Natural Resources: On the Way Out?

Perhaps you remember, as we do, the energy crisis of the 1970s. Like the authors of our children's textbooks, people thought that there weren't enough natural resources to go around, and that there would be even fewer as the population grew and people were wasteful.

Neil Hrab was exposed to the fears when a high school student in Ontario. His teacher was leading a discussion about North American energy consumption. Mesmerizing the class, the teacher raised his hand and said: "If everyone in the world consumed as much energy as we do, then"—here he snapped his fingers—"all the energy in the world would be used up in the time it took me to snap."[1] Textbooks today repeat the message.

- "Some experts estimate that if people continue to use petroleum, natural gas, coal, and uranium at present rates, most supplies will run out within the next 200 years," says the text *Journeys in Science*.[2]

- *Earth Science* writes: "World reserves [of copper] will be used up in about 60 years if present rates of use continue," and zinc will last "40 years at the present rate of consumption." Furthermore, "at present rates of use, world reserves of petroleum are estimated to last about 30 years and natural gas not much longer."[3]

- "Petroleum is particularly scarce," warns one geography text, saying that "some economists fear that only a 50-year supply may remain."[4]

These claims are not justified. World supplies of most natural resources are not running out. Fossil fuels and most minerals are more abundant than in the past—that is, they are more readily available and cheaper than they used to be. Most resources are so plentiful that they will last for centuries.

This news may come as a surprise, especially if you remember the high prices of fuel and the energy shortages in the late 1970s. How can we say with confidence that the world is not going to run out of its important nonrenewable resources? We will explain the reasons in this chapter.

Running on Empty?

Fear of scarcity pervades our children's texts. Students learn that there is only so much tin or coal or iron or oil to go around and, once used, it will be gone forever. The drumbeat is steady:

- *Science Directions 9* says that "coal, oil, and gas . . . are in limited supply on Earth. They are non-renewable energy resources, and they are being used up."[5]

- "Once they [non-renewable resources] are used, they are gone forever," says the text *Journeys in Science.*[6]

- Another text says "energy comes from burning coal, oil, or gas" and asks: "What will happen when these supplies are used up?"[7]

- *Canada—A New Geography* states: "Resources such as minerals and fossil fuels are called non-renewable since they cannot be replaced once they are used up."[8]

One reason they will be gone, say the texts, is that Canada and the United States are using too much of these resources.

- "Rich western countries, with only 20% of the world's population, use 70% or the world's energy," says the curriculum supplement *Science Is . . .*[9]

- "The average person in a developed nation uses 80 times as much energy as the average person in a developing nation, who lives without electricity or a car,"[10] says another.

- "If we consume more than our rightful share of such resources as petroleum, future generations will blame us for squandering the Earth's limited wealth," says the geography text *Canada in a Changing World.*[11]

A children's book states that "the rich countries are using up most of the world's resources—the food, and the things that make energy, such as oil and gas."[12]

Youngsters are bombarded with instructions to conserve energy. Most of these are harmless and a few are useful. After all, our children should turn off the lights when they leave a room. But many texts also urge more taxes and regulations to cope with the supposed crisis.

- Beth Savan, in the children's book *Earthcycles and Ecosystems*, says that "lately, we've been dirtying up the atmosphere with exhaust fumes from cars, furnaces and power plants." She then suggests that children "[w]rite to government decision-makers and ask for laws that require people to use less energy."[13]

- "The supply of fossil fuels is being used up at an alarming rate," says the text *Biology, An Everyday Experience*. "Governments must help save our fossil fuel supply by passing laws limiting their use."[14]

Why They Are Wrong

It is true that resources are finite, but this is largely irrelevant to human experience. Specific natural resources are limited in quantity, but in most cases the services that they provide can be supplied by other resources as well.

Throughout history, people have feared the depletion of a vital resource only to find that when the price rose, they could switch to another resource and get the same service. During the Middle Ages in Europe, charcoal from wood was the primary source of energy. As wood became more scarce, the price rose and people began to search for a substitute. Eventually, they found it in a previously worthless rock—coal. In the mid-nineteenth century, whale oil was used for lamps. As it became more difficult to find whales in the oceans, whale oil prices began to rise, and people began to fear that whale oil would disappear. According to economist J. Clayburn LaForce, however, as the price rose, people began to look for substitutes and they found one in coal oil.[15] Indeed, the steady increase in the use of coal set people worrying, too. A prominent economist, W. Stanley Jevons, said in 1865 that he doubted England's prosperity could continue once its supplies of coal were exhausted.[16]

But as the most easily mined coal was used up, the price of coal began to rise and people began searching for additional sources of energy. (They also wanted one that burned more cleanly.) Farmers in western Pennsylvania had been cursed with a black liquid substance on their land that harmed their crops and pastures, driving down the value of their land. To a few entrepreneurs, this black liquid known as "rock oil" looked promising, and in 1859 the Pennsylvania Rock Oil Company of Titusville, Pennsylvania, successfully dug for oil. The gooey substance took the pressure off coal, and today coal is plentiful, even in England.

