

1. Scarcity: An Economics Primer

This chapter introduces 10 principles of economics that shed light on environmental problems. They are presented as the answers to commonly asked questions about environmental issues. It should quickly become clear that economics is about choice, not necessarily about money, and that economics can help us understand environmental choices, both public and private.

1. In a land as rich as the United States, why do we face so many difficult choices about the environment?

Scarcity, even in a nation as wealthy as the United States, is always with us, so choices must be made.

We have vast forests in this country but not enough to provide all of the wood, all of the wilderness, and all of the accessible recreation that we want. As soon as we log trees, build roads, or improve trails and campsites, we lose some wilderness. Similarly, we have large amounts of fresh water, but if we use water to grow rice in California, the water consumed cannot be used for drinking water in California cities. If we use fire to help a forest renew itself, we will have air pollution downwind while the fire burns. We have many goals, so we have to make choices about how to allocate our limited resources. The cost of those choices is what we give up—the cost of opportunities lost.

Trouble is, people have differing goals and disagree about which choice is the best one. Pursuit of differing goals may lead to conflict. Nowhere is this clearer than in environmental matters.

California's San Bernardino County was about to build a new hospital. Less than 24 hours before groundbreaking, the U.S. Fish and Wildlife Service announced that the flower-loving Delhi Sands fly, which had been found on the site, was an endangered species. So the county had to spend \$4.5 million to move the hospital 250 feet to give the flies a few acres to live on and a corridor to the

nearby sand dunes. It also had to divert funds from its medical mission to pay for biological studies of the fly.¹

Environmentalists who want biological diversity were relieved that the hospital would move, but county officials were upset at the delay and the high cost that its hospital budget and the taxpayers would have to bear. To use resources one way sacrifices the use of those resources for other things. There is no escaping cost.

San Bernardino County faced a choice between timely provision of a health care facility and protection of a unique species. Often the choices, however, are between different environmental goals. Our old-growth forests can be preserved, but that means giving up the enhanced recreation and wildlife appreciation that trails and campsites bring for many people. Strict preservation (which is what a wilderness designation means) also means that trees can't be thinned to minimize insect infestations and potentially catastrophic fires. In that case, the choice could be between keeping old-growth trees standing—until the next fire—or cutting some of them down so that more of them will be saved in the long run.

Scarcity is a fundamental fact of life, not just of economics. It is always present in nature, even when human beings are not. Each population of a species can flourish and expand only until it reaches the limit of available habitat, sunlight, water, and nutrients. Trees grow taller as they compete for sunlight. Some plants spread their leaves horizontally, capturing sunlight while blocking access for other species that might sprout up to compete for water and nutrients. Each successful strategy captures resources, taking them from certain competing species populations.

Competition implies that some species will lose out. This loss can happen slowly over time as change occurs. When a niche in the habitat changes, each population, using a different strategy, gains or loses relative to its competitors. Even small changes in a habitat can change the competitive outcome and reallocate space, water, and nutrients among populations of various species. Every change in a local environment will favor some species at the expense of others. And local environments are always changing over time, whether humans are present or not.

¹William Booth, "Flower-Loving Insect Becomes Symbol for Opponents of Endangered Species Act," *Washington Post*, April 4, 1997, A-1.

In other words, scarcity and competition are not ideas that are limited to selfish human beings.

2. Even though economists emphasize selfish motives, don't people have common goals? Doesn't everyone want a safe and attractive environment?

People share many values, but each person has a narrow focus and somewhat different purposes; each person wants to emphasize different goals.

The goals of some individuals are selfish—intended to further only their own welfare. The goals of others are altruistic—intended to help their fellowman. In both cases, each person's concerns and vision are focused mainly on a narrow set of ends.

Even the most noble and altruistic goals are typically narrow. Consider a couple of famous examples. The concern felt by the late Mother Teresa for the indigent and the sick of Calcutta was legendary. So, too, was Sierra Club founder John Muir's love of wilderness and his focus on protecting wilderness for all time. In both cases their goals were widely regarded as noble and altruistic, not narrowly selfish.

