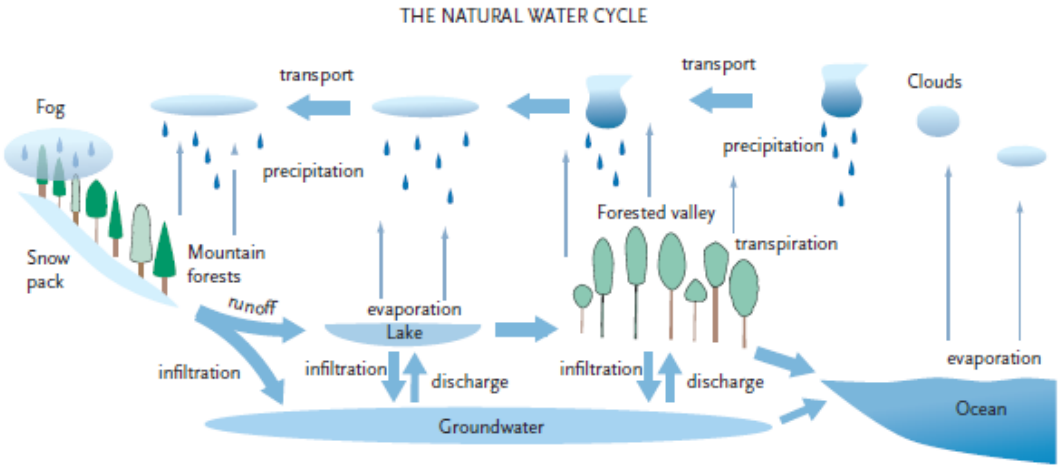
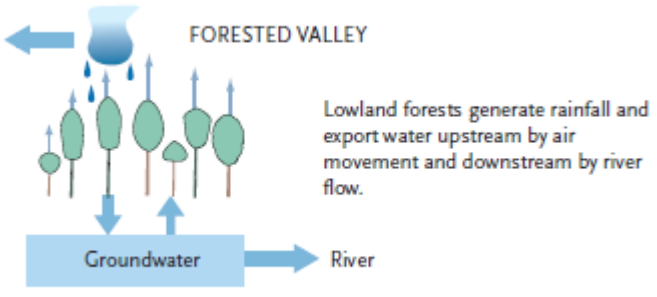
Water Cycle & Land Use

Water is the most familiar natural resource. All of us have had firsthand experience with it in its many forms -- rain, hail, snow, ice, steam, fog, dew. Water covers nearly 75% of the earth; most is sea water. But ocean water contains minerals and other substances, including those that make it salty, that are harmful to most land plants and animals. Still, it is from the vast salty reservoirs of seas and oceans that most of our precipitation comes -- no longer salty or mineral laden. Water moves from clouds to land and back to the ocean in a never-ending cycle. We call this the water cycle, or the hydrologic cycle.



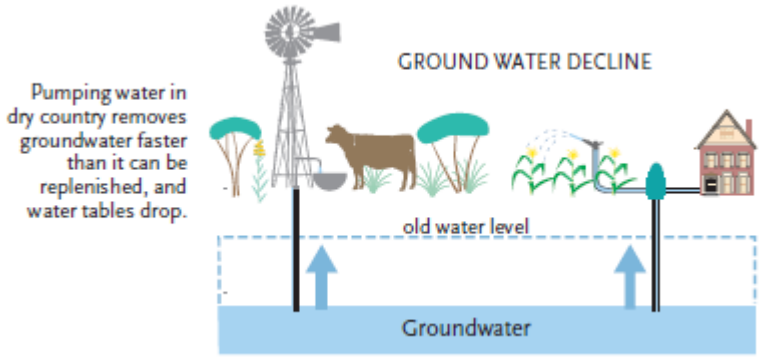
Ocean water evaporates into the atmosphere, leaving salts behind, and moves across the earth as water vapor. Water in lakes, ponds, rivers, and streams also evaporates and joins the moisture in the atmosphere. In New York, about 45 billion gallons of water evaporates from water bodies and plants per day! Soil, people, and other animals contribute moisture to the atmosphere, as do factories, automobiles, and planes.