What People Really Want

Most textbooks miss the point about natural resources. The authors think that what is important is the resource and whether it is renewable or nonrenewable. But what we want is not the resource itself, but the service provided by using the resource.

People don't really want copper wire, petroleum, and electricity; they want communication over long distances, warmth in winter, and transportation to their homes and offices. These services can be provided by many different resources, especially as technology advances.

Consider copper. Copper is a highly efficient conductor of electricity, so it is widely used for wiring that supplies electricity to our homes and connects our telephones. Some people think that the world faces a serious copper shortage, and that this could stunt economic growth. But we don't rely on copper the way we used to, not because it is scarce but because other materials are proving more useful.

For telephone lines, we are beginning to use fiber optic cables instead of copper wire. These glass fibers, derived from ordinary sand, can carry many more messages at a time than copper wire can. Because fiber optic cables can replace copper today, there will be less need to use copper for communication. Communication satellites

have also replaced copper wire. There is little reason to doubt that we will have ample supplies of copper for generations to come.

Prices Make a Difference

People shift from one resource to another in response to changes in prices. As natural resources become scarce, their prices increase. As prices increase, several things happen.

First, consumers begin to conserve. In recent history the price of oil has twice gone up dramatically. The first hike occurred after the outbreak of the Middle East War in 1973 and an oil embargo by oil-producing countries; the second occurred in the late 1970s after the overthrow of the Shah of Iran. (Both events were the result of political actions, not natural shortages.)

In both cases, the higher prices caused consumers to use less energy. They turned down their thermostats in winter, turned off the air conditioning in the summer, drove less, and tuned up their cars so they would run on less fuel. As time went on, they bought more fuel-efficient automobiles and increased the insulation in their houses. These measures didn't happen all at once, but they gradually reduced the demand for oil.

Consumers also shifted to substitutes. People can substitute warmer clothes for home heating, and can replace air conditioning with fans or fewer clothes. They can use other fuels such as coal and natural gas. In the 1970s and 1980s, people took just such steps.

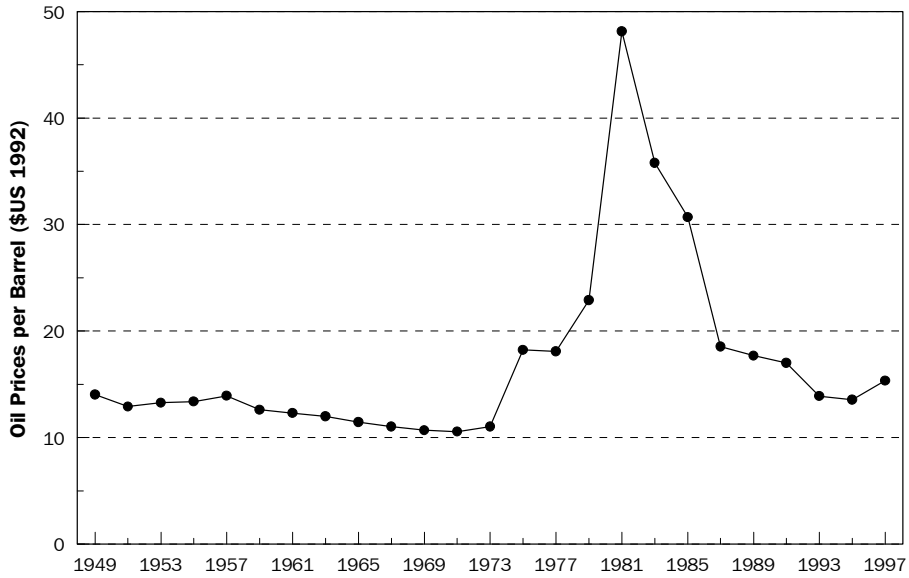
The price rise also increased the incentive of producers to supply more oil. Before the embargo, the price of oil was so low that it did not encourage exploration for new oil reserves. When prices rose, oil exploration did, too. In addition, price increases stimulated producers to increase supply by figuring out how to get oil from fields that had been considered dry. New techniques like slant drilling, water extraction, and deeper drilling could pay off when the price was higher.

