

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

What Biome Do You Live In?



At first this seems to be a relatively simple question to answer. Figure 7.9 on pages 132–133 maps the global distribution of biomes. To determine which biome you live in, just locate your area on the map and match the color to the legend. Those of us living in Boston are in the temperate broadleaf and mixed forest biome.

But this simple lesson in reading a map understates the geographic extent of your footprint. In reality, you consume environmental goods and services that come from a wide variety of biomes that are distributed across the planet. To calculate your use of net primary production (Chapter 6), you examined three types of environmental goods: foods derived from plants, foods derived from livestock, and materials derived from trees. Not all of these materials are produced in your local biome. For example, those of you in the American Southwest use paper from trees grown in temperate conifer forests or deciduous and mixed forests. Here in Boston most of the grains we eat come from plants grown in what were once temperate grasslands.

Table 1 identifies the biomes from which environmental goods are harvested or, in some cases, the biomes in which the species originated. For example, much of the corn and wheat that is grown in the United States and worldwide comes from agricultural fields that were once covered by temperate grasslands. For other environmental goods, supplies are obtained from a wide variety of biomes. For example, potatoes are grown in every U.S. state. The biome listed for potatoes is montane grasslands and scrubland—the plant is thought to have originated in highlands of South America, most likely in the area now bordering Lake Titicaca.

Calculating Your Footprint

To help identify the biome you live in, match the environmental goods that you consume to their biomes. Make a list of the biomes from which you obtain environmental goods. How many biomes supply you with environmental goods? This number is a more accurate representation of your footprint.

To demonstrate the importance of this expanded notion of your footprint, think about the following questions: How many of the environmental goods you use come from biomes other than the one in which you live? How would your lifestyle change if you could consume only products that came from the biome in which you live?

Interpreting Your Footprint

The answers to these questions highlight the benefits of trade, which go well beyond obtaining items that cannot be obtained locally. Many of the

benefits come from what economists call comparative advantage, which is trade based on what a region does best. To illustrate, let's examine a hypothetical example in which corn and wood are traded between Iowa farmers and forest owners in Massachusetts. The soils and climate of temperate grasslands allow Iowa farmers to grow corn at lower cost than a landowner in Massachusetts, who would have to chop down a local temperate broadleaf forest and replace it with a cornfield. On the other hand, landowners of temperate broadleaf forests in Massachusetts can harvest trees at lower cost than an Iowa farmer who tries to grow a forest on what was once temperate grassland.

Suppose the Massachusetts landowner can harvest 10 trees per hectare and grow only 25 bushels of corn per hectare. In Iowa growing 100 bushels of corn requires 1 hectare, but growing 10 trees would require 4 hectares of irrigated land in Iowa. (Why must the land be irrigated?)

To illustrate the benefits of trade, suppose that trees and corn are priced so that the cost of 100 bushels equals the cost of 10 trees. Under these conditions the Iowa farmer can grow one extra hectare of corn and receive 10 trees, which would have required 4 hectares to produce in Iowa. These 4 hectares could have been used to produce 400 bushels of corn. So the Iowa farmer gets 10 trees for 100 bushels of corn instead of the 400 bushels the farmer would have given up to grow the trees in Iowa. Conversely, the Massachusetts landowner gets 100 bushels of corn for 10 trees instead of the 4 hectares (and 40 trees) that would have been needed to grow that much corn in Massachusetts. In summary, both the Iowa farmer and Massachusetts landowner are better off via trade than they would have been if their footprints were restricted to their local biomes.

This example ignores the environmental impacts of corn production, tree harvests, and transportation of traded goods. In some cases these environmental costs can be large and must be subtracted from the benefits of trade. If the environmental impacts are large, trade can harm one or both parties. This may be the case in some trade between developing nations that export natural resources to developed nations such as the United States.

STUDENT LEARNING OUTCOME

- Students will be able to explain how their environmental footprint extends beyond their local biomes and how this increases their material standard of living.

Tropical Rain Forests

A well-known example of tropical rain forests is the Amazon rain forest in South America (Figure 7.10). Other tropical rain forests are found in Australia, Africa, and Asia. On each continent tropical rain forests are located within 10° of the equator, where they are supported by warm temperatures (25–27°C) and heavy rainfall (2–4 meters per year). Notice that we said warm, not hot. Contrary to popular belief,

tropical rain forests are not hot because much heat is dissipated by evaporating water. Despite high rates of evaporation, rainfall exceeds evaporation during all months, which creates abundant supplies of water.

The warm temperatures and heavy rainfall give tropical rain forest plants their shape. Individual leaves tend to be large and thin (Figure 7.9). Big leaves increase the amount of light captured, compensating for cloudiness and competi-

TABLE 1 Home Biomes for Environmental Goods

Environmental Goods	Biomes
Beverages	
Beer	Temperate grasslands
Wine	Mediterranean woodlands
Coffee	Tropical rain forest
Tea	Montane grasslands and scrublands
Grains	
Wheat	Temperate grasslands
Corn	Temperate grasslands
Rice	Temperate grasslands and wetlands
Soybeans	Temperate and tropical grasslands
Fruits and Vegetables	
Sugarcane	Tropical rain forests
Sugar beets	Temperate grasslands
Citrus	Tropical dry forest, Mediterranean woodlands
Lettuce	Temperate grasslands, Mediterranean woodlands
Tomatoes	Deserts and dry scrublands (origin)
Potatoes	Montane grassland (origin)
Meats and Fish	
Beef	Temperate grasslands, deserts and dry scrublands
Tuna	Open ocean
Whitefish	Temperate coastal seas
Shrimp	Tropical and temperate coastal seas
Clams, mussels, and oysters	Estuaries, tropical and temperate coastal seas
Salmon	Temperate coastal seas
Anchovies and sardines	Upwellings
Paper, Wood, and Fiber	
Paper	Temperate broadleaf and mixed forests, temperate coniferous forests
Lumber	Temperate broadleaf and mixed forests, temperate coniferous forests, tropical and subtropical seasonal forests
Inexpensive wood products	Temperate broadleaf and mixed forests, temperate coniferous forests
Expensive wood products	Tropical rain forests
Cotton	Tropical grasslands and savannas (irrigated warm deserts)

tion from other plants. Thin leaves can better dissipate heat generated by absorbing large amounts of direct sunlight. These benefits impose costs—large thin leaves tend to transpire lots of water. But in the tropical rain forest water is abundant year-round.

Competition for light gives tropical rain forests their characteristic three-dimensional shape. To capture light trees grow tall, and the tree leaves mingle to form a closed canopy.

This canopy provides habitat for a wide variety of animal life. Some animals, such as birds, monkeys, and sloths, rarely come to the ground. The closed canopy also means that relatively little light reaches the forest floor, which restricts plant growth. As a result, it is relatively easy to walk through a tropical rain forest—in contrast to the common notion that these forests are dark, impenetrable places that require a swing of the machete for every step forward. This notion