



Your **E C O L O G I C A L** footprint

How Much Land Do You Disturb?

Human activities disturb the environment in many ways. Our actions alter biogeochemical cycles, emit air and water pollutants, and convert natural ecosystems to human uses. These conversions generate a variety of environmental challenges. As described in the fifth and sixth sections of this book, these challenges include loss of biodiversity, changes in global climate, loss of forests, and soil erosion. Here we provide information that will allow you to calculate the amount of land that you disturb and therefore the size of your footprint on natural ecosystems.

To understand the impact of your footprint, we need to differentiate land use and land cover. Land cover describes the community that occupies a given landscape. Land cover includes both natural and human systems. Examples of natural land covers include forests and grasslands, whereas human land covers include urban areas such as houses and roads. Land use refers to how a natural or human land cover is used. Wildlife reserves, timber harvesting, mining, and agriculture are types of land use. Land use does not map directly to land cover, and vice versa. For example, forest land cover can be used as a wildlife refuge or as a source of timber. Conversely, agricultural land use can include wheat fields that look like grasslands or tree plantations that look like forests.

The difference between land use and land cover is critical because human activities convert natural land covers to particular land uses, but many land uses are not sustainable. For example, forests (land cover) are used as a source for timber (land use). But after several decades most of the economically valuable trees have been harvested, and logging may no longer be economically viable. Similarly, grasslands (land cover) are converted to agriculture (land use); but continuous agriculture increases soil erosion and reduces fertility, and this reduces the economic viability of using that landscape as farmland.

The limited life span of many human land uses implies that (1) human activity continuously converts natural land covers to human land uses and (2) human activity creates a new category of land cover—disturbed land. Disturbed land includes landscapes that are abandoned because they cannot be used for their original land uses. As such these lands are left to succession, which may or may not be able to regenerate the communities that made up the original land covers.

Calculating Your Footprint

Here we focus on the area of natural land covers that are converted to human land uses to supply the goods you consume. You can approximate one component of this disturbance from your use of net primary production and the rate of net primary production of natural land covers. Table 1 in Chapter 6's Your Ecological Footprint box (page 107) allowed you to calculate the amount of net primary production required to generate your use of plant-based food, meat, eggs, milk, paper, and wood. Table 1 in Chapter 7's Your Ecological Footprint box (page 135) allowed you to identify the biomes from which many of your environmental goods originate. Table 1 here lists the average annual rate of net production in these biomes.

Together this information will let you calculate the area needed to generate a particular environmental good. For example, Chapter 6's Your Ecological Footprint indicated that the average person in the

United States consumes about 3,774 kcal of plant-based foods per day. If we assume that most of these foods are grains, Table 1 below shows that many grains are grown on land that was once temperate grassland. This biome has a rate of net primary production of about 408.6 grams of carbon per square meter per year. This would imply that your plant-based foods require an area of about 1,213 m² per year, which is calculated as follows:

$$1,214 \text{ m}^2/\text{year} = [3,774 \text{ kcal/day} \times 365 \text{ days/year} \times 0.36 \text{ grams carbon/kcal}] / 408.6 \text{ grams carbon/m}^2/\text{year}$$

You should repeat this calculation with the other environmental goods listed in Table 1 from Chapter 6's Your Ecological Footprint. Be careful—the use of other environmental goods is listed on an annual basis, so you don't need to include the 365 days per year. When you are done, sum the values.

Interpreting Your Footprint

As will be described in Chapter 11, the average person living in the United States consumes more environmental goods than the average world citizen. Repeat the calculations with the global averages listed in Chapter 6's Your Ecological Footprint. How much larger is your environmental footprint than the global average?

The land area you just calculated probably understates the size of your footprint. If the land used to grow your food, paper, and wood is managed sustainably, your footprint equals the area you calculated. If the land is not managed sustainably, the total understates your foot-

TABLE 1 Average Annual Rate of Net Production in Biomes

Biome	Net Primary Production (grams carbon per square meter per year)
Tropical forest	1,014.92
Temperate forests	701.92
Boreal forests	211.68
Tropical savannas and grasslands	663.26
Temperate grasslands	408.63
Deserts	78.56
Tundra	97.27
Wetlands	1,228.57

Source: Data from I.C. Prentice et al., "The Carbon Cycle and Atmospheric Carbon Dioxide," eds. J.T. Houghton et al., in *Climate Change 2001: The Scientific Basis*. Cambridge University Press.

