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Economics, Policy, and Sustainable Development

Upon completing this chapter, you will be able to:

- Explain how our economies exist within the environment and rely on ecosystem services
- Describe principles of classical and neoclassical economics, and summarize their implications for the environment
- Illustrate aspects of environmental economics and ecological economics, including valuation of ecosystem services and full-cost accounting
- Describe environmental policy and assess its societal context
- Explain the role of science in policymaking
- Discuss the history of U.S. environmental policy and summarize major U.S. environmental laws
- List institutions that influence international environmental policy and describe how nations handle transboundary issues
- Compare and contrast the different approaches to environmental policymaking
- Define sustainable development, explain the “triple bottom line,” and describe how sustainable development is pursued worldwide.

Photo: Costa Rican farmers tend crops where forest once stood.

CENTRAL CASE STUDY

Costa Rica Values Its Ecosystem Services



Few nations have transformed their path of development in just a few decades—but Costa Rica has. In the 1980s, this small Central American country was losing its forests as fast as any place on Earth. Yet today this nation of 4.7 million people has regained much of its forest cover, boasts a world-class park system, and stands as a global model for sustainable resource management.

Costa Rica took many steps on this impressive road to success. One key step was to begin paying landholders to conserve forest on private land, in a novel government program called *Pago por Servicios Ambientales* (PSA)—Payment for Environmental Services.

Nature provides ecosystem services (pp. 3, 35, 97), such as air and water purification, climate regulation, and nutrient cycling. For example, forests in Costa Rica’s mountains capture rainfall and provide clean drinking water for towns and cities below. Ecosystem services are vital for our lives and our society, but historically we have taken them for granted and have not paid for them in the marketplace. As a result, these services have diminished as we degrade the natural systems that provide them. For this reason, many economists want to create financial incentives for conserving ecosystem services.

In Costa Rica, which had lost over three-quarters of its forest, political leaders adopted this approach in Forest Law 7575, passed in 1996. Since then, the government has been paying farmers and ranchers to preserve forest on their land, replant

“Costa Rica’s PSA program has been one of the conservation success stories of the last decade.”

—Stefano Pagiola, The World Bank

“In the last 25 years, my home country has tripled its GDP while doubling the size of its forests.”

—Carlos Manuel Rodríguez, former Minister of Energy and the Environment, Costa Rica

cleared areas, allow forest to regenerate naturally, or establish sustainable forestry systems. Payments are designed to be competitive with potential profits from farming or cattle ranching.

The PSA program recognized four ecosystem services that forests provide:

1. Watershed protection: Forests cleanse water by filtering pollutants, and they conserve water and reduce soil erosion by slowing runoff.
2. Biodiversity: Tropical forests such as Costa Rica’s are especially rich in life.
3. Scenic beauty: This encourages recreation and eco-tourism, which bring money to the economy.
4. Carbon sequestration: By pulling carbon dioxide from the atmosphere, forests slow global warming.

To fund the PSA program, Costa Rica’s government sought money from people and companies that benefit from these services. For watershed protection, irrigators, bottlers, municipal water suppliers, and utilities that generate hydro-power all made voluntary payments into the program, and a tariff on water users was added in 2005. For biodiversity and scenery, the country targeted ecotourism, while international lending agencies provided loans and donations. Because carbon dioxide is emitted when fossil fuels are burned, the nation used a 3.5% tax on fossil fuels to help fund the program. It also sought to sell carbon offsets in global markets (p. 328).



(a) 1940

(b) 1987

(c) 2005

FIGURE 5.1 Forest cover in Costa Rica decreased between 1940 and 1987, but it increased by 2005.

Data from FONAFIFO.

Costa Rican landholders rushed to sign up for the PSA program. The agency administering it, *Fondo Nacional de Financiamiento Forestal* (FONAFIFO), signed landowners to contracts and sent agents to advise them on forest conservation and to monitor compliance. By 2009, FONAFIFO had paid 57 billion colónes (\$110 million) to over 8300 landholders and had registered over 670,000 ha (1.66 million acres)—13% of the nation's land area.

Deforestation began to slow in Costa Rica, and forest cover rose by 10% in the decade after 1996. Policymakers, economists, and environmental advocates cheered the PSA program's apparent success in safeguarding forests and the ecosystem services they provide.

However, some observers argued that forest loss had been slowing for other reasons and that the program itself was having little effect. They contended that payments were being wasted on people who had no plans to cut down their trees. Critics also lamented that large wealthy landowners utilized the program more than low-income small farmers. All these concerns were borne out by researchers (see **THE SCIENCE BEHIND THE STORY**, pp. 100–101).

In response, the government modified its policies, making the program more accessible to small farmers and targeting the payments to locations where forest is most at risk and environmental assets are greatest.

Today forest cover in Costa Rica has risen from a low of 17% in 1983 to over 52% (**FIGURE 5.1**). The nation has thrived economically while protecting its environment; since the PSA program began, Costa Ricans have enjoyed an increase in per capita income of over 50%—a rise in wealth surpassing the vast majority of nations.

Many factors have contributed to Costa Rica's success in building a wealthier society while protecting its ecological assets. Back in 1948, Costa Rica abolished its army and shifted funds from the military budget into health and education. With a stable democracy and a healthy and educated citizenry, the stage was set for well-managed development, including innovative advances in conservation. The nation created one of the

world's finest systems of national parks, covering one-quarter of its territory. Ecotourism at the parks brings wealth to the country: Each year 2 million foreign tourists inject \$2 billion into Costa Rica's economy.

As a result, Costa Ricans understand the economic value of protecting their natural capital. They see how innovative policies and economic incentives can help conserve resources while boosting the economy and enhancing the quality of people's everyday lives. By placing economic value on nature, Costa Rica is pointing the way toward truly sustainable development. □

Economics and the Environment

An **economy** is a social system that converts resources into *goods* (material commodities made and bought by individuals and businesses) and *services* (work done for others as a form of business). **Economics** is the study of how people decide to use potentially scarce resources to provide goods and services that are in demand. The word *economics* and the word *ecology* come from the same Greek root, *oikos*, meaning “household.” Economists traditionally have studied the household of human society, and ecologists the broader household of all life.

Economies rely on goods and services from the environment

Our economies and our societies exist within the natural environment and depend on it in vital ways. Economies receive inputs (such as natural resources and ecosystem services) from the environment, process them, and discharge outputs (such as waste) into the environment (**FIGURE 5.2**).

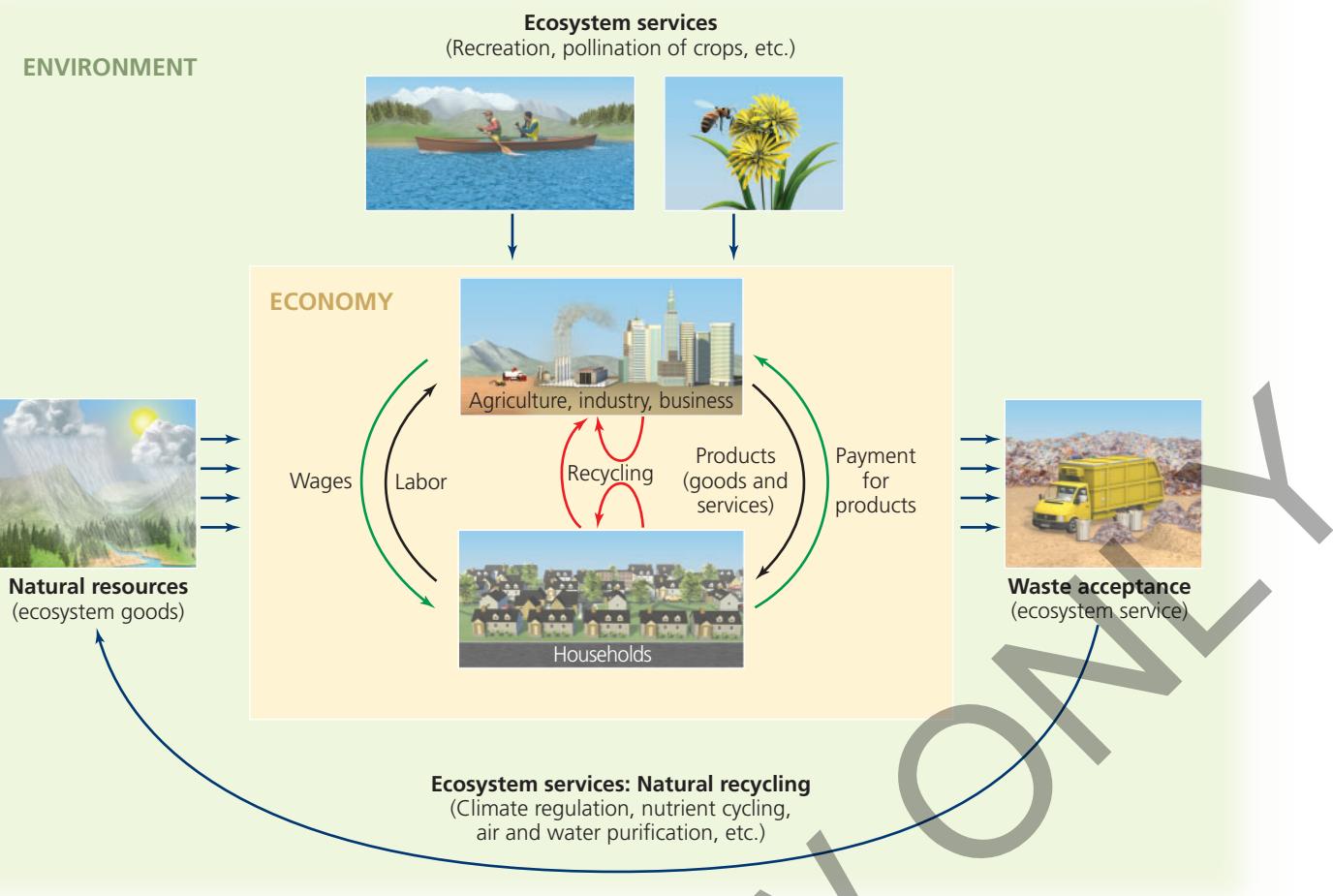


FIGURE 5.2 Economies exist within the natural environment, receiving resources from it, discharging waste into it, and benefiting from ecosystem services. Conventional neoclassical economics focuses only on processes of production and consumption among households and businesses (**yellow box in middle**) and views the environment merely as an external factor. In contrast, environmental and ecological economists emphasize that economies exist within the natural environment and depend on all that it offers.

These interactions are readily apparent, yet traditional economic schools of thought have long ignored them or overlooked their importance. Many mainstream economists still adhere to a worldview that largely ignores the environment (and instead considers only the yellow box in the middle of Figure 5.2). This conventional view, which continues to drive policy decisions, implies that natural resources are free and limitless and that wastes can be endlessly absorbed at no cost. In contrast, modern economists in the fast-growing fields of environmental economics and ecological economics (p. 95) emphasize that economies exist within the environment and depend on it for natural resources and ecosystem services.

Natural resources (pp. 2–3) are the substances and forces that sustain our society and our everyday lives: the fresh water we drink, the trees that provide our lumber, the rocks that provide our metals, and the energy from sun, wind, water, and fossil fuels. We can think of natural resources as “goods” produced by nature. Environmental systems also naturally function in a manner that supports our economies. Earth’s eco-

logical systems purify air and water, form soil, cycle nutrients, regulate climate, pollinate plants, and recycle waste. Such essential ecosystem services (pp. 3, 35, 97) support the very life that makes our economic activity possible. Together, nature’s resources and services make up the natural capital (pp. 15–16) on which we depend.

