

ACTIVITY 1:

What is your ecological footprint?

Background

Summary: Students examine their own consumption patterns and calculate their ecological footprints.

Grades: 9-12; (6-8)

Time: 3-4 class periods

Subjects: science, math, social studies, language arts

Skills: analysis, comparison, description, research, synthesis

Learning Objectives:

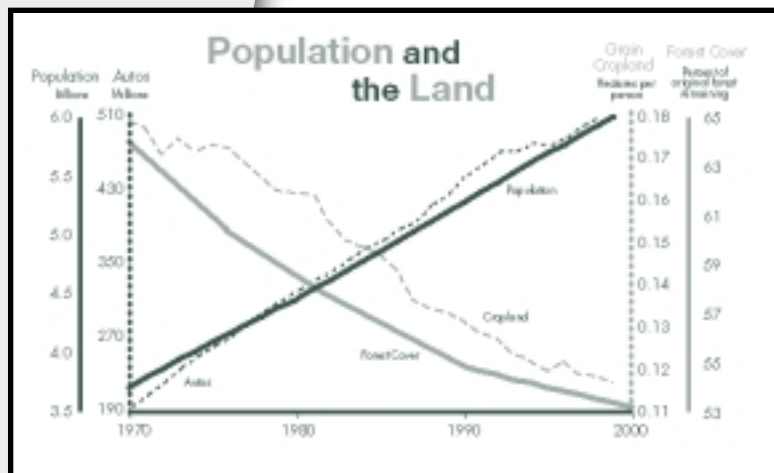
Students will be able to:

- Identify resources they use in their own lives.
- Quantify their current ecological footprint.
- Identify and present realistic ways in which they could modify their ecological footprints.

Materials: research sources, student worksheets

In *The Cost of Cool* the globe is shown and portions that consist of oceans, deserts, high mountains and other virtually uninhabitable areas are eliminated, revealing the relatively small portion of the Earth that supports human life. For example, food and fiber crops are grown on about 11% of Earth's total land area. The portion of land that can support humans is relatively inelastic and while it might be increased slightly by innovations such as irrigation or pest-resistant crop strains, it can also decrease with desertification and other consequences of global climate change. The amount of space devoted to each individual's support, however, is highly variable depending on the resources used and waste generated. As seen in the graph of *Population and the Land*, as population and the number of autos increase, cropland per person and forest cover decrease.

An **ecological footprint** is the area of productive land and water required for a given population to exist at a given consumption level. It measures how much of nature's **carrying capacity** we use to feed, clothe, and otherwise maintain ourselves. All consumption of energy and materials, and all discharge of wastes, require land or water for resource production or waste disposal. As can be seen from the table of [Ecological Footprints](#) (p. 14), each person in the U.S. requires on average 25 acres of land to maintain his or her level of consumption, while each person in Bangladesh needs only 1 acre of land. For example, the collective "footprint" of the 9.5 million people in Los Angeles County is 40 times larger than the land area of the county itself—larger than the entire land area of California. This means that Los Angeles County residents are essentially "borrowing" land from other parts of the country and the world. This is a pattern that, if it continues to grow, will be unsustainable. In this activity, students will examine the components of their own personal ecological footprints, compare to those of others, and take on the challenge of quantifying this information about the resources they use in a way that is meaningful to them.



Worldwatch Institute, World Watch, Vol. 13 No. 2, March/April 2000, Copyright 2000, www.worldwatch.org.

Resources for this activity:

Books

De Graaf, John, Wann, David, Naylor, Thomas H., 2001, *Affluenza: The All-Consuming Epidemic*, Berrett-Koehler

Durning, Alan T. and Ryan, John C. 1997, *Stuff: The Secret Life of Everyday Things*, Northwest Environment Watch.

Reeske, Mike and Ireton, Shirley Watt, 2001, *The Life Cycle of Everyday Stuff*, NSTA Press. Includes a poster of the life cycle of a pencil.

Schlosser, Eric, 2002. *Fast Food Nation*, Harper Collins, New York.

Schor, Juliet, 1999. *The Overspent American: Why We Want What We Don't Need*, HarperCollins, New York.

Wackernagel, Mathis and Rees, William 1995. *Our Ecological Footprint; Reducing Human Impact on the Earth*. New Society Publishers, Gabriola Island, B.C. Canada and Philadelphia, PA.