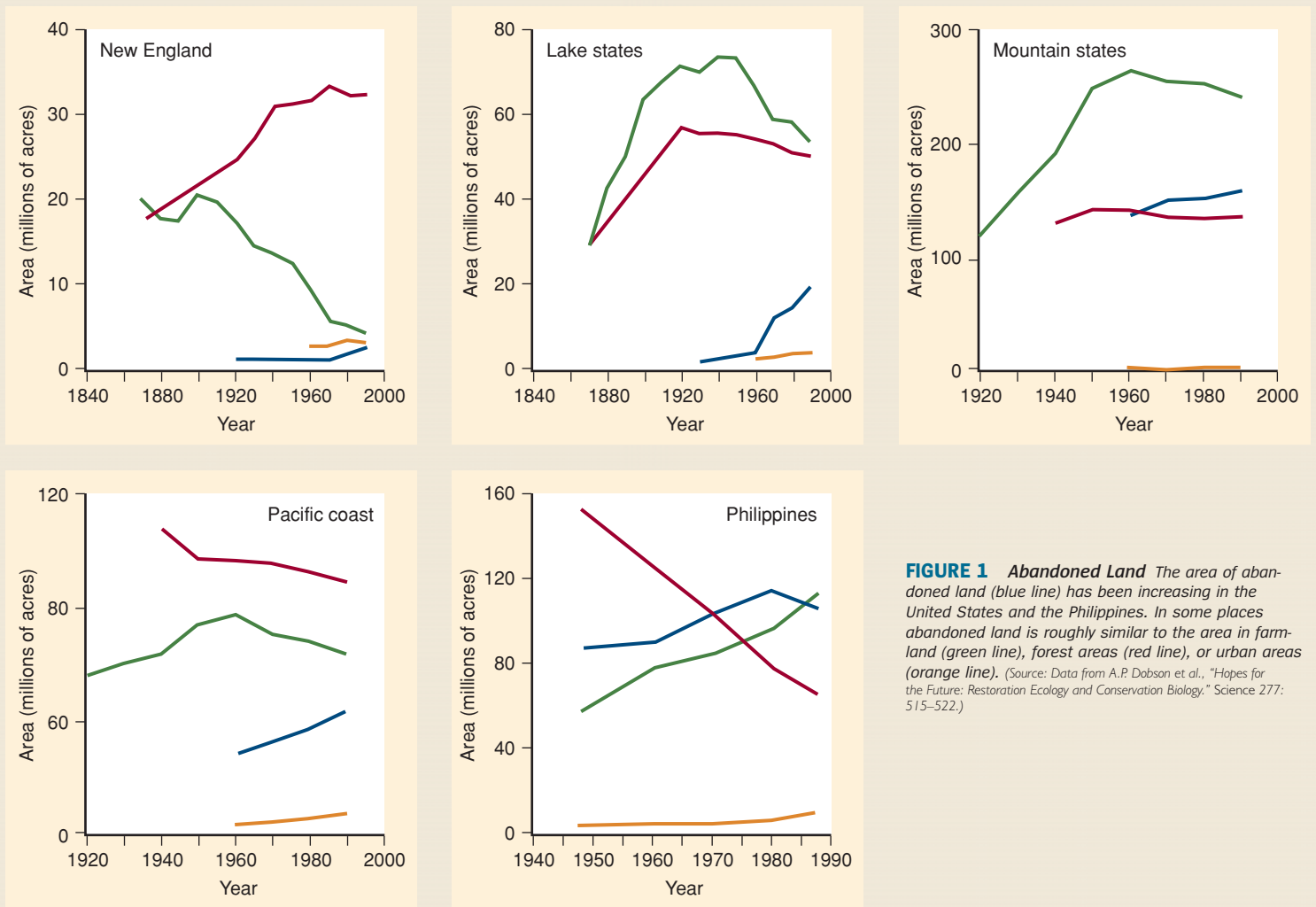


FIGURE 1 *Abandoned Land* The area of abandoned land (blue line) has been increasing in the United States and the Philippines. In some places abandoned land is roughly similar to the area in farmland (green line), forest areas (red line), or urban areas (orange line). (Source: Data from A.P. Dobson et al., "Hopes for the Future: Restoration Ecology and Conservation Biology." *Science* 277: 515–522.)

print. Suppose that production per unit land area declines 1 percent per year. By how much will your footprint grow over the next decade?

If the land used to grow your food, paper, and wood is managed poorly, some areas may eventually be abandoned. Evidence indicates that in many sections of the United States areas of degraded and abandoned land have increased over time (Figure 1). In the Pacific Coast region the area of degraded land is approaching the area occupied by active farms. In the Philippines the areas of degraded land is about the same as the area occupied by agriculture. And both of these categories are greater than the remaining area of forested land.

ADDITIONAL READING

Dobson, A.P., A.D. Bradshaw, and J.M. Walker. "Hopes for the Future: Restoration Ecology and Conservation Biology." *Science* 277 (1997): 515–522.

STUDENT LEARNING OUTCOME

- Students will be able to explain how the use of natural resources and land management determine the area of land used to provide food, paper, and wood.