Chapter 9

The Environment as an Input into Firms' Production

9.1 Introduction

In Chapters 3 through 8 we explored the problem of measuring the economic gains and losses experienced by households affected by environmental improvements and degradation. These chapters addressed the ways in which households respond when such things as their health or recreational opportunities are affected by the environment. In this chapter we investigate environmental effects on production opportunities for enterprises that sell some part of their output.

The environment can influence production in a number of ways–by changing the productivity of inputs, by altering the quality of the output that is produced, by reducing the effective supply of inputs, etc. These effects can be modeled, conceptually, by treating the environment as an uncontrolled input in the production function. As examples, dissolved oxygen and other environmental inputs, combined with fishing effort, produce fish harvests. Localized reductions in dissolved oxygen lead to fish mortality and effectively shrink the area of habitat suitable for fish. Acid deposition slows tree growth; increasing ozone levels reduce agricultural yields. Our examples highlight primary industries for a reason. Environmental quality is most likely to affect firm and household production possibilities when natural resources such as soil, fish stocks, or forests are directly exploited. In addition to the usual pathways through which the environment affects these resources, the potential for ad-

verse consequences due to climate change has also been considered.

Previous chapters have focused on the effect of the environment on the value of consumption services. The examples are largely from the industrialized countries. In this chapter examples will be drawn from both the developed and developing worlds, but the issues addressed seem more compelling to the latter. In poor countries, households with low incomes and limited time have meagre demand for environmental services as amenities. Production opportunities in poor countries are principally in the primary sectors of agriculture, forestry, fisheries and other activities directly dependent on the vitality and abundance of natural and environmental resources. Further, a greater proportion of households is affected through this route because a larger share of the population continues to live in rural areas in the developing world. The conceptual basis for valuing the environment as an input does not differ whether one investigates low-level ozone damage to crops in the U.S. or losses of mangrove swamps that serve as fish habitat in Thailand. But the scarcity of data and more tenuous market forces make the practice in developing countries different and more difficult. Empirical applications are limited by these constraints, and approximations abound.

9.2 Welfare Measures for Firm Owners

Our interest lies with the welfare effects of environmental and natural resource changes as they emerge through the pathway of production. Naturally this starts with welfare measurement for the firm. But it is important to remember that people, not firms, are the final claimants for all economic gains and losses. As we have emphasized all along, economic welfare is only defined in terms of the individual and, therefore, all costs and benefits must ultimately accrue to individuals. In models of consumer choice this is obvious. In considering firms, we must bear in mind that individuals own the firms and the capital used in production and hence are the claimants on returns to the firm.[1]

We first address the situation in which production decisions are made independent of the consumption decisions of the owners of firms and capital. This is typical of many firms in developed countries, especially when owners have no operational influence on the firm but are merely stockholders. But it is more broadly applicable as we will see in a later section of this chapter. When changes in exogenous circumstances–such as output or input prices–alter net returns to the firm but do not change the firm owners' decisions on consumption

[1] In socialist systems, the state may own the firms and capital. This does not, in principle, preclude the application of welfare economics but it does make it necessary to determine how the returns from production are redistributed in the population given the particular regime.