When we deplete natural resources and generate pollution, we degrade the capacity of ecological systems to function. Scientists with the Millennium Ecosystem Assessment, a worldwide review undertaken in 2005, concluded that 15 of 24 ecosystem services they surveyed globally were being degraded or used unsustainably. The degradation of ecosystem services can weaken economies. In Costa Rica, rapid forest loss was causing soil erosion, water pollution, and biodiversity loss. Low-income small farmers were the first to feel these impacts. Indeed, across the world, ecological degradation is harming poor and marginalized people before wealthy ones, the Millennium Ecosystem Assessment found. As a result, restoring ecosystem services stands as a prime avenue for alleviating poverty.

FAQ

Doesn't environmental protection hurt the economy?

We often hear it said that policy measures to protect environmental quality cost too much money, interfere with progress, or lead to job loss. However, growing numbers of economists dispute this. Instead, they assert that environmental protection tends to *enhance* our economic bottom line and nearly always improves our quality of life. The view one takes depends in part on whether one thinks in the short term or the long term. We often make economic judgments on short time scales, and in the short term many activities that cause environmental damage may be economically profitable. In the longer term, however, environmental degradation harms economies. Moreover, when resource extraction or development degrades environmental conditions, often a few private parties benefit economically while the broader public is harmed.

Today, concern over fossil fuels, pollution, and climate change has led many people to see immense opportunities in revamping our economies with clean and renewable energy technologies. The jobs, investment, and economic activity that come with building a green energy economy suggest how economic progress and environmental protection can go hand-in-hand.

Economic theory moved from “invisible hand” to supply and demand

As the field of economics developed in the 18th century, many people argued that individuals acting in their own self-interest harm society. However, Scottish philosopher **Adam Smith** (1723–1790) argued that self-interested economic behavior can benefit society, as long as the behavior is constrained by the rule of law and private property rights in a competitive marketplace. A founder of **classical economics**, Smith famously wrote that when people pursue their economic self-interest under these conditions, the marketplace will behave as if guided by “an invisible hand” to benefit society as a whole.

Today, Smith’s philosophy remains a pillar of free-market thought, which many credit for the tremendous gains in material wealth that capitalist market economies have achieved. Others contend that free-market policies tend to intensify environmental degradation and worsen inequalities between rich and poor.

Economists subsequently adopted more quantitative approaches. **Neoclassical economics** examines consumer choices and explains market prices in terms of our preferences for units of particular commodities. In neoclassical economics, buyers desire a low price, whereas sellers desire a high price. This conflict results in a compromise price being reached and the “right” quantity of commodities being bought and sold. This is phrased in terms of *supply*, the amount of a product offered for sale at a given price, and *demand*, the amount of a product people will buy at a given price if free to do so.

To evaluate an action or decision, economists use **cost-benefit analysis**, which compares the estimated costs of a proposed action with the estimated benefits. If benefits exceed costs, the action should be pursued; if costs exceed benefits, it should not. Given a choice of actions, the one with the greatest excess of benefits over costs should be chosen.

This reasoning seems eminently logical, but problems arise when not all costs and benefits can be easily identified, defined, or quantified. It may be simple to quantify the dollar value of bananas grown or cattle raised on a tract of Costa Rican land cleared for agriculture, yet difficult to assign monetary value to the various ecological costs of clearing the forest. Because monetary benefits are usually more easily quantified than environmental costs, benefits tend to be overrepresented in traditional cost-benefit analyses. As a result, environmental advocates often feel such analyses are predisposed toward economic development and against environmental protection.

Neoclassical economics has environmental consequences

Today’s market systems operate largely in accordance with the principles of neoclassical economics. These systems have generated unprecedented material wealth for our societies, yet four basic assumptions of neoclassical economics often contribute to environmental degradation.

Replacing resources One assumption is that natural resources and human resources (such as workers or technologies) are largely substitutable and interchangeable. This implies that once we have depleted a resource, we will always be able to find some replacement for it. As a result, the market imposes no penalties for depleting resources.

It is true that many resources can be replaced. However, Earth’s material resources are ultimately limited. Nonrenewable resources can be depleted, and many renewable resources (such as soils, fish stocks, timber, and clean water) can be used up if we exploit them faster than they are replenished.

External costs A second assumption of neoclassical economics is that all costs and benefits associated with an exchange of goods or services are borne by individuals engaging directly in the transaction. In other words, it is assumed that the costs and benefits are “internal” to the transaction, experienced by the buyer and seller alone.

However, many transactions affect other members of society. When a landowner fells a forest, people nearby suffer poorer water quality, dirtier air, and less wildlife. When a factory, power plant, or mining operation pollutes the air or water, it harms the health of those who live nearby. In such cases, people who are not involved in degrading the environment end up paying the costs. Costs of a transaction that affect people other than the buyer or seller are known as **external costs** (FIGURE 5.3). Often whole communities suffer external costs while certain individuals enjoy private gain. External costs commonly include the following:

- Health problems, stress, or anxiety among people downstream or downwind from a pollution source
- Declines in resources, such as fewer fish in a stream
- Aesthetic damage, such as from air pollution, clear-cutting, or strip-mining
- Declining real estate values, lost tourism revenue, higher health care expenses, and more



FIGURE 5.3 Air pollution is one common type of external cost.

Here, residents of an Indonesian town cycle through smoke from fires set to clear nearby forests for oil palm plantations.

If market prices do not take the social, ecological, or economic costs of environmental degradation into account, then taxpayers bear the burden of paying them. When economists ignore external costs, this creates a false impression of the consequences of our choices. External costs are one reason that governments develop environmental policy (p. 102).

Discounting Third, neoclassical economics grants an event in the future less value than one in the present. In economic terminology, future effects are “discounted.” Discounting is meant to reflect the way people value things (we’d all rather have an ice cream cone today than be promised one next month). Yet giving more weight to current costs and benefits than to future costs and benefits encourages us to ignore the long-term consequences of our decisions.

Many environmental problems unfold gradually, and discounting causes us to downplay the impacts on future generations of pollution we create and resources we deplete today. Discounting has emerged as a flashpoint in the debate over how to respond to climate change. Economists agree that climate change will impose major costs on society, but they differ on how much to discount future effects—and so they differ on how much we should invest today to battle climate change.

Growth **Economic growth** can be defined as an increase in an economy’s production and consumption of goods and services. Neoclassical economics assumes that economic growth is essential for maintaining social order, because a growing economy can alleviate the discontent of the poor by creating opportunities for poor people to become wealthier. A rising tide raises all boats, as the saying goes; if we make the overall economic pie larger, then each person’s slice can become larger (even if some people still have much smaller slices than others). However, critics of the growth paradigm maintain that endless growth cannot be sustained, because resources to support growth are ultimately limited.

How sustainable is economic growth?

Our global economy is seven times the size it was just half a century ago. All measures of economic activity are greater than ever before. Economic expansion has brought unprecedented material wealth to many people (although the rich have gained more than the poor, and gaps between haves and have-nots are wide and growing).

Economic growth can occur in two ways: (1) by an increase in inputs to the economy (such as more labor or natural resources) or (2) by improvements in the efficiency of production due to better methods or technologies (ideas or equipment that enable us to produce more goods with fewer inputs).

As our population grows and consumption rates rise, it is becoming clearer that we cannot sustain growth forever by using the first approach. Nonrenewable resources are finite in quantity, and renewable resources can also be exhausted if we overexploit them (as is happening with many fisheries today). As for the second approach to growth, we have used technological innovation to push back the limits on growth time and again. More-efficient technologies for extracting minerals, fossil fuels, and groundwater allow us to mine these resources more fully with less waste. Better machinery in our factories speeds manufacturing. We continue to make computer chips more powerful with less material input. In such ways, we are producing more goods and services with relatively fewer resources.

Can we conclude, then, that technology will allow us to overcome all environmental constraints and continue economic growth forever? We can certainly continue to innovate and achieve further efficiency. Yet ultimately, if our population and consumption continue to grow and we do not shift to full reuse and recycling, we will continue to diminish our natural capital, putting ever-greater demands on our capacity to innovate.

More and more economists recognize the challenges of achieving growth sustainably. Those in the field of **environmental economics** feel we can modify neoclassical economic principles to make resource use more efficient and thereby attain sustainability within our current economic system. Environmental economists were the first to develop methods to tackle the problems of external costs and discounting.

Economists in the field of **ecological economics** feel that sustainability requires more far-reaching changes. They stress that in nature, every population has a carrying capacity (p. 62) and systems generally operate in self-renewing cycles. Ecological economists maintain that societies, like natural populations, cannot surpass environmental limitations. Many of these economists advocate economies that neither grow nor shrink, but are stable. Such **steady-state economies** are intended to mirror natural systems. Critics of steady-state economies assert that to halt growth would dampen our quality of life. Proponents respond that technological advances would continue under a steady-state economy and wealth and happiness would rise.

Attaining sustainability will certainly require the reforms pioneered by environmental economists and may require the fundamental shifts advocated by ecological economists. One approach they each take is to assign monetary values to ecosystem goods and services, so as to better integrate them into traditional cost-benefit analyses.

We can assign monetary value to ecosystem goods and services

Ecosystems provide us essential resources and life-support services, including arable soil, waste treatment, clean water, and clean air. Yet we often abuse the very ecological systems that sustain us. Why? From the economist's perspective, people overexploit natural resources and processes largely because the market assigns these entities no quantitative monetary value—or assigns values that underestimate their true worth.

Ecosystem services are said to have **nonmarket values**, values not usually included in the price of a good or service (**FIGURE 5.4**). For example, the aesthetic and recreational pleasure we obtain from natural landscapes is something of real value. Yet because we do not pay money for this, its value is hard to quantify and appears in no traditional measures of economic worth. Or consider Earth's water cycle (pp. 38–39): Rain fills our reservoirs with drinking water, rivers give us hydropower and flush away our waste, and water evaporates, purifying itself of contaminants and later falling as rain. This

natural cycle is vital to our very existence, yet because we do not pay for it, markets impose no financial penalties when we disturb it.

For these reasons, economists have sought ways to assign market values to ecosystem services. They use surveys to determine how much people are willing to pay to protect or restore a resource. They measure the money, time, or effort people expend to travel to parks. They compare housing prices for similar homes in different settings to infer the dollar value of landscapes, views, or peace and quiet. They calculate how much it costs to restore natural systems that are damaged, to replace their functions with technology, or to clean up pollution.

For example, in Costa Rica, a team led by Taylor Ricketts of Stanford University studied native bees at a coffee plantation. By carefully measuring how bees pollinated the coffee plants and comparing the resulting coffee production in areas near forest and far from forest, Ricketts calculated that forests were providing the farm with pollination services worth \$60,000 per year.



(a) Use value: The worth of something we use directly



(b) Existence value: The worth of knowing that something exists, even if we never experience it ourselves



(c) Option value: The worth of something we might use later



(d) Aesthetic value: The worth of something's beauty or emotional appeal

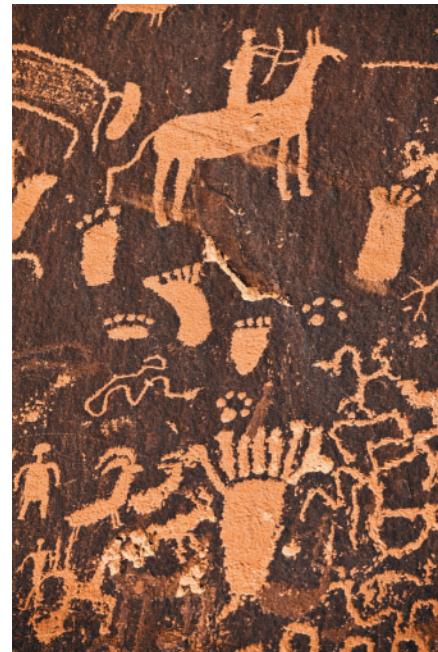


(e) Scientific value: The worth of something for research



(f) Educational value: The worth of something for teaching and learning

FIGURE 5.4 Accounting for nonmarket values may help us make better environmental and economic decisions.