Yet one might be tempted to consider that Mother Teresa would have been willing to sacrifice some of the remaining wilderness in India in order to provide another hospital for the people she cared so much about—those dying in Calcutta. And John Muir would have been willing to see fewer hospitals if that helped preserve wilderness. Individuals with unselfish goals, like all others, are narrowly focused. Each individual is willing to see sacrifices made in other less important goals in order to further his or her own narrow purposes.

As Adam Smith, the founder of classical economics, pointed out more than 200 years ago, we know and care most about things that directly affect us, our immediate family, and others close to us. We know much less about things that mostly affect people we never see. When a person furthers his or her narrow set of goals, it doesn't mean that the individual cares nothing about others. It just means that for each of us, our strongest interests are narrowly focused. These narrow sets of goals, whatever the mix of selfishness and altruism, correspond to what economists call the "self-interest" of that individual.

It is unavoidable that an individual's choices will be driven by a narrow focus. Thus, people who call themselves environmentalists may differ from others who place a higher priority on providing good schools or hospitals or making sure that poor people are well provided for. And they may also differ on which environmental goals to pursue. There are thousands of worthy environmental goals, but each competes with others for our limited land, water, and other resources. Even without selfishness, the narrow focus of individuals is enough to ensure that there will be strong disagreements and competition for scarce natural resources.

This narrowness of emphasis is important for understanding the economics of environmental issues. Depending on the circumstances, narrow goals can lead to tunnel vision, with destructive results, or to satisfying exchanges that make all participants better-off.

3. Why do fierce arguments between organizations and individuals erupt over decisions about our resources and environment?

Although scarcity guarantees competition, some forms of competition lead to constructive action that reduces scarcity, while other forms are destructive.

Disagreement on values is normal. Some environmentalists who strongly appreciate the recreational and aesthetic benefits of wild, free-flowing rivers propose that dams be removed around the nation. Other people who value the flood protection, recreation, and clean hydropower provided by the dams want to preserve them. Similarly, wilderness advocates lobby to prevent the construction of new roads in roadless areas, while people who want greater public access to the same lands lobby for additional roads and campgrounds.

The same lands and rivers cannot simultaneously provide the advantages of preservation in a wild state and the benefits of development to improve access and the delivery of other services. Competition over the management of these rivers and lands is inevitable. The only question is the form that competition will take.

Human competition can be violent or it can be peaceful and constructive. Markets are generally peaceful. Even the repellent term "cutthroat competition" refers to a constructive activity: It means offering buyers low prices in order to get them to buy something. Sellers compete for buyers by improving their products and lowering their costs.

Human competition can also be destructive. Wars are the prime example, of course, but competition can be destructive even when it is not violent. Political battles, for example, can result in costly and unpleasant smear campaigns by various sides, each seeking to take votes from the other.

4. As people seek to meet their goals, can we predict how they will choose among the many ways they can advance those goals?

Yes.

Incentives matter.

Nearly everyone would want to save a person who is drowning. But each of us is more likely to try to rescue a person who falls into two feet of water at the edge of a small pond than to try to rescue someone who falls over the edge of Niagara Falls. In other words, whatever the goal, we can predict that people will more likely act to achieve it when the cost to them is minimal, and will seek low-cost ways—low cost to themselves and their goals—to do so. These costs and benefits—or penalties and rewards—are called incentives.

Incentives help us to understand behavior. If a person's goal is to increase his or her income, that person has an incentive to devote long hours to a grueling job. If federal taxpayers can help pay the cost of a highway in one state, the state legislature has an additional incentive to build the highway. If people can protect an endangered species without disrupting their lives, they are more likely to choose to save it.

Incentives also affect the methods people use to achieve a particular goal. For example, to generate electricity from burning coal requires water for cooling. But how much water? Evaporative cooling consumes more water than coolers that work like a car radiator, recirculating the water. But using more water by evaporating it can get more electricity from the same coal. Where water is more expensive, generating companies will probably choose to use more coal and less water by using recirculating cooling methods. But where water is cheaper, generators will use more water, evaporating it into air, and save on coal. Operating steam-electric power plants can use as little as 1.3 gallons of water to generate a kilowatt-hour of electricity, or as much as 170 gallons, depending on the relative cost of water.

