2 Getting started

"Water is the great driver of nature"
— Leonardo Da Vinci

While the statement "all life depends on water" may seem obvious, it is the unique properties of water that allow life to exist on this planet. Most of the physical properties of water are unique to water.

Properties of water

Throughout the universe most matter exists as hot gases or frozen solids, but the earth is almost entirely covered with liquid. Within the huge range of possible temperatures, water exists as a liquid for only a relatively few degrees. It is this small temperature range that is most suited to life as we know it.

Water's density as a solid is less than it is as a liquid. This unique property allows ice to float.

The world's rivers act as pipelines for dissolved and suspended materials.

Water freezes first on the surface where heat is lost at the greatest rate by conduction, radiation and evaporation. Surface ice forms an insulating layer over water, and life can continue beneath it throughout the winter. In some instances, heavy ice along the edges of streams can be harmful to aquatic organisms, especially juvenile fish.

Water has the greatest ability to store heat (specific heat) of any liquid. This means it can absorb or release large amounts of heat without much change in its own temperature. For plants and animals living in water, temperatures change more slowly than on land. Water's moderating effects keep land near water warmer at night and during the winter, and cooler during the day and in summer.

Water is often called the "universal solvent" because of how easily most solids, liquids, and gases can dissolve in it. Not only do the world's rivers move water over long distances, they also act as pipelines for dissolved and suspended materials. Most aquatic organisms can survive in water only if it contains enough dissolved oxygen to satisfy their requirements. Nutrients transported by water make the rich variety of aquatic life possible.

Photosynthesis, the basis of most life, is a complex reaction involving carbon dioxide, water, chlorophyll, and light to form carbohydrates and oxygen. It can take place in water because of the dissolved carbon dioxide and water's unique transparency.

Demands on water

Weather and climate patterns replenish each watershed's water supply. Oregon's weather and climate patterns are largely controlled by the moderating influence of the Pacific Ocean and the effects of the Coast and Cascades mountain ranges on precipitation. Because of the endless movement of water through the water cycle, the

amount of water in existence in Oregon and elsewhere is constant. But the amount of water available for use is limited. Demand for water continues to grow. Whatever amount is available to humans and wildlife depends on the quality that is maintained. Increasing numbers of users and uses place demands on our water resources. Competition and conflict will occur

In western Oregon, 200 communities currently obtain at least a portion of their water supply from municipal watersheds. Increasing population and per capita water use create greater demands.

Forestry

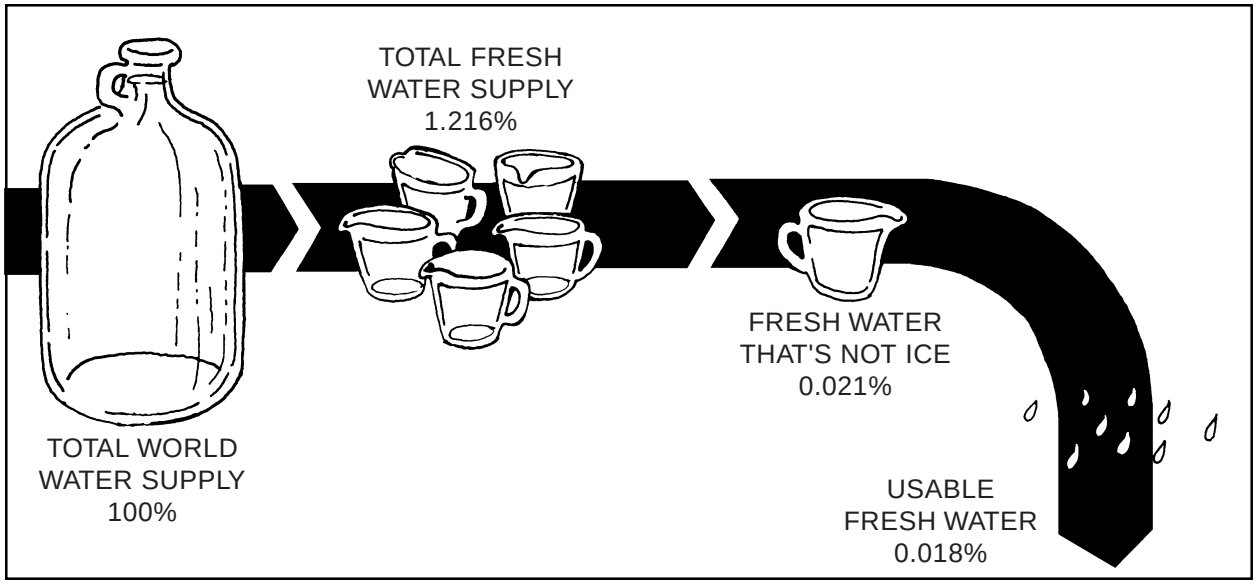
Forest practices and their impact on riparian (streamside) and upland environments are a frequent source of controversy. The size of riparian management areas left when logging near streams, the role of old-growth forests in water quality, and the impacts of timber harvest and road building on forested watersheds are public concerns. While not all issues have been resolved to everyone's satisfaction, improvements have been made. State Forest Practice rules regulate forest operations near streams and are designed to protect water quality as well as fish and wildlife habitat.

