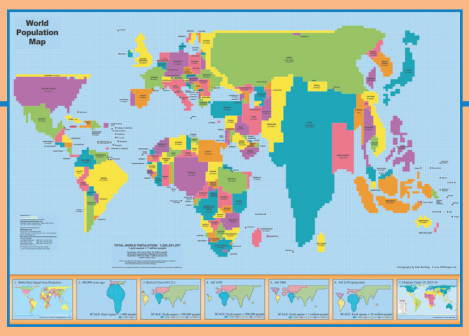








Land Use Squared



World Population Map Activity Guide

Introduction:

The World Population Map, a **population cartogram**, provides a snapshot of human population for the year 2015 while a conventional land area map shows the relative size of the earth's land masses. These two pieces of information, population and land area, can be useful to explore alone. But when the population cartogram and land area map are explored together, they tell us much more.

Consider that not all land is created equal. Some land is **arable** and will grow crops while other land will not. Some land is tree-covered, some is developed with houses, stores and malls, and some is used for a country's infrastructure. As the population continues to grow, how people use and interact with the land changes. Where people live changes as well; **urbanization** is on the rise, resulting in more people living in cities and **megacities**. These factors are related and will be explored in this activity as students analyze individual countries' land use and urban populations.

Materials:

World Population Map
Equal area map
Student Worksheet
Cross section graph paper (10 x 10 squares per inch)
PowerPoint presentation of data (click here)

Procedure:

1. Display the Population World Map alongside a conventional land area map and give students time to study each. Then discuss the following:
   a. Which countries are prominently featured on one map but not the other?
   b. What is the significance of this? Why is your observation important?
   A country's size does not determine its population. A country with a large land area can have a small number of people and a country with a small land area can have a large number of people.
   c. When a country is prominently featured on the population map, but not the land map, what might that mean? And vice versa?
   A prominent country on the population map, but not the land map: Answers might include: large population, small land mass, higher population density, less land for farming, more/larger cities. Example: Pakistan is the sixth most populous country in the world but is not a large land area. It is densely populated with 596 people per square mile.
   A prominent country on the land map, but not the population map: Answers might include: large amount of land, fewer people, less dense population, more land for farming, fewer/smaller cities.

Concept:

How land is utilized within a country depends on the types of land available, where people are located, and the demographics of the country.

Objectives:

Students will be able to:

- Demonstrate correct application of data from a population cartogram and a land area map simultaneously.
- Create visual displays of land and population data.
- Analyze a country's land use based on current data and share this information in class discussions.
- Summarize and communicate the interconnections between population growth and various land types.
- Write about potential future land challenges based on current trends.

Skills:

Mapping skills, converting between scales, calculating percentages and ratios, organizing and analyzing numerical data, research, argumentative writing

Method:

Students compare the World Population Map with an equal area map to calculate statistics related to arable land, megacities, and urban population.

Example: Canada is ranked only 37th in population size but has more than 11 times the land area of Pakistan. Canada is much less dense with roughly 10 people per square mile.

2. Divide the class into groups of 2-3 students and assign each group a country from [slide 1]. Distribute graph paper and the Student Worksheet to each student – each individual will need a copy of their country's data for the homework assignment.
3. Have each group find their country on both the land map and the World Population Map. Ask them to note, along with the country's name, its population and the total number of population grid squares at the top of their worksheet.
4. Project [slide 2], Total Land, for the class to see and explain that a hectare is 10,000 square meters or 2.47 acres. (Most city blocks are 2.2 to 2.5 acres or roughly one hectare.) As a class, convert the actual land area of each country on the list into the appropriate number of land squares using the scale: 1 million hectares = 1 land square. Fill in the PowerPoint slide with the answers and have students record the information for their country in Section A on their worksheet.
5. Facilitate the activity.
6. For assessment, assign the homework found on the Student Worksheet. Before the students leave class, project [slide 11] so students can note their country's 2050 population projection.