It is not difficult for us as individuals to recognize and evaluate the cost of different choices. We are well-tuned to the relative costs

to us of alternatives that are available to us. However, it's more difficult to recognize and take into account the costs facing others. Costs to others will have less effect on our choices than the costs—and benefits—that we incur directly.

Typically, we expect people in business or individuals seeking personal goals to be more sensitive to their own costs than to those of others. We sometimes assume that government officials will not be. But a well-known court case brought by South Carolina developer David Lucas shows that officials of South Carolina were also more sensitive to their own costs than to those of their constituents.²

The saga began when the state passed a law regulating construction along its coastline, presumably to preserve open space and to prevent possible erosion. David Lucas owned two lots along the shore, but once the law was passed, officials told him that he could not build there, even though people next to his property had already built homes on their shoreline properties.

Lucas lost nearly all the value of his land. He believed that if the state wanted to control his land for a public purpose (other than stopping him from harming other people or property), the state should pay for it. So he sued to force payment. Initially, Lucas lost, but he appealed all the way to the U.S. Supreme Court and finally won. The court told South Carolina that it must pay for the land because it had taken from Lucas the same rights to use it that his neighbors enjoyed.

Once the state was faced with having to pay Lucas more than \$1 million, officials changed their minds about keeping the land from development. In fact, the state sold the land to a developer!

Earlier, when they thought Lucas would pay the cost of stopping development, state regulators had little incentive to worry about the cost. But when forced to bear the cost from their own budget, they made the opposite decision: They allowed development. Incentives mattered.

The Endangered Species Act illustrates the harm that can occur when one party (in this case, the government) determines how another (in this case, landowners) must use land. Under the act,

²More details about the Lucas case can be found in James R. Rinehart and Jeffrey J. Pompe, "The Lucas Case and the Conflict over Property Rights," in *Land Rights: The 1990s' Property Rights Rebellion*, Bruce Yandle, ed. (Lanham, Md.: Rowman & Littlefield, 1995), 67–101.

government officials have great latitude in telling landowners what to do if they find an endangered animal such as a red-cockaded woodpecker on their properties. The government chooses the protection methods, but the landowner must pay the costs. For example, the owner may not be allowed to log land within a certain distance of the bird's colony. In some cases, government officials have prevented discing (that is, plowing up land to create a firebreak) and even farming. With this power, the government is likely to be lavishly wasteful of some resources (such as land) while ignoring other ways of protecting the species (such as building nest boxes). To the government agency, the land is almost a free good.

The point of these two examples is that when people have to pay for what they use, they carefully weigh the costs and benefits.

Although incentives are important, they are not the only factors in decisionmaking. For example, income levels affect how people deal with environmental problems. People with high incomes tend to have more concern about the protection of natural environments, such as old-growth timber or the habitat for rare plants or animals. Those with lower incomes frequently want to see those same lands managed to produce more food, raw materials, and jobs. Very poor people, wanting the basics of environmental protection such as drinking water free of parasites and microbial diseases in order to stay alive, may not be able to go much beyond that to effect environmental quality, even if given some incentive to do so. The same incentive may not have the same effect on people in different circumstances.

Other factors matter, too. Cultural norms and traditions affect how people value various parts of their environment. Whether people toss litter on the ground or out of a car window reflects their education and probably the attitudes of those with whom they associate.

5. In market exchange, people can only gain at the expense of others—right?

Wrong!

Voluntary exchange—that is, market trading—creates wealth.

It's amazing but true that simple voluntary exchange can create wealth. Both sides can gain. One way to understand this principle is to think about something that people really disagree about—say,

music. John likes opera. Jane likes rock music. If John has a rock concert ticket, and Jane an opera ticket, just exchanging the tickets will make each person wealthier.

Trade can create value in three ways:

1. Trade channels resources, products, and services from those who value them less to those who value them more. Without any change in production, the trade of the opera ticket for the rock concert ticket produces value.
2. Trade enables individuals to direct their resources to the activities where they produce the greatest value so that they can then trade the fruits of those activities for the items they want for themselves. The farmer in central Montana who grows wheat produces far more than he wants to consume. He trades the wheat for income to buy coffee from Guatemala, shoes from Thailand, and oranges from Florida. The Montana farmer might have been able to grow oranges, but given the cold Montana climate, doing so would have squandered resources. Trade enables people to obtain many things they would not have the proper talent or resources to produce efficiently themselves.
3. Trade enables everyone to gain from the division of labor and from economies of scale. Only with trade can individuals specialize narrowly in computer programming, writing books, or playing professional golf—developing highly productive skills that would be impossible to obtain if each family had to produce everything for itself. Similarly, the sales of large automobile factories that bring the cost of cars within reach of the average worker would not be feasible without large-scale trade that enables the product of one factory to be sold in a wide market area.

