Book Unit 1 - Introduction

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1. Introduction

Water is essential to human and other forms of life. Therefore, attention should be paid not only to regulating the exploitation of water and diminishing or halting pollution of single water bodies, but also protecting and preserving the entire ecosystems of which water resources constitutes integral part.

For example, deforestation in a watershed can affect its streams, which in turn can affect fish and other aquatic life and lead to flooding. The cascade of social and economic consequences that can flow from the loss of healthy ecosystems demonstrates that freshwater ecosystems should not be seen as something separate from human society and well being. They are, in fact, an integral part of a country’s economy and should be both protected and enhanced accordingly.

2. Regulation

Freshwater resources have been the object of regulation long before the emergence of environmental protection and sustainable development concerns. International rules and principles, as well as national regimes, have been developed to regulate their navigational and other uses. These regimes, perhaps with the exception of sanitation standards, mostly treated water as an economic resource, and dealt largely with the quantitative aspect of water resources.

The emergence of environmental protection obligations and of the principle of sustainable development, as well as the increased awareness that water resources have to be managed in a holistic approach, have highlighted the need to integrate existing water regulation regimes with rules and principles concerning the environmental aspects of freshwater resources, and to regulate the quantitative and qualitative aspects in an integrated manner. Therefore, in order to reflect the evolution of the law in this area and the interlinkages between the regulation of the use of water and the protection and conservation of water resources and their ecosystems, this course will also address the issue of water allocation rights, falling under what is traditionally referred to as water law.

3. The Hydrological Cycle

Most freshwater on Earth is in constant motion in the hydrologic cycle. This expression refers to the process whereby water evaporates into the atmosphere and returns to Earth's surface through condensation and precipitation. Evaporation may occur from any wet surface. Most water evaporates from the oceans, since they cover about 70% of the planet, but also from other bodies of water, such as lakes, reservoirs and rivers, as well as from moist soil and other surfaces. Considerable amounts of water vapour enter the atmosphere through transpiration and evaporation from vegetation in a process referred to as evapotranspiration. Thus crops, trees and other vegetation act as virtual "pumps," transferring water from the ground into the atmosphere. Therefore, large-scale elimination of vegetation can affect local and regional climate patterns.

When water returns to land through precipitation, it may either remain on the surface, as standing water or as runoff, or soak into the ground through infiltration. Runoff flows into streams, lakes and other forms of surface water, generally finding its way into the ocean. Water entering the ground through infiltration may be held in the soil, to eventually return to the surface through capillary action and evaporate, or may percolate downward to become groundwater. The area on the land surface where infiltration occurs is called the recharge area. This may lie a considerable distance from the place where groundwater is withdrawn or emerges naturally, for example, by flowing into a river, or emanating from the ground in the form of a spring. The underground geologic structures containing water are often referred to as aquifers. These porous, permeable water-bearing formations are composed of such material as sand, gravel or limestone. The water contained in these aquifers is called groundwater.

Groundwater

The upper surface of groundwater is the water table. Water moves not only from Earth's surface to the atmosphere and back again, but also from the surface into the ground and back again to the surface. For example, considerable water seeps from streams through their beds into the ground, changing from surface water to groundwater. This groundwater may later rejoin the stream, emerge as a spring or flow underground into a lake or the ocean. However, there are certain aquifers containing what is sometimes called confined groundwater, or fossil water, that do not interact with surface water or other aquifers, but these are highly exceptional.

It is estimated that over three-quarters of all freshwater on Earth is frozen in polar ice-caps and glaciers and is inaccessible as a practical matter. Approximately 97% of the remaining water consists of groundwater, while surface water accounts for a surprisingly small percentage of the total of freshwater on earth. Therefore, a high percentage (about one-third) of the global population depends upon groundwater, much of which is drawn from shallow aquifers, which are more subject to pollution than deep aquifers.

5. Water Scarcity

Although water has been the same for billions of years, as it neither grows nor diminishes over time, concerns about its scarcity derive largely from intensified human demand for a finite supply and deterioration of its quality caused by human activities. Intensified human demand largely due to rapid population growth. According to the UNEP´s 5th Global Environment Outlook (GEO-5) “About 80 per cent of the world’s population lives in areas with high levels of threat to water security. The most severe threat category encompasses 3.4 billion people, almost all in developing countries. More people are likely to experience more severe water stresses in the coming decades, with projected climate change impacts and continuing population growth“

Water quality is an important consideration for its intended use. Therefore, water quality and quantity are interrelated: water resources may be plentiful but unsuitable for human use because of contamination. This problem is becoming more serious, particularly in urban areas where the need to provide adequate and safe supplies of water and dispose of the increasingly large quantities of wastewater in a safe and environmentally sound way is becoming an increasingly pressing concern.

