Looking Ahead

This book has focused on three issues—the allocation of resources, the distribution of income, and the scale of the economy relative to the ecosystem—with special emphasis on the third. A good allocation of resources is efficient; a good distribution of income or wealth is just; a good scale is at least ecologically sustainable.

Allocation and distribution are familiar concepts from standard economics—for any given distribution of income, there is a different optimal allocation of resources with its corresponding optimal set of prices. Standard economics focuses primarily on the allocation issue, paying secondary attention to distribution, first because a given distribution is logically necessary for defining efficient allocation, and second because distributive fairness is important in its own right.

The third issue of scale, the physical size of the economy relative to the containing ecosystem, is not recognized in standard economics and has therefore become the differentiating focus of ecological economics. The preanalytic vision of the economy as an open subsystem of a larger ecosystem that is finite, nongrowing, and materially closed (though open with respect to solar energy) immediately suggests three analytical questions: How large *is* the economic subsystem relative to the containing ecosystem? How large *can* it be? How large *should* it be? Is there an optimal scale beyond which physical growth in the economic subsystem begins to cost more at the margin than it is worth in terms of human welfare? This text has tried to explain the reasons for an affirmative answer to this last question.

If the economy grew into the void, it would encroach on nothing, and its growth would have no opportunity cost. But since the economy in fact grows into and encroaches upon the finite and nongrowing ecosystem, there *is* an opportunity cost to growth in scale, as well as a benefit. The costs arise from the fact that the physical economy, like an animal, is a "dissipative structure" sustained by a metabolic flow from and back to the environment. This flow, which we have called throughput (adopting the term from engineers) begins with the depletion of low-entropy useful resources from the environment, is followed by the processes of production and consumption, which, despite the connotations of the words, are only physical transformations, and ends with the return of an equal quantity of high-entropy polluting wastes.

Depletion and pollution are costs. Not only does the growing economy encroach spatially and quantitatively on the ecosystem, it also

qualitatively degrades the environmental sources and sinks of the metabolic throughput by which it is maintained. This forces a continual coevolutionary adaptation between the economy and the ecosystem. If that adaptation is made in such a way that the throughput remains within the natural capacity of the ecosystem to absorb wastes and regenerate resources, then the scale of the economy is considered "sustainable." Nonrenewable resources, of course, cannot be exploited in a sustained yield manner, but we discussed some rules of thumb for "quasi-sustainable" exploitation, along with the analysis of sustained yield exploitation of renewable resources.

From a policy perspective, we have insisted that optimal allocative prices do not guarantee a sustainable scale any more than they guarantee a just distribution of income. Attaining a sustainable scale, a just distribution, and an efficient allocation are three distinct problems. They are certainly not isolated, but solving one does not solve the others. Achieving three different goals generally requires three different policy instruments. This is illustrated by the cap-and-trade systems, a favored policy of ecological economists. Three policy actions are required in proper sequence. First, a quantitative limit is set reflecting judgments of sustainable scale—that is, a previously unlimited or free good is recognized as scarce and the scale of its use is limited. Second, the newly scarce good or right is now a valuable asset—who owns it? Deciding who owns it is a question of distributive justice. Third, once scale and distribution decisions have been politically made, we can have individualistic trading and efficient market allocation.

As growth pushes us from an empty world to a full world, the limiting factor in production, as we have argued, increasingly becomes natural capital, not manmade capital—for example, the fish catch today is no longer limited by manmade capital of fishing boats but by the complementary natural capital of fish populations in the sea. As we move into a full world, economic logic remains the same—to economize on and invest in the limiting factor. But the identity of the limiting factor changes from manmade to remaining natural capital, and our economizing efforts and policies must change accordingly. Therefore, it becomes more important to study the nature of environmental goods and services in both their stock-flow and fund-service dimensions—are they rival or nonrival, excludable or nonexcludable—in order to know if they are market goods or public goods.

Ecological economics accepts the standard analysis of allocative efficiency, given prior social determination of the distribution and scale questions, and given that the good in question is rival and excludable. Although the main difference has been the focus on scale, that difference has entailed more attention to dimensions of distribution often

neglected—namely, intergenerational distribution of the resource base and distribution of places in the sun between humans and all other species (biodiversity). Also, as more vital resources cease being free goods and are allocated by the market, the fairness of the distribution underlying market allocation becomes more critical. Once growth in scale has become uneconomic, it can no longer be appealed to as the solution to poverty. Poverty reduction requires increased sharing. Other issues of debate include whether natural and manmade capital are primarily substitutes or complements, the degree of coupling between physical throughput and GNP, and the degree of coupling between GNP and welfare.

One question not explicitly addressed in the text, but which students are sure to ask, is: What is the relationship between ecological economics and courses in resource economics or environmental economics that are sometimes taught in economics departments? The difference is that the latter are both subfields of neoclassical economics; they do not consider scale an issue, have no concept of throughput, and are focused on efficiency of allocation. Resource economics deals with the efficiency of allocation of labor and capital devoted to extractive industries. It develops many useful concepts that we have covered in this text, such as scarcity rent and user cost. Likewise, environmental economics also focuses on efficiency of allocation and how it is disrupted by pollution externalities. Concepts of internalizing externalities by Pigouvian taxes or well-defined and enforceable property rights (see Coase Theorem, Chapter 10) are certainly useful, and we have discussed them. Nevertheless, the aim of both resource and environmental economics is allocative efficiency via right prices, not sustainable scale.

Ecological economics connects resource and environmental economics by recognizing the real-world connection between depletion with pollution via the concept of throughput. We have also paid much more attention to impacts on, and feedbacks from, the rest of the ecosystem induced by economic activities that cause depletion, pollution, and entropic degradation. In addition, we have investigated the basic principles (energy flows, material cycles, ecosystem structure and function) governing the containing ecosystem itself, thereby at least partially integrating economics with ecology.

Finally, we have insisted on policy as our guiding philosophical viewpoint. This has led us to recognize and defend the logical presuppositions of policy—namely, nondeterminism and non-nihilism. It really is possible for things to be other than they are, and we really can distinguish better from worse states of the world. If that were not the case, then our effort in writing this book, and your effort in reading it, would both have been in vain.