Facilitating the Activity:

For each of the sections that follow – Total Land, Population:Land ratio, Arable Land, Population:Arable Land ratio, Change in Total Population, Change in Urban Population, Megacities – use this basic procedure:

1. Have each group complete the section on their worksheet using their country-specific data – this could include calculations and/or drawing a diagram. Each group will be responsible for submitting their answer for use in the class discussion.
2. When all groups have found the appropriate information, come together for class discussion. When instructed to list the countries in a particular order, have the students create a visual "human list." A student from each group will write the country's name on a piece of paper and stand in a line at the front of the class to represent that country's place in the appropriate order.
3. Display the corresponding slide from the PowerPoint presentation. (Note: Each new slide will display the new list alongside the previous lists so students can see how the order has changed.)
4. Go over the Discussion Questions.

LAND USE

A. Total Land by Area – List the countries from largest land area to smallest land area. Project [slide 3].

Discussion Questions:

1. What do you notice about where your country is on the list? Do you think your placement is good or bad?
2. Are there benefits to having a large land area? Benefits of having a small land area?

B. Population:Land ratio – Using the standardized ratio of 1 population square:x land squares, list the countries from most land per person to least land per person. Project [slide 4].

Discussion Questions:

1. How has the order of countries changed?
2. What do you notice about where your country is on the list? Do you think your placement is good or bad?

3. What does it mean for a country to have a large population to land ratio (a lot of land per person)?
4. Which three countries have the most land per person?
   Australia, Botswana, Canada

   4a. Are these three countries similar in other ways?
   They all have a small total population.

   4b. Dissimilar?
   The countries are located in different geographic regions, have different climates, different cultures, different land composition, etc.
5. Not all land is created equal and people depend on their country's land for many things. List the various land types that might be found in a country.
   Answers might include: arable land/farm land, industrial areas, forests, prairie, cities/urban areas, oil fields, mountains, landfills, parks

   5a. Define arable land.
   Arable land – Farmland, land where crops are grown.[1]

C. Percentage of Arable Land – List the countries from highest percentage of arable land to lowest percentage of arable land. Project [slide 5].

Discussion Questions:

1. How has the order changed?
2. What do you notice about where your country is on the list? Do you think your placement is good or bad?
3. Why is it important for a country to have arable land?
   Answers might include: food production for people, food for livestock, vegetation for oxygen creation, vegetation soaks up CO_2
4. What are the benefits of having a large percentage of arable land?
5. Are there any downsides to having a large percentage of arable land?

D. Population:Arable Land ratio – List the countries from most arable land per person to least arable land per person. Project [slide 6].

Discussion Questions:

1. How has the order changed?
2. What do you notice about where your country is on the list? Do you think your placement is good or bad?
3. How would a high or low population to arable land ratio impact a country?
   High ratio: more food grown per person, food security independence, can export food stuffs for profit
   Low ratio: import more food stuffs, more fertilizer/pesticide use, more conflict over food, more aid needed, increased hunger/malnutrition
4. What factors could change this ratio?
   Changes could result from an increase/decrease in population or an increase/decrease in total arable land.
5. What does this ratio not tell us about the food situation in a country?
   The ratio doesn't relay how food is distributed among the people, who has access to food, how much food is wasted, what kinds of crops are grown and for what purpose, etc.

6. The lowest authoritative estimate of the minimum amount of arable land required to feed one person without intensive use of synthetic fertilizers is 0.17 acres (not including crops for textiles or cash crops neededfor income).[2] Some countries are below this minimum. What might this mean for the country and its residents?
   Answers might include: a need to import food from other countries, greater use of fertilizers and pesticides to increase productivity of the land, conflict over food, hunger and malnutrition

URBAN AREAS

E. Change in Total Population

i. List the countries in order from those with the most to the least people added from 1980 to 2015.

ii. Now list the countries in order from those with the largest percentage population increase to those with the least percentage increase. (To calculate: additional population squares/1980 population squares = percentage increase in population)

iii. Project [slide 7].

