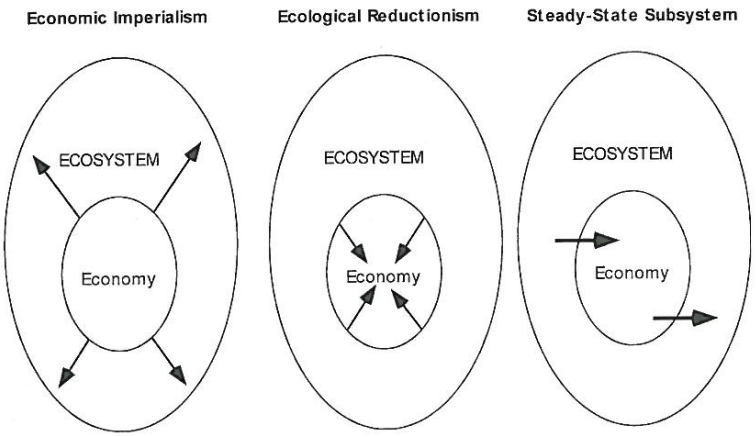

Figure 3.2 • Three strategies for integrating ecology and economics.

THREE STRATEGIES FOR INTEGRATING ECOLOGY AND ECONOMICS

Previous attempts to integrate economics and ecology have been based on one of three strategies: (1) economic imperialism, (2) ecological reductionism, or (3) steady-state subsystem. Each strategy may be thought of as beginning with the picture of the economy as a subsystem of the ecosystem. The differences concern the way each treats the boundary between the economy and the rest of the ecosystem (Figure 3.2).

Economic Imperialism

Economic imperialism seeks to expand the boundary of the economic subsystem until it encompasses the entire ecosystem. The goal is one system, the macroeconomy as the whole. This is to be accomplished by complete internalization of all external costs and benefits into prices. Price, of course, is the ratio (e.g., dollars per gallon) at which something is exchanged for money (or for some other commodity) by individuals in the market. The aspects of the environment not customarily traded in markets can be treated as if they were by imputation of "shadow prices"—the economist's best estimate of what the price of the function or thing would be if it were traded in a competitive market. Everything in the ecosystem is theoretically rendered comparable in terms of its ability to help or hinder individuals in satisfying their wants. Implicitly, the single end pursued is ever-greater levels of consumption, and the only intermediate means to effectively achieve this end is growth in market goods. Economic imperialism is basically the neoclassical approach.

Subjective individual preferences, however whimsical, uninstructed, or ill-considered, are taken as the source of all value. Since subjective wants are thought to be infinite in the aggregate, as well as sovereign, there is a tendency for the scale of activities devoted to satisfying them to expand. The expansion is considered legitimate as long as all costs are internalized. But most of the costs of growth we have experienced have come as surprises. We could not have internalized them if we could not first imagine and foresee them. Furthermore, even after some external costs have become visible to all (e.g., greenhouse warming), internalization has been very slow and partial. As long as the evolutionary fitness of the environment to support life is unperceived by economists, it is likely to be destroyed in the imperialistic quest to make every molecule in creation, including every strand of DNA, pay its way according to the pecuniary rules of present value maximization.

Furthermore, this imperialism sacrifices the main virtue of free-market economists, namely their antipathy to the arrogance of central planners. Putting a price tag on everything in the ecosystem requires information and calculating abilities far beyond anything attempted by Gosplan in the old Soviet Union.[25] As an example, let's take a look at what calculations would be needed to accurately quantify and internalize the costs associated with global warming. Currently we are incapable of accounting for even carbon dioxide flows, the most basic piece of the puzzle. How much carbon is being absorbed by oceans or terrestrial ecosystems? How will it affect these ecosystems? Will global warming lead to positive feedback loops, such as a release of methane from a thawing arctic tundra and increased atmospheric water vapor from more rapid evaporation from the oceans (both potent greenhouse gases), or negative feedback loops via increased sequestration of carbon by forests? How will temperature changes affect global weather patterns over the next century? (And how certain can we be about such estimates, when we cannot even accurately predict the weather next week?) What changes would have occurred even in the absence of global warming? What technologies will evolve to cope with these problems, and how much will changing our rate of greenhouse gas emissions affect the rate of technological advance? Finally, how will these factors affect the economy? Bear in mind that while a meteorologist cannot accurately predict the weather in a week, she can at least stick her head out the window and say, "It's raining." Economists, on the other hand, at the time of this writing are in the midst of a heated debate over whether or not the economy is in a recession *right now*.

