Lesson 2

Mapping the Impact

Students create a web diagram to illustrate environmental, social, and economic impacts associated with everyday items. This activity expands the concept of "ecological footprint" to consider impacts of a given lifestyle on people and societies. Students develop ideas to reduce the ecological footprint and associated impacts related to an everyday item.

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SUPPLY CHAIN OF A LAPTOP

Objectives

Students will:

- Identify resources, processes, and impacts embodied in material goods
- Analyze interconnections among lifestyle, population, economy, and environment
- Determine ways to reduce ecological footprint and other impacts associated with material goods

Inquiry/Critical Thinking Questions

- What are environmental, economic, and social impacts of commonly used items?
- What can we do to reduce negative impacts associated with resource consumption?

Subject Areas

- Social Studies (Global Studies, Contemporary World Problems, Geography)
- Science (Environmental, Biology)

Time Required

Two 45-minute periods; to make this a one-day lesson, omit the Steps for Day 1

Key Concepts

sustainability—meeting current needs without limiting the ability of people to meet their needs in the future

ecological footprint—the area of Earth's productive surface that it takes to produce the goods and services necessary to support a particular lifestyle

resource consumption—the process of using natural resources, materials, or finished products to satisfy human wants or needs

National Standards Addressed

National Council for the Social Studies

III (People, Places, and Environments)

VII (Production, Distribution, and Consumption)

IX (Global Connections)

National Science Education Standards

F (Science in Personal and Social Perspectives)

Additional Vocabulary

ecology—the study of relationships among organisms with each other and with their environments

natural resources—things found in nature that are useful to humans, such as trees and fish

climate change—a change in long-term weather patterns (including precipitation, temperature, and wind) over time

lifestyle—the way an individual or a group of people lives

population—the total number of people living in a country, city, or other defined area

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Optional Background Reading

- Louise Story, "The Hidden Life of Paper and Its Impact on the Environment," *The New York Times,* October 25, 2006, www.nytimes.com/2006/10/25/business/media/25adco.html—Story writes about the impacts of the paper industry on the environment and what some companies are doing to decrease these impacts.
- Evan Osnos, "The hidden cost of your hardwood floor," *Chicago Tribune,* December 18, 2006, www.chicagotribune.com/news/watchdog/chi-china-timber-htmlstory,0,5318153.htmlstory—Osnos writes about the extraction, production, and distribution of wood exported to the United States to make hardwood floors and the environmental and human impacts that result.