Discussion Questions:

1. How many countries increased their population between 1980 and 2015?
   All of the countries except Russia increased in population between 1980 and 2015.
2. Is it possible to determine this increase from the World Population Map?
   No. The cartogram only provides a snapshot in time.

F. Change in Urban Percentage – List the countries from those with the largest difference in urban percentage (1980-2015) to those with the smallest difference in urban percentage. Project [slide 8]. (To calculate: "percentage living in urban areas (2015)" – "percentage living in urban areas (1980)" = change in urban percentage)

Discussion Questions:

1. How many countries increased the percentage of their population living in urban areas between 1980 and 2015?
   All of the countries' percentage of urban population increased except for Singapore, where it stayed the same at 100%.
2. Have populations become more urban or less urban? What drove the change?
   Over time, populations have become more urban and in 2010, we reached the point where globally more people were living in urban areas than rural. This shift, referred to as urbanization*, often happens as countries industrialize and move away from agrarian and/or subsistence ways of life. Cities with proper infrastructure can provide access to health care, education, and opportunities.*
3. With the exception of Japan and Singapore, less developed countries saw a larger increase in their urban population while more developed countries saw less of an increase. Why might this be?
   More developed countries saw their populations migrate to cities prior to 1980. The rural to urban shift took place earlier in history and therefore they already had a high urban percentage in 1980. In regards to Japan, by 1980 almost two-thirds of the Japanese population was living in urban areas – that's a higher urban percentage than some less developed countries have today. So even though Japan saw a large increase in the urban percentage, they went from a high percentage to a very high percentage where almost the entire population is living in urban areas.
   Less developed countries experienced the rural to urban shift more recently and thus have a larger increase. These are also the countries that are seeing a high population increase in general. In regards to Singapore, it is a small island nation and has the smallest land area of the countries profiled with just 70,000 hectares or 0.07 land squares. By 1980, Singapore's population to land ratio was such that 100% of the people were already living in cities.

G. Megacities – Project the list of megacities [slide 9 and slide 10] for the class.

i. What countries had megacities in 1980? Ask those country representatives to stand.
Japan – Tokyo, US – New York, Brazil – Sao Paulo

ii. What countries will have megacities in 2015? Ask those country representatives to stand and share with the class how many megacities are in their country.
China: 6, India: 3, Japan: 2, Brazil: 2, US: 2, Nigeria: 1, Russia: 1, Indonesia: 1

Discussion Questions:

1. What are potential disadvantages of megacities?
If an urban area grows too fast, the systems necessary to support the population cannot keep up. If no infrastructure for education, health care, employment, etc., is in place, these areas are at high risk for poverty and instability. Several megacities have developed urban slums because services couldn't keep up with population growth. These cities experience high economic disparities among the "haves" and "have nots." Crowding can have negative environmental impacts such as higher pollution concentrations, smog, overwhelmed sanitation systems and public health risks.

2. What are potential advantages of megacities?
*Because **population density** is higher, open rural spaces can be preserved for things such as wildlife habitat, agriculture, forests, etc. City dwellers might have a smaller environmental footprint – people use public transportation or walk, people live in smaller homes, apartment-type buildings use less energy and materials. If a city can prepare for their projected growth – by strategically planning the infrastructure and using sustainable urban design – they may be able to economically prosper as a result.*

3. China's six current megacities all surpassed 10 million people within the last 25 years and it now has the most megacities of any country. Do either of these facts surprise you? Evaluate and explain.
China's population in 1980 was just under one billion people. At that time the cities in question were already on the map, just with a smaller population size. Over the past 25 years, China's population has grown 39% (not a huge increase compared to some of the other countries) but the percentage of people living in urban areas increased from 20% to over 50%. The rural to urban shift in China is the largest among the countries profiled.

