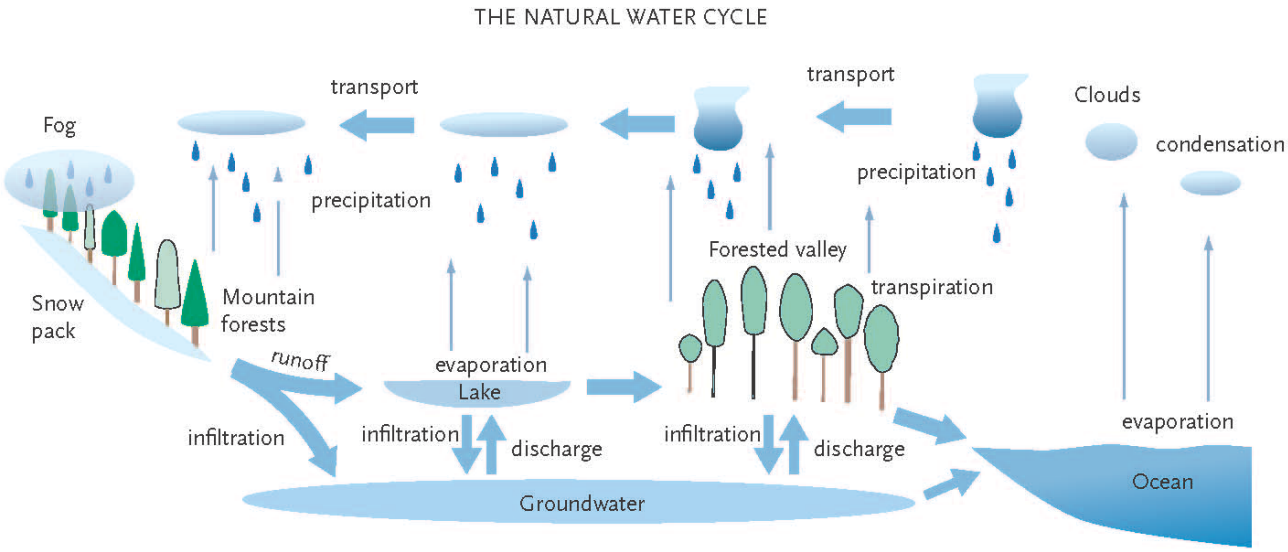
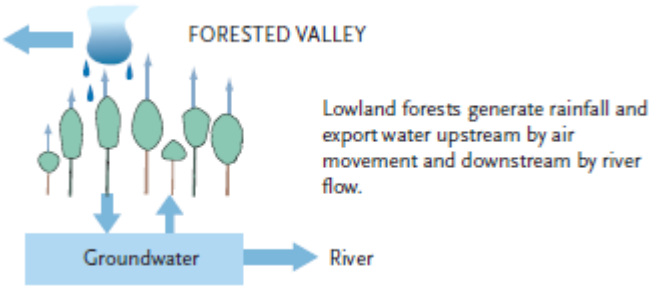
# Water Cycle & Land Use

Perhaps the most familiar natural resource, water covers nearly 75% of the earth. Most of this is sea water, which contains minerals and salts that are harmful to most land plants and animals. Yet, did you know that most of our precipitation comes from the vast, salty reservoirs of seas and oceans? No longer salty or mineral-laden, water moves from clouds to land and back to the ocean in a constant cycle. We call this the water cycle, or the hydrological cycle.

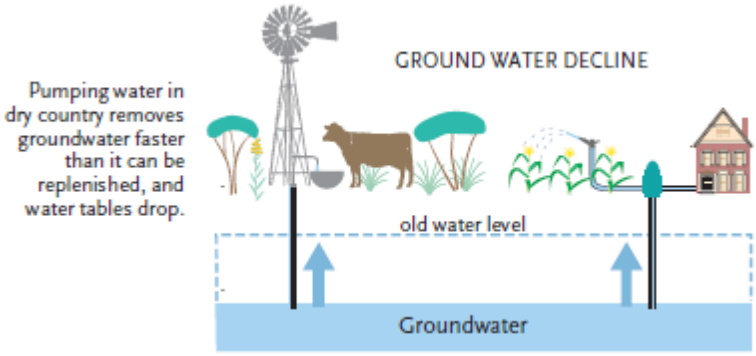



Leaving its salts and minerals behind, ocean water evaporates into the atmosphere and moves across the earth as water vapor. Soil, people, and other animals contribute moisture to the atmosphere, as do factories, automobiles, and planes. Water in lakes, ponds, rivers, and streams also evaporates and adds to the moisture in the atmosphere. Plants, too, contribute large amounts of moisture to the atmosphere through the process of transpiration: plant roots "pull" up water from the soil and send it to their stems and leaves, where it keeps cells alive and rigid. Some water is used in photosynthesis, but most is lost through leaves as water vapor. Transpiration can be a major input to the water cycle, particularly during the warm summer months in deciduous forests when a lot of plants are actively photosynthesizing. In New York alone, about 45 billion gallons of water evaporates from water bodies and plants per day!

