

# FOOD FOR THOUGHT

Food for Thought is a spatial graphing activity that uses the participants as part of the graph. The activity helps students develop a feeling for the similarities and differences between populations. Many measures are used for comparison including population, population density, population growth rates, energy consumption, CO<sub>2</sub> emissions, and more.

<b>Grade Level:</b>	Middle to high school
<b>Time Required:</b>	Two 45-minute class periods
<b>Standards Addressed:</b>	The geographically informed person knows and understands how to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective; the physical and human characteristics of places; and the characteristics, distribution, and migration of human populations on Earth's surface.
<b>Vocabulary:</b>	Population density, total fertility rate, infant mortality rate, rate of natural population increase, domesticated land, urban, GNI per capita PPP*, energy consumption.  * Although usually referred to as GNI per capita in this lesson plan, the provided data is converted to "international" dollars using a purchasing power parity (PPP) conversion factor. International dollars indicate the amount of goods and services one could buy in the United States with a given amount of money.
<b>Objectives:</b>	As a result of completing this learning activity, students will: <ul style="list-style-type: none"><li>• Develop an improved mental map of the population characteristics of six major regions of the world,</li><li>• Understand and properly use population-related vocabulary,</li><li>• Create two- and three-dimensional graphs,</li><li>• Analyze population related geographic information, and</li><li>• Formulate and answer population-related geographic questions.</li></ul>
<b>Materials Needed:</b>	See the set up information table for quantities on the next page. <ul style="list-style-type: none"><li>• Six colors of yarn</li><li>• Masking tape</li><li>• Ambassador cards (see below)</li><li>• 6 signs with names of regions: North America, Latin America, Africa, Europe (including Russia), Asia (excluding China), and China</li><li>• 3x5 card showing the task for the advisory board</li><li>• Peanuts (to show calorie consumption per person per day; 1 peanut = 400 calories)</li><li>• Chocolate kisses (to show GNI per region; 1 kiss = \$1,000)</li><li>• "Red Hots" or "Atomic fire balls" (to show energy consumption; 1 candy = 500Kg of oil equivalent consumed per capita)</li><li>• Paper plates and/or plastic bags to hold the peanuts and candy for each region</li><li>• Black balloons (to show CO<sub>2</sub> emissions per capita, metric tons; 1 balloon = 1 metric ton), string, rubber bands</li><li>• Clear cups of water (to show percentage of people who have access to safe drinking water; clear water for safe water, colored water for unsafe) or use construction paper in the shape of glasses (with blue for safe and brown for unsafe water)</li><li>• Outline maps of the world and graph paper for students to graph information presented in the demonstration or laminated world maps and poker chips to be used to create three-dimensional graphs of the data.</li></ul>

## Set up Information Table

Region	Class Size	# Students	Gross National Income (GNI)	Calories		Energy	CO <sup>2</sup> Emissions	Drinking Water	
			# Kisses	# Peanuts	# Fireballs	# Balloons	# Cups Safe	# Cups Unsafe	
			1=\$1,000	1=400	# Needed	500 Kg	1 = 1 metric ton		
North America	25	1	A bag of 41	9 each	9	A bag of 16	20	1	0
	30	1			9			1	0
	40	2			18			2	0
Latin America	25	2	A bag of 8	7 each	14	A bag of 2	3	1.8	0.2
	30	3			21			2.7	0.3
	40	3			21			2.7	0.3
Africa	25	3	A bag of 2	6 each	18	A bag of 1	1	2	1
	30	4			24			2.5	1.5
	40	5			30			3	2
Europe	25	3	A bag of 21	8 each	24	A bag of 7	8	3	0
	30	4			32			4	0
	40	5			40			5	0
Asia (excl. China)	25	10	A bag of 6	6 each	60	A bag of 2	2	8	2
	30	12			72			10	2
	40	16			96			13	3
China	25	6	A bag of 7	7 each	42	A bag of 2	3	4.6	1.4
	30	6			42			4.6	1.4
	40	9			63			7	2
Total Amount Needed	25	25	85	167 in 25 bags	30	37	21	6	
	30	30	85	200 in 30 bags	30	37	26	7	
	40	40	85	268 in 40 bags	30	37	33	8	

These quantities are based on the following data.