Measuring Learning:

Have the students complete the homework listed on the Student Worksheet. Through the writing assignment, gauge their understanding.

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[1] Full definition of Arable Land – The land under temporary crops (multiple-cropped areas are counted only once), temporary meadows, land under market and kitchen gardens and land that is temporarily (less than five years) fallow. From the Food and Agriculture Organization of the United Nations. www.fao.org

[2] Engelman, Robert, and Pamela LeRoy. Conserving Land: Population and Sustainable Food Production. Population Action International, Washington, DC, 1995. p. 9.

Name:_____ Date:_____

Student Worksheet

My country: _____

Population: _____

Total Population Grid Squares: _____

LAND USE

A. Total Land by Area

Record your country's total land area in hectares: _____

Record your country's total number of land squares: _____

B. Population:Land ratio

On graph paper, draw a diagram to represent the land area of your country using the scale: 1 square = 1 million hectares.

Using the World Population Map, find the ratio of people to land for your country: _____ population squares:_____ land squares

Reduce the ratio to one population square and calculate the number of land squares: 1 population square:_____ land squares

C. Arable Land

Compare your country's total land to the amount of arable land by shading the appropriate number of squares on the land diagram to represent the amount of arable land in your country.

Country	Arable Land Squares (1 square = 1 million hectares)
Australia	48
Botswana	0.3
Brazil	79
Canada	48
China	126
Germany	12
India	170
Indonesia	43
Japan	5
Nigeria	39
Russia	123
Singapore	0.0007
United States	163

Calculate the percentage of arable land in your country. _____ %

D. Population:Arable Land ratio

Now compare population to arable land. What is the ratio of people to arable land for your country? Complete the ratio: 1 population square:_____arable land square. (Hint: first find the ratio of "total population squares:total arable land squares." Then reduce the ratio.)

URBAN AREAS

E. Change in Total Population

Draw population diagrams representing your country's population in the year 1980 (using the data from the chart below) and 2015 (using the World Population Map).

i. Number of additional population squares from 1980 to 2015: _____

ii. Percentage change: _____

Country	1980 Population (in millions)	Percentage living in urban areas (1980)	Percentage living in urban areas (2015)
Australia	14.7	85%	89%
Botswana	1.0	17%	57%
Brazil	121.7	67%	85%
Canada	24.6	75%	82%
China	981.2	20%	54%
Germany	78.3	73%	75%
India	699.0	23%	32%
Indonesia	145.5	23%	53%
Japan	116.8	60%	93%
Nigeria	73.7	25%	47%
Russia	139.0	70%	74%
Singapore	2.4	100%	100%
United States	227.2	75%	81%

F. Change in Urban Percentage

For both population diagrams, use the data above to calculate how much of your country's population lived/lives in urban areas and then determine the number of 'urban population squares.' Shade the appropriate number of squares on each diagram.

1980 Urban Population Squares: _____ % living in urban areas _____

2015 Urban Population Squares: _____ % living in urban areas _____

By how many percentage points has the urban population changed between 1980 and 2015? _____

G. Megacities

Megacities are characterized by a population of 10 million or greater. Under the 1980 and 2015 population diagrams, list any megacities within your country and note their populations.

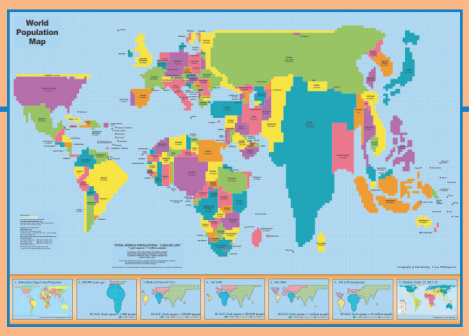
HOMEWORK

My country's projected 2050 population: _____

Draw a population diagram using the projected population for 2050. Write a 1-2 page paper that answers the following questions:

1. How are your assigned country's current population growth, arable land, urban population, and megacities interrelated?
2. How is your country similar or different from the other countries studied?
3. Consider what you've learned about your country's land use and do additional research to hypothesize answers to the following questions:
    a. What environmental and social challenges might my country face in the year 2050?
    b. What changes might my country need to make in order to deal with those challenges? Consider: imports/exports, labor force, infrastructure (roads, schools, hospitals, etc.), and others.

