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LESSON:
Is Your Community a Food Desert?

Summary   Students read an article about food deserts and develop a usable definition of *food desert* for the purposes of their own research. Students then identify and map the locations of food stores within their own community, as well as graph and use census data to determine if their community is a food desert.

Lesson Type   **Experiment**—students collect, manipulate, and/or summarize data from an experiment or activity they conduct.

Graphic Organization and Modeling—students organize information graphically (e.g., using figures, graphs, and/or webs).

EHP Article   The Sprawl of Food Deserts
Environ Health Perspect 116:A335 (2008)
http://www.ehponline.org/docs/2008/116-8/forum.html#thes

Objectives   By the end of this lesson, students should be able to

- define *food desert*
- identify and define different types of food stores
- create a map of food stores in their community
- obtain data from the U.S. Census Bureau website
- graphically present these data

Class Time   2–3 hours

Grade Level   High school, college

Subjects Addressed   Environmental Science, General Science, Social Studies

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▶ Aligning with Standards

SKILLS USED OR DEVELOPED

- Classification
- Communication (oral, written)
- Comprehension (listening, reading)
- Critical thinking and response
- Graphing
- Observation
- Reading maps and legends
- Research

SPECIFIC CONTENT ADDRESSED

- Community mapping
- Disparities
- Food deserts

NATIONAL SCIENCE EDUCATION STANDARDS MET

Science Content Standards

Unifying Concepts and Processes Standard
- Systems, order, and organization
- Evidence, models, and explanation
- Change, constancy, and measurement

Science as Inquiry Standard
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Science in Personal and Social Perspectives Standard
- Personal and community health
- Science and technology in local, national, and global challenges

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▶ Prepping the Lesson (1 hour)

INSTRUCTIONS

1. Download and review the article "The Sprawl of Food Deserts" at http://www.ehponline.org/docs/2008/116-8/forum.html#thes.

2. Review Background Information, Implementing the Lesson, Assessing the Lesson, and Student Instructions for this lesson.

3. Make copies of the Student Instructions and the article.

4. Make copies or an overhead transparency of the Class Data Sheet. Students will need to see all of the class data for graphing.

5. Obtain a map, as detailed as possible, of your town/city. You can download maps from the U.S. Census Bureau website (directions provided in Step 6 below and the Accessing Census Data handout at the end of this lesson) or contact your library or city transportation office for assistance. MapQuest, Google Maps, or Google Earth also may be used to obtain a map of the surrounding area, but you should confirm when the satellite images from Google Earth were taken, because older images may miss new construction. Be sure you know the scale used on the map you select, even if you have to determine it yourself.

6. If you are not familiar with the census tracts in your area, you will first need to view the census tract maps for your region.

   • Go to the U.S. Census Bureau American FactFinder homepage at http://factfinder.census.gov/.

   • On the left side of the FactFinder homepage is a "Maps" option. Select "Reference Maps (boundaries)" from the list of options that opens to the right when you roll your cursor over "Maps." This will take you to a page where you can select the type of map you want.

   • Select "2000 Census Tracts and Blocks," type your ZIP code into the appropriate box, then press "GO" to obtain your map.

   • A map of the selected area will open, showing census tract boundaries. You can zoom in or out of the map as needed.

   • You can print the maps and/or keep this window open for future reference.

7. Divide the map so each group of students can analyze a different section ("community") of the town/city. You can divide your map by census tracts (recommended, since we will use census data in this lesson), by delineations within the town/city (e.g., up-, mid-, and downtown), or by access to transportation (e.g., major roads, bus or train routes). Each community should include at least one residential area. Some groups may need to have several census tracts included within their assigned community.

8. It may be useful to print maps on overhead transparencies.

9. Decide whether you want the students to go to the U.S. Census Bureau website to obtain population and average annual income data for their assigned community or whether you will provide the information for them when you hand out the maps.

10. If you will be providing population and income data to the students, go to the U.S. Census Bureau website to obtain the data.

    • Go to the U.S. Census Bureau American FactFinder homepage at http://factfinder.census.gov/.

    • On the left side of the FactFinder homepage is a "Data Sets" option. Select "Decennial Census" from the list of options that opens to the right when you roll your cursor over "Data Sets."

    • Select the radio button next to "Census 2000 Summary File 3 (SF 3) - Sample Data." A grey box will open to the right. Select the "Custom Table" option.