Agriculture

Riparian vegetation is often removed to the stream's edge to create more agriculturally productive land. Plant loss weakens streambank structure, lowers the water table, and could contribute to loss of valuable land during high flows. Additionally, sediment loads increase when unprotected banks are eroded by water. Soils and plants in healthy watershed capture and store precipitation and release it to a stream over time. Long term soil loss reduces the watersheds ability to hold and provide water for cropland and rangeland plant growth.

In many parts of the country, demand is growing more rapidly than aquifers can recharge.

Figure 1. World's Water Supply



Agricultural water use is not immune to controversy. Humans have irrigated crops for more than 6,000 years. Today, slightly less than one-half of all water used in the United States is for irrigation of various food and fiber crops, livestock, and livestock feed. In many parts of the country, demand is growing more rapidly than aquifers (underground reservoirs) can recharge. In some areas of Oregon, restrictions have been placed on new well drillings to reduce the rate at which local aquifers are being depleted.

Nationwide, the amount of water used by industry is about equal to that used for domestic purposes.

Grazing is another agricultural practice that may affect riparian areas. Grazing in riparian areas allows short-term economic return from rangeland. If livestock or wildlife concentrate near cool, green waterways and remove too much vegetation, the result can be increased erosion and decreased water retention.

Many central, eastern, and southwestern Oregon streams, once perennial, are now dry during the summer months. Without vegetation, unchecked spring runoff has eroded once stable streambanks to deep cutbanks, lowered the water table, and dried out formerly green lowland pastures.

Brush, particularly juniper, is rapidly spreading onto the uplands in central and eastern Oregon. It has drastically affected summer streamflows by intercepting surface water before it gets to the riparian areas.

Encroachment of brush on the uplands coincides with human management schemes. For example, fire suppression and overgrazing have allowed brush species to overtake areas where a mix of perennial bunchgrasses and brush species were co-dominant. The loss of grasses prevents fire from controlling the brush.

Some eastern Oregon streams are again perennial because of brush control and maintenance of mixed vegetation, including good grass cover on upland areas. This clearly shows the health of streams is interwoven with the health of upland and riparian areas.

Industry

Many industries use large amounts of water in processing and manufacturing. Nationwide, the amount of water used by industry is about equal to the amount used for domestic purposes. In the Pacific Northwest, large quantities are also put to use in production of electricity at hydroelectric plants. Power produced by these facilities is relatively pollution-free and inexpensive when compared with coal, diesel, or nuclear power sources.

Adequate facilities for upstream migration of adult fish and downstream passage for juvenile fish around dams are critical. Fish populations, as well as jobs and industries that rely on fisheries are at stake. Fish hatchery production replaces part of the fish lost to dam passage mortality and degraded spawning areas. Ultimately, the goal is to achieve and maintain naturally reproducing fish populations at levels similar to historic levels.

Urban areas

Urban development significantly impacts riparian and upland areas. Development includes filling and altering stream channels, removing vegetation for construction, and building roads. Pollutants from residential and commercial sites and roadways find their way into streams, adversely affecting water quality and aquatic organisms, especially fish and invertebrates. Increased loss of wetlands and groundwater recharge areas continue to significantly alter levels of urban streams.

Recreation

As population and leisure time increase, demand for water-based recreation also increases. While proper planning can provide some types of recreation and clean water for other uses, conflicts occur over how, and how much, water should be allotted to each use.

Fish and wildlife

Within each watershed are many species of wildlife. Beaver live in streams, elk move among many different watersheds, insects might never leave a watershed, birds may fly thousands of miles to live their lives in other watersheds during different parts of the year, and many more. Each of these animals requires food, water, shelter and space from the watershed.

Populations of different wildlife species within the watershed vary from season to season and from year to year. These variations may be natural, like migration and predation, or the result of human management, like hunting seasons.

Each species has an impact on the watershed. Some impacts are quite direct, as in the case of burrowing animals, beavers, or fish. Others are less direct.

Healthy populations of fish and wildlife depend on water. They provide recreation and aesthetic values and are an indicator of overall environmental health. Fish and wildlife habitat needs are frequently threatened by the needs and desires of other user groups.

Vegetation

Growth of vegetation in the watershed depends on many factors. Starting with soil from which plants draw nutrients and water required for photosynthesis to the slope on which they grow, each factor is some way affects the type and density of plant life. Soils within a watershed can vary greatly, resulting in differing amounts of plant nutrients and differing materials for root support. Climate determines temperature and rainfall and influences which plant species and plant associations can survive.

Interdependence

It is important to note the complexity of the entire watershed system. All components—weather, climate, soils, water, plants, aquatic and terrestrial organisms—are bound by a tight web of interdependence. A disturbance in one part may be reflected throughout the entire system. It is equally important for us, as managers of watersheds, to be aware of these relationships, and to take full responsibility for wise management of this valuable resource.

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