Resource owners gain by trading in three different ways: across uses (for example, out of low-valued crops into ones that earn more money), across space (marketing products across geographic distance to different states or nations), and across time (gaining from conservation or speculation by saving resources until they become more valuable).

Many farmers in the western United States own rights to divert and use water from streams to produce crops. In recent years, more people have been seeking high-quality streams for fly-fishing. They

recognize that many streams have a tendency to dry up in hot summer months when farmers divert large amounts of water for their fields. These fly-fishers may want more water kept in streams to keep fish thriving. To keep the streams full of water, some fishers are willing to trade cash for the farmers' water rights. And some farmers are happy to part with a portion of the water they have been using in exchange for cash.

That exchange is being done in Oregon. Andrew Purkey of the Oregon Water Trust works out trades between his organization, which is committed to protecting salmon, and farmers who are willing to give up some of their water. For example, Purkey paid a rancher \$6,000 to not grow hay one year. The water the rancher would have used stayed in the stream and supported the fish.

Other farmers might gain by selling some of their water rights to growing cities, which can then save the cost (and the environmental disturbance) of building another dam—or a saltwater desalinization plant to make fresh water from ocean water. When such trades among willing buyers and willing sellers are allowed by law, both buyer and seller are made better-off. Value is added to the water's use. Wealth is created. Unfortunately, right now the federal government and many Western states have laws that pose obstacles to trade in water. These obstacles, such as the rule that only some uses of water are allowed, tend to keep the water in agriculture, reducing efficient use and conservation.

Even trade in garbage can create wealth. Consider a city that disposes of garbage in a landfill. If the city is located in an area where underground water lies near the surface, disposing of garbage is dangerous, and very costly measures would have to be taken to protect the water from leakage. Such a city may gain by finding a trading partner with more suitable land where a properly constructed landfill does not threaten to pollute water. Such a landowner may be willing to accept garbage in return for pay. If so, both parties will be better-off.

6. What do profits achieve for the environment? And for that matter, what do they do for consumers?

In a competitive market, profits and losses direct businesses toward activities that increase consumer wealth and conserve resources.

Profits attract producers and sellers. Where there is profit to be made, consumers benefit from the increased competition to produce

the good or service. And profits lead to careful use of natural resources because, to make profits, producers must minimize their costs.

Producers spend untold hours figuring out how to save on resources in search of increased profit. That's why soda cans weigh at least 27 percent less than they did in the 1960s, why steel high-rise buildings today require about one-third the amount of steel they needed several decades ago, and why a fiber-optic cable made from 60 pounds of sand can carry 1,000 times more information than a cable made from 2,000 pounds of copper.³

Profits reward those who succeed in producing goods and services that people are willing to buy at a price higher than the cost of supplying them. Losses have their place, too. They penalize those who have not been able to discover how to create more value than the cost to produce. In effect, people are telling a money-losing firm that they want to see the firm's resources go to other products or services that are more valuable to them.

Large profits have a way of disappearing. The competition of new entrants, drawn by profits, gradually lowers the sales of existing firms and often their prices as well, reducing the level of those profits. Entry continues until profits fall to what economists call normal rates of return. Entry then stops. The first firms to innovate successfully may make above-normal profits, but the profit rate falls as competition heats up.

Usually, an entrepreneur seeking to exploit a new profit opportunity must (a) discover the new opportunity, and (b) find investors willing to take the risk that profits will in fact be gained. It may also be necessary to sell potential buyers on the new product or service. All of these activities are costly. But expected profit provides an incentive to persevere for entrepreneurs, investors, and those who must sell the idea to investors and the product to buyers. It rewards them for making the necessary investments of time, effort, and money to accomplish their tasks. New ideas may need years of effort before they reach fruition. Expected profit is the carrot to attract the needed efforts.