    • The first field asks you to "Select a geographic type." Using the pull-down menu, select ".... .... Census Tract."

    • Next, select your state and county. All the census tracts for that county will appear in the next drop-down menu. Use the map you pulled up previously to help you decide which census tracts you want to use. Select a tract and press the "Add" button. Repeat until all the tracts you want appear in the window titled "Current geography selections."

    • Press the "Next" button.

    • A list of tables will appear in a new window. Select the first option, "P1. Total Population," then press "Go."

    • A new window will open, asking you to select one or more data elements. Select the check box next to "Total" and press "Add." Your selection will appear in a new window titled "Current data element selections."

    • Return to the original list of tables, scroll down, and select "P53. Median Household Income in 1999 (Dollars)," then press "Go."

    • When your selection appears in the window below, select the check box next to "Median household income in 1999" and press "Add."

    • Now both of your population and income selections should appear in the bottom window titled "Current data element selections." Again, click the check boxes next to each field and press "Next."

    • Select "Show Result," and a table will appear with the data for each census tract you selected.

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There are many other census data options that can be explored with respect to the topic of this activity. For example, "P30. Means of Transportation to Work for Workers 16+ Years" may provide some clues into the modes of transportation used in different locations. Transportation was one important factor the original study authors considered in their research on food deserts.

11. NOTE: Income is an important socioeconomic factor in environmental health and health disparities. Income issues may be an uncomfortable topic for students, especially if people will be looking at income data for the areas where they live. However, students need to be aware of these issues so they can understand issues around and factors potentially contributing to disparities. The income elements could be left out of the activity. However, allowing students to discuss the issue openly and respectfully will improve their comfort level with the topic.

MATERIALS

per student
- 1 copy of "The Sprawl of Food Deserts," preferably in color
- 1 copy of the Student Instructions
- graph paper (or access to a computer with graphing software such as Microsoft Excel)

per group of 3–5 students
- 1 copy or overhead transparency of the Class Data Sheet
- 1 map of the local area with a community highlighted and the scale used on the map
- ruler with the appropriate measurement used for the scale on the map or other tool for measuring distances (e.g., a map wheel)
- highlighter
- computer(s) with Internet access
- Yellow Pages (optional)
- Accessing Census Data handout (optional)

VOCABULARY
- community mapping
- disparities
- food desert
- food store
- geographic information system (GIS)
- population density
- scale
- suburbanization

BACKGROUND INFORMATION

This lesson develops several different science skills (defining terminology and variables, mapping, graphing, and analyzing data) within the context of an environmental health concept called the "built environment." The built environment refers to how the design, construction, and placement of buildings within a community, as well as the design of the surrounding community (e.g., zoning, sidewalks, parks), may impact human health. Research in the built environment is a relatively new field and is still, in many ways, being defined.

Defining new terms, research approaches/protocols, and variables is one important element in the scientific process, and in this lesson students will explore how to generate meaningful and usable definitions for research. Generating or refining definitions for purposes of research (and, by extension, developing an understanding of how modifying definitions can impact research results) is practiced less often than other skills (such as graph reading) in many science classes. In a well-established field of study, definitions may be fairly stable, having gone through the peer-review process and been used or vetted through repeated processes. Newer areas of study often experience a state of flux or change as definitions, processes, and variables become refined. In this activity students are asked to analyze a definition of the term *food desert* as used in a published research study, then generate their own definition of the term on the basis of social, economic, and geographic parameters that are personally and/or regionally relevant.

Students also map locations of food stores in their local communities, then analyze how data and/or interpretations of data change with varying definitions of *food desert*. Community mapping is an important tool in many types of environmental health research, providing a visual representation of a local area and its resources, disease distribution, or potential exposure(s), depending on the variables being studied. In studies about resource availability in the built environment, individuals and groups are typically mobilized to identify local resources within their community, such as health clinics, grocery stores, physical exercise locations, schools, and recreation sites. Community maps are a powerful tool for assessing whether a community's resources match its needs. When a community's resources do not match its needs, disparities can occur, which can negatively impact human health, quality of life, and the economic value of the area. Disparities are often associated with areas of lower socioeconomic status.

As discussed in the *EHP* article "The Sprawl of Food Deserts," a food desert is a neighborhood with poor access to healthful foods

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such as fresh fruits and vegetables. In many urban areas, the number of small grocery stores has steadily decreased, leaving behind mainly convenience stores, which are typically stocked with soda, chips, and other unhealthy foods. Meanwhile, the number of large supermarkets in suburban areas has increased, but these stores are not usually within walking distance.