Development in Motion



World Population Map Activity Guide

Introduction:

The World Population Map presents the relative population size of all the countries in the world. But population size, alone, does not shape a country's demographics. Exploring other data that relates to population, such as economics, family size and health, provides a more complete picture of countries' well-being. This activity will utilize the interactive website, www.gapminder.com, to show statistics in a dynamic display with the intention of highlighting different development trends around the world.

Materials:

Student Worksheet
Computer with Internet and Adobe Flash software (available free at www.adobe.com)

Explaining the Trendalyzer

Demonstrate how the trendalyzer software works.

1. At www.gapminder.org, click on the *Gapminder World* tab to load the software. Project the site onto a screen for the class to see.
2. Explain to the students that each bubble on the graph represents a country and the bubble's size indicates its relative population (just like on the World Population Map). The color of the country bubble corresponds to its geographic region (see world map in upper right corner).
3. Explain to the students that the bubbles will move over a 200-year time period. Animation speed can be controlled with the button located to the right of the play button. The x- and y-axes can be changed to compare various statistics by clicking on the axes' title and selecting from the drop-down menu.

Part 1: Wealth and Health of Nations – Teacher Demonstration Procedure:

1. When the trendalyzer program first opens, the graph for *Wealth and Health of Nations* is initially displayed. Press "Play" on the graph to show the students the comparison of **life expectancy** vs. income in different countries. On this graph, many countries had a low life expectancy and low incomes in 1800 but end with a much higher life expectancy and higher income by 2012.
2. Replay the graph and ask the students what they think is happening to certain geographical regions at different points in history. You can pause the graph to focus on specific historical events (ex: World War I – 1914-1918; Influenza epidemic of 1918; World War II – 1939-1945) and scroll over color-coded regions at the top right to highlight them.

Concept:

Graphic representations of world statistical trends can help illustrate changes in quality of life around the globe and connections among quality of life indicators.

Objectives:

Students will be able to:

- Construct and interpret dynamic graphs using current data and the trendalyzer software.
- Identify factors that impact family size around the world.
- In writing, summarize connections between multiple quality of life indicators for low, middle, and high income countries.

Skills:

Graphing, analyzing graphic data, critical thinking, making inferences, using evidence to develop claims, communicating conclusions

Method:

Using the trendalyzer software from www.gapminder.org, students construct and interpret dynamic graphs and discuss differences in life expectancy, fertility rates, economics, and total population among several different countries.

Discussion Questions:

1. What bubbles surprised you with their movement?

2. Why did the bubbles moved towards a higher income and life expectancy as time passed? How are these two indicators related? Does one naturally lead to the other?
   As societies prosper, money can be allocated to improving people's living conditions (better sanitation, food production, education, transportation infrastructure, healthcare, etc.), which ultimately affects health and life expectancy. Higher life expectancy, in turn, can create a more prosperous society. For example, in areas where child survival rates are highest, parents are more confident of their families' well-being and tend to have smaller families, leaving more money for education and health care.

3. Which countries had consistently high incomes? (*European and North American countries*) Which had consistently low incomes? (*Sub-Saharan African countries*)

4. Has life expectancy in Sub-Saharan African countries increased?
   Yes, but they still have a relatively lower life expectancy compared to other countries.

Part 2: Family Size – Independent Practice

Procedure:

1. Now that students have some familiarity with the trendalyzer program, distribute the Student Worksheet and have them complete the first section, Family Size Matters. They will need to make the data selections and answer questions to solidify their understanding of how family size varies among countries and how it relates to development indicators.
2. Once the Family Size Matters section is completed, go over the answers as a class.