(g) Cultural value: The worth of something that sustains or helps define a culture

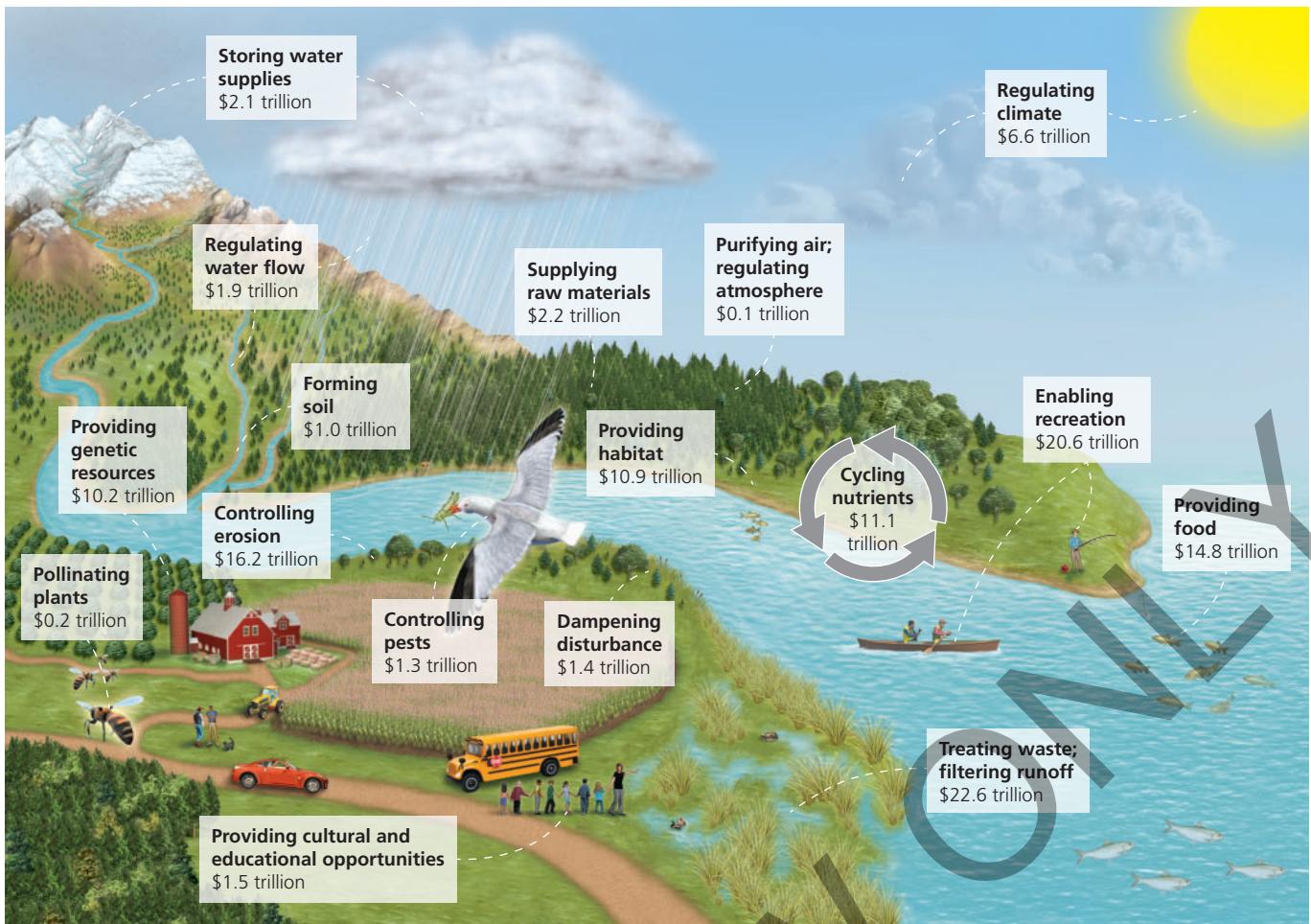


FIGURE 5.5 Ecological economists have estimated the value of the world's ecosystem services at more than \$143 trillion (in 2014 dollars). This amount is an underestimate because it does not include ecosystems and services for which adequate data were unavailable. Shown are subtotals for each ecosystem service, in 2007 dollars. Data from Costanza, R., et al., 2014. Changes in the global value of ecosystem services. *Global Env. Change* 26: 152–158.

Researchers have even set out to calculate the total economic value of all the services that oceans, forests, wetlands, and other systems provide across the world. Teams headed by ecological economist Robert Costanza have combed the scientific literature and evaluated hundreds of studies that estimated dollar values for 17 major ecosystem services (FIGURE 5.5). The researchers reanalyzed the data using multiple valuation techniques to improve accuracy, then multiplied average estimates for each ecosystem by the global area it occupied. Their initial analysis in 1997 was groundbreaking, and in 2014 they updated their research. The 2014 study calculated that Earth's biosphere in total provides more than \$125 trillion worth of ecosystem services each year, in 2007 dollars. This is equal to \$143 trillion in 2014 dollars, an amount that exceeds the GDP of all nations combined!

Costanza also joined Andrew Balmford and 17 other colleagues to compare the benefits and costs of preserving natural systems intact versus converting wild lands for agriculture, logging, or fish farming. After reviewing many studies, they reported that a global network of nature reserves covering 15% of Earth's land surface and 30% of the ocean would be worth \$4.4 to \$5.2 trillion. This amount is 100 times

greater than the value of those areas were they to be converted for direct exploitative human use.

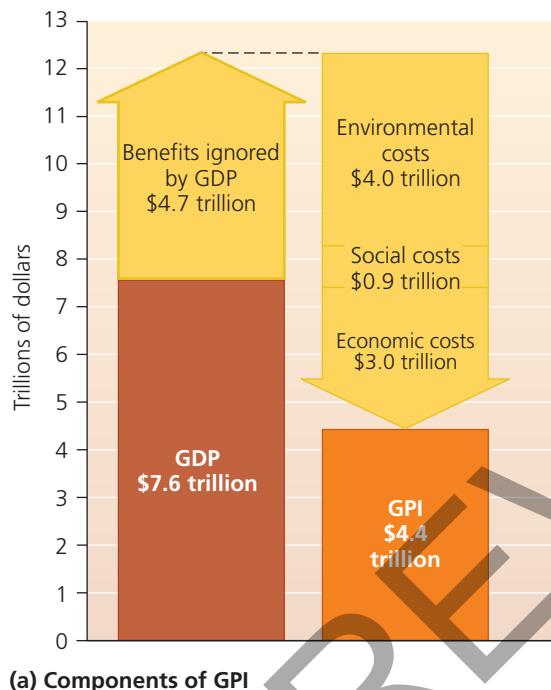
Such research has sparked debate. Some ethicists argue that we should not put dollar figures on amenities such as clean air and water, because they are priceless and we would perish without them. Others say that arguing for conservation purely on economic grounds risks not being able to justify it whenever it fails to deliver clear economic benefits. However, backers of the research counter that valuation does not argue for making decisions on monetary grounds alone, but instead clarifies and quantifies values that we already hold implicitly.

In 2010, researchers wrapped up a large international effort to summarize and assess attempts to quantify the economic value of natural systems. *The Economics of Ecosystems and Biodiversity* study has published a number of fascinating reports that you can find online. This effort describes the valuation of nature's economic worth as "a tool to help recalibrate [our] faulty economic compass." It concludes that this is useful because "the invisibility of biodiversity values has often encouraged inefficient use or even destruction of the natural capital that is the foundation of our economies."

We can measure progress with full cost accounting

If assigning market values to ecosystem services gives us a fuller and truer picture of costs and benefits, then we can take a similar approach in measuring our economic progress as a society. For decades, we have assessed each nation's economy by calculating its **Gross Domestic Product (GDP)**, the total monetary value of final goods and services the nation produces each year. Governments regularly use GDP to make policy decisions that affect billions of people. However, GDP fails to account for nonmarket values. It also lumps together all economic activity, desirable and undesirable. GDP can rise in response to crime, war, pollution, and natural disasters, because we spend money to protect ourselves from these things and to recover from them.

Environmental economists have developed indicators meant to distinguish desirable from undesirable economic activity and to better reflect our well-being. One such alternative to the GDP is the **Genuine Progress Indicator (GPI)**. To calculate GPI, we begin with conventional economic activity and add to it positive contributions not paid for with money, such as volunteer work and parenting. We then subtract negative impacts, such as crime and pollution (FIGURE 5.6a).



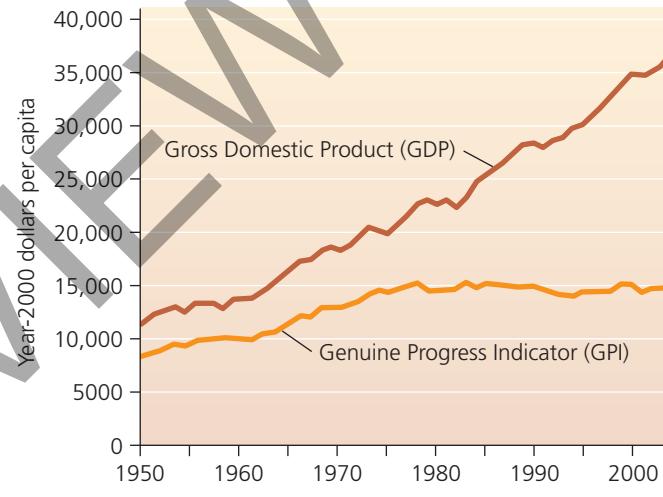
(a) Components of GPI

GPI can differ strikingly from GDP: FIGURE 5.6b compares these indices for the United States across 50 years. On a per-person basis, the nation's GDP rose greatly, but its GPI remained flat for 30 years. This discrepancy suggests that Americans have been spending more and more money but that their quality of life is not improving.

The GPI is an example of **full cost accounting**, also called **true cost accounting**, because it aims to account for all costs and benefits. Several U.S. states are beginning to use the GPI to measure progress and help guide policy. Since Maryland's governor embraced the approach in 2010, that state's GPI has grown faster than its GDP.

Critics of full cost accounting argue that the approach is subjective and too easily driven by ideology. Proponents respond that making a subjective attempt to measure progress is better than using a more objective indicator such as the GDP in a task for which it wasn't intended.

Today, attempts are gaining ground to measure happiness (rather than economic output) as the prime goal of national policy. The small Asian nation of Bhutan has pioneered this approach with its measure of Gross National Happiness. Another indicator is the Happy Planet Index, which measures how much happiness we gain per amount of resources we consume. By this measure, Costa Rica was calculated to be the top nation in the world.



(b) Change in U.S. GDP vs. GPI

FIGURE 5.6 Full cost accounting indicators such as the GPI attempt to measure progress and well-being more effectively than pure economic indicators such as the GDP. We see in (a) how the Genuine Progress Indicator (orange bar at right) adds to the Gross Domestic Product (red bar at left) benefits such as volunteering and parenting (upward gold arrow). The GPI then subtracts external environmental costs such as pollution, social costs such as divorce and crime, and economic costs such as borrowing and the gap between rich and poor (downward gold arrow). Shown are values for the United States in 2004. We see in (b) that per capita U.S. GDP has increased dramatically since 1950, yet per capita U.S. GPI leveled off after 1975. Data from Talberth, J., C. Cobb, and N. Slattery, 2007. The Genuine Progress Indicator 2006: A tool for sustainable development. *Redefining Progress*, Oakland, CA. By permission of John Talberth, Ph.D. All data are adjusted for inflation by using year-2000 dollars.