In the original research study (Larsen and Gilliland 2008), researchers divided the city of London, Ontario, Canada, by classifications used by local city planners: urban, suburban, and rural. Researchers also used census tracts as a proxy measure of neighborhoods. Geographic information system (GIS) and census data were used to determine walking distance from block of residence to the nearest grocery store.

Reference

Larsen K, Gilliland J. 2008. Mapping the evolution of 'food deserts' in a Canadian city: supermarket accessibility in London, Ontario, 1961–2005. *Int J Health Geogr* 7:16. http://www.ij-healthgeographics.com/content/pdf/1476-072X-7-16.pdf

RESOURCES

Environmental Health Perspectives, Environews by Topic page, http://ehp.niehs.nih.gov/. Choose Diet and Nutrition, Health Disparities, Urban Issues

Google Earth. Download free software to view maps with satellite imagery. http://earth.google.com/

Google Maps. Type in your location to obtain a map of the local area. Zoom in and out to change area. http://maps.google.com/

MapQuest. Type in your location to obtain a map of the local area. Zoom in and out to change area. http://www.mapquest.com/

National Community YouthMapping. Search maps created by high school students. http://www.communityyouthmapping.org/default.asp

PolicyLink. Provides information on community mapping and links to resources and databases. http://www.policylink.org/EDTK/Mapping/default.html

Project ATLAS: Mapping Your Community. Describes a classroom community mapping activity using GPS devices. http://cfa-www.harvard.edu/space_geodesy/ATLAS/community.html

Raise Your Voice: Community Mapping Guide. Resource guide for creating community maps. http://www.actionforchange.org/mapping/

U.S. Census Bureau. 2007 American Community Survey 1-Year Estimates, Geographic Comparison Tables. Search data to determine the percentage of people below the poverty level in the past 12 months within your area. http://factfinder.census.gov/servlet/GCTGeoSearchByListServlet?ds_name=ACS_2007_1YR_G00_&_lang=en&_ts=239539678786

U.S. Census Bureau. Search for population estimates, census tracts, and other information. http://www.census.gov/

Yellow Pages. Search for businesses by ZIP code. http://www.yellowpages.com/

▶ Implementing the Lesson

INSTRUCTIONS

1. Distribute copies of the Student Instructions and the article, then have the students complete Steps 1 and 2 of the Student Instructions.

2. Inform the class they will be conducting their own research into the number and distribution of food stores in surrounding communities. In general, part of research involves defining concepts and terminology. Two important concepts/terms in this activity are *food stores* and *food deserts*. Complete Step 3 of the Student Instructions by discussing the following questions and points as a class. Takes notes on the board as needed to capture students' ideas.

   a. How would you define *food store*? Are there any limitations or restrictions you would place on a definition of *food store*? Does a convenience store constitute a food store? Why or why not?

   b. What are the differences between convenience stores, delicatessens, farmer's markets, supermarkets, fast-food restaurants, and other restaurants? Consider the types of food, cost, whether the foods are prepared or highly processed, selection, availability of fresh fruits and vegetables, hours of operation, etc.

      - Convenience stores usually have a limited selection of highly processed foods that are high in sugar and unhealthy fats. Prices may be slightly higher for the same product compared with grocery store prices. Convenience stores are often open long hours, making access relatively easy.

      - Delis typically sell meats and cheeses. Many of the meats are highly processed. Some delis also sell prepared side dishes and sandwiches, which may contain low-nutrient, high-fat ingredients. Deli hours are usually restricted (e.g., 10 A.M. – 5 P.M.).

      - Supermarkets generally have a large variety of fresh fruits and vegetables and minimally processed whole-grain products. They also have a large selection of moderately and highly processed foods. Prices are lower compared with other food venues, and hours of operation are typically long, sometimes 24 hours.

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- Restaurants serve prepared foods, giving consumers limited or no control over food choice and the types and amounts of fats and sugar used in preparation. Fast food typically has very high fat and sugar/refined carbohydrate content, but other restaurant fare can as well. Fast-food restaurants are generally less expensive than other restaurants, but other than the "dollar menus" at some fast-food places, eating in restaurants in general tends to be more expensive than eating food prepared at home. Some fast-food restaurants are open 24 hours or have longer hours of operation than other restaurants, which typically have more restricted hours of operation.