## Data Table

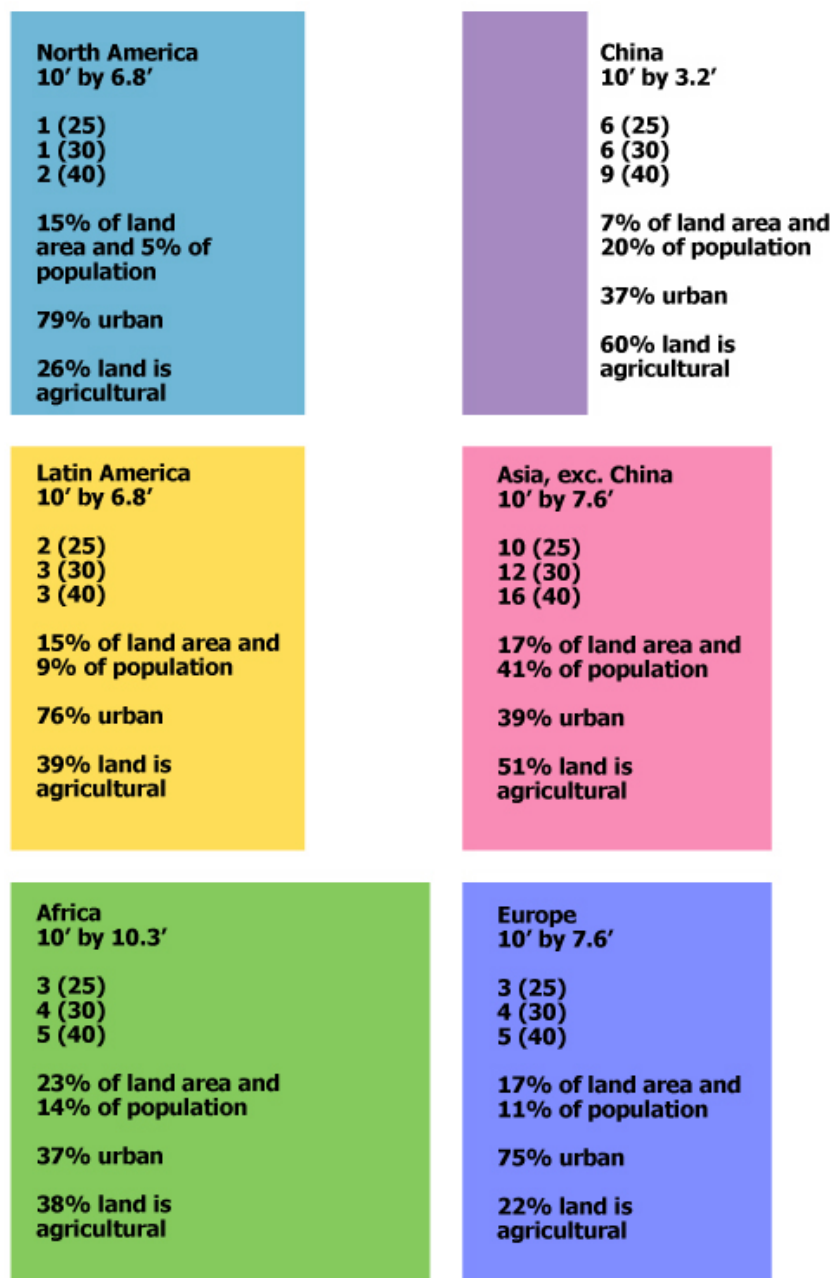
	North America	Latin America	Africa	Europe	Asia excl. China	China
<b>2006 Population (millions)</b>	332	566	924	732	2,657	1,311
<b>Natural Increase %</b>	0.6	1.5	2.3	-0.1	1.6	0.6
<b>% Total Population</b>	5	9	14	11	41	20
<b>Total Fertility Rate</b>	2	2.5	5.1	1.4	2.8	1.6
<b>Land Area, % of World Total</b>	15	15	23	17	17	7
<b>% Urban Population</b>	79	76	37	75	39	37
<b>Agricultural Land, % of Region</b>	26	39	38	22	51	60
<b>Gross National Income, \$/capita</b>	\$40,980	\$7,950	\$2,480	\$21,120	\$5,640	\$6,600
<b>Calories/person/day</b>	3,770	2,820	2,380	3,300	2,480	2,960
<b>Energy Consumption (Kg of oil equivalent/capita)</b>	7,946	1,159	692	3,614	1,017	960
<b>Pollution CO<sup>2</sup> Emission/capita (metric tons)</b>	20	3	1	8	2	3
<b>% Population w/Access to Safe Drinking Water</b>	100	90	63	100	71	77
<b>Infant Mortality Rate (/1000 births)</b>	7	36	84	7	54	27
<b>Est. Population in 2025 (millions)</b>	387	700	1355	717	3,263	1,476