Student Worksheet Answers:
Part 2 - "Family Size Matters"

1. *4-8*
2. *1-7.6*
3. *Sub-Saharan Africa, Europe, Central Asia, Americas*
4. *China, India, US, Indonesia, Brazil, Russia, Bangladesh, Pakistan, Nigeria*
5. *In 1800, China and India already had larger population totals than the other countries. Combining high total population with high fertility until the 1970s led to very high populations of over one billion each.*
6. *Over the past 40 years, Mexico's **total fertility rate** (TFR) has dropped considerably from 6.8 to 2.2, while Guatemala's has only dropped to 3.8. The Mexican government used successful social marketing campaigns over those years to encourage smaller families, while also making contraceptives widely available. In comparing South Africa (TFR 2.4) and Niger (TFR 7.6) today, it is useful to see the difference in per capita GDP ($9,657 vs. $707).*
7. *Answers might include: age at first marriage for women, education level and literacy, infant mortality rates, life expectancy, health, urbanization, poverty, and agricultural work as percentage of labor force*

Part 3: You Choose – Extension and Assessment

With the trendalyzer's large and expanding database, there are innumerable ways students can examine relationships between different data sets and trace the progress of different countries over time.

Procedure:

1. Have students complete the "You Choose" assignment on the Student Worksheet in which they track the progress of three countries they select from different income levels. Students should use the chart on the worksheet to help them organize their data.

2. After data is collected for their three countries, each student will write a summary of the connections they discovered. The summaries should be written in paragraph form on a separate piece of paper.

Measuring Learning:

Review the Student Worksheet and written paragraphs to gauge student success in:

a. using the trendalyzer software and interpreting dynamic graphs.

b. determining indicators that influence family size.

c. making connections between quality of life indicators for low, middle, and high income countries.

Name:_____ Date:_____

Student Worksheet

Family Size Matters

Go to www.gapminder.org and load *Gapminder World*. Change the graph to compare the following two indicators: Population Total on the y-axis (*vertical*) and Children per Woman (total fertility) on the x-axis (*horizontal*). Play the graph. You may want to watch it several times to help you answer the questions below.

1. How many children do women worldwide have in the beginning of the animation, around 1800? (give a range) _____

2. How many children do women worldwide have at the end of the animation, around 2012? (give a range) _____

3. In which geographic region do women tend to have the most children? The fewest? _____
_____

4. Knowing that our population is over seven billion and growing, which countries are currently contributing the most population to this number? _____
_____

5. Why do China and India have such a high population in 2012 based on the two indicators chosen? _____
_____

6. Statistics can vary quite a bit among countries in the same world region. Set the graph up to compare these same two indicators – Population Total and Children per Woman – in pairs of countries in the same geographical region (Mexico and Guatemala; Niger and South Africa). What do you observe? Why might this be true?
_____
_____
_____
_____

7. What factors might determine how many children, on average, women have in different regions of the world? _____
_____
_____
_____

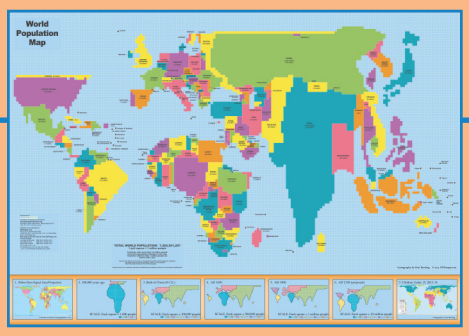
Can you find indicators in the data sets to test your hypotheses? If so, what are they and why do you think they influence family size?
_____
_____
_____
_____

You Choose

With the x-axis showing Income per Person, select three countries – one low income, one middle income, and one high income (ex: Burundi, Uruguay, and Denmark). Then select 5-10 indicators on which to track those countries' progress. The indicators can be as varied as cell phone use and forest cover to school enrollment and nutrition. Note your findings for each country in the chart and then write a summary, in paragraph form, of the connections you see between indicators.

