

8.6: The Anthroposphere

Although some authorities object to recognizing the things that people make, modify, and use as a separate environmental sphere — the **anthrosphere**—as a distinct environmental sphere, it is essential to consider it in the achievement of sustainability. Just a look around us shows the dwellings, buildings, roads, airports, factories, power lines and numerous other things constructed and operated by humans as visible evidence of the existence of the anthrosphere on Earth (see Figure 8.7). The anthrosphere and its influences are so obvious and even intrusive that the Nobel

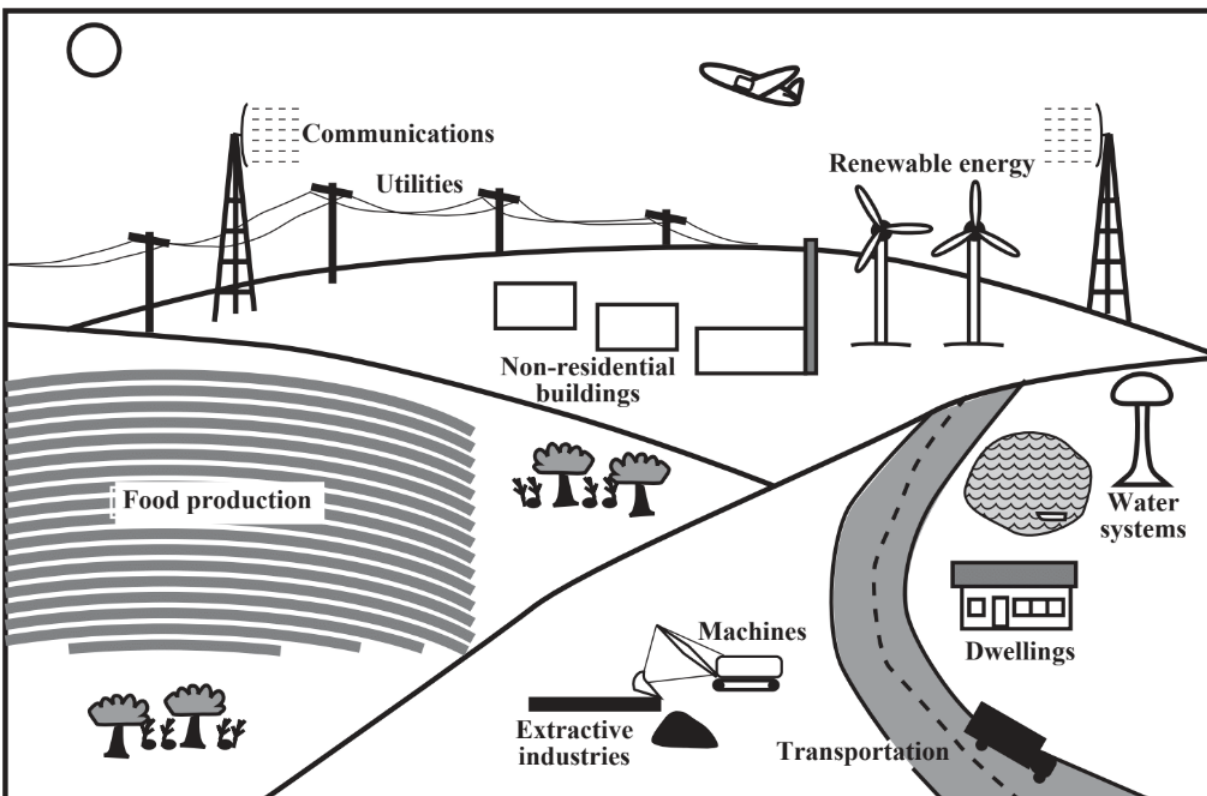


Figure 8.7. There are many aspects to the anthroposphere as illustrated by the examples in this figure. It is tied closely with the other environmental spheres

Prize-winning atmospheric chemist Paul Crutzen has argued convincingly that Earth is undergoing a transition from the holocene geological epoch to a new one, the **anthropocene**. This is occurring because human activities are now quite significant compared to nature in their impact on Earth's environment and are changing Earth's fundamental physics, chemistry, and biology. There is concern that, especially through changes in global climate, activity in the anthroposphere will detrimentally alter Earth's relatively stable, nurturing environment and produce one that is much more challenging to human existence.

