Watersheds: Upstre
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Certain resources inextricably link people, and one such resource is water. Historically, land was managed in discrete units because there was little or no understanding of how management decisions might be affecting people many miles away. Over time, we learned that the cumulative effects of management decisions made over large areas determine quality and quantity of our water resources. This fact resulted in the development of the "watershed concept" which has, in turn, led to efforts at land management on a watershed level.

So, what is a watershed? If you look up the term in *Merriam-Webster's Collegiate Dictionary*, you will find the following definitions: "1a) a divide; 1b) a region or area bounded peripherally by a divide and draining ultimately to a particular water course or body of water; 2) a crucial dividing point, line or factor: a turning point." These definitions are helpful in visualizing a watershed.

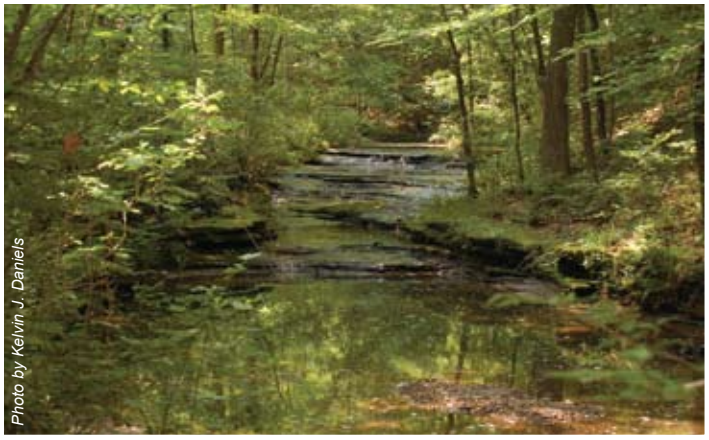
Photo by Kelvin J. Daniels

Watersheds, also called catchments or basins, have physical boundaries that are determined by elevation and the direction of water movement toward or away from a particular stream. The elevational high points act as a "divide." Inside a watershed, water moves toward the stream located within the boundaries; but outside of the boundary, water movement is toward a different stream or river. In other words, watersheds are defined hydrologically.

The next logical question is, "How big are watersheds?" The answer is, "It depends." The term watershed can be applied to the area that feeds a very small stream (these are also often referred to as "sub-watersheds") or to an area that provides water to a large river. For example, the watershed of the Mississippi River includes most of the central United States and even parts of southern Canada. This means that the water quality and quantity of the Mississippi River at its mouth is determined by all of the land management activities that occur within that huge land area. From a management perspective, watersheds are usually divided up into smaller sub-watersheds nested within the larger one. This makes it easier to quantify the impacts of an area on the water quality and quantity of water flowing out of the larger watershed. One sub-watershed may be almost entirely forested and yield a steady supply of high-quality water; another may be heavily developed or disturbed and yield pulses of low-quality water. The quality, quantity, and flow pattern of water leaving the larger watershed will reflect the synthesis of the water conditions of these different sub-watersheds.

So, how does water move through a watershed? When water reaches the earth's surface as rain or snow, it moves over and through the surrounding landscape. Some of this water is lost to evaporation. The remainder either flows over the surface of the soil until it reaches a stream or other water body, or is absorbed by the soil. Water that enters the soil will either be taken up by vegetation, held in the soil, or it will move laterally through the soil and enter the stream, or move downward to become groundwater.

The condition of the land over which water moves has a significant effect on the pathway of that movement. For example, vegetated landscapes typically have less overland flow than areas with exposed soil. This is because more litter is present in

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vegetated areas and this litter slows the movement of water and holds it until it can infiltrate the soil surface. Vegetated soils are also usually less compacted than exposed areas, resulting in more soil pore space into which water can move. Lateral movement of water through the soil takes longer than movement of water over the soil surface, and this ensures a steadier stream flow.

Additionally, water that moves over vegetated surfaces picks up less sediment than water moving over exposed soil. The increase in erosion that occurs as water moves over exposed soils ensures higher sediment loads in the streams, unless some type of best management practice is employed to filter out the sediment. At the same time, since less water is actually moving into the soil, there is less subsurface recharge of groundwater and less lateral movement of water into streams. This results in streams that are "flashy." This means that the water level of the stream rises more quickly in response to rainfall; however, because the lateral movement of water through the soil is decreased, the stream falls more quickly after rainfall ceases, making water supply less predictable. This flashy characteristic will also increase the frequency and severity of downstream flooding.

Photo by Kelvin J. Daniels

One of the challenges to managing land at the watershed level is that hydrologic boundaries do not conform to municipal, county, state, regional or, sometimes even, national boundaries. In addition, individual landowners may own land that lies within more than one watershed, municipality, county, or state. This means that unless the different governmental entities within a watershed work together, regulations regarding land management and water resources may be different. In short, management of land at the watershed level is more complicated than management of land in discrete parcels.

So, why would we make the extra effort to manage land at the watershed level? Because, even though this approach is more complicated, downstream communities are dependent on upstream communities for the quality, quantity, and timing of delivery of their water. Streams and rivers connect us to people we don't know and, unless we work together to ensure that water quality and quantity is well-managed, upstream decisions can quickly become major downstream problems.

One important issue raised by landowners is that the cost of protecting water quality and quantity is borne by an individual, while the benefits go to many people. This reality has resulted in the development of a market for environmental services. This market, still fairly new or even unheard of, provides an opportunity for landowners to reap financial rewards for land management decisions that protect the water quality and quantity of people living downstream.

If you are interested in learning more about the watershed you live in, go to "Surf Your Watershed" at **www.epa.gov/surf**. If you would like to find out what you can do to protect the water in your watershed, visit "Adopt Your Watershed" at **www.epa.gov/adopt**.