Indicator	**Country:** _____	**Country:** _____	**Country:** _____

Life by the Numbers



World Population Map Activity Guide

Introduction:

Looking at the World Population Map, we see the population size of every country. What the map doesn't reveal, however, is what life is actually like for the people within these countries. What is the status of health care? How many of those people are literate? Is the environment able to support the lifestyles of the population?

The countries in each region of the world differ greatly in their demographic, environmental, and social challenges. In this activity, pairs of students find data on a world region, determine the impacts of population growth patterns, and then brainstorm an initiative that would positively impact their region. Presenting on their findings gives students valuable communication skills and also allows the class to compare and contrast differences among world regions.

Materials:

Student Worksheet
Computer with internet access

Procedure:

1. Divide students into pairs and assign each group a region to research. Selections should be made from the sub-regions listed by the Population Reference Bureau (PRB) – for example, Eastern Europe, Western Africa, Central America, Southeast Asia, etc. A full list of the sub-regions, as well as the countries within them, can be found on the PRB data sheet.
2. Pass out the Student Worksheet and explain that students will be using internet sources to find selected data on their region.
3. To find regional data, students can look on the PRB website or the International section of the US Census Bureau website. **To find regional totals for indicators not listed on either site, students will have to calculate per capita data for every country in their region, and then find an average. Students must refer to the Population Reference Bureau to determine which countries are within their region.** Some good sources for finding country specific data are listed on the Student Worksheet.
4. As they collect data, there will be questions to "consider" along the way that they must answer. They will use these answers to draw conclusions on the two larger Guiding Questions at the top of the worksheet.
5. After researching, students must formulate answers to the Guiding Questions and present their conclusions to the class. Allow students flexibility in how to they present their information – the goal is to communicate clearly. Ideas on presentation options could include a PowerPoint, poster, Glog, video, oral report, newscast, etc.

Concept:

Each world region is faced with unique demographic, environmental and social challenges and there are large inequities in quality of life and consumption habits between regions.

Objectives:

Students will be able to:

- Gather and evaluate data to determine how population growth patterns are impacting the well-being of world regions.
- Determine what statistical data is best used to explore a region's quality of life and environmental health.
- Organize key findings and communicate their conclusions to classmates.
- Take part in discussion that compares and assesses the differences between regions in terms of population, society, environment, and global economics.

Skills:

Gathering and evaluating data, calculating averages, using evidence to develop claims, communicating conclusions

Method:

Working in pairs, students research a world region to find demographic, social, environmental, and economic data, then present findings to the class.

6. Allow students plenty of time to conduct their research and develop their presentations.
7. As student groups present, discuss differences between regions in terms of population, society, environment, and global economics.

Note to the Teacher:
For several categories of research, students have freedom to decide which indicators to include. Common indicators used to assess quality of life include: literacy rates/education levels, GDP, fertility rate, infant mortality rate, life expectancy, access to improved sanitation, number of nurses/midwives per 1,000 people, access to electricity, etc. Common indicators to determine environmental health include: emissions per capita, forested land area, number of threatened wildlife species, water pollution, percentage of protected areas, etc.

Measuring Learning:

Use the included rubric to assess students' ability to gather, analyze, and report on the indicated data for their world region. You may want to provide the rubric to students in advance so that they know how their presentation will be scored. Monitor class discussion to determine if students are making accurate comparisons between world regions.