These changes caused the price of oil to stop climbing. In fact, in the mid-1980s, to the surprise of many people, the price of oil collapsed. It had been US$34 per barrel in 1981 but it was US$10 per barrel in early 1986[17] (about US$12 when adjusted for inflation). Today oil is readily available and relatively inexpensive—in spite of large new taxes that have been added to the price.

Another Misunderstood Idea: "Known" Reserves

Most of the predictions in our children's textbooks are based on a simple calculation that is used inappropriately. The textbooks report the "known" or "proven" reserves of important minerals or source of energy. They divide this figure by the consumption per year to predict how soon we will run out.

Oil Prices per Barrel, 1949–1993



Source: Energy Information Administration, *Annual Energy Review 1998* (Washington, DC: U.S. Department of Energy, 1998).

As every geologist knows, "proven" or "known" reserves is a very limited concept. It is not meant to describe all the reserves on the planet, but those that can be recovered economically at present prices.[18] If oil costs $25 a barrel, oil that can't be extracted for less than $25 isn't counted as a reserve because no one is willing to extract it. So "known" reserves at $25 per barrel exclude a lot of oil that we know about, that would be extracted at $30 or $40 a barrel, but not at $25.

If we began to deplete the "known reserves," prices would go up, at least temporarily. Petroleum companies would seek out additional sources, and "known" reserves would increase.

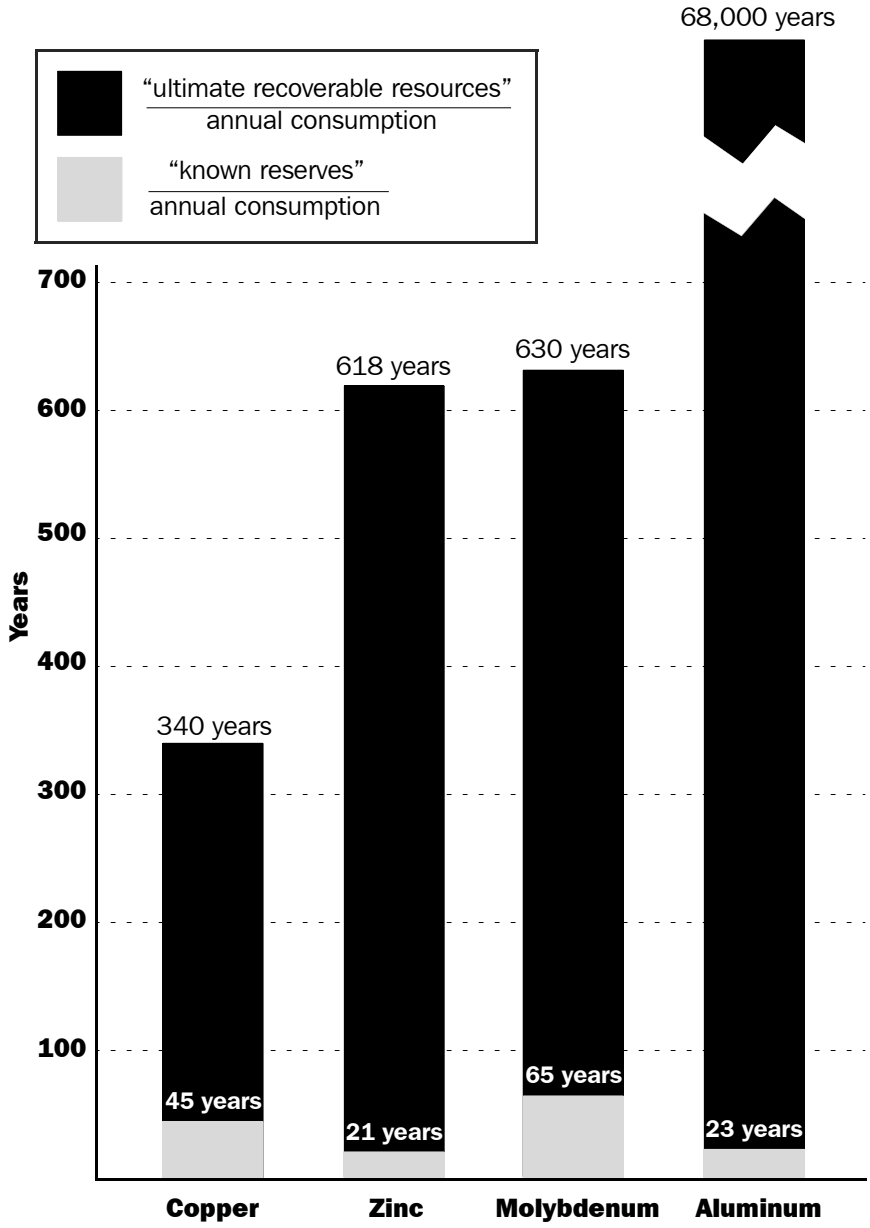
The U.S. Geological Survey (USGS) has developed estimates that reflect this fact. In addition to "known" reserves, the USGS estimates "ultimate recoverable" resources, which are 0.01 percent of the material in the top kilometer (six-tenths of a mile) of the earth's crust. It even includes the amount estimated to be in the entire Earth's crust. As the graph on page 92 indicates, when these estimates are used, the number of years until depletion of a resource goes up dramatically.[19]