DATA Q What was the ratio of GDP to GPI in 1950? (Divide GDP by GPI.) What was this ratio in the year you were born? What was this ratio in 2004? What do the changes in these values indicate to you?

Costa Rica is also one of five nations working with the World Bank (p. 108) in a program to implement full cost accounting methods. Together they are addressing questions such as how much economic benefit the nation's forests, national parks, and other natural amenities generate through tourism and watershed protection.

FAQ

Does having more money make a person happier?

This age-old question has long been debated in the realm of philosophy. In recent years, though, social scientists have conducted serious research on the issue. So far, studies have found a surprising degree of consensus: In general, we become happier as we get wealthier, but once we gain a moderate level of wealth (roughly \$50,000–\$90,000 in yearly income), attaining further money no longer increases our happiness. Apparently reaching a basic level of financial security alleviates day-to-day economic worries, but once those worries are taken care of, our happiness revolves around other aspects of our lives (such as family, friends, and the satisfaction of helping others). Research on happiness can help us guide our personal life decisions. It also suggests that enhancing a society's happiness might best be achieved by raising many people's incomes up by a little, rather than by raising some people's incomes up by a lot.

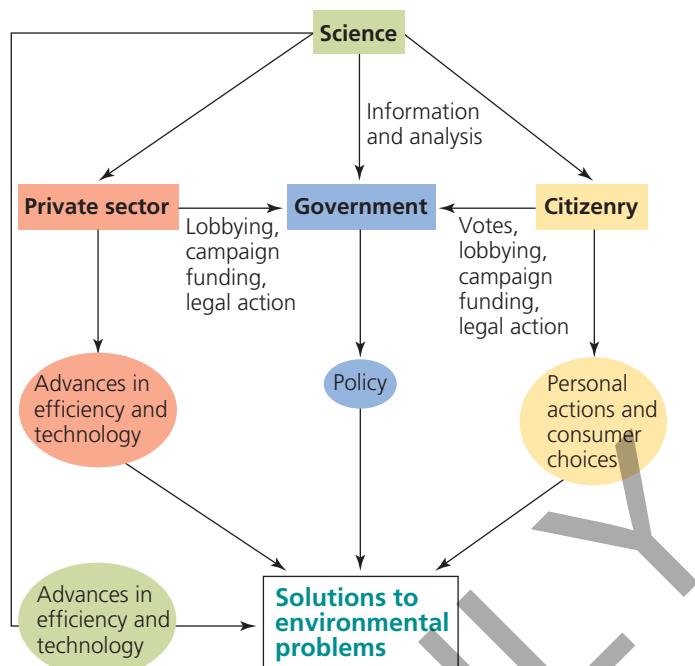


FIGURE 5.7 Policy plays a central role in addressing environmental problems.

Markets can fail

When markets do not take into account the positive outside effects on economies (such as ecosystem services) or the negative side effects of economic activity (external costs), economists call this **market failure**. Traditionally, we have tried to counteract market failure by using government intervention. Government can restrain individual and corporate behavior through laws and regulations. It can tax harmful activities. It can also design economic incentives that use market mechanisms to promote fairness, resource conservation, and economic sustainability. Paying for the conservation of ecosystem services, as Costa Rica does, is one way of deploying economic incentives toward policy goals. We will now examine these approaches in our discussion of environmental policy.

Environmental Policy: An Overview

When a society comes to feel that a problem exists, its leaders may try to resolve the problem using **policy**, a formal set of general plans and principles intended to guide decision making. **Public policy** is policy made by governments. **Environmental policy** pertains to our interactions with our environment. Environmental policy generally aims to regulate resource use or reduce pollution to promote human welfare and protect natural systems.

Forging effective policy requires input from science, ethics, and economics. Science provides information and anal-

yses needed to identify and understand problems and devise solutions. Ethics and economics offer criteria by which to assess problems and help clarify how society might address them. Government interacts with citizens, organizations, and the private sector to formulate policy (**FIGURE 5.7**).

Environmental policy addresses issues of fairness and resource use

Because market capitalism is driven by incentives for short-term economic gain rather than long-term social and environmental stability, it provides businesses and individuals little motivation to minimize environmental impact or to equalize costs and benefits among parties. As we noted, such *market failure* has traditionally been viewed as justification for government involvement. Governments typically intervene in the marketplace for several reasons:

- To provide social services, such as national defense, healthcare, and education
- To provide “safety nets” (for the elderly, the poor, victims of natural disasters, and so on)
- To eliminate unfair advantages held by single buyers or sellers
- To manage publicly held resources
- To minimize pollution and other threats to health and quality of life

Environmental policy aims to protect people’s health and well-being, to safeguard environmental quality and conserve natural resources, and to promote equity or fairness in people’s use of resources.

Do Payments Help Preserve Forest?



Workers on a Costa Rican farm plant native trees for Arbofilia, an organization helping farmers to restore forest.

Costa Rica's program to pay for ecosystem services has garnered international praise and inspired other nations to implement similar policies. But have Costa Rica's payments actually been effective in preventing forest loss? A number of research teams have sought to answer this surprisingly difficult question by analyzing data from the PSA program.

Some early studies were quick to credit the PSA program for saving forests. A 2006 study conducted for FONAFIFO, the agency administering the program, concluded that PSA payments in the central region of the country had prevented 108,000 ha (267,000 acres) of deforestation—38% of the area under contract. Indeed, deforestation rates fell as the program proceeded; rates of forest clearance in 1997–2000 were half what they were in the preceding decade.

However, some researchers hypothesized that PSA payments were not responsible for this decline and that forest loss would have slowed anyway because of other factors. To test this hypothesis, a team led by G. Arturo Sanchez-Azofeifa of the University of Alberta and Alexander Pfaff of Duke University worked with FONAFIFO's payment data, as well as data on land use and forest cover from satellite surveys. They layered these data onto maps using a geographic information system (GIS) (p. 34) and explored the patterns revealed.

In 2007 in the journal *Conservation Biology*, they reported that only 7.7% of PSA contracts were located within

1 km of regions where forest was at greatest risk of clearance. PSA contracts were only slightly more likely to be near such a region than far from it. This meant, they argued, that PSA contracts were not being targeted to regions where they could have the most impact.

Moreover, since enrollment was voluntary, most landowners applying for payments likely had land unprofitable for agriculture and were not actually planning to clear forest (FIGURE 1). In a 2008 paper, these researchers compared lands under PSA contracts with similar lands not under contracts. PSA lands experienced no forest loss, whereas the deforestation rate on non-PSA lands was 0.21%/yr. However, their analyses indicated that PSA lands had only a 0.08%/yr likelihood of being cleared in the first place, suggesting that the program prevented only 0.08%/yr of forest loss, not 0.21%/yr. Other research was bearing this out; at least two studies found that many PSA participants, when interviewed, said they would have retained their forest even without the PSA program.

These researchers argued that Costa Rica's success in halting forest loss was likely due to other factors. In particular, Forest Law 7575, which had established the PSA system, had also banned forest clearing nationwide. This top-down government mandate, assuming it was enforceable, in theory made the PSA payments unnecessary. However, the PSA program

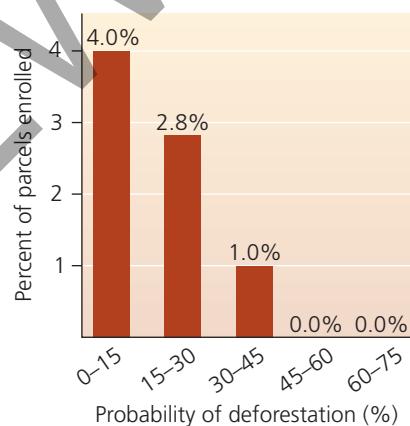
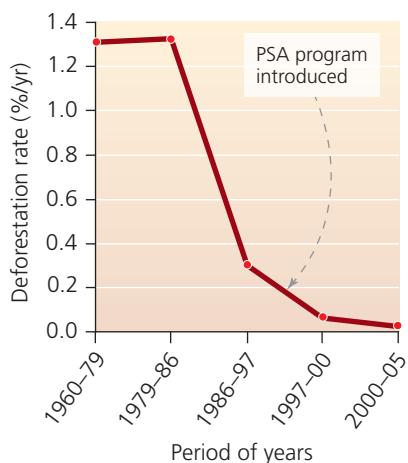


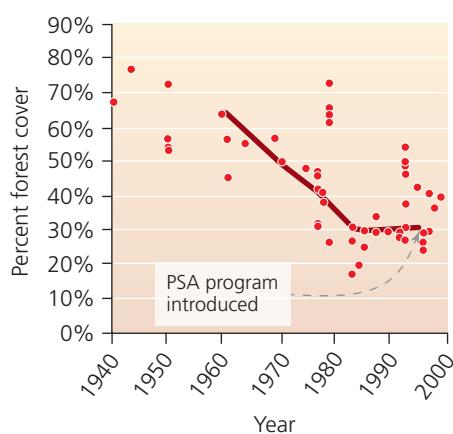
FIGURE 1 In areas at greater risk of deforestation, lower percentages of land parcels were enrolled in the PSA program. This is because land more profitable for agriculture was less often enrolled.
Data: Pfaff, A., et al. 2008. Payments for environmental services: Empirical analysis for Costa Rica. Working Papers Series SAN08-05, Terry Sanford Institute of Public Policy, Duke University.

The tragedy of the commons When publicly accessible resources are open to unregulated exploitation, they tend to become overused, damaged, or depleted. So argued environmental scientist Garrett Hardin in his 1968 essay "The Tragedy of the Commons." Basing his argument on

an age-old scenario, Hardin explained how in a public pasture (or "common") open to unregulated grazing, each person who grazes animals will be motivated by self-interest to increase the number of his or her animals in the pasture. Because no single person owns the pasture, no one has



(a) Deforestation decreased



(b) Forest cover began increasing

made the mandate far more palatable to legislators, and Forest Law 7575 might never have passed had it not included the PSA payments.

Despite the PSA program's questionable impact in preserving existing forest, scientific studies show that it has been effective in regenerating new forest. In Costa Rica's Osa Peninsula, Rodrigo Sierra and Eric Russman of the University of Texas at Austin found in 2006 that PSA farms had five times more regrowing forest than did non-PSA farms. Interviews with farmers indicated that the program encouraged them to let land grow back into forest if they did not soon need it for production.

In the nation's northern Caribbean plain, a team led by Wayde Morse of the University of Idaho combined satellite data with on-the-ground interviews, finding that PSA payments plus the clearance ban reduced deforestation rates from 1.43%/year to 0.10%/year and that the program encouraged forest regrowth still more. Meanwhile, dissertation work by Rodrigo Arriagada indicated that the regeneration of new forest seemed to be the PSA program's major effect at the national level as well.

Most researchers today hold that Costa Rica's forest recovery results from a long history of conservation policies and economic developments. Data show that deforestation rates had been dropping before the PSA program was initiated (**FIGURE 2**). There are several major reasons:

- Earlier policies (tax rebates and tax credits for timber production) encouraged forest cover.

incentive to expend effort taking care of it. Instead, each person takes what he or she can until overgrazing causes the pasture's food production to collapse, hurting everyone. This scenario, known as the **tragedy of the commons**, pertains to many resources held and used in common by the

FIGURE 2 Forest recovery was underway in Costa Rica before the PSA program began.