The sources for this data table follow on the next page.

## Sources:

- *2006 World Population Data Sheet* (Population Reference Bureau, 2006): 2025 population, natural increase, 2006 population, total fertility rate, infant mortality rate, % urban, per capita GNI ppp, land area % of region, % total population.
- *2005 World Population Data Sheet* (Population Reference Bureau, 2005): energy consumption, % of population with access to safe drinking water.
- *The State of Food and Agriculture 2005* (Food and Agriculture Organization, 2005): % agricultural land, calories per person/day.
- *World Resources 2005: The Wealth of the Poor* (UNDP, UNEP, The World Bank, World Resources Institute): CO<sup>2</sup> emissions per capita.

## Floor Diagram



# The Lesson Activities

## Background:

This activity graphically illustrates different population characteristics for six major regions of the world: North America, Latin America, Africa, Europe (including Russia), Asia (excluding China), and China. For the demonstration, the teacher will need to purchase and prepare materials. To do the demonstration the class will need a large open floor space.

## Preparing for the Activity:

1. Measure or sort out the following:
  - a. The correct amount of peanuts per person representing calorie consumption for each region on paper plates or in plastic bags;
  - b. The correct amount of chocolate representing GNI per capita for each region;
  - c. The correct amount of fireballs (or other candy) representing energy consumption for the regions;
  - d. The number of balloons needed for each region based on the carbon dioxide emissions. You can have the students blow up the balloons during class or blow up the balloons ahead of time and tie together the balloons for each region; and
  - e. The correct number of glasses of safe and unsafe water for each region (or use construction paper in the shape of glasses with blue for safe and brown for unsafe water).
2. Arrange yarn in shapes on the floor in approximate proportion to the size of the region in relation to the rest of the world (see sample floor diagram on the previous page). Putting knots in the yarn at the corners of the rectangles will help you to maintain the proper size (changing the shape will change the area within the rectangle).
3. Mark off a portion with tape or yarn within the region that represents the "agricultural" and "nonagricultural" land in the country. After dividing the class into different regions, you will subdivide the people in each region into "agricultural" and "urban" areas (on the edge of the region).
4. Estimate the number of participants. The following script is designed to use a total of 25, 30, or 40 "citizens." Extra people can form a United Nations International Advisory Board. Ask these advisors to closely observe this lesson and to recommend at least three policies to help deal with the population/food/income/energy inequalities among regions.

## Script:

I'm going to show you a simulation called "Food for Thought" which will help you gain an appreciation for world population distribution among regions as well as urban/rural dwelling patterns, arable or farmable land, caloric consumption, wealth, and energy consumption. I need 6 volunteers to be ambassadors from these regions. (If no one volunteers, quickly appoint; give each ambassador an ambassador's card.)