Web Sites

Ecological Footprint Calculator, Center for a Sustainable Future

http://csf.concord.org/esf/Software_EFC.cfm

This Ecological Footprint Calculator provides a tool for students that will help them learn how ecological footprints are often calculated and what the different land uses are that make up their footprint (crops, grazing land, forest, developed land, etc.). In addition, students can use this tool to open up different surveys, create their own footprint surveys, edit and create new questions, and research for themselves the impact of human activities.

Ecological Footprint of Nations

<http://www.ecouncil.ac.cr/rio/focus/report/english/footprint/>

Produced by the Universidad Anáhuac de Xalapa in Mexico, this "Rio+5 Forum" study was commissioned and financed by The Earth Council in San José, Costa Rica.

It lists comparative footprints for 52 nations, along with the data and methods used to make the calculations.

Redefining Progress

<http://www.rprogress.org/programs/sustainability/ef/>

Produced by the non-profit organization, Redefining Progress, this website offers a footprint quiz and calculator, comparative statistics, as well as suggestions and links for changing personal consumption patterns.

Leadership for Environment and Development

<http://www.lead.org/leadnet/footprint/intro.htm>

Provides a household ecological footprint calculator with simple questions for students to answer. Provided by Leadership for Environment and Development (LEAD), International.



Note: All websites in this guide were active at the time of publication and were reviewed by NWF staff. However, listing in this guide does not constitute endorsement of the content or organizations represented by the websites. Teachers are encouraged to preview all sites in advance and encourage their students to think critically about all site content.

Procedure

1. Ask students to think about how much they purchase from day to day. Have students individually create a list of everything they bought or that was bought for them in the past week and write it down. Alternatively, you could ask students to record everything they buy or that is bought for them in the week ahead. Encourage them to try to think of all the kinds of items they need to get through their week (food, clothing, transportation, heating/cooling in their apartments or houses, entertainment, etc.) to include on their lists. Students should record their individual lists.



2. After students have written their individual lists, place them into small groups (4-5) and compare lists, adding to their lists items that they may have forgotten and modifying as they discuss, to prepare a group list. Then have groups compare their lists to those of other groups. (Note: If you feel it is appropriate for your particular group of students, have them assign prices to all the items on their lists and compute a group average, put these numbers on a board, and then compute a class average. *Does this number surprise them? Is it higher or lower than what they might have predicted?*)

3. Now, ask students to think of the individual environmental impact of each of the items they bought. Ask them to think about the T-shirt example in the *Cost of Cool* video. In the video, the resources required to make one T-shirt are given:

- 14 square feet of land
- Water
- Pesticides - 10% of all pesticides are used to grow cotton
- If polyester - oil, with attendant air pollution
- Large machines to cultivate and process cotton
- Chemical dyes which are sometimes toxic
- Shipping to stores - trucks and gas
- Packaging - plastic from oil, paper from trees

How many T-shirts do each of your students have in their closets? Ask them to calculate how much land is represented by the T-shirts they buy in one year. Could this land be used for anything else? Encourage students to think about endangered and threatened species. Habitat destruction is a primary contributing factor in the endangerment of most endangered and threatened species. Point out, or help your students realize that all the land on Earth must be shared with wildlife (plants and animals) as well as the ever-growing human population. On the other hand, everyone needs clothes to wear. How can we balance these needs?

4. T-shirts are not the only things we own. *Where do each of the items on the students' lists come from? What did it take to produce it? What are the potential effects on wildlife of each step in the process? Ask each group to select one item from their lists that they want to investigate. Encourage them to select relatively simple items, such as a book, pencil or food item, rather than a very complex item like a computer, and try*

to ensure a wide representation of products among the group. As a group, they should develop a list of questions they want to answer and divide up roles for this research project. For example, a couple of students could look at the manufacturing processes required to make a product, others could examine transportation to get it to the store, another could look at packaging, another could look at the cost of disposal, and so forth, depending on the questions students want to investigate. Students may use the worksheet on page 15 to get started.

5. Give students ample time to conduct their research, as it may require sources that they may not be familiar with, such as calling corporate information lines, tracking down newspaper articles, and other sources (See the listed books and websites for some guidance.) Ask students to develop a chart or diagram showing all the steps the product goes through to get to the consumer and all the steps it goes through for disposal. This graphic should show all the locations involved (U.S. and abroad), materials, natural resources, and processes that go into this product at each step. Students should try to calculate a cost and amount of land represented for each of these steps. In the example of the T-shirt, students would show the origin of the oil for making polyester, the factories where polyester is made, the farms where the cotton is grown, the mill where it is made into thread and fabric, the chemicals and pesticides used in its creation, the factory where the shirt was sewn together, the packaging used, the route by which it got to the local store. They would use all of these components to calculate a rough estimate of cost and land used to make one T-shirt, which in this case is given at about 14 square feet.