(a) Deforestation rates had already dropped steeply, indicating that other factors were responsible. Forest cover **(b)** also began increasing shortly before the program's initiation (the graph gathers together estimates from many studies). Data: From Daniels, Amy E., et al. 2010. Understanding the impacts of Costa Rica's PES: Are we asking the right questions? *Ecological Economics* 69: 2116–2126.

- The creation of national parks fed a boom in ecotourism, so Costa Ricans saw how conserving natural areas could bring economic benefits.
- Falling market prices for meat discouraged ranching.
- After an economic crisis roiled Latin America in the 1980s, Costa Rica ended subsidies that had encouraged ranchers and farmers to expand into forested areas.

To help the PSA program make better use of its money, most scientists today feel that PSA payments should be targeted. Instead of paying equal amounts to anyone who applies, FONAFIFO should prioritize applicants, or pay more money, in regions that are ecologically most valuable or that are at greatest risk of deforestation. In a 2008 study, Tobias Wünscher of Bonn, Germany, and colleagues modeled and tested seven possible ways to target the payments, using data from Costa Rica's Nicoya Peninsula. Wünscher's team suggested using auctions, in which applicants for PSA funds put in bids stating how much they were requesting. Because applicants have outnumbered available contracts 3 to 1, FONAFIFO could favor the lower bids to keep costs down, while the auction system could make differential payments politically acceptable.

Costa Rica's government is responding to suggestions from researchers by aiming payments toward regions of greater environmental value and by making the program more accessible to low-income farmers in undeveloped regions. The government has also raised the payment amounts considerably. Researchers—and other nations—are watching closely to see how the program develops. □

public: forests, fisheries, clean air, clean water—even the global climate.

When shared resources are being depleted or degraded, it is in society's interest to develop guidelines for their use. In Hardin's example, guidelines might limit the number of

animals each person can graze or might require pasture users to help restore and manage the resource. These two concepts—restriction of use, and management—are central to environmental policy today.

Public oversight through government is a standard way to alleviate the tragedy of the commons, but we can also address it in other ways. Resource users can voluntarily cooperate to prevent overexploitation. This may work if the resource is localized and enforcement is simple, but these conditions are rare. Alternatively, the resource can be subdivided and allotments sold into private ownership, so that each owner gains incentive to manage his or her portion. Privatization may be effective if property rights can be clearly assigned (as with land), but it tends not to work with resources such as air or water. Privatization also opens the door to short-term profit-taking at the long-term expense of the resource.

Free riders A second reason we develop policy for publicly held resources is the **free rider** predicament. Let's say a community on a river suffers from water pollution that emanates from 10 different factories. The problem could in theory be solved if every factory voluntarily agreed to reduce its own pollution. However, once they all begin reducing their pollution, it becomes tempting for any one of them to stop doing so. A factory that avoids the efforts others are making would in essence get a “free ride.” If enough factories take a free ride, the whole collective endeavor will collapse. Because of the free rider problem, private voluntary efforts are often less effective than efforts mandated by public policy.

External costs Environmental policy also aims to promote fairness by dealing with external costs (pp. 94–95). For example, a factory that discharges waste into a river imposes external costs (water pollution, health impacts, reduced fish populations, aesthetic impacts) on downstream users of the river. If the government forces the company to clean up its pollution, pay fees, or reimburse affected residents, this helps to “internalize” costs. The costs are paid by the company, which will likely pass them on to consumers by raising the prices of its products. Higher market prices may reduce demand for the products, and consumers may instead favor less-expensive products whose production imposes fewer costs on society.

WEIGHING THE ISSUES

Internalizing External Costs Imagine that we were to use policy to internalize all the external costs of gasoline (pollution, health impacts, climate change, damage from oil drilling and transport, etc.), and that as a result, gas prices rise to \$13 per gallon. What effects do you think this would have on the choices we make as consumers (such as driving behavior and types of vehicles purchased)? What influence might it have on the types of vehicles produced and the types of energy sources developed? What effects might it have on our taxes and our health insurance premiums? In the long run, do you think that internalizing external costs in this way would end up costing society more money, or saving society money? What factors might be important in determining the outcome?

Various factors can obstruct environmental policy

If the goals of environmental policy are so noble, why are environmental laws and regulations often challenged? One reason is the perception that environmental protection means economic sacrifice (see FAQ, p. 94). Businesses and individuals often view regulations as restrictive, bureaucratic, or costly. Landowners may fear that zoning (p. 413) or protections for endangered species (p. 179) will restrict how they can use their land. Developers complain of time and money lost in obtaining permits; reviews by government agencies; and required environmental controls, monitoring, and mitigation.

Another hurdle for environmental policy stems from the nature of environmental problems, which often develop gradually over long time periods. Human behavior is geared toward addressing short-term needs, and this is reflected in our social institutions. Businesses usually opt for short-term financial gain. The news media give more coverage to new and sudden events than gradual long-term trends. Politicians often act in their short-term interest because they depend on reelection every few years. For all these reasons, environmental policy may be obstructed.

Policy in general can be held up for many reasons, even if a majority of people favor it. Checks and balances in a constitutional democracy seek to ensure that new policy is implemented only after extensive review and debate. However, less desirable factors can also hinder policy. In democracies such as the United States, each person has a political voice and can make a difference—yet money yields influence. People, organizations, industries, or corporations with enough wealth to buy access to power exert disproportionate influence over policymakers.

Science informs policy but is sometimes disregarded

Policy that is effective is generally informed by science. For instance, Costa Rica’s PSA program was inspired by scientific research into the importance of ecosystem services. Once researchers diagnosed shortcomings in the way the program was being run, policymakers responded with remedies. When deciding whether to regulate a substance that may pose a public health risk, government agencies may comb the scientific literature for information or commission new studies to resolve outstanding questions. When crafting a bill to reduce pollution, a legislator may consult scientific data that quantifies impacts of the pollution or that predicts benefits from its reduction. In today’s world, a nation’s strength depends on its commitment to science. This is why governments devote a portion of our taxes to fund scientific research.

Alas, sometimes policymakers allow political ideology, rather than science, to determine policy on scientific matters. Politicians may ignore scientific consensus on well-established matters such as evolution, vaccination, or climate change if it suits their political needs. Some may reject or distort scientific advice if this helps to please campaign contributors

or powerful constituencies. Whenever taxpayer-funded science is suppressed or distorted for political ends, society loses. We cannot take for granted that science will play a role in policy. As scientifically literate citizens of a democracy, we need to stay vigilant and help ensure that our representatives in government are making proper use of the tremendous scientific assets we have at our disposal.

U.S. Environmental Law and Policy

The United States provides a good focus for understanding environmental policy in constitutional democracies worldwide for several reasons. First, the United States has pioneered innovative environmental policy. Second, U.S. policies serve as models—of both success and failure—for other nations and for international bodies. Third, the United States exerts a great deal of influence on the affairs of other nations. Finally, understanding U.S. policy at the federal level helps us to understand policy at local, state, and international levels.

The federal government's three branches shape policy

Federal policy in the United States results from actions of the legislative, executive, and judicial branches of government. Congress creates laws, or **legislation**, by crafting bills that can become law with the signature of the head of the executive branch, the president. Once a law is enacted, its implementation and enforcement is assigned to an administrative agency in the executive branch. Administrative agencies create **regulations**, specific rules intended to achieve objectives of a law. These agencies also monitor compliance with laws and regulations. Several dozen administrative agencies influence U.S. environmental policy, ranging from the Environmental Protection Agency to the Forest Service to the Food and Drug Administration to the Bureau of Land Management.

The judiciary, consisting of the Supreme Court and various lower courts, is charged with interpreting law and is an important arena for environmental policy. Grassroots environmental advocates and organizations use lawsuits to help level the playing field with large corporations and agencies. Conversely, the courts hear complaints from businesses and individuals challenging the constitutional validity of environmental laws they feel to be infringing on their rights. Individuals and organizations also lodge suits against government agencies when they feel the agencies are failing to enforce their own regulations.

The structure of the federal government is mirrored at the state level with governors, legislatures, judiciaries, and agencies. States, counties, and municipalities all generate policy of their own. They can act as laboratories experimenting with novel ideas, so that policies that succeed may be adopted elsewhere. In the “cooperative federalism” approach, a federal agency sets national standards and then works with state agencies to achieve them in each state.

Early U.S. environmental policy promoted development

Environmental policy in the United States was created in three periods. Laws enacted during the first period, from the 1780s to the late 1800s, accompanied the westward expansion of the nation and were intended mainly to promote settlement and the extraction and use of the continent’s abundant natural resources (**FIGURE 5.8**).

Among these early laws were the *General Land Ordinances of 1785 and 1787*, by which the new federal government gave itself the right to manage the lands it was expropriating from Native Americans. These laws created a grid system for surveying these lands and readying them for private ownership.



(a) Settlers in Nebraska, circa 1860



(b) Loggers felling an old-growth tree, Washington

FIGURE 5.8 Early U.S. environmental policy promoted settlement and natural resource extraction. The Homestead Act of 1862 allowed settlers (a) to claim, for a \$16 fee, 160 acres of land by living there for 5 years and farming or building a home. The timber industry was allowed to clear-cut the nation’s ancient forests (b) with little policy to encourage conservation. The General Mining Act of 1872 legalized and promoted mining by private individuals on public land for just \$5 per acre, with no government oversight.

From 1785 onward, the government promoted settlement in the Midwest and West and doled out millions of acres to its citizens and to railroad companies, encouraging settlers, entrepreneurs, and land speculators to move west.

Western settlement provided U.S. citizens with means to achieve prosperity while relieving crowding in Eastern cities. It expanded the geographical reach of the United States at a time when the young nation was still jostling with European powers for control of the continent. It also wholly displaced the millions of Native Americans who had inhabited these lands for millennia. U.S. environmental policy of this era reflected a perception that the vast western lands were inexhaustible in natural resources.

The second wave of U.S. environmental policy encouraged conservation

In the late 1800s, as the continent became more populated and its resources were increasingly exploited, public perception and government policy toward natural resources began to shift. Reflecting the emerging conservation and preservation ethics (p. 13) in American society, laws of this period aimed to alleviate some of the environmental impacts of westward expansion.

In 1872, Congress designated Yellowstone the world's first national park. In 1891, Congress authorized the president to create forest reserves to prevent overharvesting and protect forested watersheds. In 1903, President Theodore Roosevelt created the first national wildlife refuge. These acts launched the



FIGURE 5.9 Scientist and writer Rachel Carson revealed the effects of DDT and other pesticides in her 1962 book, *Silent Spring*.

creation of a national park system, national forest system, and national wildlife refuge system that still stand as global models (pp. 194, 199). These developments reflected a new understanding that the continent's resources were exhaustible and required protection.

Land management policies continued through the 20th century, targeting soil conservation in the wake of the Dust Bowl (p. 142) and wilderness preservation with the Wilderness Act of 1964 (p. 199).

The third wave responded to pollution

Further social changes in the 20th century gave rise to the third major period of U.S. environmental policy. In a more densely populated nation driven by technology, industry, and intensive resource consumption, Americans found themselves better off economically but living amid dirtier air, dirtier water, and more waste and toxic chemicals. Events in the 1960s and 1970s triggered greater awareness of environmental problems, bringing about a profound shift in public policy.

A landmark event was the 1962 publication of *Silent Spring*, a book by American scientist and writer Rachel Carson (FIGURE 5.9). *Silent Spring* awakened the public to the ecological and health impacts of pesticides and industrial chemicals (pp. 210–211). The book's title refers to Carson's warning that pesticides might kill so many birds that few would be left to sing in springtime.