For example, "known reserves" of copper are expected to last about 45 years but "ultimate recoverable" reserves would last about 340 years, and the amount in the Earth's crust represents 242,000,000 years.[20] These figures are largely ignored in the textbooks.

Talking to Your Children

The most important point your children should understand about natural resources is that they change over time. Natural resources aren't useful until human beings figure out how to use them, and human ingenuity is constantly finding how to use new resources or old resources in new ways.[21] As long as the human mind is free to be creative and ingenious, we should not worry about depleting our natural resources. Now you can answer some questions your children may ask.

Known Reserves and Estimated Ultimate Recoverable Resources



Source: David Osterfeld, *Prosperity versus Planning: How Government Stifles Economic Growth*. New York: Oxford University Press, 1992, 95, table 4-5, citing William Nordhaus.

- Are we running out of natural resources?

  No. Most natural resources are plentiful. While some may become more scarce over time, price changes will cause people to find substitutes. The resources that we use will change over time. Materials that were previously unknown or neglected will provide the services we want.

- How much oil is left in the ground?

  No one knows for sure. The textbooks claim that we may run out of reserves of oil and other raw materials in a specified number of years. But these estimates reflect only the reserves that can be obtained at current prices. If prices go up, "known" reserves will increase.

- Should we conserve natural resources?

  Conservation of natural resources is a good idea but it should not be placed above all other considerations. People *inevitably* conserve when prices go up. They use less and look for products that provide similar services at lower cost. There is a natural tendency to conserve when something becomes scarce.

Activities for Parents and Children

Here are some activities and discussions that you can share with your children to help them develop a more accurate understanding of natural resources.

A Trip along the Telephone Wires

Ask your children to take an imaginary trip along the telephone wires. Discuss with them how their voice travels from your telephone to their grandmother's phone (or to another relative who lives across

the country). Most children can understand that the voice is converted into a fluctuating electrical current that travels along copper wires and through switching stations. Tell them that the telephone network was originally like this but it has changed.

As the number of phones, fax machines, and computers increased in recent years, more and more phone lines were needed. The price of copper wire began to be a problem for the phone companies. Phone companies wanted to find a cheaper way to send the multitude of signals. So now that same call may travel from your house to a satellite station, where it is converted into microwaves and transmitted to a satellite in space and then transmitted back to earth near your grandmother's house, where it is converted back to electrical impulses and travels by copper wire to her telephone. Or the phone call may leave the house and be put on a fiber optic cable made of glass (which originally came from ordinary sand) and travel with thousands of other calls to a distant location. You and your children may wish to draw these different ways to transmit information.

Another way to illustrate these concepts is to take your children to an electronics store and have the manager show them all the products that can be linked by telephone (computers, fax machines, etc.). Or take your children to the phone company and have an engineer explain how the phone network in the country works. You can also point out the various advertisements on television (MCI, Sprint, etc.), which show how extensive our communication network is. Human ingenuity responding to higher prices has constructed a communication system that is less dependent on copper than in the past.

"Betting the Planet"

Your children may enjoy the story, "Betting the Planet," which appeared in the *New York Times* in 1990.[22] Ten years earlier, at the crest of a wave of public alarm over the rising price of oil and other commodities, economist Julian Simon offered to make a wager. He chal-

lenged anyone to select a commodity and name a future date. On that date, he said, the commodity would be cheaper than it was when the bet was made (assuming that general inflation was taken into account). If the material turned out to be more expensive, Simon would pay an agreed-upon amount. If it was cheaper, the other person would pay Simon.

Paul Ehrlich, the well-known advocate of population control, took up the challenge. He selected five metals—copper, chrome, nickel, tin, and tungsten—that he was sure would cost more in ten years because we would start running out of them. Simon bet that the prices would be lower.

By 1990, the five metals had fallen in real (that is, in inflation-adjusted) terms. Julian Simon easily won the bet. Simon wasn't simply lucky. He knew that the prices of all major commodities have fallen over time and saw no reason to expect that process to change. When materials appear to be scarce, prices go up, but these price hikes are usually temporary. Higher prices lead consumers to look for substitutes and spur producers to seek out new sources of supply. Over time, more supply and less demand cause prices to fall.