Climate Change

An additional factor that has profound effects on water supplies is global climate change, whose consequences, as estimated by the Intergovernmental Panel on Climate Change (IPCC) created by the WMO and UNEP to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation) include not only higher temperatures but also rising sea levels, altered precipitation patterns, and an increase in extreme climatic events and storm surges, among other effects. All of these factors impact on the availability and quality of freshwater resources and are exacerbated by human demand for freshwater.

The world's water is unevenly distributed. Some geographic regions have more water than they can possibly use while others do not have enough. Governments have sometimes responded to this phenomenon by transferring water from places where it is abundant to those where it is scarce. While water transfers may address needs of the present and short-term future, they may also have unforeseen and harmful longer-term effects on ecosystems and even human populations.

6. Water Pollution

Principal sources of freshwater pollution include untreated sewage, agricultural run-off and discharge of chemical substances. These affect all forms of freshwater and marine water in coastal areas, degrade associated ecosystems and threaten the health and livelihoods of people dependent upon them.

The lack of adequate sanitation is the primary cause of water contamination and water-related diseases, such as cholera, dengue fever, diarrhoea and typhoid fever. Billions people are afflicted with these diseases each year. Children are particularly vulnerable since their immune systems are not fully developed. The poor are the most likely to have inadequate sanitation facilities and to suffer consequent adverse effects on their health and environment.

Substances deposited on land surfaces (for example, fertilizers, pesticides and other chemicals used in agriculture), may filter into groundwater, which could be affected by other sources of pollution affecting streams that eventually replenish the aquifer. Once contaminated, groundwater is very difficult to purify unless it is extracted and treated which process would be experience as well.

The quality of groundwater in coastal areas may also be affected by over-pumping, or mining. Mining of groundwater occurs when withdrawals exceed the average rate of replenishment. Because coastal aquifers are often geologically connected with the adjacent ocean, these withdrawals can cause sea water to be drawn into the aquifers, increasing the salinity of the freshwater and making it unfit for many uses.

7. Water Uses

Humans use freshwater in a wide variety of ways. Nevertheless, it is possible to identify several broad categories of uses for convenience: domestic uses; industrial uses; agricultural uses; recreational uses; navigational uses; waste-disposal uses; and in-stream uses (such as fishing, conservation of fish and other aquatic life, recreation, safeguarding aesthetic values and preservation of aquatic ecosystems).

These categories may be further subdivided. For example, domestic uses include the use of water for drinking, washing, food preparation, sanitation and subsistence farming, among other uses.

Conflicts

It is important to bear in mind the potential for different uses of water to come into conflict with each other. Thus, for example, the use of water for drinking would conflict with any other use, for instance waste-disposal use - that made the water unfit for drinking.

Conflicts between uses of land and water must also be confronted. For example, deforestation can increase runoff, causing erosion of soil which can lead to increased turbidity of streams and sedimentation of their beds; sedimentation can, in turn, cause flooding and decrease infiltration of water from streams into aquifers. Agriculture may result in the direct or indirect discharge of pollutants into water sources and affect the extent to which those sources are available for other uses.

More broadly the interest of the international community in environmentally sound management of water resources is to provide a framework of peaceful cooperation and avoidance of conflicts that could jeopardize peace and security among countries sharing the resource. Conflict resolution mechanisms are at all times at the core of underlying cooperation.

Fresh, coastal and marine water resources

The relationship between fresh, coastal and marine water resources must also be borne in mind. Nearly one-third of the world's population lives in coastal zones. Since most watercourse systems eventually reach the sea, coastal residents bear the effects of freshwater management practices in the relevant basins. Thus, freshwater systems, wetlands, and coastal and marine waters should be managed holistically.

Estuaries, partly enclosed aquatic zones where seawater mixes with freshwater from rivers, deserve special protection, as they provide sanctuaries, breeding and feeding grounds for many important species and serve as nurseries for half of the living organisms in the world's oceans. Also marshes and wetlands serve critical ecological functions, by regulating water regimes, and by providing habitats for flora and fauna as well as important water purification services. They are often relied upon by local populations for food and even shelter.