Ohio's Cuyahoga River (FIGURE 5.10) also drew attention to pollution hazards. The Cuyahoga was so polluted with oil and industrial waste that the river actually caught fire near Cleveland a number of times in the 1950s and 1960s. This spectacle, coupled with an oil spill offshore from Santa Barbara, California, in 1969, moved the public to prompt Congress and the president to better safeguard water quality and public health. The first Earth Day event in 1970 helped to galvanize public support for action to address pollution problems.



FIGURE 5.10 Ohio's Cuyahoga River was so polluted with oil and waste that the river caught fire multiple times in the 1950s and 1960s and would burn for days at a time.

TABLE 5.1 Major U.S. Environmental Protection Laws, 1963–1980

	Clean Air Act 1963; amended 1970 and 1990 Sets standards for air quality, restricts emissions from new sources, enables citizens to sue violators, funds research on pollution control, and established an emissions trading program for sulfur dioxide. As a result, the air we breathe today is far cleaner (pp. 284–287).		Resource Conservation and Recovery Act 1976 Sets standards and permitting procedures for the disposal of solid waste and hazardous waste (p. 392). Requires that the generation, transport, and disposal of hazardous waste be tracked “from cradle to grave.”
	Endangered Species Act 1973 Seeks to protect species threatened with extinction. Forbids destruction of individuals of listed species or their critical habitat on public and private land, provides funding for recovery efforts, and allows negotiation with private landholders (pp. 177–179).		Clean Water Act 1977 Regulates the discharge of wastes, especially from industry, into rivers and streams (p. 272). Aims to protect wildlife and human health, and has helped to clean up U.S. waterways.
	Safe Drinking Water Act 1974 Authorizes the EPA to set quality standards for tap water provided by public water systems, and to work with states to protect drinking water sources from contamination.		Soil and Water Conservation Act 1977 Directs the U.S. Department of Agriculture to survey and assess soil and water conditions across the nation and prepare conservation plans. Responded to worsening soil erosion and water pollution on farms and rangeland as production intensified.
	Toxic Substances Control Act 1976 Directs the EPA to monitor thousands of industrial chemicals and gives it power to ban those found to pose too much health risk (p. 221). However, the number of chemicals continues to increase far too quickly for adequate testing.		CERCLA (“Superfund”) 1980 Funds the Superfund program to clean up hazardous waste at the nation’s most polluted sites (p. 404). Costs were initially charged to polluters but most are now borne by taxpayers. The EPA continues to progress through many sites that remain. Full name is the Comprehensive Environmental Response Compensation and Liability Act.

Public demand for a cleaner environment during this period inspired a number of major laws that underpin modern U.S. environmental policy (**TABLE 5.1**). You will encounter many of them again later in this book, and they have already helped to shape the quality of your life.

Historians suggest that major advances in environmental policy occurred in the 1960s and 1970s because (1) environmental problems became readily apparent and were directly affecting people’s lives, (2) people could visualize policies to

deal with the problems, and (3) citizens were politically active and leaders were willing to act. In addition, photographs from NASA’s space program allowed humanity to see, for the first time ever, images of Earth from space (see photos on pp. 1 and 425). It is hard for us to comprehend the power those images had at the time, but they revolutionized many people’s worldviews by making us aware of the finite nature of our planet.

Today, largely because of policies enacted since the 1960s, our health is better protected and the nation’s air and

water are considerably cleaner. Thanks to the many citizens who worked tirelessly in grassroots efforts, and to the policy-makers who listened and chose to make a difference in people's lives, we now enjoy a cleaner environment where industrial chemicals, waste disposal, and resource extraction are more carefully regulated. Much remains to be done, but all of us alive today owe a great deal to the dedicated people who inspired policy to tackle pollution during this period.

Passage of NEPA and creation of the EPA were milestones

One of the foremost U.S. environmental laws is the **National Environmental Policy Act (NEPA)**, signed into law by Republican President Richard Nixon in 1970. NEPA created an agency called the Council on Environmental Quality and required that an **environmental impact statement (EIS)** be prepared for any major federal action that might significantly affect environmental quality. An EIS summarizes results from studies that assess environmental impacts that could result from development projects undertaken or funded by the federal government.

The EIS process forces government agencies and businesses that contract with them to evaluate impacts in a cost-benefit approach (p. 94) before proceeding with a new dam, highway, building project, or similar action. The EIS process rarely halts development projects, but it serves as an incentive to lessen environmental damage. NEPA grants ordinary citizens input in the policy process by requiring that EISs be made publicly available and that policymakers solicit and consider public comment on them.

In 1970 policymakers also created the **Environmental Protection Agency (EPA)**. The EPA was charged with conducting and evaluating research, monitoring environmental quality, setting and enforcing standards for pollution levels, assisting the states in meeting the standards, and educating the public.

The social context for policy evolves

In the 1980s Congress strengthened, broadened, and elaborated upon the laws of the 1970s. But the political climate in the United States soon changed, and advocates of environmental protection watched their hard-won gains begin to erode. Although public support for the goals of environmental protection remained high, many people began to feel that the regulatory means used to achieve these goals too often imposed economic burdens on businesses or individuals. Attempts were made to roll back environmental policy, beginning with the administration of Ronald Reagan and culminating in an array of efforts by the George W. Bush administration and by the Congresses in power from 1994 through 2006.

Today in the United States, legal protections for public health and environmental quality remain strong in some areas but have been weakened in others. Past policies restricting toxic substances such as lead and DDT have improved public health, but scientists and regulators cannot keep up with the flood of new chemicals being introduced by industry. As demand for energy rises while concern over climate change intensifies, today's policy debates focus on oil exploration,

coal-burning power plants, hydraulic fracturing ("fracking") to extract oil and gas, piping petroleum from oil sands, exporting coal to other nations, taxpayer subsidies, and mandates for renewable sources.

Environmental policy advances today on the international stage

Amid the heightened partisanship of U.S. politics today, environmental policy has gotten caught in the political crosshairs. Despite the fact that some of the greatest early conservationists were Republicans, and even though the words *conservative* and *conservation* share the same root meaning, environmental issues have today become identified as a predominantly Democratic concern. As a result, significant bipartisan advances rarely occur, and the United States now wields less clout internationally on environmental policy.

Meanwhile, other nations have forged ahead with innovative policy. Germany has used policy to make impressive strides with solar energy (pp. 365–366). Sweden maintains a thriving society while promoting progressive environmental policies. Small developing nations such as Costa Rica and Bhutan are bettering their citizens' lives while protecting and restoring their natural capital. Even China, despite becoming the world's biggest polluter, is taking the world's biggest steps toward renewable energy, reforestation, and pollution control.

Worldwide, we have embarked on a fourth wave of environmental policy, one focused on sustainability and sustainable development (pp. 18, 111–112) to safeguard natural systems while raising living standards for the world's people. In addition, global climate change (Chapter 14) has come to dominate discussion of environmental policy (FIGURE 5.11). A series of international conferences (pp. 325–326) has brought together the world's nations to grapple with issues of how to reduce the greenhouse gas emissions that drive climate change.



FIGURE 5.11 **Concerns over climate change are driving environmental policy in all nations.** Here, college students and activists urge U.S. leaders to enact policies to help bring the atmosphere's carbon dioxide concentration back down to 350 parts per million. Many scientists feel this is the level needed to avert catastrophic climate change.

International Environmental Policy

Environmental systems pay no heed to political boundaries, and neither do environmental problems. Climate change is a global issue because carbon pollution from any one nation spreads through the atmosphere and oceans, affecting all nations. Because one nation's laws have no authority in other nations, international policy is vital to solving "transboundary" problems in our globalizing world.

Globalization makes international institutions vital

We live in an era of rapid and profound change. **Globalization** describes the process by which the world's societies have become more interconnected, linked by trade and communication technologies in countless ways. Globalization has brought us many benefits by facilitating the spread of ideas and technologies that empower individuals and enhance our lives. Billions of people enjoy a degree of access to news, education, arts, and science that we could barely have imagined in the past, and billions also now live under more democratic governments. A better awareness of other cultures promotes peace and understanding, and warfare is on the decline.

Yet as globalization proceeds, societies and ecological systems are altered at unprecedented rates and scales. People move organisms from one continent to another, allowing invasive species to affect ecosystems everywhere. Multinational corporations operate outside the reach of national laws and rarely have incentive to conserve resources or limit pollution while moving from nation to nation. Our biggest environmental challenges are now global in scale (such as climate change, ozone depletion, overfishing, and biodiversity loss)—yet we lack an adequate global legal framework to address these

issues effectively. For all these reasons, in today's globalizing world the institutions that do shape international law and policy play increasingly vital roles.

International law includes customary law and conventional law

International law known as **customary law** arises from long-standing practices, or customs, held in common by most cultures. International law known as **conventional law** arises from conventions, or treaties (written contracts), into which nations enter. One example is the United Nations Framework Convention on Climate Change, a 1994 treaty that established a framework for agreements to reduce greenhouse gas emissions that contribute to global climate change. The Kyoto Protocol (*a protocol* is an amendment or addition to a convention) later specified the agreed-upon details of the emissions limits (p. 325). **TABLE 5.2** shows a selection of major environmental treaties ratified by most of the world's nations.

Treaties are also signed among pairs or groups of nations. The United States, Mexico, and Canada entered into the **North American Free Trade Agreement (NAFTA)** in 1994 (**FIGURE 5.12**). NAFTA eliminated trade barriers such as tariffs on imports and exports, making goods cheaper to buy. Yet NAFTA also threatened to undermine protections for workers and the environment by steering economic activity to areas where regulations were most lax. Side agreements aimed to address these concerns, and NAFTA's impacts on jobs and on environmental quality in the three nations have been complex. Some U.S. jobs moved to Mexico, but fears that pollution would soar and regulations would be gutted largely did not come to pass, while some sustainable products and practices spread from nation to nation. The debates over such issues recur with each proposed free trade agreement among nations, as we try to find ways to gain the benefits of free trade while avoiding environmental damage and harm to working people.

TABLE 5.2 Major International Environmental Treaties

CONVENTION OR PROTOCOL	YEAR IT CAME INTO FORCE	NATIONS THAT HAVE RATIFIED IT	U.S. STATUS
CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora (p. 179)	1975	175	Ratified
Ramsar Convention on Wetlands of International Importance	1975	159	Ratified
Montreal Protocol , of the Vienna Convention for the Protection of the Ozone Layer (p. 294)	1989	196	Ratified
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (p. 403)	1992	172	Signed but has not ratified
Convention on Biological Diversity (p. 179)	1993	168	Signed but has not ratified
Stockholm Convention on Persistent Organic Pollutants (p. 222)	2004	152	Signed but has not ratified
Kyoto Protocol , of the UN Framework Convention on Climate Change (p. 325)	2005	184	Signed but has not ratified



FIGURE 5.12 The North American Free Trade Agreement (NAFTA) eliminated trade barriers to make goods cheaper. However, some U.S. manufacturing jobs moved to Mexico (such as to this garment factory in Tehuacan), where wages are lower and health and environmental regulations are more lax.

Several organizations shape international environmental policy

In this age of globalization, a number of international institutions act to influence the policy and behavior of nations by providing funding, applying political or economic pressure, and directing media attention.

The United Nations Founded in 1945 and including representatives from all nations of the world, the **United Nations (U.N.)** seeks “to maintain international peace and security; to develop friendly relations among nations; to cooperate in solving ... problems and in promoting respect for human rights and fundamental freedoms; and to be a centre for harmonizing the actions of nations in attaining these ends.” Headquartered in New York City, the United Nations plays an active role in environmental policy by sponsoring conferences, coordinating treaties, and publishing research.

The World Bank Established in 1944 and based in Washington, D.C., the **World Bank** is one of the largest funding sources for economic development. It shapes policy by funding dams, irrigation systems, and other major projects. In fiscal year 2013, the World Bank provided \$31.5 billion in loans and support for projects designed to benefit low-income people in developing countries.