- Farmer's markets usually have a wide selection of fresh fruits and vegetables. Some may sell butchered meats, grains, deli goods, and prepared food products. Some farmer's markets are large, permanent establishments that are open daily. Others occur seasonally, a few days a week, for part of the day. Prices tend to be competitive with supermarket prices.

c. For this activity we are going to define food stores as businesses that sell a variety of groceries from which a well-balanced meal can be made (e.g., fresh fruits and vegetables, unprocessed meats, and grain products such as pasta, beans, and rice). Discuss the potential reasons why we might want to use a definition like this for public and environmental health research.

- Having a healthy population is an important metric in the fields of public health and environmental health. Thus, a major goal in these fields is to identify and reduce exposures to unhealthy or toxic substances. As researchers you want to identify unhealthy versus healthy options. Defining food stores in this manner better differentiates the healthy from the unhealthy.

- Choice is often one element when considering unhealthy exposures in the context of environmental and public health—does a person have the ability and means/resources to choose a healthier alternative? Discuss the difference between having choices or limited choices in food types and availability (e.g., having the ability to choose between an apple or a donut versus having access only to the donut.)

d. Inform the students that creating detailed definitions of terms or concepts or defining the elements of research (such as variables) is an important part of the scientific process. Ask the students to imagine how the study they read about would change if convenience stores were included in the definition of *food stores* (e.g., the number of food stores might increase by a lot—would the research then be as meaningful, or would important information get lost?). Tell the students that although they will read a specific definition of *food desert* used in another research study, in this activity they will investigate and define what *food desert* means within their own community.

3. Divide the class into small groups of 3–5 students each, and instruct them to complete Step 4 of the Student Instructions. Review instructions as needed.

4. When students are ready to begin Step 5 of the Student Instructions, provide them with their maps and assigned community. Discuss how you divided the communities. As needed, review the scale used on the map, and make sure students can use the map scale to measure distances between places. Allow students time to search for food stores within their area using MapQuest, Google Maps, Google Earth, or the Yellow Pages. To complete Steps 6 and 7, students also need to be provided with or research their community's population density and poverty level using the U.S. Census Bureau databases (see Prepping the Lesson for more information).

5. Have students complete Step 8 of the Student Instructions, copying their data from Step 7 onto the Class Data Sheet. The Class Data Sheet can be in the form of an overhead; alternatively, once all the data are entered, the sheet can be copied for each group to use to complete Steps 9 and 10.

6. Lead the class discussion in Step 11 of the Student Instructions. Below are some questions that may be used to advance the discussion. Take notes on the board or an overhead as needed.

- Does your community have a low socioeconomic status? Should that be a factor in defining a food desert? Why or why not?

- Are there enough food stores in the community? How is "enough" defined? Should you use comparative metrics such as between different towns or between different "eras" as described in the article they read?

- Is the food quality and quantity adequate? How might one determine that? How would you define the cutoff between adequate and inadequate? Does a simple majority of "mostly unhealthy" food stores imply a food desert, or is a percentage, such as 50% or 75%, necessary?

- What might you learn from looking at a ratio of convenience stores to food stores (as food stores were defined for this activity)?

- How did perspectives and definitions change when looking at a proportion of food stores to population or accessibility of food stores as a function of distance from a residential area?

- Would people in the community be interested in the students' results? Why or why not? What might make the community

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interested? What might a community do with these data?

- In the Background section and in the note found in Step 4 of Assessing the Lesson we also provide a brief description of how the scientists conducted the London, Ontario, study. You may want to discuss advantages and disadvantages of the different approaches (e.g., accuracy, confounding factors, challenges in implementing the research in a classroom environment); researchers often have to go through a similar process in order to decide the best way to approach a study.