6. When students have completed their research projects, have them present these projects to the class, demonstrating what they found and the most interesting aspects of the information they discovered. As each

group presents their findings, have one member of the group write key information on the board, such as the total monetary cost they were able to calculate for their product, the amounts of natural resources involved, the amount of land used, wildlife species affected by the process, or a list of the different manufacturing processes that were involved. By the time all groups have presented, there should be a long list of these factors on the board.

7. Ask students to look at these lists and challenge them to come up with a way to quantify all of this information. Remind them that each group looked at only one item, but the total impact of consumption in one week would include ALL of these items and many more that they did not investigate. *How many natural resources do all these products represent together? How much land do these products use in their production?* If they could calculate this information for everything they used in the past week (referring to their lists), the answer to this question would be the students' "ecological footprint" for that week. And if



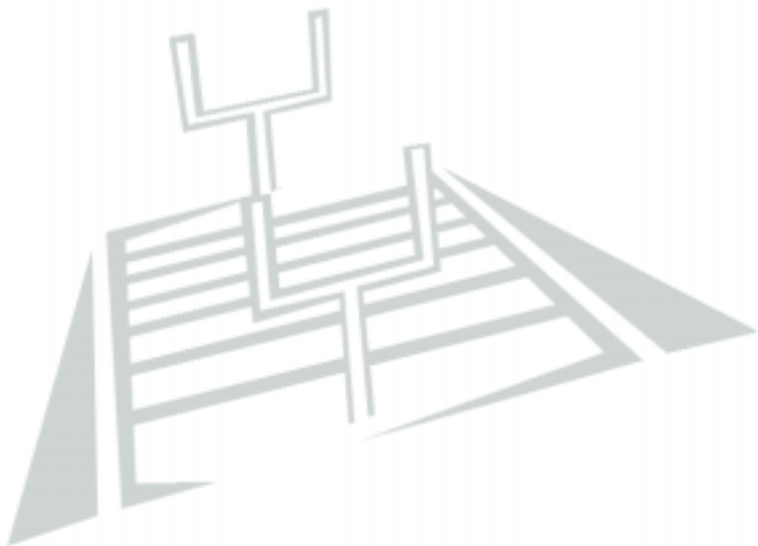
they could calculate it for one week, they could estimate it for a year, keeping in mind that certain things are only purchased a few times in a year, or every few years (like a car, a house, a bicycle, birthday cake, etc.). Ecological footprints are usually expressed by scientists as the total area of land needed to produce the resources and take care of the waste of a single person. However, if students have come up with additional ways to express this information that include other factors in addition to land, such as monetary cost, effects on wildlife species, amount of transportation required, etc., these factors may add meaning for them. Alternatively, ask students to translate the amount of land in their footprint into a useful comparison, such as football fields, local parks, or another local example. Encourage students to present their data in chart, table, or graphic format. See the list for footprint-related resources to help guide your students.

8. Ask students, *So does this mean that you shouldn't buy anything? What are some of the positive effects of buying (fulfills needs for food, clothing, shelter, etc.; jobs for manufacturers, truckdrivers, advertisers; benefits the country's economy; makes people happy, status, and so on)?* Ask students to think about the differences between

products that they *need* and those they may *want*. Encourage students to think of these issues in a complex way—the size of an individual's footprint will be determined by many factors, including his exactly *what* and *how much* that person buys.

9. Show students the chart of comparisons between the average ecological footprint in the United States and that of other countries (p. 14). *What do they notice? What does the deficit column mean?* (It means that Americans need/use more land than exists in our own country.) *How might it be possible to reduce this deficit?* Ask students to consider ways in which their “ecological footprint” could be reduced in size—how they could use less land and fewer resources. Encourage them to come up with their own ideas; some possibilities and examples to help them start thinking might include:

