

irrigation or other factors sometimes extends the local frontier of productive agriculture. We also have to bear in mind that not all cultivable land is of the same quality. This leads to the concept of the **carrying capacity** of agricultural land: the maximum population that can be maintained in a place under current technologies and best practices, without damaging the overall productivity of that or other places.

Industrial Resources A high proportion of the world's key industrial resources—basic raw materials—are concentrated in Russia, the United States, Canada, South Africa, and Australia. The United States, for example, in addition to having 42 percent of the world's known resources of hydrocarbons (oil, natural gas, and oil shales) and 38 percent of the lignite ("brown coal," used mainly in power stations), has 38 percent of the molybdenum (used in metal alloys), 21 percent of the lead (used for batteries, gasoline, and construction), 19 percent of the copper (used for electrical wiring and components and for coinage), 18 percent of the bituminous coal (used for fuel in power stations and in the chemical industry), and 15 percent of the zinc. Russia has 68 percent of the vanadium (used in metal alloys), 50 percent of the lignite, 38 percent of the bituminous coal, 35 percent of the manganese, 25 percent of the iron, and 19 percent of the hydrocarbons (Figure 8.5).

Resources and Development

The concentration of known resources in just a few countries is largely a result of geology, but it is also partly a function of countries' political and economic development. Political instability in much of postcolonial Africa, Asia, and Latin America has seriously hindered their exploration and exploitation of resources. In contrast, the relative affluence and great political stability of the United States have led to a much more intensive exploration of resources. We should also bear in mind that the significance of particular resources is often tied to particular technologies. As technologies change, so do resource requirements, and the geography of economic development is "rewritten." One important example of this was the switch in

the manufacture of mass-produced textiles from natural fibers like wool and cotton to synthetic fibers in the 1950s and 1960s. When this happened, many farmers in the U.S. South had to switch from cotton to other crops.

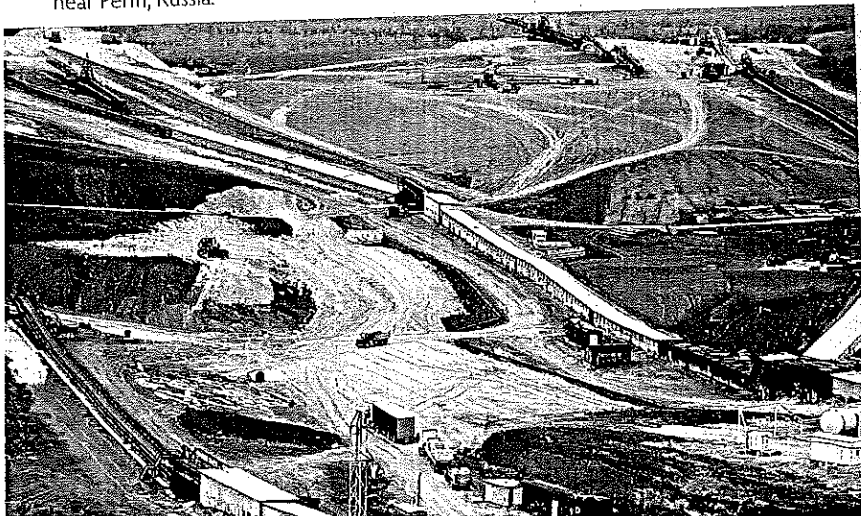
Regions and countries that are heavily dependent on one particular resource are vulnerable to the consequences of technological change. They are also vulnerable to fluctuations in the price set for their product on the world market. These vulnerabilities are particularly important for countries whose economies are dependent on nonfuel minerals, such as the Democratic Republic of the Congo (copper), Mauritania (iron ore), Namibia (diamonds), Niger (uranium), Sierra Leone (diamonds), Togo (phosphates), and Zambia (copper).

Resources and Sustainability The ideal of **sustainable development** is one that achieves a balance among economic growth, the environmental impacts of that growth, and the fairness, or social equity, of the distribution of the costs and benefits of that growth. The importance of sustainability is cogently illustrated by the concept of an **ecological footprint**, which is a measure of the human pressures on the natural environment from the consumption of renewable resources and the production of pollution. It represents a quantitative assessment of the biologically productive area required to produce the resources (food, energy, and materials) and to absorb the wastes of an individual, city, region, or country. The ecological footprint of a country or region changes in proportion to population size, average consumption per person, and the resource intensity of the technology being used.