Materials and Preparation

Handout: *Hamburger, Fries, and a Cola,* 1 per student

(Optional) Cards: *What Does It Take to Make?,* 1 per group of 3-4 students

Large sheets of butcher or chart paper, 1 per group

Colored marking pens, 3-4 per group

Activity

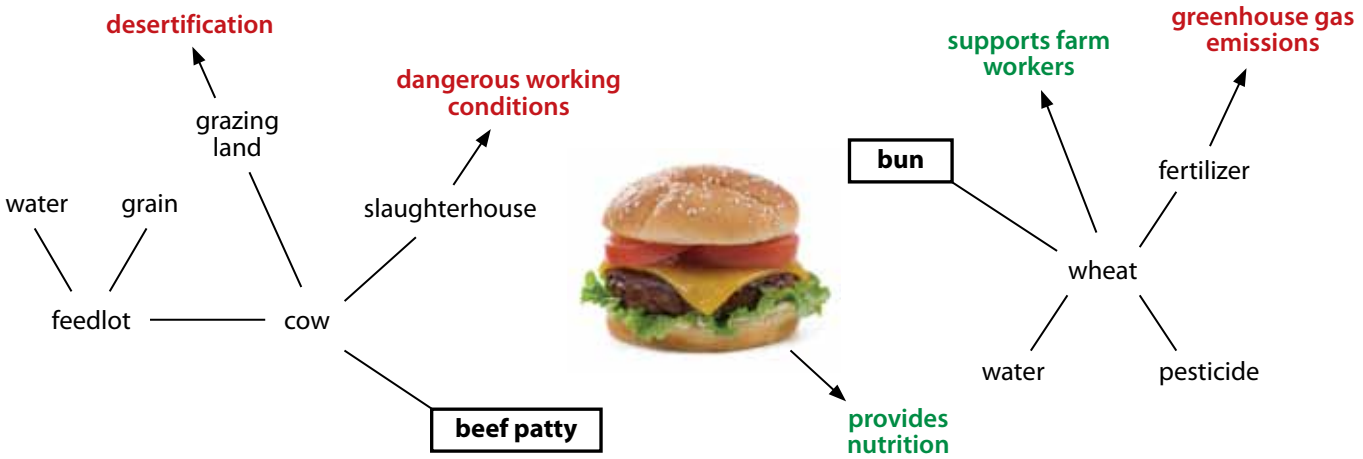
Introduction—Day 1

1. Introduce the idea of "ecological footprint" to students by first asking them what they think the term might mean, based on their knowledge of the terms "ecology" and "footprint." *(The term "ecological footprint" refers to the area of the earth's productive surface, both land and sea, that it takes to support a person's or a population's lifestyle. Ecological footprint includes natural resources needed from the environment, plus space for infrastructure, recreation, and waste disposal. A more resource-intensive lifestyle results in a larger ecological footprint.)*
2. Ask students what sorts of impacts from consumption are left out of this type of measurement. *(An ecological footprint measures environmental impacts, rather than impacts on human societies.)*
3. Let students know that they will be creating a web diagram to illustrate the ecological footprint and human impacts associated with an everyday item. But first, you will do an example together.

Steps—Day 1

1. Ask students to raise their hands if they have eaten a hamburger in the last week. Has anyone eaten a hamburger today?

Sample Impact Diagram: Hamburger



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2. Distribute the handout, *Hamburger, Fries, and a Cola,* to each student. Give students 5–10 minutes to read through the handout. Ask them to circle or highlight the following as they read: resources required to produce the meal and impacts to the environment and people.
3. Draw a hamburger in the middle of a board or other location where all students can see it. Then proceed through the following exercise to diagram the impacts associated with producing the hamburger. [See the Sample Impact Diagram above if you need ideas to get started.]
   - **a.** Ask them what basic ingredients are needed to create a hamburger. (e.g., *cow, bun*)—Draw or write student answers around the hamburger.
   - **b.** There are several steps required to raise the cow. What are they? (e.g., *grazing land, feedlot*)—Write student answers on your example.
   - **c.** Between the cow and the burger, what else happens? (e.g., *slaughterhouse, processing/grinding the meat, transportation of the beef to the restaurant, the energy to heat the stove to cook the burger*)—Write student answers on your example.
   - **d.** What impacts result from each of the processes and technologies required to produce the hamburger? (e.g., *soil erosion, pesticide runoff, climate change, high injury rates among workers*)—Include these impacts on your diagram wherever appropriate.
   - **e.** Lastly, have students consider additional impacts that have not yet been shared, perhaps ones beyond those mentioned in the reading. What are some impacts of hamburger consumption on people and societies, including people involved in producing it and people who consume it? (e.g., *safety concerns for workers, health concerns from consumption, waste from disposable wrapping*)—Write these impacts on your diagram where they seem most appropriate.
4. **Option:** You may also want to have students identify positive consequences of producing and consuming the hamburger, such as economic benefits. Include these on your diagram in a way that distinguishes them from negative impacts (such as by writing them in a different color.)