³Lynn Scarlett, *New Environmentalism*, NCPA Policy Report 201 (Dallas: National Center for Policy Analysis, January 1997), 11.

Which producers win the competition for the use of scarce resources? Investors and producers who expect more profit are willing to pay more when necessary to get resources for successful production. Those who expect losses are not willing (and those already experiencing losses are less able) to compete for those same resources. Taking resources from high-valued to low-valued uses in a market setting imposes losses on those who do so. Moving resources to higher-valued uses confers profits. Losses discipline investors and producers whose expectations were too optimistic, while profits reward those who make the best use, as seen by consumers, of the available resources.

7. Information is the resource of the modern age; every decision should be made with full information. Right?

Wrong again!

Information is a valuable, but costly, resource.

Let's say that a private owner decides to build a landfill for garbage. The owner is liable for damages if waste deposited in the landfill leaks out and harms others. So the owner must decide how to prevent leaks and how to clean them up if they occur. Spending too little on preventing harm from escaping pollutants could bring costly lawsuits. But spending more than is necessary imposes needless costs and wastes resources. How many resources should be devoted to preventing harm? In other words, how much should be spent? That is the question facing the owner.

To make the decision, good information is crucial. Yet gathering more information (Where is the groundwater underneath this land? How effective will a clay cap be? What liner will be the safest?) to make a better decision also is costly.

This owner, operating in the private sector, has an incentive to gather just enough information—not too much and not too little—because both the costs and the benefits of seeking more information fall upon the owner. Weighing the costs and benefits of more information, the owner won't end up with perfect or complete information but will make a reasonable choice based on the costs and benefits of seeking more knowledge.

Now suppose that a government regulator (perhaps someone in the local zoning office) has the authority to decide whether the landfill can be built. This individual's desire for information will be

much different. If damage occurs, the regulator could be blamed, so his or her incentive will be to require as much information possible before allowing the landfill to be built. Further, the regulator doesn't face the costs of seeking more information or the costs of choosing the most expensive way to reduce risks from the landfill. The regulator may ask for study after study to make sure that the proposed landfill will really be safe. Not surprisingly, people running small businesses often complain that regulators are simply asking for too much paperwork.

In other words, the information-gathering process is affected by where the costs fall. A regulator might demand too much information, but under some conditions the owner might seek too little. Suppose the property rights of neighbors are not effectively protected under law, and the private owner of the waste site is not accountable for harm caused by materials escaping the site. In that case, the owner may minimize the cost of preventing pollutants from seeping out of the site, trusting that the costs of any harm will fall on others. The incentive to seek additional information is weak because the owner doesn't expect to pay the costs of making a poor decision.

Important decisions require good information. Should a forest be cut now and replanted? Should the owner of a potentially polluting hazardous waste site be forced to spend several million dollars in a cleanup effort? Should mineral exploration for new mineral deposits be conducted now or later? Should an environmental rule be further tightened?

Each of these decisions involves gathering scarce and costly information, and each decision must be made without complete information. But the information-gathering process will be shaped by the incentives facing the decisionmaker.

8. New technology may be cheaper, but doesn't it destroy the environment? Wouldn't we be better-off, environmentally, if only older, tried-and-true technologies are allowed?

No.

Advanced technologies typically help the environment because they decrease resource waste and increase resource productivity.

Sometimes we wish for the good old days before we suffered from the pollution and congestion caused by automobiles. But our

ancestors didn't think of cars that way. To them, the advent of the automobile was a blessing since it meant that horses no longer clogged the streets with horse manure. And today, thousands, perhaps millions, of acres have reverted to forest because the land is no longer devoted to growing grass and hay for horses. Also, new farming technologies allow for more production from fewer acres, freeing still more land for reversion to habitat and recreation.

Yes, the automobile does pollute. But today's cars emit a tiny fraction of the pollution emitted by the cars of the early 1970s. And while even very expensive and clean-running electric cars require energy from burning fuel in power plants, the emissions from such plants have gone down drastically, too, as owners have searched out low-sulfur coal and technical devices to reduce pollution. Advances in technology continue to make cars cleaner and safer, just as diesel train engines replaced dirty steam locomotives, and gas and electricity replaced coal for home heating.