Humanity's footprint first grew larger than global biocapacity in the 1980s, and this overshoot has been increasing every year since. In 2006, demand exceeded supply by about 40 percent. This means that it took almost a year and five months for Earth to produce the ecological resources we used in that year. At 9.0 hectares (23.6 acres) per person, the United States currently has the sixth-largest per capita ecological footprint on the planet, just behind the United Arab Emirates, Qatar, Bahrain, Denmark, and Belgium. Other countries with extremely large ecological footprints include Australia, Canada, the Netherlands, Finland, and Sweden. Countries with the smallest ecological footprints, between 0.5 and 0.75 hectares (1.2 to 1.9 acres) per person, include Afghanistan, Bangladesh, Haiti, and Malawi.

Sustainable development means using renewable natural resources in a manner that does not eliminate or degrade them—by making greater use, for example, of solar and geothermal energy and recycled materials. It means managing economic systems so that all resources—physical and human—are used optimally. It means regulating economic systems so that the benefits of development are distributed more equitably (if only to prevent poverty from causing environmental degradation). It also means organizing societies so that improved education, health care, and social welfare can contribute to environmental awareness and sensitivity and an improved quality of life. A final and more radical aspect of sustainable development involves moving away from wholesale globalization toward increased "localization": a return to more locally based

▼ Figure 8.5 Resource extraction Mining potassium salt (to be used as a fertilizer) near Perm, Russia.





▲ Figure 8.6 Promoting local economies Increasing awareness of the benefits of locally produced foods has encouraged many supermarkets, like this one in Lugano, Switzerland, to feature local products.

economies where production, consumption, and decision making are oriented to local needs and conditions (Figure 8.6).

Defined this way, sustainable development sounds eminently sensible yet impossibly utopian. A succession of international summit meetings on the topic has revealed deep conflicts of interest between core countries and peripheral countries. One of the most serious obstacles to prospects for sustainable development is continued heavy reliance on fossil fuels as the fundamental source of energy for economic development. This not only perpetuates international inequalities but also leads to transnational problems such as acid rain, global warming, climatic changes, deforestation, health hazards, and, many would argue, war. The sustainable alternative—renewable energy generated from the sun, tides, waves, winds, rivers, and geothermal features—has been pursued half-heartedly because of the commercial interests of the powerful corporations and governments that control fossil-fuel resources.

A second important challenge to the possibility of sustainable development is the rate of demographic growth in peripheral countries. Sustainable development is feasible only if population

size and growth are in harmony with the changing productive capacity of the ecosystem. It is estimated that 1.2 billion of the world's 6.9 billion people are undernourished and underweight.

But the greatest single obstacle to sustainable development is the inadequacy of institutional frameworks. Sustainable development requires economic, financial, and fiscal decisions to be fully integrated with environmental and ecological decisions. National and local governments everywhere have evolved institutional structures that tend to separate decisions about what is economically rational and what is environmentally desirable. International organizations, while better placed to integrate policy across these sectors and better able to address economic and environmental “spillovers” from one country to another, have (with the notable exception of the European Union) not acquired sufficient power to promote integrated, harmonized policies. Without radical and widespread changes in value systems and unprecedented changes in political will, “sustainable development” is likely to remain an embarrassing contradiction in terms.

APPLY YOUR KNOWLEDGE

1. How sustainable do you think your lifestyle is, compared to other places in the world?
2. Calculate your ecological footprint to find out how your lifestyle compares by using this calculator on the Global Footprint Network: <http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/>

THE ECONOMIC STRUCTURE OF COUNTRIES AND REGIONS

The *economic structure* of a country or region can be described in terms of its relative share of primary, secondary, tertiary, and quaternary economic activities (see Table 8.1).

Variations in economic structure—according to primary, secondary, tertiary, or quaternary activities—reflect *geographical*

TABLE 8.1 Economic Structure

Primary activities	concerned directly with natural resources	agriculture, mining, fishing, and forestry
Secondary activities	process, transform, fabricate, or assemble the raw materials derived from primary activities or that reassemble, refinish, or package manufactured goods	steelmaking, food processing, furniture production, textile manufacturing, automobile assembly, and garment manufacturing
Tertiary activities	involve the sale and exchange of goods and services	warehousing, retail stores, personal services such as hairdressing, commercial services such as accounting, advertising, and entertainment
Quaternary activities	deal with the handling and processing of knowledge and information	data processing, information retrieval, education, and research and development (R&D)