Another Way to Look at Materials

A policy analyst, Stephen Moore, has compiled an index that illustrates how cheap some metals are today. His index is based on how long it would take for a person to earn enough money to buy a pound of the metal. Instead of using the actual figure, he used 100 as the figure for 1990, and based all the other numbers on the 1990 figure.

In 1980, the figure for copper was 125. That means that a person had to work 25 percent more time to earn enough money to buy a pound of copper than he or she would in 1990. (If it took 100 minutes of work for the average worker in 1990 to buy a specific amount of copper in 1990, it would have taken 125 minutes in 1980.) The table indicates that the cost of copper in terms of hours worked went down dramatically during the past century.

Sit down with your children and a piece of graph paper. Using the numbers provided below, ask them to make a graph (it could be one graph or as many as three) showing how prices have changed for these metals.

Index for Comparing Changes in the Price of Metals

	Copper	Lead	Mercury
1890	928	683	1496
1900	944	651	1238
1910	568	513	1025
1920	278	324	619
1930	217	236	923
1940	158	184	1184
1950	135	215	248
1960	129	123	409
1970	155	109	532
1980	125	136	235
1990	100	100	100

Source: Stephen Moore, *Doomsday Delayed: America's Surprisingly Bright Natural Resource Future*, p. 30.

Discuss with your children why the price has decreased. There may be a number of reasons. Demand for copper, as we have seen, fell because substitutes were cheaper. Lead is known to be dangerous, so people have been looking for alternatives to use in paint and gasoline. Also, there may have been an increase in the supply of these metals. In any case, producers have more than kept pace with the demand for these metals. We can expect that progress to continue with these and with all major natural resources.

Notes

1 Personal fax from Neil Hrab, July 22, 1997 to Laura Jones.
2 Peter Beugger, Larry Yore, *et al*., *Journeys in Science 6* (Toronto: Collier Macmillan Canada, Canadian ed., 1990), 89.
3 Samuel N. Namowitz and Nancy E. Spaulding, *Heath Earth Science* (Toronto: DC Heath Canada, Canadian ed.,1987), 75–79.
4 Stewart Dunlop, *Towards Tomorrow: Canada in a Changing World—Geography* (Toronto: Harcourt Brace Jovanovich Canada, 1987), 14.
5 Robert A. Douglas, *Science Directions 9* (Edmonton: Arnold, 1991), 157.
6 Peter Beugger, Larry Yore, *et al*., *Journeys in Science 5* (Toronto: Collier Macmillan Canada, Canadian ed., 1990), 90.
7 Robert A. Douglas, *Science Directions 8* (Edmonton: Arnold, 1991), 143.
8 Ralph Krueger and Ray Corder, *Canada: A New Geography* (Toronto: Holt, Rinehart, and Winston, 1982), 496.
9 Susan V. Bosak, *Science Is*... (Co-edited by Richmond Hill, ON/ Markham, ON: Scholastic Canada/The Communication Project, 1991), 354.
10 James E. Davis and Phyllis Maxey Fernlund, *Civics: Participating in Our Democracy* (Menlo Park, CA: Addison-Wesley, 1993), 565.
11 Dunlop, 14.
12 Shelley Tanaka, *A Great Round Wonder: My Book of the World* (Toronto: Douglas and McIntyre, 1993), 43.
13 Beth Savan, *Earthcycles and Ecosystems* (Toronto: Kids Can, 1991), 47.
14 Albert Kaskel *et al*., *Biology, An Everyday Experience* (Lake Forest, IL: Glencoe, 1992), 677.
15 J. Clayburn LaForce, "The Energy Crisis: The Moral Equivalent of Bamboozle," Original Paper 11 (Los Angeles, International Institute for Economic Research, April 1978).

16 Quoted in Julian Simon, *The Ultimate Resource* (Princeton: Princeton University Press, 1981), 93.

17 James D. Gwartney and Richard L. Stroup, *Economics: Private and Public Choice* (New York: Harcourt Brace Jovanovich, 1987), p. 653.

18 U.S. Bureau of Mines, *Mineral Facts and Problems* (Washington, DC: Government Printing Office, 1985), 3.

19 David Osterfeld, *Prosperity Versus Planning: How Government Stifles Economic Growth* (New York: Oxford Press, 1992), 95.

20 Osterfeld, 95.

21 To convey this point, Julian Simon entitled his book on population and natural resources *The Ultimate Resource*.

22 John Tierney, "Betting the Planet," *New York Times Magazine,* December 2, 1990, 52–53ff.