Would the ambassadors please choose some citizens to populate their regions? The ambassador from North America will need to pick 1(25) 1(30) 2(40) citizens. (See set up information table for the correct number of citizens based on the number of participants. Please note, the ambassador might need to be counted as one of the citizens.) The ambassador from Latin America, 2(25) 3(30) 3(40) citizens; from Africa 3(25) 4(30) 5(40) citizens; from Europe 3(25) 4(30) 5(40) citizens; from China 6(25) 6(30) 9(40) citizens, all the rest of you will populate Asia, excluding China. (Give sign with name of region to ambassador. If you have more people than the simulation calls for, form a group to represent the UN International Advisory Board.)

Ambassadors, please tell us something about your regions by reading the cards you've been given. First let's hear from the North American ambassador. (Ask to hear from each ambassador. Then allow students to ask questions about what they have heard. If necessary, define terms and compare regions on some data.)

## Ambassador Cards

I am the North American ambassador, representing Canada and the United States, which contains 5% of the world's population and consumes approximately 24% of the world's energy, according to World Resources Institute. Our population growth rate is the highest among the industrialized regions. At \$40,980, our GNI per capita is the highest of any region in the world.

I am the Latin American ambassador, representing the Caribbean, Central America, and South America. Nine percent of the world's population resides in our area. Our region has two of the five largest cities in the world, São Paulo and Mexico City. Our GNI per capita is \$7,950.

I am the African ambassador, representing 56 countries. One out of seven people in the world lives in my region. Our population growth rate is the highest in the world and women on average have approximately five children each. Africa has the lowest literacy rate in the world, where 70% of women can read and write. Our GNI per capita is \$2,480.

I am the European ambassador, representing 44 countries including Russia. Europe contains 11% of the world's people and currently has the lowest birth rate of any region in world history. Ours is the only region that has a higher death rate than birth rate. GNI per capita is \$21,120.

I am the ambassador for Asia except for the population giant China, which has its own representative. Asia is, by far, the most populous region, with over one third of the world's people. Our diverse region includes one of the world's poorest countries, Yemen, and one of the richest, Japan. Our GNI per capita is \$5,640.

I am the ambassador from China, the country with the largest population in the world. One out of five people in the world is Chinese. Despite government legislation that restricts family size to one child, our population is still increasing steadily. Our GNI per capita is \$6,600.

I am the representative of the UN International Advisory Board. We will be observing these activities carefully to recommend three or more policies to address any inequalities presented between the regions.

Task (not to read aloud): Observe the presentation carefully. At the end of the presentation your advisory board must recommend three or more policies to help deal with the population/food/income/energy inequalities among regions.

You might consider, for example:

- Should food aid be given to countries that have not yet come to terms with their "population problems"?
- Do donor countries have the right to link food aid to certain policies?
- Should rich countries reduce their consumption levels? How could this be encouraged or enforced?

**Back of Ambassador Cards**

**Latin America**

**North America**

**Europe**

**Africa**

**China**

**Asia, except for the  
population giant  
China**

**Chairperson: United Nations International  
Advisory Board**

**Script  
continued:**

Now let's look at land areas and how they're used. How many people are there compared to the amount of land in each region? How many people live in cities? How much agricultural land is there per person?

**North America** has 15% of the world's land area but has only 5% of its population. In North America, about 3/4 of the population live in urban areas. North American ambassador, please have about 3/4 of your people stand on the border of the region, away from the countryside. Now, not all of the land in the countryside is agricultural. Please note that in North America only about 1/4 of the region is agricultural. (Account for proportions of urban dwellers and agricultural land in each continent. For younger students you may wish to mark off this proportion with masking tape or yarn.)

**Latin America** has 15% of the world's land area, but has 9% of the world's population. In Latin America, 3/4 of the population is urban. Latin American ambassador, have 3/4 of your people stand on the border, and the rest spread over the countryside. Please note that in Latin America only 1/3 of the land is agricultural.