Despite its admirable mission, the World Bank is often criticized for funding projects that cause environmental impacts, such as dams that flood forests and farmland to provide electricity. Providing for the needs of growing human populations in poor nations while minimizing damage to the ecological systems people rely on can be a tough balancing act. Environmental scientists agree that the concept of sustainable development must be the guiding principle for such efforts.

The World Trade Organization Based in Geneva, Switzerland, the **World Trade Organization (WTO)** represents multinational corporations and promotes free trade by reducing obstacles to international commerce and enforcing fairness among nations in trading practices. The WTO has authority to impose financial penalties on nations that do not comply with its directives.

The WTO has interpreted some national environmental laws as unfair barriers to trade. In 1995, the U.S. EPA issued regulations requiring cleaner-burning gasoline in U.S. cities. Brazil and Venezuela filed a complaint with the WTO, saying the new rules discriminated against the dirtier-burning petroleum they exported to the United States. The WTO agreed, ruling that even though the dirty gasoline posed a threat to human health in the United States, the EPA rules were an illegal trade barrier. The ruling forced the United States to weaken its regulations.

WEIGHING THE ISSUES

Trade Barriers and Environmental Protection If Canada has stricter laws for environmental protection than Mexico, and if these laws limit Mexico's ability to export its goods to Canada, then by WTO policy Canada's laws could be overruled in the name of free trade. Do you think this is fair? Now consider that Canada is wealthier than Mexico and that Mexico could use an economic boost. Does this affect how you would respond?

Nongovernmental organizations A number of **nongovernmental organizations (NGOs)**—nonprofit, mission-driven organizations not overseen by any government—have become international in scope and exert influence over policy. Groups such as the Nature Conservancy focus on conservation objectives on the ground (such as purchasing and managing land and habitat for rare species) without becoming politically involved. Other groups, such as Greenpeace, Conservation International, and Population Connection, attempt to shape policy through research, education, lobbying, or protest.

Approaches to Environmental Policy

When most of us think of environmental policy, what comes to mind are major laws or regulations. However, environmental policy is diverse.

Policy can follow three approaches

Environmental policy can utilize a variety of strategies within three major approaches (**FIGURE 5.13**).

Lawsuits in the courts Prior to the legislative push of the 1960s and 1970s, most environmental policy questions were addressed with lawsuits in the courts. Individuals

suffering external costs from pollution would sue polluters, one case at a time. The courts sometimes punished polluters by ordering them to stop their operations or pay damages to the affected parties. However, as industrialization proceeded and population grew, pollution became harder to avoid, and judges became reluctant to hinder industry. People began to view legislation and regulation as more effective means of protecting public health and safety.

Command-and-control policy Most environmental laws and regulations of recent decades use a **command-and-control** approach, in which a regulating agency prohibits certain actions—or sets rules, standards, or limits—and threatens punishment for violations. This simple and direct approach to policymaking has brought citizens of the United States and other nations cleaner air, cleaner water, safer workplaces, healthier neighborhoods, and many other advances. The relatively safe, healthy, comfortable lives most of us enjoy today owe much to the command-and-control environmental policy of the past several decades.

Even in plain financial terms, command-and-control policy has been effective. Each year the White House Office of Management and Budget analyzes U.S. regulatory policy to calculate the economic costs and benefits of regulations. These analyses have consistently revealed that benefits far outweigh costs and that environmental regulations are most beneficial of all. You can explore some of these data in *Calculating Ecological Footprints* (p. 114).

Economic policy tools Despite the successes of command-and-control policy, many people dislike the top-down nature of an approach that dictates particular solutions to problems. As an alternative approach, we can aim to channel the innovation and economic efficiency of market capitalism in ways that benefit the public. Economic policy tools use financial incentives to promote desired outcomes by encouraging private entities competing in a marketplace to innovate and generate new or better solutions at lower cost.

All three of these approaches aim to “internalize” external costs suffered by the public by building these costs into

Problem

Pollution from factory harms people's health



FIGURE 5.13 Three major policy approaches exist to resolve environmental problems. To address pollution from a factory, we might 1 seek damages through lawsuits, 2 limit pollution through legislation and regulation, or 3 reduce pollution using market-based strategies.

Solutions

Three policy approaches



- 1 People can sue factory in court.



- 2 Government can regulate emissions.



- 3 Economic policy tools can create incentives: A factory that pollutes less (right) will outcompete one that pollutes more (left) through permit trading, avoiding green taxes, or selling ecolabeled products.

market prices. Each approach has strengths and weaknesses, and each is best suited to different conditions. The approaches may also be used together. For instance, Costa Rica's Forest Law 7575 was a command-and-control law that banned forest clearing, but it also established the PSA program as an economic policy tool to help the policy succeed. Government regulation is often needed to frame market-based efforts, and citizens can use the courts to ensure that regulations are enforced. Let's now explore several types of economic policy tools: taxes, subsidies, ecolabeling, and emissions trading.

Green taxes discourage undesirable activities

In taxation, money passes from private parties to the government, which uses it to pay for services to benefit the public. Taxing undesirable activities helps to internalize external costs by making these costs part of the normal expense of doing business. Taxes on environmentally harmful activities and products are called **green taxes**. When a business pays a green tax, it is essentially reimbursing the public for environmental damage it causes.

Under green taxation, a corporation owning a polluting factory pays taxes on the pollution it discharges—the more pollution, the higher the tax payment. This gives factory owners a financial incentive to reduce pollution while allowing them the freedom to decide how to do so. One polluter might invest in pollution control technology if this is more affordable than paying the tax. Another polluter might instead choose to pay the tax—funds the government can use to reduce pollution in some other way.

Costa Rica uses a green tax to help fund its PSA program. It applies a tax of 3.5% to sales of fossil fuels and then uses the revenue to pay for conserving forests, which soak up carbon emissions from fossil fuel combustion. In the United States, similar “sin taxes” on cigarettes and alcohol are long-accepted tools of U.S. social policy. Taxes on pollution are more common in Europe, where many nations have adopted the **polluter-pays principle**, which specifies that the party creating pollution be held responsible for covering the costs of its impacts. Today there is wide debate over carbon taxes—taxes on gasoline, coal-based electricity, and fossil-fuel-intensive products—to fight climate change (p. 327).

Subsidies promote certain activities

Another economic policy tool is the **subsidy**, a government giveaway of money or resources that is intended to support or promote an industry or activity. Subsidies take many forms, and one is the *tax break*, which relieves the tax burden on an industry, firm, or individual. Costa Rica's PSA program subsidizes the conservation and restoration of forests by transferring public money to landowners who conserve and restore forests. Ironically, much of the nation's deforestation had resulted from ranching and farming that the government had previously been subsidizing.

Subsidies like Costa Rica's payments for ecological services promote environmentally sustainable activities—but all too often subsidies are used to prop up unsustainable ones.

In the United States, subsidies for grazing (p. 145), timber extraction (p. 194), and mineral extraction (p. 243) on public lands all benefit private parties while often degrading publicly held resources.

Fossil fuels have been a major recipient of subsidies over the years. From 1950 to 2010, the U.S. government gave \$594 billion of its citizens' money to oil, gas, and coal corporations (most of this in tax breaks), according to one recent compilation (**FIGURE 5.14**). In comparison, just \$171 billion was granted to renewable energy, and most of these subsidies went to hydropower and to corn ethanol, which is not widely viewed as a sustainable fuel (p. 382). Globally in 2007–2010, fossil fuel subsidies outpaced renewable energy subsidies by nearly 8 to 1, according to the International Energy Agency.

In 2009, President Obama and other leaders of the Group of 20 (G-20) nations resolved to gradually phase out their collective \$300 billion of annual fossil fuel subsidies. Doing so would hasten a shift to cleaner renewable energy sources and accomplish half the greenhouse gas emissions cuts needed to hold global warming to 2°C. However, since that time, fossil fuel subsidies have *grown*, not shrunk. A prime reason is that consumers are accustomed to artificially low subsidized prices for gasoline and electricity and might punish policymakers who let these prices rise.

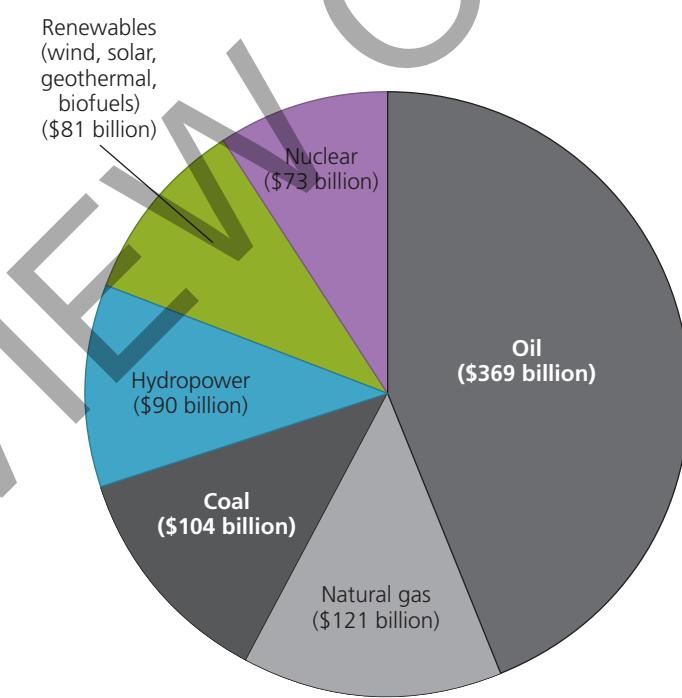


FIGURE 5.14 The well-established fossil fuel industries receive more subsidies than the young renewable energy industries. Cumulative data for the United States from 1950 to 2010 are shown. Apportionments remain similar today. Data from: Management Information Services, Inc. 2011. 60 years of energy incentives: Analysis of federal expenditures for energy development. Washington, D.C.

DATA Q How many dollars in subsidies have gone to fossil fuels (oil, coal, and natural gas) for every dollar that has gone to renewable energy (excluding hydropower)?

Ecolabeling empowers consumers

With subsidies and green taxes, policymakers deploy financial incentives in direct and selective ways. However, we may also pursue policy goals by establishing financial incentives and then letting marketplace dynamics run their course. With **ecolabeling**, sellers who use sustainable practices in growing, harvesting, or manufacturing products advertise this fact on their labels, hoping to win approval from buyers (FIGURE 5.15). Examples include labeling recycled paper (pp. 395–396), organic foods (pp. 155–158), dolphin-safe tuna, and sustainably harvested lumber (p. 197).

In many cases, ecolabeling grew from initial steps taken by government to require the disclosure of information to consumers. Once established, ecolabeling can spread in a free market as businesses seek to win consumer confidence and to out-compete less sustainable brands. Of course, some businesses may try to mislead us into thinking their products are more sustainable than they actually are—a phenomenon called *green-washing*. Independent certification by an outside party helps ensure that consumers get accurate information. When labeling information is accurate, each of us as consumers can provide businesses a powerful incentive to switch to more sustainable processes when we buy ecolabeled products.

Emissions trading can produce cost-effective results

Another approach that employs market dynamics to achieve policy goals is **emissions trading**. In an emissions trading system, a government creates a market in permits for the emission of pollutants, and companies, utilities, or industries then buy and sell the permits among themselves. In a **cap-and-trade** emissions trading system, the government first caps the overall amount of pollution it will allow, then grants or auctions off permits to polluters that allow them each to emit a certain fraction of that amount. As polluters trade these permits, the government progressively lowers the cap of overall emissions allowed (see Figure 14.29, p. 327).

