

8.1: Five Environmental Spheres

In Section 1.2 it was noted that Earth's environment may be regarded as consisting of five spheres: (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). All of these spheres are closely interconnected and interactive, continuously exchanging matter and energy and influencing each other. Much of this interaction is through biogeochemical cycles in which biological, geochemical, aquatic, atmospheric, and, increasingly, anthrospheric processes act to exchange matter and energy among the five environmental spheres and determine Earth's environment. The next several chapters address these five environmental spheres and the cycles in which they are involved.

Consideration of the five environmental spheres and their interactions through biogeochemical cycles are very important in green chemistry, science, and technology as well as sustainability as a whole. Earth's natural capital (see Section 1.4) resides in the four "natural" spheres and is utilized (sometimes shamelessly exploited) and managed in the anthrosphere. The interfaces between spheres are particularly important for, among other reasons, they are where materials and energy are exchanged. As discussed in Section 1.2, one such interface is the one between the geosphere and the atmosphere where most plants grow that support life on Earth. Like most such interfaces, it is very thin compared to the spheres themselves, generally extending into the geosphere for only the meter or less penetrated by plant roots and into the atmosphere only to the height of the plants. The boundary between the anthrosphere and the atmosphere is where air pollutants from automobile engines and other sources enter the atmosphere. Many other examples of important interfaces could be given.

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