It is not completely accurate to believe that pre-industrial humans had little influence on the biosphere and ecosystems. The grazing habits of excessive numbers of goats bred by humans form eat and milk centuries ago contributed to the transformation of formerly productive grasslands of the Middle East and North Africa to deserts. Some pre-Columbian native South Americans created their unique anthroposphere by building terraces, draining wetlands, and constructing raised agricultural fields to grow a variety of food crops. As much as one third of the Midwestern prairies first encountered by early European settlers in the present day U.S. were created through the pyromaniacal tendencies of Native Americans who burned forests to create grasslands that supported game animals. Subsequently, forestation, largely with European tree varieties, often followed in the paths of the first non-native settlers. Compared to the modern industrial era, however, the impact of humans until just a few centuries ago was comparatively benign. Particularly with the development of fossil fuel resources and the large machines powered by these fuels, during the last approximately 200 years, humans have built a pervasive anthroposphere that is having massive environmental impact.

The boundaries between the anthroposphere and the other environmental spheres are sometimes blurred. Most of the anthroposphere including buildings, highways, and railroads is anchored to the geosphere. Gardens that adorn the anthroposphere are planted on geospheric soil and the flowering plants in them are part of the biosphere. Farm fields are modifications of the geosphere, but the

crops raised on them are part of the biosphere. Coal mines are burrowed into the anthrosphere. Ships move over ocean waters in the hydrosphere and airplanes fly through the atmosphere.

There are many distinct segments of the anthrosphere as determined by a number of factors including where and how humans dwell; the movement and distribution of goods; the provision of services; the utilization of non-renewable materials; the provision of renewable food, fiber, and wood; the collection, conversion, and distribution of energy; and the collection, treatment, and disposal of wastes. With these factors in mind it is possible to list a number of specific things that are parts of the anthrosphere as shown in Figure 8.7. These include dwellings as well as other structures used for manufacturing, commerce, education, and government functions. Utilities include facilities for the distribution of water, electricity, and fuel, systems for the collection and disposal of municipal wastes and wastewater (sewers), and — of particular importance to sustainability, — systems for materials recycle. Transportation systems include roads, railroads, and airports, as well as waterways constructed or modified for transport on water. The anthrospheric segments used in food production include cultivated fields for growing crops and water systems for irrigation. A variety of machines, including automobiles, trains, construction machinery, and airplanes are part of the anthrosphere. The communications sector of the anthrosphere includes radio transmitter towers, satellite dishes, and fiber optics networks. Oil and gas wells are employed for extracting fuels from the geosphere and mines are excavated into the geosphere for removing coal and minerals.

The Crucial Infrastructure

A critical part of the anthrosphere may be classified as **infrastructure**. Infrastructure is generally considered to be parts of the anthrosphere used by large numbers of people in common. It consists of utilities, facilities and systems essential to a properly operating society. Physical components of the infrastructure include electrical power generating facilities and distribution grids, communications systems, roads, railroads, air transport systems, airports, buildings, water supply and distribution systems, and waste collection and disposal systems. A very important part of infrastructure is non-physical, composed of laws, regulations, instructions, and operational procedures. Because they are used in common by many people, crucial parts of the infrastructure are in the public sector; other segments are privately owned and operated. For example, major airports are almost always publicly owned whereas the aircraft that serve them are generally owned by private corporations.

Consider a computer operating system as infrastructure. The use of the system enables a computer to run programs for word processing, record keeping, calculation, drawing, communication, and other common computer operations. The operating system enables the computer to properly record, store, correlate, and output the products of the programs that it operates. By analogy, the infrastructure of the anthrosphere facilitates infrastructure activities including acquisition and processing of materials, the conversion of materials to manufactured items, and the distribution of such items. Crash-prone computer systems that are outdated or poorly designed in the first place cause lost productivity and general distress to the computer user. Similarly, an outdated, cumbersome, poorly designed, worn-out anthrospheric infrastructure causes economic systems and societies to operate in a very inefficient manner that is inconsistent with sustainability. Catastrophic failure can result as has occurred with cascading breakdowns of electrical power grids or failure of wastewater treatment systems resulting in discharge of sewage to streams.