Notes & Helpful Hints

- Google Maps and MapQuest are easy to use and allow you to type in an address zoom in/out and print maps. Be sure to note the scale used for the map you select. The scale may appear on the screen but not print on the map.
- Google Earth requires free software to be downloaded onto the computer. It provides pictures with satellite imagery, which is very exciting for students but can be more complicated to use. Also, the resolution may not be clear depending on your computer and printer.
- If possible, students can conduct the mapping in person by canvassing their neighborhood and plotting food stores on a map.
- Mapping is an important element in environmental health research and is used in many different ways, such as identifying a disease cluster in a population, identifying sources of exposure to specific chemicals, tracking the spread of communicable diseases, and, in this case, identifying potential resource disparities that may negatively impact a community's health. The *EHP* Science Education Program has published several other lessons that incorporate the creation and use of maps. Each of these lessons is unique in its subject matter and approach, but includes an element of map reading or map making, which may be helpful in expanding this lesson for your students:

  – Mapping the Effects of War (students visually depict environmental changes resulting from war in specific countries). http://www.ehponline.org/science-ed/2005/wareffect.pdf

  – Investigating PAHs: Your Own Mini-Epi Study (students plot demographic and pollutant data on a map to estimate frequency of high exposures). http://www.ehponline.org/science-ed/2005/pah.pdf

  – Mapping the Air in Your School (students plot temperature and humidity data for individual classrooms on a floorplan of the school). http://www.ehponline.org/science-ed/2005/mapair.pdf

  – Mapping Solutions for Obesity (students chart exercise routes of varying lengths and strenuousness levels on maps of their community). http://www.ehponline.org/science-ed/2005/mapping.pdf

  – Mapping in the Time of Cholera (students follow step-by-step instructions on how to use Google Earth and its "pushpin" features to plot the path of a 1992/1993 cholera epidemic). http://www.ehponline.org/science-ed/2007/cholera.pdf

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▶ **Assessing the Lesson** (steps not requiring teacher feedback are not listed below; see Student Instructions for complete step-by-step instructions)

Step 2   **How is the term *food desert* defined in the article you just read?**

"Areas within city centers where low-income people have poor access to vegetables, fruits, and other whole foods."

Step 3   **Participate in a class discussion about food stores.**

Assess students as needed through the class discussion.

Step 4   **Divide into groups of 3–5 students each. The definition of *food desert* contains several elements: type of food, geographic considerations/accessibility, and socioeconomics/type of population. Within your group, discuss how each element is defined in the article (refer to your answer in Step 2) as well as other potential ways the element could be defined.**

Students may have limited ideas for other potential definitions at the early stages of this exercise. Students will be asked to return to this step after they do their own community mapping, then add to the other potential definitions they listed previously.

Type of food

Article definition: whole foods, fresh fruits and vegetables

Other potential definitions: Answers will vary, but the definition of this element likely will not change much. Students may add some additional economic elements such as affordable healthy foods or food that can be prepared at home (which

allows greater control of fat and sugar content).

Geographic considerations/accessibility

Article definition: City centers are a specific location focus. Accessibility is not explicitly defined in the *EHP* article, but the article does mention that in 1961 "more than 75% of London's inner-city population lived within 1 kilometer of a supermarket."

NOTE: The authors of the original research study measured supermarket accessibility in relation to walking and public transit (a link to the study is provided under Background Information, above). Accessibility for walking was primarily defined as 1,000 meters (m) from the home to the supermarket. Accessibility using public transit was defined as a 500-m walk at the beginning and/or end of the trip with a 10-minute ride with no transfers. The authors used block-level population counts and looked at the percentage of the population in each block with access to supermarkets using the accessibility criteria just described. These metrics for supermarket accessibility may be useful for many non-U.S. cities or for U.S. cities with extensive subway systems, such as New York. Many U.S. suburban areas have poor public transportation infrastructure, many low-income people in the U.S. have cars but limit their use due to gas prices and other factors, and many U.S. communities are miles from the supermarket. These are examples of reasons why students may need to develop their own definition relevant to the area where they live. Again, students may only begin to recognize this need to redefine the term once they start their own mapping activities.

Other potential definitions: A variety of locations based on community specifics; average distance from a defined area to a food store; average length of time it takes to drive to a food store from a specific area.

Socioeconomics/type of population

Article definition: Low-income

Other potential definitions: Students may consider expanding the definition to include higher-income residents or explore eliminating the income element of the definition (e.g., is it a food desert if residents of a highly populated middle-class area have to drive a long way to access fresh food?). There is also a question of low-income U.S. residents having cars (according to the original research study, low-income people in the United States are more likely to have a car than their Canadian counterparts). Low-income people may have less time to make longer-distance treks to a store (e.g., because they may work several jobs).

