FACT SHEET No. 4

Rangeland Watershed Program

U.C. Cooperative Extension and U.S.D.A. Natural Resources Conservation Service

What is a Watershed?

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We can think of a watershed—using the simplest description—as the land on which water falls from the atmosphere, is stored within the soil, and over a period of time is released downslope to other locations. All land is part of a watershed.

We can also visualize each watershed as a catchment area divided from the next watershed by topographic features like ridgetops. The water that falls within a watershed or catchment, but isn't used by existing vegetation, will seek the lowest points ultimately; it should appear in the streams and rivers draining the system.

All life depends on the soil, the water falling on that soil, and the air above and within the soil. Entire societies have disappeared because they didn't properly understand and care for their soil resource.

No other resource comes close to the soil's importance. Without healthy, productive soil, plants and animals—and people—probably couldn't exist.

We don't directly manage soil for the most part. We manage the vegetation that grows in the soil. We directly manage domestic grazing animals; we indirectly manage grazing wildlife. We also alter the soil surface on forest and rangelands by building roads and by mining; both activities directly affect the water cycle. affect the water cycle.

With respect to watersheds, the water cycle refers to those processes in which water falls in either liquid or solid form and:

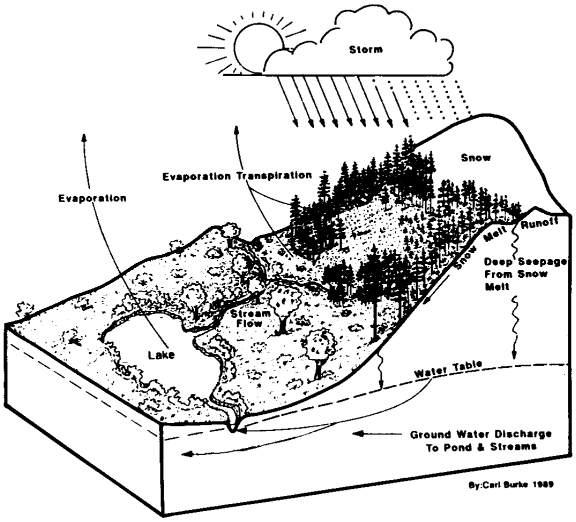
- is captured so it has an opportunity to move into the soil,
- stays and is retained in the soil, or
- moves through the soil by gravity into springs, streams, rivers, lakes, and ultimately the sea.

From that liquid form, it can then return to the atmosphere by evaporation and start the cycle again.

Watershed Functions

A watershed has three primary functions (the concept and the terms are Hugh Barrett's):

1. capturing water
2. storing water, and
3. releasing it safely.



Watershed Functions[1]

Capture

Capture means the process of water from the atmosphere getting into the soil. All moisture received from the atmosphere, whether in liquid or solid form, should have the maximum opportunity to enter the ground where it falls.

Managers of range and forest land can affect water capture by influencing how far the water infiltrates the soil surface and percolates.

Infiltration is the movement of moisture from the atmosphere into and through the soil surface. Percolation is the downward movement of water through the soil profile. Several factors affecting infiltration rate are fixed, such as soil type (primarily texture and depth), topography, and climate (probable type of weather events).

However, you can influence infiltration rates by managing vegetation. The form and pattern of vegetation for any site can be managed to give water the maximum opportunity to penetrate the surface where it falls. This minimizes the overland flow that causes erosion.

[1]Source — Watersheds: Their Importance and Functions, Oregon Watershed Improvement Coalition.

You can manage vegetation structure and the density of plant cover at or near the soil surface so almost all moisture that falls reaches and can enter the ground. Good infiltration rates are beneficially influenced by:

1. plant cover that reduces raindrop impact upon the soil surface and minimizes soil crusting,
2. plant litter and organic matter on and incorporated into the soil surface to absorb moisture and help maintain soil structure, and
3. plant cover that will trap snow at or very near the soil surface (this also will retard the rate of soil freezing to enhance water's chance to enter soil during winter months).

Some moisture is captured in the foliage of trees and shrubs. In areas of low precipitation where trees and shrubs have come to dominate a site, these plants often catch snow and even some rain so that it evaporates or sublimates (goes from solid to vapor phase directly) before it has a chance to reach the soil surface and infiltrate.

Healthy vegetative cover with its accompanying root mass can keep soil more permeable so moisture readily percolates into the soil profile for storage. Water often follows abandoned root channels as well as live roots, which may penetrate compacted soil layers or deeper horizons. Percolation also is aided by activity from burrowing animals, insects, and earthworms.

Storage of Water in Soil

Once water permeates into the soil, it's stored between soil particles in the soil profile. Management practices can significantly affect storage capacity on any particular site. However, keep in mind that the amount of moisture soil can hold depends on its depth, texture, and structure.

Beyond the field capacity, which is the amount of water a soil holds when saturated, water will either percolate deeply or run off the surface. Soil moisture is lost in three ways:

1. through plants that grow on the site,
2. through excessive water that flows through the soil profile and into subsurface flows or seeps and then released, and
3. through direct evaporation from bare soil surfaces (capillary action).

The kinds and amount of vegetation and the plant community structure can greatly affect the storage on any particular site. For example, a site can have a high amount of less desirable vegetation, noxious weeds, brush, or weedy trees that extract water from the deeper soil profile.

If you can reduce a significant amount of that vegetation, allowing more beneficial plants to succeed, the soil water formerly used by the undesirables can either be used by the more desirable plants or percolate through the soil profile.

Management or treatment practices which modify the above soil surface microclimate to reduce evaporation (slow the air movement, shade the soil, and reduce temperatures) can also conserve moisture.

Safe Release

In this process, water moves through the soil profile to seeps, springs, and ultimately into streams and rivers which are the conduits from the uplands. The amount and rate of water released depends on two factors:

1. the water already in the soils of the uplands, riparian areas, and streambanks in excess of field capacity, and
2. precipitation that exceeds the infiltration rate and flows over the soil surface (overland flow).

We make one premise that needs to be stated here. We assume it's desirable that water should be released slowly through the stream system rather than rapidly running over the land—which results in short and severe peaks in streamflow.

The form and amount of vegetation growing in the various riparian zones strongly and directly affects both the quality and, to some extent, the quantity of timing of water moving through the soil. The most severe example of rapid release of water, whether or not safely stored or captured, would be a straight or straightened channel with little resistance to water movement.

We recognize the ideal outcomes of keeping water where it falls resulting in less runoff and more even streamflow are difficulty to obtain. There are a number of circumstances or situations that interrupt the capture, storage, and safe release of water but are beyond our control.

One example is when warm rains melt snow over frozen ground. Water can't infiltrate and has no place to go but run off. However, we do feel there are many ways we can conduct management that will beneficially affect those processes.

Managing a watershed is not complicated. We need to realize it is management of every small area and understanding the three processes that lead to successes. The entire watershed must be completely cared for regardless of ownership. Each small piece of the landscape plays its part in the health of the entire watershed. All parts of watershed are equally important.

Paying attention primarily to the riparian zone, which is mostly a watershed's release mechanism, will not make up for lack of attention to any part of the associated uplands which are so important for water capture and storage.