Deterioration of the infrastructure is a continuing concern. One of the greatest problems is corrosion, a chemical process in which metals, such as the steel that composes bridge girders, tend to revert to the state in which they occur in nature (in the case of steel, rust). Human negligence, misuse and vandalism can all cause premature loss of infrastructure function. A major concern with terrorism is potential damage to infrastructure including cybercrime that could cripple electrical distribution systems. Infrastructure problems frequently begin with improper design. Sustainability requires that elements of the infrastructure be properly designed, maintained, and protected to avoid the expense and material and energy required to rebuild infrastructure if it fails before its expected lifetime is up.

To date much of infrastructure has been dedicating to thwarting what nature does naturally, often a losing proposition in the long run. A prime example consists of levees constructed along rivers which work well until overwhelmed by extraordinarily heavy precipitation events. Much more consideration must be given to sustainability and the maintenance of environmental quality in the development of infrastructure. Examples include highly effective waste treatment systems with recovery of materials and energy from wastes, high-speed rail systems to replace inefficient movement of people and freight by private carriers, and electrical systems that use wind power to the maximum extent possible.

The Sociosphere

The **sociosphere** is the societal organization of people including their governments, laws, cultures, religions, families, and social traditions and is a critical part of infrastructure. A well functioning sociosphere enables people to lead good lives within a

sustainable environment and economic system. Largely because of disfunctional social systems, the quality of life and the environment in some countries with substantial resources, especially of petroleum, is often sub-standard. Societies in countries with dictatorial, corrupt governments that do not nurture human rights are not beneficial in the maintenance of sustainability. Sustainability and quality of life are also not well served by anti-government creeds that reject the role of well-functioning governments in implementing sensible well-administered laws and regulations designed to protect the environment and maintain sustainability.

An important consideration in the sociosphere is the science of **economics**, which describes the production, distribution, and use of income, wealth, and materials (commodities). Much of economics as it is usually practiced is inconsistent with the development of sustainability upon which functional economic systems must ultimately depend. Economic value has traditionally been measured in terms of financial and material possessions with emphasis on growth and with an arrow view of the environment. Earth has been largely regarded as a part of the economic system from which materials may be extracted, which is to be “developed” with structures and other artifacts of the anthrosphere, and into which wastes are to be discarded. Such an approach is putting an unacceptable strain on environmental support systems and Earth’s natural capital. A more enlightened economic view regards Earth’s natural capital as an endowment. As with financial endowments, Earth’s endowment of natural capital should be nurtured, with only a portion of its income spent for immediate needs and the rest devoted to enhancing the natural capital. Therefore, it is essential for sustainability that economics be viewed as a part of Earth’s greater environmental system, rather than viewing the environment as a subsection of a world economic system. Instead of defining wealth in material possessions it should be measured in terms of well-being and satisfaction with life, operating within rules that promote and require sustainability.

The Human Microsociosphere

The immediate environment in which humans carry out their daily activities may be regarded as a human microsociosphere. For many people recent years have seen a marked change in this microenvironment as the consequence of a flood of electronic devices including personal computers, cellular telephones, and other devices that flood individuals with information and communications. Some psychological studies have suggested that this deluge of information is changing human behavior, not necessarily in beneficial ways. Many people engage in multitasking, for example by texting or talking on cell phones while working or performing other tasks. The consequences of this can even be deadly as happens when people get into automobile accidents while talking or — worst of all — texting on a cell phone. Some people have several computers and screens at their workplace and attempt to follow several streams of information simultaneously. It is the feeling of some reputable neuroscientists that this kind of activity forces the human brain to function in ways that it has not evolved to handle making multitaskers more stressed, impatient, impulsive, and forgetful. Extreme cases have been documented of people who fall asleep with a laptop computer on their chest and whose first action after waking up is to connect to the internet.

Despite the benefits of modern computer and communications technology, the “always-plugged-in existence” that many people now lead has a definite downside. Not the least of these harmful effects can be upon human social interaction in which the major kind of interaction is through a computer rather than with other human beings. On the other hand, e-mail and other modes of electronic communication have made it possible for people to stay in constant, virtually instantaneous contact and to expand their circle of human contact, even if it is over a computer screen. The challenge of dealing with the kinds of problems discussed here is expected to be most acute for the increasing numbers of people who work from home on computers.

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