Step 5   **a.   Create a list of the food stores (with addresses) in your assigned community. Search online or look in the Yellow Pages for food stores. If needed, separate the list into two columns, with one column labeled "definite food store" and the other labeled "maybe a food store." If you plan to map both the "definite" and "maybe" lists, you may want to use a color-coded or symbol system (e.g., use green dots for "definite" businesses and yellow dots for "maybe" businesses).**

Each group should have a clearly written list with addresses and food stores differentiated between "definite" and "maybe." Students may need some guidance in this process (e.g., discuss how they might find out if a store they are unfamiliar with fits the definition of a food store being used for this activity).

b.   How many "definite" food stores are in your assigned community?

The number of definite food stores should be checked based on the list provided in Step 5a above.

c.   Determine the scale used on the map (e.g., 1 inch = 1 mile). Write the scale below.

Scale should be provided with units.

d.   Using a ruler, measure the length and width of your assigned community, and convert the length and width to distance. Write that information below, then calculate the area of your community. Show your work clearly and include units.

Students should list the length and width measurements, multiplied together to get square miles or kilometers (or whatever distance units are being used).

e.   Using the food store list you created as a class in Step 5a, plot each food store on your map using different symbols/ colors as needed. Be sure to include a key so your map can be correctly interpreted.

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Check for consistency between what is on the map and what is listed in Step 5a (number of stores, addresses mapped correctly, etc.).

Step 6

a. Describe the community you mapped. What defines it as a community?

Groups should provide a brief description about their assigned community. For example, was it defined based on census maps? Known neighborhoods? Specific road boundaries? Some other feature?

b. List the following characteristics of your assigned community [population density, average income].

Answers will vary. Check for accuracy at the U.S. Census Bureau website.

c. Using a ruler, measure a straight line between each of the food stores. What is the average direct distance between your food stores? Show your work.

Students should show how they calculated the average if there are multiple food stores in their assigned community. Make sure units are included.

d. Locate and mark the center of the neighborhoods where people live in your assigned community. Using a highlighter, mark the shortest travel route from the center of each neighborhood to the closest food store by following the roads on your map. Use a ruler and measure that travel route. Then list each of the neighborhoods in your assigned community and the travel distances to the closest food store (if there are multiple segments in your route, list those and add them up to get your total travel distance).

On their maps, students should show the center of the neighborhood(s) and the highlighted travel route to the food store. On the Student Instructions worksheet, students should write the distances for their shortest travel route and include units (e.g., 0.25 mile for one leg + 0.5 mile for the next leg = 0.75 mile total distance from the center of a neighborhood to the nearest food store).

e. What is the average travel distance between the center of your neighborhood(s) and the closest food store? Show your work.

Students should show their calculations and include units (distances for each neighborhood-to-store route should be added together and averaged).

f. Are food stores in your assigned community easily accessible by walking or public transportation? Why or why not? How do you know? (If you are not familiar with the area, Google Earth may be helpful in viewing features such as walking paths, sidewalks, or major roads that may be difficult to cross. Public transportation routes can usually be found online.)

Students should provide a description of accessibility and how they determined accessibility (e.g., they live nearby and are familiar with the area, they consulted Google Earth and saw there were no sidewalks on the route, etc.).

g. Based upon the data you just collected, would you characterize your assigned community as a food desert? Why or why not? If you are not sure, describe what additional information you would need to help you recognize or define whether your community is a food desert.

Look for a thorough and reasonable explanation of why students would or would not characterize their assigned community as a food desert. If students indicate they are not sure at this point, they need to describe why they are not sure and what information they think would help them be sure.

Step 7

Community Name	Area	Total Number of "Definite" Food Stores	Population of the Community	Average Household Income	Average Direct Distance between Food Stores	Average Travel Distance to Closest Food Store
Community name	Must include units; units should be same for everyone so data can be compared	This number should match Step 5b	This number can be obtained from the U.S. Census Bureau	This number can be obtained from the U.S. Census Bureau	This number should match Step 6c	This number should match Step 6d

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Summarize the data from Steps 5 and 6 for your community in the table below.