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Steps—Day 2

1. Give the following directions before grouping students: "In groups, brainstorm and diagram all of the resources, processes, and impacts associated with one everyday object, such as an item of clothing or a piece of sports equipment. For example, if you decide to diagram the impacts of a cell phone, you would write and/or draw it in the center of the paper, and then write and/or draw the resources and processes required to produce each part of the phone and all the impacts you can think of that might be related to producing and using it."
   - **Note:** There is no single "right" way to do this activity. A simple web diagram could include lines or arrows connecting the various components of an item to all of the related inputs and impacts. This activity could also be expanded to include student research on the materials required to produce a given item and how the production of the item affects the lives of people in various places.
2. Arrange students in groups of 3-4. Provide each group with a large sheet of paper and marking pens.
3. Ask each group to decide on one item that will be the focus of their web diagram. They might want to create an impact diagram for a favorite meal, an article of clothing, a favorite object, or a mode of transportation.
   - **Alternative:** If you want to make this activity more structured, distribute one *What Does It Take to Make?* card to each group. Groups can use information from these cards to get started. Note that information on these cards is just a starting point; there are many inputs and resources not listed.
4. If students need help organizing their thoughts, you may want to create a chart on the board like the following example to get them started.

Component/ Part	**What is it made of?**	**What resources are needed?**	**Is transportation required?**	**What are possible environmental, social, and economic impacts?** (positive or negative)

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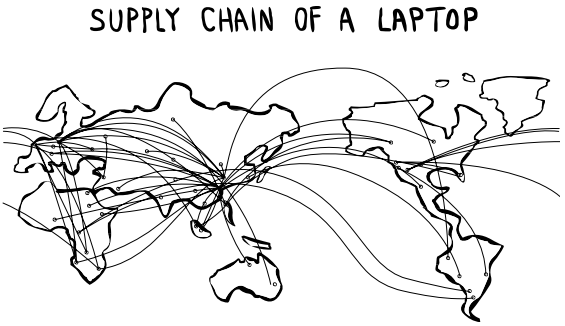
5. Allow about 20 minutes for this portion of the activity. Encourage students to be creative and think of everything that is related to the object. Remind them to consider impacts related to transportation of a product, the marketing of popular brand items, health issues, and waste disposal.
6. After completing their diagrams, have students brainstorm and list ways to reduce the ecological footprint and other impacts associated with creating or using the object. Give them 5-10 minutes to brainstorm. Students might come up with an alternative to the item, or an alternate way of producing or using it that might impact people and the planet in more positive ways. Ask them to record this information on their sheet of paper.
   - **Note:** Be sure to emphasize that they do not need to give up everything they like, but rather should focus on positive ways to reduce their impacts. For example, instead of saying that people should never drive cars, they could suggest that people ride a bike or carpool to school when possible.
   - Also, you may want to have students think here about how products can have both negative *and positive* impacts on consumers. What are ways of consuming products that can have positive impacts on the environment, societies, and/or economies?
7. Have groups present their diagrams and their proposed ideas for reducing the item's negative impacts on people and the planet.
8. **Option:** Post the impact diagrams around the room or in a hallway where other students can view them.

Reflection

1. How is the ecological footprint of a person's lifestyle connected to social and economic impacts?
2. Would the production, use, and disposal of these everyday items be sustainable if only a small number of people purchased the items?
3. How would the impacts associated with an item change if everyone in the world purchased or used it?
4. Does lessening our impacts necessarily mean reducing our quality of life? Why, or why not?
5. How might businesses be encouraged to produce these items in ways that have more positive impacts on the environment and on people?
6. Often negative impacts associated with an item are not paid directly by the people who purchase and use the items. Who might end up paying for those impacts? Why do you think these impacts are not included in an item's purchase price?



History Extension

Have students research how ecological footprint size has changed throughout history, either in the U.S. or in other countries, by finding evidence of past and present lifestyles and consumption patterns. How has humanity's ecological footprint changed over time? What might be causing these changes?

Action Project

Have student groups research social, environmental, and economic impacts of the items from the *What Does It Take to Make?* cards (or other products they are interested in learning more about). Each group can write an engaging article about all the impacts associated with the item and ways that people can use the product or an alternative in a way that results in more positive impacts. Compile the articles into a 'zine that can be shared with other students through the school's newspaper or website. Students might even ask a local newspaper to publish one or more of their articles in order to educate community members about the hidden impacts of what we buy.