New technology is almost always adopted because it is more efficient. It usually uses fewer resources to produce the same result. Stifling new technology unnecessarily forces us to forgo additional gains that could be delivered over time.

9. If the rich countries would just stop consuming so much, couldn't we all live more comfortably on this planet?

No.

As people's incomes increase, their willingness to pay for protecting the environment increases.

Even poor communities are willing to make sacrifices for some basic components of environmental protection, such as access to safe and clean drinking water and sanitary handling of human and animal wastes. As incomes rise, citizens raise their environmental goals. Once basic demands for food, clothing, and shelter are met, people demand cleaner air, cleaner streams, more outdoor recreation, and the protection of wild lands. With higher incomes, citizens place higher priorities on environmental objectives.

The connection of income with better environmental quality has been noted numerous times by economists. One study, for example, showed that in countries where rising incomes reached about \$6,000 to \$8,000 per year in 2001 dollars and where there initially was an increase in certain types of air pollution, air

pollution began to decline.⁴ Also, the kinds of water and air pollution (indoor air pollution and water with parasites or micro-organisms) that very poor people confront fell steadily with rising incomes.

Another study suggests that the willingness of citizens to spend and sacrifice for a better environment rises far faster than income itself increases—more than twice as fast, according to recent economic research.⁵ (That same willingness and ability to pay for a better environment falls with falling income.) The fact that readers of *Sierra* magazine (most of whom are members of the Sierra Club) have incomes almost twice as high as that of average Americans is another indicator that there is a link between income and active concern about environmental matters.

One implication of this link is that the wealthier the people of North America, the more concerned about the environment they will be. Similarly, if incomes fall, people will be less interested in environmental protection. Policymakers should also recognize that if improvement in environmental quality can be achieved at a lower cost—rather than wasted through bureaucratic red tape, for example—public support for additional environmental measures will be greater. Policies that do not deliver good environmental quality at the least cost to the economy needlessly reduce the citizens' willingness and ability to pay for environmental quality measures.

10. *What is the single most common error in thinking about the economics of environmental policy?*

The most common error in economics, as in ecology, is to ignore the secondary effects and long-term consequences of an action.

It is easy to overlook the unintended side effects of an action, especially if those effects will not be experienced soon. When individuals are not personally accountable for the full costs of their actions, they tend to ignore the secondary costs of what they do.

Consider the classic case of overgrazing on a commons, a pasture open to all herdsmen for cattle grazing. Each herdsman captures the immediate benefits of grazing another cow, but may hardly be aware of the reduction in next year's grass that the extra animal

⁴Gene M. Grossman and Alan B. Krueger, "Economic Growth and the Environment," *Quarterly Journal of Economics* 110, no. 2 (1995), 353–77.

⁵Don Coursey, *The Demand for Environmental Quality*. (St. Louis, Mo.: John M. Olin School of Business, Washington University, December 1992).

grazing this year is causing. The individual herdsman is forced to bear only a fraction of the costs—the reduced grazing available next year due to excessive grazing now—because all users share the future costs. If the herdsman removed his cow, he would bear fully the burden of reducing his use. Thus, each herdsman has an incentive to add cows, even though the pasture may be gradually deteriorating as a result. This situation is known as the tragedy of the commons.

A similar problem can occur when a fishing territory is open to all fishers. Each fisher captures all the benefits of harvesting more fish now, while paying only a small part of the future costs—the reduction of the fish population for future harvest. It is easy to ignore the indirect costs that will occur in the future, especially if the fisher will not ultimately pay the full, true cost of his or her actions.

Government decisionmaking provides additional examples. It is typical for cities to be years behind in the maintenance of their water delivery systems. The cost of a repair that will reduce water leaks is borne now, while much of the benefit lies in the future. The present costs tend to be more vividly seen and felt than the future benefits, so repairs are often postponed, even though that makes the future costs much larger. Because the costs of postponement are not as direct and are not immediate tend to encourage the costly postponement of maintenance.

Conclusion

These 10 points provide a good start toward understanding how economics applies to environmental decisionmaking. These principles lay the foundation for understanding, first, how cooperation can help to protect the environment and, second, why conflict often occurs instead. Cooperation is the subject of Chapter 2.