**Africa** has 23% of the land area, but has only 14% of the world's population. In Africa, more than 1/3 of the population is urban. African ambassador, have 1/3 of your people stand on the border, and the rest spread over the countryside. Please note that in Africa only 1/3 of the land is agricultural.

**Europe** has 17% of the land area, but has 11% of the world's population. In Europe, about 3/4 of the population is urban. European ambassador, have 3/4 of your people stand on the border, and the rest spread over the countryside. Please note that in Europe almost 1/4 of the land is agricultural.

**Asia** has 17% of the land area, but has 41% of the world's population. In Asia, over 1/3 of the population is urban. Asian ambassador, have 1/3 of your people stand on the border and the rest spread over the countryside. Please note that in Asia only 1/2 of the land is agricultural.

**China** has 7% of the land area, but has 20% of the world's population. In China, more than 1/3 of the population is urban. Chinese ambassador, have 1/3 of your people stand on the border, and the rest spread over the countryside. Please note that in China more than 1/2 of the land is agricultural.

Let's summarize what we've seen so far: We've shown the **distribution** of the world's population by region. We've looked at the urban-rural distributions of each region's population. And we've also seen the proportion of agricultural land in each region. This demonstration provides an answer to people who ask, "With all that land to farm, how can there be food scarcity?" We see that there is much less agricultural land per region than most people think.

Now, let's look at the **calorie consumption** per person in these regions. The peanuts on this plate/in this bag (hold it up) represent calorie consumption per person per day in (region name). Each peanut represents 400 calories. After I have given the peanuts to each ambassador, the ambassador may distribute the peanuts to the citizens. (Pause to let this happen.) In which region do the citizens consume the most calories? The least?

Now, let's look at the **per capita GNI** for each region. Who can tell me what per capita GNI means? (It's the total value of all the goods and services produced, plus payments on their foreign investments, in a region divided by the population of the region.) It is important to note that not everyone in a region shares equally in the wealth. The chocolate in this bag (hold it up) represents per capita GNI in (region name). Each piece

**Script  
continued:**

represents \$1,000. Will the ambassadors please select one person to represent a citizen earning the equivalent of the per capita income? Please step forward. (Give chocolate to the representative. Distribute bags to all regions.) Will the representatives please hold their bags of candy high so everyone can see? In which region do the citizens have the highest per capita GNI? The lowest? The representative may now share his/her wealth with others.

Now, let's look at the **energy consumption** for each region. The candy in this bag (hold it up) represents per capita energy consumption in (region name). Each piece of candy represents 500Kg of oil used per capita. Will the ambassadors please select one person to represent a citizen who is consuming energy? Please step forward. (Give the bag of candy to the consumer from each region.) Will the consumers please hold their bags of candy high so everyone can see? In which region do the citizens have the most energy consumption per capita? The least?

Now, let's look at the **pollution** produced in a region using for our example **CO<sub>2</sub>** or **carbon dioxide emissions** per capita. Who can tell me what carbon dioxide is and how it is produced? (Carbon dioxide is a gas that is produced when fuels are burned.) The balloons represent CO<sub>2</sub> emissions in (region name). Each balloon represents 1 metric ton of CO<sub>2</sub> emission per capita. Will the ambassador please select one person to represent a citizen producing pollution? Please step forward. (Hand out the balloons to the representative from each region.) Will the citizens please hold their balloons so everyone can see? In which region do the citizens have the highest carbon dioxide emissions per capita? The least? Is it better to be highest or lowest? Why?

Lastly, let's look at the percent of population that has **access to safe drinking water**. The water in this glass (hold up a glass of clear water) represents safe drinking water. The water in this glass (hold up a glass of dark colored water) represents unsafe drinking water. These glasses of water are for (region name). Will the ambassadors please help me distribute the water to the citizens of your regions? Please hold up your glasses so everyone can see. In which regions do the largest percentage of citizens have access to safe drinking water? The smallest percentage?