- Substituting current consumption patterns with less land consumptive items. For example, one acre of land can produce 36,000 lbs. of potatoes, 45,000 lbs. of strawberries, 14,000 lbs. of sweet corn or 37.1 bushels of wheat—enough to make 2,600 loaves of bread (www.norwich.net/~fb/agfacts.htm). By comparison, one acre of land produces far less meat; it takes on average of about 8 lbs. of grain to produce one pound of meat.
- Using products made from recycled materials and recycling aluminum, paper and plastics saves landfill space, forestland and land for the energy extraction required to produce new products.
- Buying products with less packaging and/or with recyclable packaging. See, for example, *Packaging and the Environment: Alternatives, Trends and Solutions*, 2nd Edition, by Susan E. Selke, Technomic Publication Company, 1994 or *Packaging for the Environment: A Partnership for Progress* by E. Joseph Stilwell, R. Claire Canty, Amacom, 1991.



Several of the websites listed on the activity resource page show where different kinds of choices have the most impact on total footprints.

10. Have students make a list of the kinds of things they would be willing to do to reduce their footprint and then repeat the calculation they did for the first part of this activity and see what difference they would be able to make.

Modifications for Younger Students (Grades 6-8):

For younger students, you may want to assign them particular products to research, and provide them with specific resources for those products. One place to start is www.eiolca.net, which is the Economic Input-Output Lifecycle Assessment webpage. It is somewhat complicated for students, but can give you some ideas to help get them started or provide some broad statistics for industries, such as food, fabrics, paper, and so on.

Extensions

- Have students construct and conduct a survey for their peers and family members, asking them which activities they would be willing to change in order to reduce their average footprint, and which they would not, with their reasons. Ask students to report back on the challenges of changing their ecological footprint.
- Have students investigate ecological footprints in different countries around the world. Use the comparison chart on p. 14 to start.) Why are there such vast differences? What kinds of factors make these differences exist? Is there anything we can learn from any of these other countries?
- Have students investigate purchasing patterns at their school's cafeteria, offices, or classrooms. What kinds of impacts do they discover?

In 1960, the average American produced two and a half pounds of garbage per day. Now, we produce – on average – nearly four and a half pounds per day.

U.S. EPA, Characterization of Municipal Solid Wastes in the United States: 1995 Update, Executive Summary, EPA Office of Solid Waste and Emergency Response, March 1996, EPA530-S-96-001.

Assessment

Have students detail their current ecological footprint, in writing or in graphic representation, indicate which components of this footprint have the most impact, and develop different scenarios for ways to reduce that footprint. Ask them to write a couple of paragraphs describing which of these activities they would actually be willing to change in their daily lives, which they might not, and why. What impacts would these changes have on their lives?

Comparison of Ecological Footprints for Selected Countries

An Ecological Footprint is the total area of land—wherever it might be located—required to produce the resources and assimilate the waste of a person. An acre of land is about the size of a football field.

Country	1997 Population (In Millions)	Footprint (Acres/Person)	Deficit* (Acres/Person)
Bangladesh	126	1	0.5
Brazil	167	8	(+9)
Canada	30	19	(+5)
China	1,250	3	1
Germany	82	13	1
India	970	2	1
Japan	126	11	6
Mexico	97	6	3
Nigeria	118	4	2
Russia	146	15	6
U.S.	268	25	9
World	5,850	7	2

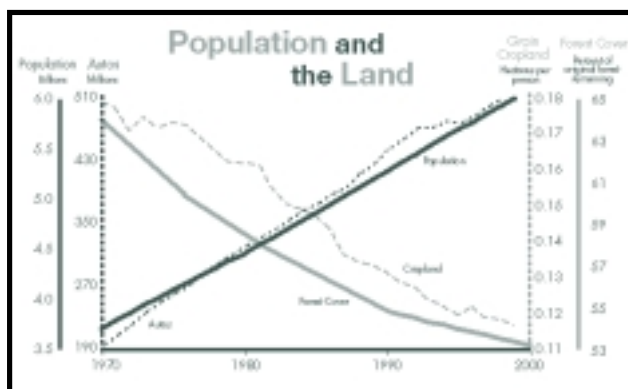
* Amount by which footprint exceeds locally available productive land and water area. Numbers in parentheses (+) indicate presently unused ecological capacity inside borders. Source: Wackernagel et al., Ecological Footprint of Nations, 1997.

Ecological Footprint Background

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Sample chart for guidance investigating a product			
Stages	Materials Use	Energy Use	Residues (pollutants)
Pre-manufacture			
Manufacturing			
Product Delivery			
Product Use			
Refurbishment, disposal, recycle			