Resources for research:

- *Good Stuff?: A Behind-the-Scenes Guide to the Things We Buy* (www.worldwatch.org/taxonomy/term/44)
- EPA poster: *The Life Cycle of a CD or DVD* (www.epa.gov/waste/education/pdfs/finalposter.pdf)
- EPA poster: *The Life Cycle of a Cell Phone* (www.epa.gov/osw/education/pdfs/life-cell.pdf)
- Global Exchange website, Fair Trade Coffee (www.globalexchange.org/campaigns/fairtrade/coffee/)
- *Stuff: The Secret Lives of Everyday Things* by John C. Ryan and Alan Thein Durning (Sightline Institute, 1997)
- "The Secret Life" film series, paper and cell phones (www.secret-life.org)
- Water Footprint Network (www.waterfootprint.org)

Additional Resources

- **Website:** www.myfootprint.org
  Students can calculate their own ecological footprint and compare it to average footprints from around the world.
- **Website:** www.goodguide.com
  The Good Guide provides information about the health, social, and environmental impacts of products. Students can click on "Browse Product Ratings" to learn more about specific impacts of everyday items.

Hamburger, Fries, and a Cola,
What Did It Take to Produce This American Meal?*

The meat came from cattle grazed initially on public or private land, and later fed grain. Some of the public lands in the western United States have been turned to desert by overgrazing, which happens when livestock eat so much vegetation that it no longer grows back. Streamside lands where cattle graze have been especially damaged.

It took approximately 2 pounds of grain to produce that quarter pound of meat. Grain production from unsustainable farming methods results in topsoil loss due to erosion. Producing that grain also took substantial amounts of pesticides and fertilizers (half of all fertilizer in the United States is applied to feed corn for animals), some of which ran off into surface water or seeped into groundwater supplies. Commercial fertilizers have been linked to climate change. The creation of nitrogen fertilizers releases the greenhouse gas nitrous oxide, which can combine with other greenhouse gases in the atmosphere to make temperatures on Earth warmer.

At a feedlot, where cattle are fattened before they are slaughtered for food, a typical steer will eat about 3,000 pounds of grain to increase in weight 400 pounds. By the time the steer was finished in the feedlot, it took 600 gallons of water to build that hamburger patty. At the meatpacking plant where the steer was slaughtered and butchered, most of the workers receive low wages and no health insurance or vacation days. These workers face high injury rates.

Once slaughtered and processed, the meat was frozen, shipped by truck, kept cold, and then cooked on a grill using natural gas. Both the diesel fuel to run the truck and the natural gas grill require burning fuels that contribute to climate change.

The 5-ounce order of fries came from one 10-ounce potato grown in Idaho on half a square foot of soil. It took 7.5 gallons of water to raise that potato, plus quantities of fertilizer and pesticides, some of which ran off into the Columbia or Snake Rivers. Because of that, and dams that generate power and divert water for irrigation, the Snake River sockeye salmon is virtually extinct.

* Unless otherwise noted, environmental impacts adapted from *Stuff: The Secret Lives of Everyday Things* by John C. Ryan and Alan Thein Durning (Seattle: Sightline Institute, 1997), and human impacts derived from *Fast Food Nation* by Eric Schlosser (New York: Perennial, 2002).

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Beef cattle in a feedlot

Farmers receive a small fraction of the price of the fries, maybe 1 or 2% of the price a customer paid for the fries. Most potatoes are now grown on large farms that require large potato-harvesting equipment. This reduces the number of potato farmers that are required to produce potatoes.

The potato was dug with a diesel-powered harvester and then trucked to a processing plant where it was dehydrated, sliced, and frozen. The freezing was done by a cooling unit containing hydrofluorocarbons (HFCs), some of which escaped into the atmosphere where they may contribute to global climate change. The frozen fries were then trucked to a distribution center, then on to a fast-food restaurant where they were stored in a freezer and then fried in corn oil heated by electricity generated by hydropower.

The meal was served in a fast-food restaurant built on land that was originally forest, then farmland, and then converted to commercial/industrial uses as the city expanded. Many of the workers in the fast-food restaurant are teenagers and young adults who work part-time for minimum wage.