Scoring Rubric for Class Presentation

	1	2	3	4
Guiding Questions	The Guiding Questions are not answered.	The Guiding Questions are addressed but only partially answered.	The Guiding Questions are answered but the answers lack detail and need to be developed further.	The Guiding Questions are fully answered and the answers clearly address the appropriate "consider" questions.
Gathering Data	Answers to the Guiding Questions are not supported by data or weak sources are used.	Answers to the Guiding Questions are partially supported by data and some weak sources are used.	Answers to the Guiding Questions are fully supported by data but some weak sources are used.	Answers to the Guiding Questions are fully supported by sound data from strong sources.
Choosing and Justifying Indicators (for Quality of Life and Environment sections)	Inappropriate indicators are chosen and no justification given.	Some inappropriate indicators are chosen and with only moderate justification.	Informative indicators are chosen but only with moderate justification.	Informative indicators are chosen and strongly justified.
Evaluating Data	Data is not evaluated to reach conclusions.	Data is evaluated but the conclusions are incorrect.	Data is evaluated but weak in some areas and doesn't always inform conclusions.	Data is correctly evaluated to inform conclusions.
Information Organization and Clarity of Communication	The information is disorganized and the presentation was confusing.	The information is mostly organized but the class presentation was hard to follow.	The information is organized and most parts of the class presentation were easy to follow.	The information is well organized and the presenters were clear in their delivery to the class.

Name:_____ Date:_____

Student Worksheet

Through internet research, you must answer the Guiding Questions below for your assigned world region. Carefully read each of the Guiding Questions before beginning your research. Within each of the sections – Demographics, Quality of Life, Environment, and Global Economics – gather information in the FIND category, and then answer the CONSIDER questions. You must use this information to answer the Guiding Questions and then present your findings to the class. Your presentation can be done in whatever format you choose: PowerPoint, a poster, Glog, video, oral report, newscast, etc. Happy researching!

Research Sources

For Regional-Level Data:

Population Reference Bureau – www.prb.org/DataFinder.aspx

International section of the U.S. Census Bureau – www.census.gov/population/international

For Country-Level Data:

World Bank – data.worldbank.org

UN Statistics Division Country Profiles – http://data.un.org/CountryProfile.aspx

CIA World Factbook – www.cia.gov/library/publications/the-world-factbook

World Wildlife Fund's Ecological Footprint Index – wwf.panda.org/about_our_earth/all_publications/living_planet_report/living_planet_report_graphics/footprint_interactive

Guiding Questions

1. What effects, if any, do population size and growth have on the well-being of your region and its people in terms of quality of life, environment, and global economics? Use the data to support your claim.
2. Consider the future of your region. What do you predict the major issues will be in 2050? Choose one issue that you think will be most important to your region's well-being. What initiative/s would you implement to alleviate this issue?

Demographics

FIND: Total Population, Population Growth Rate, Total Fertility Rate (births per woman), 2050 Population Projection

CONSIDER: Are all countries in your region experiencing the same growth? What connections can you find between these numbers? Explain.

Quality of Life

FIND: At least five pieces of data that you think best determine the quality of life within a region. Your data could include indicators related to education, wealth, health, communications, technology, access to resources like water and sanitary living conditions, etc. In your class presentation, you will need to justify why you chose these indicators.

CONSIDER: How do you think population trends might impact quality of life in your region? How might these indicators affect the daily life of someone living in your region? What do you predict will happen to these numbers in 2050 and why? Is there a country in this region that is skewing the data? Explain.

Environment

FIND: At least five pieces of data that you think best identify the environmental health of your region. Your data could include indicators related to forest coverage, carbon emissions, solid waste generation, water pollution, renewable energy use, health of plant and animal species, etc. In your class presentation, you will need to justify why you chose these indicators.

CONSIDER: How do you think population growth patterns are impacting these indicators? How would you predict the future environmental health of your region? What effects might the environmental health of your region have on its neighbors and with what consequences? Explain.

Global Economics

FIND: Net ODA (Official Development Assistance) Received per Capita, Net Migration, Amount of Imports (total US dollars), Amount of Exports (total US dollars)

CONSIDER: How do you think the indicators from other categories impact these numbers? How do you think your regional economy compares with other regions? Is there a country in your region that is skewing the data? Explain.