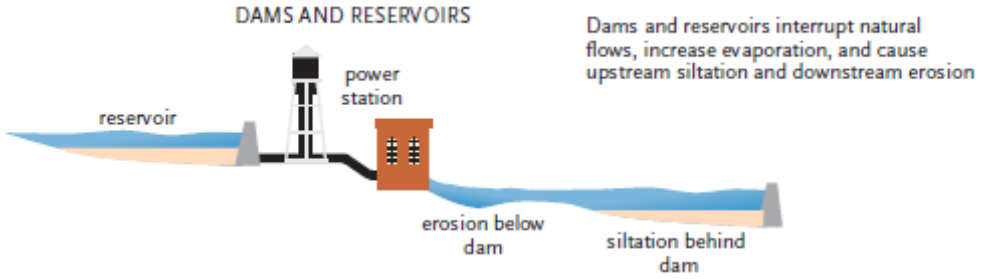



Some of the water vapor in the atmosphere is visible to us as fog, mist, or clouds. When water vapor condenses, it falls to earth as rain, snow, sleet, or hail depending on the climate, season, and topography. Global precipitation over land surfaces averages 26 inches per year, but it is not

evenly distributed. For example, most places in New York receive 40 inches of precipitation per year (about 90 billion gallons per day).

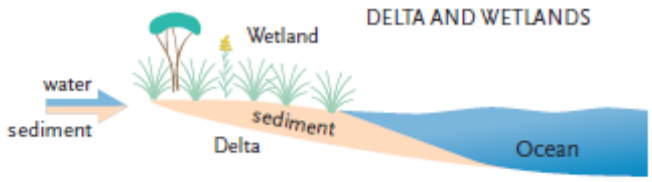



Humans can live on a gallon or so of water a day for drinking, cooking, and washing, but we rarely do. In medieval times people used no more than 3-5 gallons each day. In the 1800s, and individual in the United States used around 95 gallons of water each day. Currently, each of us uses approximately 2,000 gallons of water per day to satisfy our needs and comforts including recreation, cooling, food production, and industrial supply. As a whole, New Yorkers use 36 million gallons of water each day for irrigating agricultural crops, and 300 million gallons/day for industrial uses, and 4-9 billion gallons/day for thermoelectric power generation. All of this water comes from underground storage areas (aquifers) or surface water reservoirs, created by damming rivers. However, dams also have a number of negative consequences. They are barriers to natural fish migration patterns, cause silt to accumulate upstream, and reduce natural water flows downstream, among others.

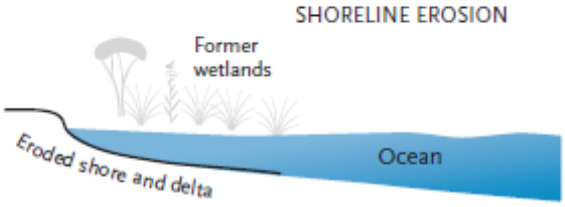



When water hits the ground, some of it soaks into the soil and the rest runs off over the surface. Depending on the type of surface that precipitation falls on, the water may or may not reach the groundwater and recharge the aquifers. Since we can't change the input side of the water cycle (i.e. the amount of precipitation we receive), our primary supply of water is firmly fixed. However, our land use activities can alter the quality and quantity of the water that is available to us. Our land use decisions have *direct* impacts on our water availability through activities such as dam installation or discharging nutrients and other pollutants into our waterways and *indirect* impacts, such as those contributing to climate change (e.g. deforestation, among others). For more about climate change, see the reading titled "Carbon Cycle & Climate Change."

Surface runoff from rain or melting snow can carry away huge amounts of soil via erosion. Freshly plowed farmland, cleared areas in new housing developments, and highway fills and banks are especially vulnerable. Moving water loosens soil particles and carries them away. Soil erosion by surface runoff is a main source of sediment pollution, which fills streams, decreases water clarity, and kills aquatic life. Yet if shoreline ecosystems don't receive enough sediment due to river channelization and dam creation, wetlands begin to erode, leaving the shore vulnerable to damage from storms.



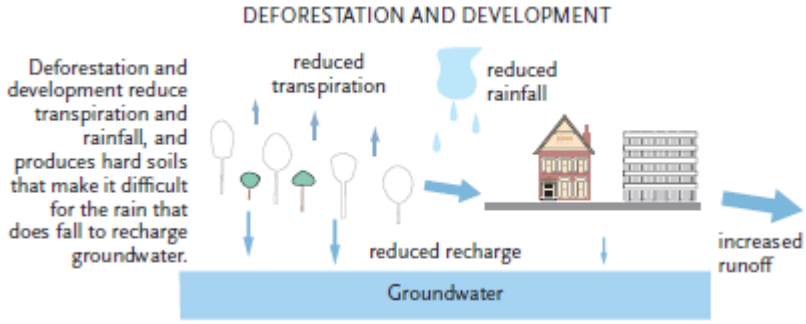

Natural rivers deposit sediment at their mouths, building deltas which support wetlands and protect the shore from erosion.




Because dammed rivers lack sediment, their deltas erode, and the ocean shores at their mouths erode and flood easily.

In cities and suburbs, where much of the land is paved or covered with streets, buildings, and parking lots, water runs off as much as 10 times faster than on unpaved land. Since this water cannot soak into the soil, it flows rapidly down storm drains or through sewer systems, contributing to floods and often carries overflow sewage and other pollutants to streams.

The greater the land area covered by impervious surface, the greater the risk of flooding, higher the local temperatures, more severe the erosion and pollution, and the lower the levels of aquatic biodiversity.




As populations and per capita water use increase throughout the world, so does our need for clean water. Our land use activities and water management determine whether or not we have enough clean, healthy, quality freshwater to meet our needs. In order to meet our current and future water needs, we must take good care of our aquatic ecosystems, minimize our personal water use, and ensure that the water we do use returns to the environments that support us in as clean a form as possible.