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Step 8   Transfer the information in the table in Step 7 onto the Class Data Sheet. Then, using the class data, create the following graphs on graph paper or the computer:

a. **Food stores as a function of population number for each community.**

x-axis (independent variable) = population number

y-axis (dependent variable) = number of food stores

Communities can be represented by different symbols. Be sure axes are clearly and accurately labeled, graph keys are provided, and data are accurately and clearly plotted.

b. **Food stores as a function of average household income for each community.**

x-axis (independent variable) = household income

y-axis (dependent variable) = number of food stores

Communities can be represented by different symbols. Be sure axes are clearly and accurately labeled, graph keys are provided, and data are accurately and clearly plotted.

c. **The average direct distance between food stores for all of the communities assigned in the class.**

x-axis (independent variable) = communities

y-axis (dependent variable) = average distance between food stores

Be sure axes are clearly and accurately labeled, graph keys are provided, and data are accurately and clearly plotted.

d. **The average closest travel distance between the center of each neighborhood and the closest food store for each community assigned in the class.**

x-axis (independent variable) = communities

y-axis (dependent variable) = average travel distance between the center of a neighborhood and a food store

Be sure axes are clearly and accurately labeled, graph keys are provided, and data are accurately and clearly plotted.

Step 9   a. **Are there any noticeable differences between the availability of food stores for the various communities investigated in the class? Describe.**

Make sure student responses are clearly communicated and consistent with the data.

b. **Do you see any trends in the availability of food stores as a function of variables such as population and average household income? Describe.**

Make sure student responses are clearly communicated and consistent with the data. Statements/conclusions need to be well supported.

c. **When looking at the class data as a whole, do you see any potential food deserts? Why or why not?**

Make sure student responses are clearly communicated and consistent with the data. Statements/conclusions need to be well supported.

d. **In Step 6g you were asked whether you thought your assigned community was a food desert. Would you change your answer based on what you know now? Why or why not?**

Student answers will vary. Make sure student responses are clearly communicated and consistent with the data. Statements/conclusions need to be well supported.

Step 10   **Revisit Step 4 and add to the "other potential definitions" for each element of the *food desert* definition. How would you now define a food desert for your community?**

Student answers will vary. Make sure student responses are clearly communicated and consistent with the data. Statements/conclusions need to be well supported.

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Is Your Community a Food Desert?

Step 1   Read the article "The Sprawl of Food Deserts."

Step 2   How is the term *food desert* defined in the article you just read?

Step 3   Participate in a class discussion about food stores.

Step 4   Divide into groups of 3–5 students each. The definition of *food desert* contains several elements: type of food, geographic considerations/accessibility, and socioeconomics/type of population. Within your group, discuss how each element is defined in the article (refer to your answer in Step 2) as well as other potential ways the element could be defined.

Type of food
Article definition:

Other potential definitions:

Geographic considerations/accessibility
Article definition:

Other potential definitions:

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Socioeconomics/type of population

Article definition:

Other potential definitions:

Step 5 As a group you will identify and map the number and location of food stores in your town/city. Your teacher will assign your group a community within your town/city.

Recall that food stores are defined as businesses that sell a variety of groceries from which a well-balanced meal can be made (e.g., fresh fruits and vegetables, unprocessed meats, and grain products such as pasta, beans, and rice). Food stores do not include restaurants or gasoline/convenience stores like Circle K or 7-Eleven.

Complete the following steps:

a. Create a list of the food stores (with addresses) in your assigned community. Search online or look in the Yellow Pages for food stores. If needed, separate the list into two columns, with one column labeled "definite food store" and the other labeled "maybe a food store." If you plan to map both the "definite" and "maybe" lists, you may want to use a color-coded or symbol system (e.g., use green dots for "definite" businesses and yellow dots for "maybe" businesses).

b. How many "definite" food stores are in your assigned community?

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    c. Determine the scale used on the map (e.g., 1 inch = 1 mile). Write the scale below.

    d. Using a ruler, measure the length and width of your assigned community, and convert the length and width to distance. Write that information below, then calculate the area of your community. Show your work clearly and include units.

    e. Using the food store list you created as a class in Step 5a, plot each food store on your map using different symbols/colors as needed. Be sure to include a key so your map can be correctly interpreted.

Step 6 Answer the following questions.

    a. Describe the community you mapped. What defines it as a community?

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b. List the following characteristics of your assigned community (your instructor may provide this data or you may have to find it. Instructions on how to locate the census data are provided on the handout "Accessing Census Data").

Population density:

Average income:

c. Using a ruler, measure a straight line between each of the food stores. What is the average direct distance between your food stores? Show your work.

d. Locate and mark the center of the neighborhoods where people live in your assigned community. Use a ruler and measure the shortest travel route from the center of each neighborhood to the closest food store by following the roads on your map. Then list each of the neighborhoods in your assigned community and the travel distances to the closest food store (if there are multiple segments in your route, list those and add them up to get your total travel distance).