[25]Gosplan is the Russian acronym for the State Planning Committee, which centrally developed 5-year and annual plans for the Soviet economy, at all levels from individual enterprises to the national level.

These calculations, a small fraction of those that would be needed to estimate the costs of global warming, are clearly beyond the capabilities of modern science and quite probably beyond the capacity of the human mind. And calculating all the costs at the time they occur is the straightforward part. How do we determine the present value of costs to future generations? The currently favored approach, intertemporal discounting (to which we return in Chapter 10), gives less value to future costs and benefits than those that occur today, and the discount rate we choose in this calculation is likely to be as important as any other of the variables mentioned earlier. But discounting in this case implies that future generations have no inalienable right to a stable climate, economic growth will continue throughout the discount period, and economic growth is a satisfactory substitute. Yet the discount rate we choose for internalizing costs will itself affect the rate of growth.

THINK ABOUT IT!

The Stern Review on the economics of climate change concludes that society should spend about 1% of global GNP to reduce the risk of climate catastrophe.[26] Economist William Nordhaus uses a higher discount rate in a similar study and concludes that 1% of GNP annually greatly exceeds the benefits of avoiding catastrophe. In 2007, per-capita global GNP grew at about 3%. In other words, Nordhaus argues that accepting our living standards from four months ago is too high a price to pay to avert catastrophe. Do you think Nordhaus appropriately discounts future impacts? Do you think those impacts should be discounted at all?[27]

The global warming example brings up another serious problem with economic imperialism: the assumption that the most efficient mechanism for allocating almost any means among any ends is the market. In fact, markets are incapable of allocating goods that cannot be owned and inefficient at allocating goods for which use does not lead to depletion (either or both of which are properties of the bulk of ecosystem services). Even if we could put an appropriate charge on greenhouse gas emissions to internalize their costs, who would receive the charge? It would seem only fair that it would go to those who bear the costs. Would it even be a market transaction if when we purchased something, we did not pay the person who bore the costs of production? However, global warming is likely to affect the entire population of the planet for countless generations into the future. This would imply that not only would we need to calculate all

[26]N. Stern, *Stern Review: The Economics of Climate Change*. HM Treasury, London, 2006.

[27]W. Nordhaus, "Critical Assumptions in the Stern Review on Climate Change," *Science*. 317(13)(2007):201–202.

the costs, we would need to do so for *each individual*. Strangely enough, as we will discuss later, some neoclassical economists argue that those who bear the costs of externalities should not receive the payments,[28] but in this case, how could we say that the result resembles a market solution? A major goal of this text will be to explain exactly why many goods and services are not amenable to market solutions, independently of whether or not we are able to internalize all costs.

Let's play the role of the stereotypical economist and assume away all these problems. There is, then, no doubt that once the scale of the economy has grown to the point that formerly free goods become scarce, it is better that these goods should have a positive price reflecting their scarcity than to continue to be priced at zero. But there remains the prior question: Are we better off at the new scale with formerly free goods correctly priced or at the old scale with free goods also correctly priced at zero? In both cases, the prices are right. This is the suppressed question of optimal scale, and it is not answered by market prices.

Ecological Reductionism

Ecological reductionism begins with the true insight that humans are not exempt from the laws of nature. It then proceeds to the false inference that human action is totally explainable by, reducible to, the laws of nature. It seeks to explain whatever happens within the economic subsystem by exactly the same naturalistic principles that it applies to the rest of the ecosystem. It shrinks the economic subsystem to nothing, erasing its boundary. Taken to the extreme, in this view energy flows, embodied energy costs, and relative prices in markets are all explained by a mechanistic system that has no room for purpose or will. This may be a sensible vision from which to study some natural systems. But if one adopts it for studying the human economy, one is stuck from the beginning with the important policy implication that policy makes no difference. We encounter again all the problems of determinism and nihilism already discussed.