Suppose you own an industrial plant with permits to release 10 units of pollution, but you find that you can make your plant more efficient and release only 5 units instead. You now have a surplus of permits, which you can sell to some other plant owner who needs them. Doing so generates income for you and meets the needs of the other plant, while the total amount of pollution does not rise. By providing firms an economic incentive to reduce pollution, emissions trading can lower expenses for both industry and the public relative to a conventional regulatory system.

The United States pioneered the cap-and-trade approach with its program to reduce sulfur dioxide emissions, established by the 1990 Clean Air Act amendments. Since then, sulfur dioxide emissions have declined by 67%, acid rain has been reduced, and air quality has improved (see Figure 13.21, p. 297). Similar cap-and-trade programs have shown success with smog in the Los Angeles basin and with nitrogen oxides in northeastern states.

To address climate change, European nations are operating a market in greenhouse gas emissions (p. 327). In the



FIGURE 5.15 Ecolabeling enables all of us to promote sustainable business practices through our purchasing decisions. Organic, fair-trade, and shade-grown coffee varieties are examples of the many ecolabeled products now widely available.

United States, carbon trading markets are running in California and among northeastern states (pp. 326–327), while other states and nations are considering programs. We will assess some of these efforts in Chapter 14.

Market incentives are diverse at the local level

You may have already taken part in transactions involving financial incentives as policy tools. Many municipalities charge residents for waste disposal according to the amount of waste they generate. Some cities place taxes or fees on items whose safe disposal is costly, such as tires and motor oil. Others give rebates to residents who buy water-efficient toilets and appliances, because rebates can cost a city less than upgrading its wastewater treatment system. Likewise, power utilities may offer discounts to customers who buy high-efficiency appliances, because doing so is less costly than expanding the generating capacity of their plants.

The creative use of economic policy tools is growing, while command-and-control regulation and legal action in the courts continue to play vital roles in environmental policy. As a result, we have a variety of strategies available as we seek sustainable solutions to our society's challenges.

Sustainable Development

Today's vital search for sustainable solutions centers on **sustainable development**, economic progress that maintains resources for the future. The United Nations defines sustainable development as development that “meets the needs of the present without sacrificing the ability of future generations to meet their own needs.” Sustainable development is an economic pursuit shaped by policy and informed by science. It is also an ethical pursuit because it asks us to manage our resource use so that future generations can enjoy similar access to resources.

Sustainable development involves environmental protection, economic well-being, and social equity

Development involves making purposeful changes intended to improve our quality of life. Construction of homes, schools, hospitals, power plants, factories, and transportation networks are all examples of development. In the past, “sustainable development” might have been viewed as an oxymoron—a phrase that contradicts itself. Advocates of development felt that protecting the environment threatened people’s economic needs, whereas advocates of environmental protection held that development degrades the environment, jeopardizing the very improvements for our lives that were intended. Today, however, people increasingly perceive how we all depend on a healthy and functional natural environment.

We also now recognize that society’s poorer people tend to suffer the most from environmental degradation. As a result, advocates of environmental protection, economic development, and social justice began working together toward common goals. This cooperation gave rise to the modern drive for sustainable development, which seeks ways to promote social justice, economic well-being, and environmental quality at the same time (**FIGURE 5.16**). Governments, businesses, industries, and organizations pursuing sustainable development aim to satisfy a **triple bottom line**, a trio of goals including economic advancement, environmental protection, and social equity.

Programs that pay for ecosystem services are one example of a sustainable development approach that seeks to satisfy a triple bottom line. Costa Rica’s PSA program aims to enhance its citizens’ well-being by conserving the country’s natural assets while compensating affected landholders for

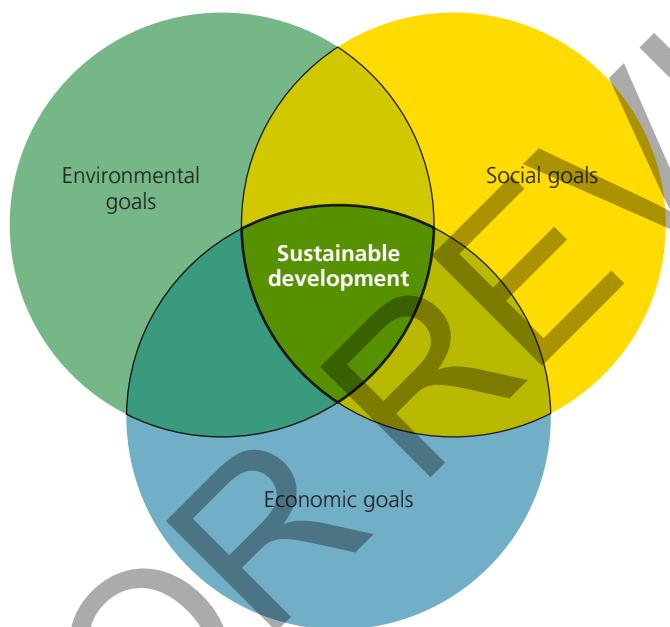


FIGURE 5.16 Sustainable development occurs where three sets of goals overlap: social, economic, and environmental goals.

TABLE 5.3 U.N. Millennium Development Goals for 2015

- Eradicate extreme poverty and hunger
- Achieve universal primary education
- Promote gender equality and empower women
- Reduce child mortality
- Improve maternal health
- Combat HIV/AIDS, malaria, and other diseases
- Ensure environmental sustainability
- Develop a global partnership for development

Source: United Nations. *End poverty 2015: Millennium Development Goals*. © United Nations. Reproduced with permission.

any economic losses. The intention is to achieve a win-win-win result that pays off in economic, social, and environmental dimensions.

Sustainable development is global

Sustainable development has blossomed as an international movement. The United Nations, the World Bank, and other global organizations sponsor conferences, fund projects, publish research, and facilitate collaboration across borders among governments, businesses, and nonprofit organizations.

The Earth Summit at Río de Janeiro, Brazil, in 1992 was the world’s first major gathering focused on sustainable development. With representatives from over 200 nations, this conference gave rise to notable achievements, including the Convention on Biological Diversity (p. 179) and the Framework Convention on Climate Change (p. 325). Ten years later, nations met in Johannesburg, South Africa, at the 2002 World Summit on Sustainable Development. Then in 2012, the world returned to Río de Janeiro for the Rio-Plus-20 conference and explored the latest strategies for promoting economic vitality, social equity, and environmental quality.

Meanwhile, in 2000, world leaders adopted the United Nations Millennium Declaration, which set forth eight *Millennium Development Goals* for humanity (**TABLE 5.3**). Each broad goal for sustainable development has several specific underlying targets to be met by implementing concrete strategies. For instance, strategies to “develop a global partnership for development” include working with governments and corporations of wealthy nations to provide poor nations with more financial aid, more debt relief, freer access to global markets, and better access to inexpensive drugs and to technologies such as cell phones and Internet access.

Many of the Millennium Development Goals were given a 2015 target date, and we have made better progress on some than on others. We still have a long way to go to resolve the many challenges facing our world. Pursuing solutions that meet a triple bottom line of environmental, economic, and social goals can help pave the way for a truly sustainable global society.

Conclusion

Environmental policy is a problem-solving tool that makes use of science, ethics, and economics. Command-and-control legislation and regulation remain the most common policy approaches, but innovative market-based policy tools are also being deployed. Environmental and ecological economists are quantifying the value of ecosystem services and devising

alternative means of measuring progress, thereby helping to show how economic progress is tied to environmental protection and resource conservation. In pursuing sustainable development, we recognize that economic, social, and environmental well-being depend on one another and can be mutually reinforcing. If we can enhance our economic and social well-being without depleting natural resources, then truly sustainable solutions will be within reach.

Testing Your Comprehension

1. Name and describe two key contributions that the natural environment makes to our economies.
2. Describe four ways in which neoclassical economic approaches can contribute to environmental problems.
3. Compare and contrast the views of neoclassical economists, environmental economists, and ecological economists, particularly regarding the issue of economic growth.
4. What are ecosystem services? Give several examples. Describe how some economists have tried to assign monetary values to ecosystem services.
5. Describe at least one major goal of and justification for environmental policy. Now articulate three problems that environmental policy commonly seeks to address.
6. Summarize how the first, second, and third waves of environmental policy in U.S. history differed from one another. Describe two current priorities in international environmental policy.
7. What did the National Environmental Policy Act accomplish? Briefly describe the origin and mission of the U.S. Environmental Protection Agency.
8. Compare and contrast the three major approaches to environmental policy: lawsuits, command-and-control, and economic policy tools. Describe an advantage and disadvantage of each.
9. Explain how each of the following work: a green tax, a subsidy, and emissions permits.
10. How can *sustainable development* be defined? What is meant by the triple bottom line? Why is it important to pursue sustainable development?

Seeking Solutions

1. Do you think that a steady-state economy is a practical alternative to our current approach that prioritizes economic growth? Why or why not?
2. Do you think we should attempt to quantify and assign market values to ecosystem services? Why or why not? What consequences might this have?
3. Reflect on causes for the transitions in U.S. history from one type of environmental policy to another. Now peer into the future, and consider how life and society might be different in 25, 50, or 100 years. What would you predict about the environmental policy of the future, and why? What issues might it address? Do you predict we will have more or less environmental policy?
4. Compare the roles of the United Nations, the World Bank, the World Trade Organization, and nongovernmental organizations. If you could gain the support of

just one of these institutions for a policy you favored, which would you choose? Why?

5. **THINK IT THROUGH** You have just returned from serving in the U.S. Peace Corps in Costa Rica, where you worked closely with farmers, foresters, ecologists, and policymakers on issues related to Costa Rica's PSA program. You have now been hired as an adviser on natural resource issues to the governor of your state. Think about the condition of the forests, land and soil, water supplies, and other natural resources in your state. Given what you learned in Costa Rica, would you advise your governor to institute some kind of program to pay citizens to conserve ecosystem services? Why or why not? Describe what policies you would advocate to best conserve your state's resources and ecosystem services while advancing the economic and social condition of its citizens.

Calculating Ecological Footprints

Critics of command-and-control policy often argue that regulations are costly to business and industry, yet cost-benefit analyses (p. 94) repeatedly show that regulations bring citizens more benefits than costs, overall. Each year the U.S. Office of Management and Budget assesses costs and benefits of major federal regulations of administrative agencies. Results

from the most recent report, covering the decade from 2003 to 2013, are presented in the table (shown are averages from ranges of estimates). Subtract costs from benefits, and enter these values for each agency in the third column. Divide benefits by costs, and enter these values in the fourth column.

Costs and benefits of major U.S. federal regulations, 2003–2013
(average values from ranges of estimates, in billions of dollars)

Agency	Benefits	Costs	Benefits minus costs	Benefit : Cost ratio
Department of Energy	15.6	5.9	9.7	2.6
Department of Health and Human Services	32.4	4.6		
Department of Transportation	25.4	11.6		
Environmental Protection Agency (EPA)	507.2	42.2		
Other departments	25.1	8.1		
Total (billions of dollars)	605.7	72.4		

Data from U.S. Office of Management and Budget, 2014. 2014 draft report to Congress on the benefits and costs of federal regulations and unfunded mandates on state, local, and tribal entities. OMB, Washington, D.C.

1. For how many of the agencies shown do regulations exert more costs than benefits? For how many do regulations provide more benefits than costs?
2. Which agency's regulations have the greatest excess of benefits over costs? Which agency's regulations have the greatest ratio of benefits to costs?
3. What percentage of total benefits from regulations comes from EPA regulations? Most of the benefits and costs from EPA regulations are from air pollution rules resulting from the Clean Air Act and its amendments. Judging solely by these data, would you say that Clean Air Act legislation has been a success or a failure for U.S. citizens? Why?

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