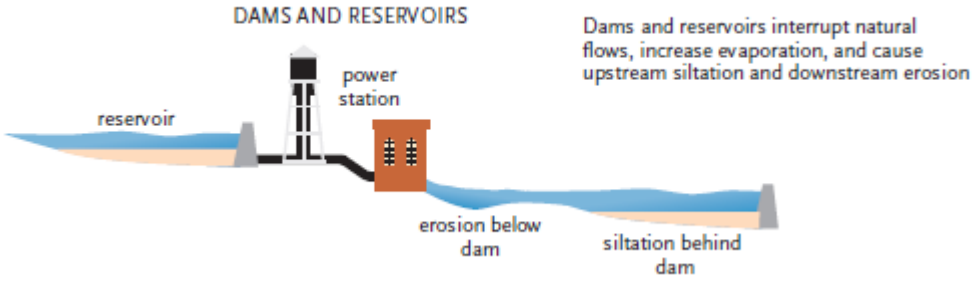


Plants contribute large amounts of moisture to the atmosphere through transpiration. Plant roots "pull" up water from the soil and send it to their stems and leaves, where it keeps cells alive and rigid. Some water is used in photosynthesis, but most is lost through leaves as water vapor. In deciduous forests during the summer months when trees are actively photosynthesizing, this water loss, called transpiration, is a major input to the water cycle.

Some of the water vapor in the atmosphere is visible to us as fog, mist, or clouds. Water vapor condenses and falls to earth as rain, snow, sleet, or hail depending on region, climate, season, and topography. Global precipitation over land surfaces averages 26 inches per year, but it is not evenly distributed. Most places in New York receive 40 inches per year (about 90 billion gallons per day).

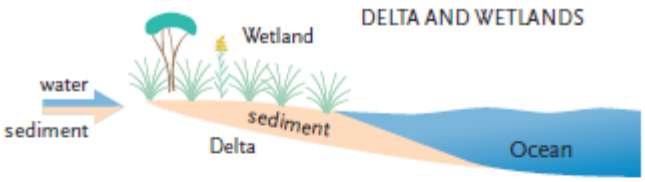
Humans can exist on a gallon or so of water a day for drinking, cooking, and washing, but we rarely do. In medieval times people used no more than 3-5 gallons a day. In the 1800s in the United States daily water use averaged around 95 gallons. Currently, each of us uses approximately 2,000 gallons of water each day for our needs and comforts including recreation, cooling, food production, and industrial supply. New Yorkers use 36 million gallons a day for irrigating agricultural crops, and 300 million gallons a day for industrial uses, and between 4,000-9000 million gallons a day for thermoelectric power generation. All of this water comes from underground storage areas (aquifers) or surface water reservoirs, which are created by damming rivers. Dams have a number of negative consequences, since they are barriers to natural fish migration patterns, cause silt to accumulate upstream, and reduce natural water flows downstream.



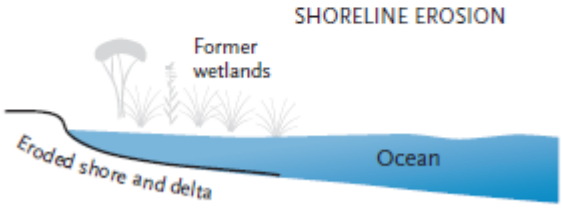


When water hits the ground, some of it soaks into the soil and the rest runs off over the surface. Depending on the type of surface that precipitation falls on, the water may or may not reach the groundwater and recharge the aquifers. Since we can't change the input side of the water cycle, our primary 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. In some parts of the world, climate change is affecting the amount of fresh water people have access to, as glaciers melt at increasingly alarming rates. 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



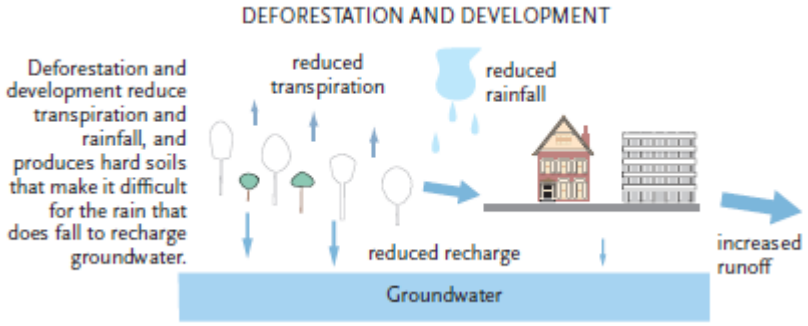
Natural rivers deposit sediment at their mouths, building deltas which support wetlands and protect the shore from erosion.



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

highway fills and banks are especially vulnerable. The water loosens soil particles and carries them away. Soil erosion by surface runoff is the source of sediment that fills streams, polluting water and killing aquatic life. However, if shoreline ecosystems don't receive enough sediment due to channelization of rivers and the creating of dams, wetlands begin to erode, leaving the shore vulnerable to large storms.

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 carrying overflow sewage and other pollutants to streams.



The more land area that is covered by impervious surface, the higher the rates of erosion, flooding, pollution levels, and temperature, and the lower the levels of aquatic biodiversity.

Throughout the world, the need for water continues to increase, as population increases and per capita use of water increases. Our land use activities and our management of water determines whether or not we have both the quantity and quality of water to meet our needs. It is our obligation to use as little water as possible, and to return the water we do use in as clean a form as possible to the ecosystems that support us.