Economic imperialism and ecological reductionism have in common that they are monistic visions, albeit rather opposite monisms. It is the monistic quest for a single substance or principle by which to explain all value that leads to excessive reductionism on both sides. Certainly one should strive for the most reduced or parsimonious explanation possible without ignoring the facts. But respect for the basic empirical facts of chance and necessity on one hand and self-conscious purpose and will on the other hand should lead us to a kind of practical dualism or polarity

[28] E. T. Verhoef, "Externalities." In J. C. J. M. van den Bergh, ed., *Handbook of Environmental and Resource Economics*, Northampton, MA: Edward Elgar, 1999.

reflected in the ends-means spectrum. After all, the fact that our being should consist of two fundamental elements offers no greater inherent improbability than that it should rest on one only. How these two fundamental elements of our being interact is a mystery—precisely the mystery that the monists of both kinds are seeking to avoid. But economists are too much in the middle of the spectrum to adopt either monistic "solution." Economists are better off denying the tidy-mindedness of either monism than denying the untidy and mysterious facts.

The Steady-State Subsystem

The remaining strategy is the **steady-state subsystem**, the one adopted here. It does not attempt to eliminate the subsystem boundary, either by expanding it to coincide with the whole system or by reducing it to nothing. Rather, it affirms the fundamental necessity of the boundary and the importance of drawing it in the right place. It says that the scale of the human subsystem defined by the boundary has an optimum and that the throughput by which the ecosystem maintains and replenishes the economic subsystem must be ecologically sustainable. Once we have drawn this boundary in the appropriate place, we must further subdivide the economic subsystem into regions where the market is the most effective means of allocating resources and regions where it is inappropriate. These regions are determined by inherent characteristics of different goods and services, to be discussed at length in this text.

Box 3-2 THE STEADY-STATE ECONOMY

The idea of a steady-state economy comes from classical economics and was most developed by John Stuart Mill (1857), who referred to it as the "stationary state." The main idea was that population and the capital stock were not growing. The constancy of these two physical stocks defined the scale of the economic subsystem. Birth rates would be equal to death rates and production rates equal to depreciation rates, so that both the stock of people (population) and the stock of artifacts (physical capital) would be constant—not static, but in a state of dynamic equilibrium. Most classical economists dreaded the stationary state as the end of progress, but not Mill:[a]

It is scarcely necessary to remark that a stationary condition of capital and population implies no stationary state of human improvement. There would be as much scope as ever for all kinds of mental culture, and moral and social progress; as much room for improving the Art of Living and much more likelihood of its being improved, when minds cease to be engrossed by the art of getting on.

Mill thought we would pay more attention to getting better once we ceased to be so preoccupied with getting bigger. He also recognized that growth could become uneconomic:

> *If the earth must lose that great portion of its pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, for the mere purpose of enabling it to support a larger, but not a happier or better population, I sincerely hope, for the sake of posterity, that they will be content to be stationary, long before necessity compels them to it.*

In physical terms, populations of both human bodies and things are what physicists call "dissipative structures," things that fall apart, die, and decay if left to themselves. People die, goods wear out. To keep a population of dissipative structures constant requires births equal to deaths and production equal to depreciation—in other words, input equal to output equal to throughput, a concept with which you are now familiar. But births can equal deaths at low rates or at high rates. Either one will keep the population constant. Which do we want? If we want a long life expectancy for individuals, we must choose low birth rate equal to low death rate. For an equilibrium population with birth equal to death rates at 40 per thousand per year, the average age at death must be 25 years. If we want people to live to be 67 rather than 25, we will have to lower birth and death rates to 15 per thousand per year. Can you explain why? Can you apply the same logic to lifetime or durability of the stock of goods?

To summarize: The main idea of a steady-state economy is to maintain constant stocks of wealth and people at levels that are sufficient for a long and good life. The throughput by which these stocks are maintained should be low rather than high, and always within the regenerative and absorptive capacities of the ecosystem. The system is therefore sustainable—it can continue for a long time. The path of progress in the steady state is no longer to get bigger but to get better. This concept was a part of classical economics but unfortunately was largely abandoned by NCE. More precisely, the terms *stationary* and *steady state* were redefined to refer not to constant population and capital stock but to their proportional growth—a constant ratio between ever-growing stocks of people and things!

---

[a] *J. S. Mill,* Principles of Political Economy, Book IV, *Chapter VI (1848). Online: http://www.econlib.org/library/Mill/mlPbl.html.*