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e. What is the average travel distance between the center of your neighborhood(s) and the closest food store? Show your work.

f. Are food stores in your assigned community easily accessible by walking or public transportation? Why or why not? How do you know? (If you are not familiar with the area, Google Earth may be helpful in viewing features such as walking paths, sidewalks, or major roads that may be difficult to cross. Public transportation routes can usually be found online.)

g. Based upon the data you just collected, would you characterize your assigned community as a food desert? Why or why not? If you are not sure, describe what additional information you would need to help you recognize or define whether your assigned community is a food desert.

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Step 7 Summarize the data from Steps 5 and 6 for your community in the table below.

Community Name	Area	Total Number of "Definite" Food Stores	Population of the Community	Average Household Income	Average Direct Distance between Food Stores	Average Travel Distance to Closest Food Store

Step 8 Transfer the information in the table in Step 7 onto the Class Data Sheet. Then, using the class data, create the following graphs on graph paper or the computer:

   a. Food stores as a function of population number for each community.

   b. Food stores as a function of average household income for each community.

   c. The average direct distance between food stores for all of the communities assigned in the class.

   d. The average closest travel distance between the center of each neighborhood and the closest food store for each community assigned in the class.

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Step 9 Answer the following questions.

    a. Are there any noticeable differences between the availability of food stores for the various communities investigated in the class? Describe.

    b. Do you see any trends in the availability of food stores as a function of variables such as population and average household income? Describe.

    c. When looking at the class data as a whole, do you see any potential food deserts? Why or why not?

    d. In Step 6g you were asked whether you thought your assigned community was a food desert. Would you change your answer based on what you know now? Why or why not?

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Step 10 Revisit Step 4 and add to the "other potential definitions" for each element of the *food desert* definition. How would you now define a food desert for your community?

Step 11 As a class, discuss the following items:

- The definition of *food desert* and whether there are possible food deserts in your town/city.
- If and how your class's definition of food deserts differs from the definition you read in the article.
- Whether you think your town/city or communities within your town/city would be interested in your class's research results.

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Class Data Sheet

Community Name	Area	Total Number of "Definite" Food Stores	Population of the Community	Average Income	Average Direct Distance between Food Stores	Average Travel Distance to Closest Food Store

Accessing Census Data

To view census tract maps for your region:

- Go to the U.S. Census Bureau American FactFinder homepage at http://factfinder.census.gov/.
- On the left side of the FactFinder homepage is a "Maps" option. Select "Reference Maps (boundaries)" from the list of options that opens to the right when you roll your cursor over "Maps." This will take you to a page where you can select the type of map you want.
- Select "2000 Census Tracts and Blocks," type your ZIP code into the appropriate box, then press "GO" to obtain your map.
- A map of the selected area will open, showing census tract boundaries. You can zoom in or out of the map as needed.
- You can print the maps and/or keep this window open for future reference.

To obtain census data on population and income:

- Go to the U.S. Census Bureau American FactFinder homepage at http://factfinder.census.gov/.
- On the left side of the FactFinder homepage is a "Data Sets" option. Select "Decennial Census" from the list of options that opens to the right when you roll your cursor over "Data Sets."
- Select the radio button next to "Census 2000 Summary File 3 (SF 3) - Sample Data." A grey box will open to the right. Select the "Custom Table" option.
- The first field asks you to "Select a geographic type." Using the pull-down menu, select ".... .... Census Tract."
- Next, select your state and county. All the census tracts for that county will appear in the next drop-down menu. Use the map you pulled up previously to help you decide which census tracts you want to use. Select a tract and press the "Add" button. Repeat until all the tracts you want appear in the window titled "Current geography selections."
- Press the "Next" button.
- A list of tables will appear in a new window. Select the first option, "P1. Total Population," then press "Go."
- A new window will open, asking you to select one or more data elements. Select the check box next to "Total" and press "Add." Your selection will appear in a new window titled "Current data element selections."
- Return to the original list of tables, scroll down, and select "P53. Median Household Income in 1999 (Dollars)," then press "Go."
- When your selection appears in the window below, select the check box next to "Median household income in 1999" and press "Add."
- Now both of your population and income selections should appear in the bottom window titled "Current data element selections." Again, click the check boxes next to each field and press "Next."
- Select "Show Result," and a table will appear with the data for each census tract you selected.