(Students may now return to their seats before you begin the summary.)

**Summary:**

Let's summarize the distributions we have seen so far. First we looked at calorie consumption. We noticed that not all people consume the same number of calories. In some areas people consume more calories than they need. In some areas, they do not consume enough calories. Why is this a problem?

The second distribution was per capita GNI. What regions of the world had the most? How does the uneven distribution affect the people? What might be the relationship between the countries that are high and the countries that are low?

The third phenomenon we looked at was energy consumption, measured by the Kg of oil consumed per capita. Why do some regions of the world consume more energy per capita than others?

The fourth phenomenon we looked at was pollution produced in a region using CO<sub>2</sub> or carbon dioxide emissions per capita. What is the relationship between the consumption of oil and the amount of carbon dioxide emissions per capita? Why is it not an exact relationship? (You can discuss the fact that burning wood produces CO<sub>2</sub> so it is not a direct tie to petroleum-based manufacturing and transportation by automobile. Also some regions with lots of manufacturing and auto transportation may be using more pollution control devices to reduce emissions than regions that may have a little less manufacturing but are using no control devices.)

**Concluding the Activity:**

The last phenomenon we looked at was access to safe drinking water. Why do some areas of the world have safer drinking water than other areas? Why is this important?

Have the United Nations International Advisory Board report their recommended policies to help deal with the population/food/income/energy inequalities among regions. If you had no advisory board, pose a few questions for a class discussion.

They might consider for example:

- Should food aid be given to countries which have not yet come to terms with their "population problems"?
- Do donor nations have the right to link food aid to certain policies?
- Should rich countries reduce their consumption levels? How could this be encouraged or enforced?

If there is no time to do this, save this activity for the second day.

**Extensions:**

It is important that a follow up activity reinforces the concepts learned in the demonstration. This is particularly important if all the variables were used. Students should be encouraged not only to know "where" the phenomena are located but to try to discover "why there" and "what of it."

1. Assign students to create two dimensional graphs of some of the data for the regions presented in the demonstration. Use data from PRB's World Population Data Sheet. Students can create bar graphs of the data on graph paper, cut out the bars (each different colors), and paste them on an outline map in the center of the region each represents. This could be assigned as homework for the next day. Another way to create a graph is to use poker chips: determine how many poker chips would represent data and place them in the center of the region on an outline map or laminated world map.
2. Have students look at graphs and formulate questions related to the graphs. Encourage them to ask such questions as: Why is the fertility rate in China lower than in the rest of Asia? Why is the rate of natural increase in Europe less than zero? How many calories per person per day are needed? How many are too much? Too few? Students could be assigned to small groups to research the reasons why a particular distribution pattern occurs for one of the variables discussed and to research the answers to the questions that they have raised. Findings could be presented in an oral report or on a poster.
3. If there is time after the research has been presented, students may want to rethink their policies to help deal with inequities. What would be the problems in attempting to implement the policies? What new policy might be better?

**Evaluating the Activity:**

For the evaluation:

1. Test students' knowledge of the major concepts and vocabulary. Ask them to compare two contrasting regions (such as Europe and Africa).
2. Ask students to develop maps of the world illustrating certain population characteristics.
3. Students can be asked to find data for countries or subregions and create a presentation comparing the countries in graphic form.



**Alternative  
Strategies for  
Lower Grades:**

For Lower Grades:

1. Keep the number of variables or phenomena small for younger students.
2. Do a few variables each day, with follow-up discussion.
3. Work with the math teacher to create the graphs. With younger students you can provide graphs with the numbers indicated for the students to color in.
4. Discuss how the students felt when they were citizens of a poor region or a rich one. Ask what actions they might take because of how they felt. Expect answers such as: migrate or start a war (to take what they want). Discuss instances when this has happened or is happening now.

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