The cola came from a Seattle processing plant. It is made of 90% water from the Cedar River. The high-fructose corn syrup came from Iowa, as did the carbon dioxide used to produce the fizz, which is produced by fermenting corn. The caffeine came from a processing plant that makes decaffeinated coffee. The cola can was made from one-third recycled aluminum and two-thirds bauxite ore strip-mined in Australia. It came to Washington State on a Korean freighter, and was processed into aluminum using an amount of energy equivalent to a quart of gasoline. The energy came from some of the same dams mentioned earlier that have contributed to an estimated 97% decrease in the salmon runs of the Columbia Basin.

Cola has been called "liquid candy" because of its high sugar content. In the late 1950's a typical fast-food cola was 8 ounces. Today a large cola might be 32 ounces, containing over 300 calories and a third of the daily maximum amount of sugar recommended for an adult. High amounts of calories and sugars can lead to conditions like obesity and diabetes. In the United States an estimated 34% of adults are obese.[1] Cola is extremely profitable for fast-food restaurants. It costs a restaurant just 9 cents to buy the syrup needed for a medium cola that sells for around $1.29.

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Fresh potatoes in the field

The typical mouthful of food consumed in the U.S. traveled 1,200 miles for us to eat it. Along the way, it required packaging, energy, roads, bridges, and warehouses. Both people and machines were required for each step of the food production.

1 National Center for Health Statistics, "Health, United States, 2008," www.cdc.gov/nchs/data/hus/hus08.pdf, 32.

What Does It Take to Make?

Cup of Coffee

Beans
- Beans grown in Colombia
- Pesticide from Germany applied to beans
- Beans roasted in New Orleans

Sugar and Cream
- Sugar produced in Florida
- Cream from dairy near Seattle

Disposable Cup
- Made from 10% recycled paper
- Virgin paper from trees grown in Canada
- Cup lined with a thin layer of plastic, made from oil drilled in Venezuela

T-shirt

T-shirt is 50% cotton / 50% polyester.

Polyester
- Crude oil drilled in Venezuela
- Crude oil refined in Curacao
- Refined oil processed in Delaware to create polyester fiber

Cotton
- Cotton grown in Mississippi
- Cotton fibers spun into yarn in North Carolina

Assembly
- Shirt sewn in Honduras

Computer

Computer Chip
- Made of silicon mined in Washington State
- Silicon processed in Oregon
- Sent to chip manufacturer in California
- Copper from Arizona and gold from South Africa applied to chip

Circuit Board
- Made of tin from Brazil and lead obtained from recycled car batteries in Houston

Monitor
- Assembled in Japan
- Plastic created from oil drilled in Saudi Arabia and processed in the U.S.

Athletic Shoes

Athletic shoes are made of leather and synthetics.

Leather
- Cows raised in Texas
- Cow hides shipped to South Korea for tanning (to make leather soft and durable)

Synthetics
- Synthetic insole made of oil drilled in Saudi Arabia and refined in South Korea
- Synthetic rubber sole made of oil drilled in Saudi Arabia and refined in Taiwan

Cardboard Box
- Made from recycled paper in New Mexico

Newspaper

Newspaper is made of recycled and virgin paper.

Virgin Paper
- Trees grown in British Columbia

Recycled Paper
- Recycled paper processed in Michigan

Assembly
- Virgin and recycled paper are made into newsprint in a Detroit paper mill

Ink
- Made from petroleum drilled in Gulf of Mexico

Bicycle

Metal frame
- Recycled steel from Chicago
- Manufactured and painted in Wisconsin

Aluminum gears, brakes, and spokes
- Made from ore mined in Australia and smelted (where metal is pulled from the ore) in Russia
- Manufactured in Japan

Tires
- Synthetic rubber made in Taiwan from petroleum

* Information adapted from *Stuff: The Secret Lives of Everyday Things* by John C. Ryan and Alan Thein Durning (Sightline Institute, 1997).

