

## 1.2: The Environment and the Five Environmental Spheres

Since this book deals with the environment, it is important to know what is meant by the environment. Essentially, the **environment** consists of our surroundings, which may affect us and which, in turn, we may affect. A part of the environment may consist of rock formations several kilometers below Earth's surface, so deep that humans cannot reach them and of which they are scarcely aware except in those instances when the rock formations shift along a fault line and cause an earthquake, which may be very destructive and take many lives. Another part of the environment is the atmosphere touching Earth's surface, a part of the environment with which humans are always in contact and which is essential for the life-giving oxygen that they require. In discussing the environment it is helpful to regard it as consisting of the following five spheres as shown in Figure 1.1: (1) The **hydrosphere**, (2) the **atmosphere**, (3) the **geosphere**, (4) the **biosphere**, and (5) the **anthrosphere** (that part of the environment constructed and operated by humans). These spheres overlap and interact strongly. For example, fish are part of the biosphere, dwell in the hydrosphere, and acquire dissolved oxygen that they need from the atmosphere. Mineral nutrients required by the fish and by the algae upon which the fish feed come from the geosphere. The part of the hydrosphere in which the fish reside may be a reservoir constructed by impounding a stream with a dam that is part of the anthrosphere. Many other such examples may be cited.

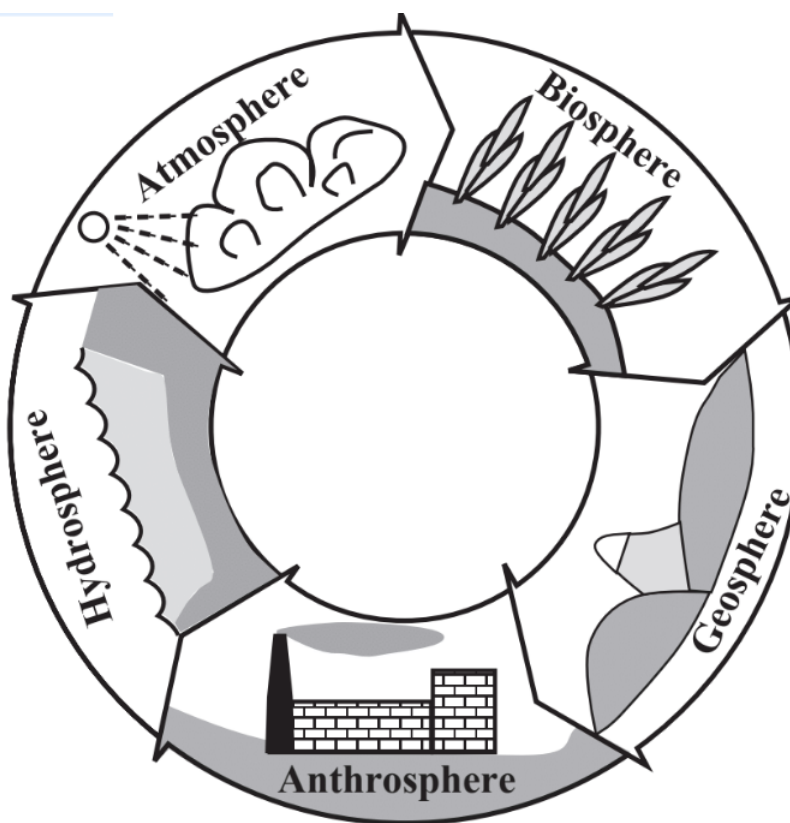


Figure 1.1. The environment may be considered as consisting of five spheres that exchange materials and energy, largely through biogeochemical cycles.

**Biogeochemical cycles** describe the exchange of materials among the five environmental spheres. Aspects of these environmentally crucial cycles are covered in various parts of this book. As the name implies, these cycles involve biological and geochemical phenomena but may also include processes that occur in the atmosphere and the hydrosphere as well as human influences on them. An important part of these cycles consists of the interfaces between the environmental spheres. The interfaces are often very thin with respect to Earth's whole environment. An important example of such an interface is the one between the geosphere and the atmosphere where most plants grow that support life on Earth. Typically this region extends into the geosphere for only the meter or less penetrated by plant roots and into the atmosphere only to the height of the plants. Within this region there are other interfaces including the biosphere/geosphere boundary between plant roots and soil and the biosphere/atmosphere boundary across which oxygen and carbon dioxide gas are exchanged between leaf surfaces and the atmosphere.

The study of the environment is **environmental science**, in its broadest sense the science of the complex interactions that occur among the terrestrial, atmospheric, aquatic, living, and anthropological systems that compose Earth and the surroundings that may

affect living things.<sup>3</sup> It includes all the disciplines, such as chemistry, biology, ecology, sociology, and government, that affect or describe these interactions. For the purposes of this book, environmental science will be defined as the study of the earth, air, water, and living environments, and the effects of technology there on. To a significant degree, environmental science has evolved from investigations of the ways by which, and places in which, living organisms carry out their life cycles. This discipline used to be known as natural history, which later evolved into ecology, the study of environmental factors that affect organisms and how organisms interact with these factors and with each other.

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