WATERSHEDS

(from New Mexico's Forest Practices Guidelines)
Towns and cities throughout New Mexico depend on ground and surface water collected within forested watersheds for their domestic public water supply. Forest lands act as collectors and purifiers of clean water; protecting these sources is the responsibility of forest landowners, forest managers, and timber operators.

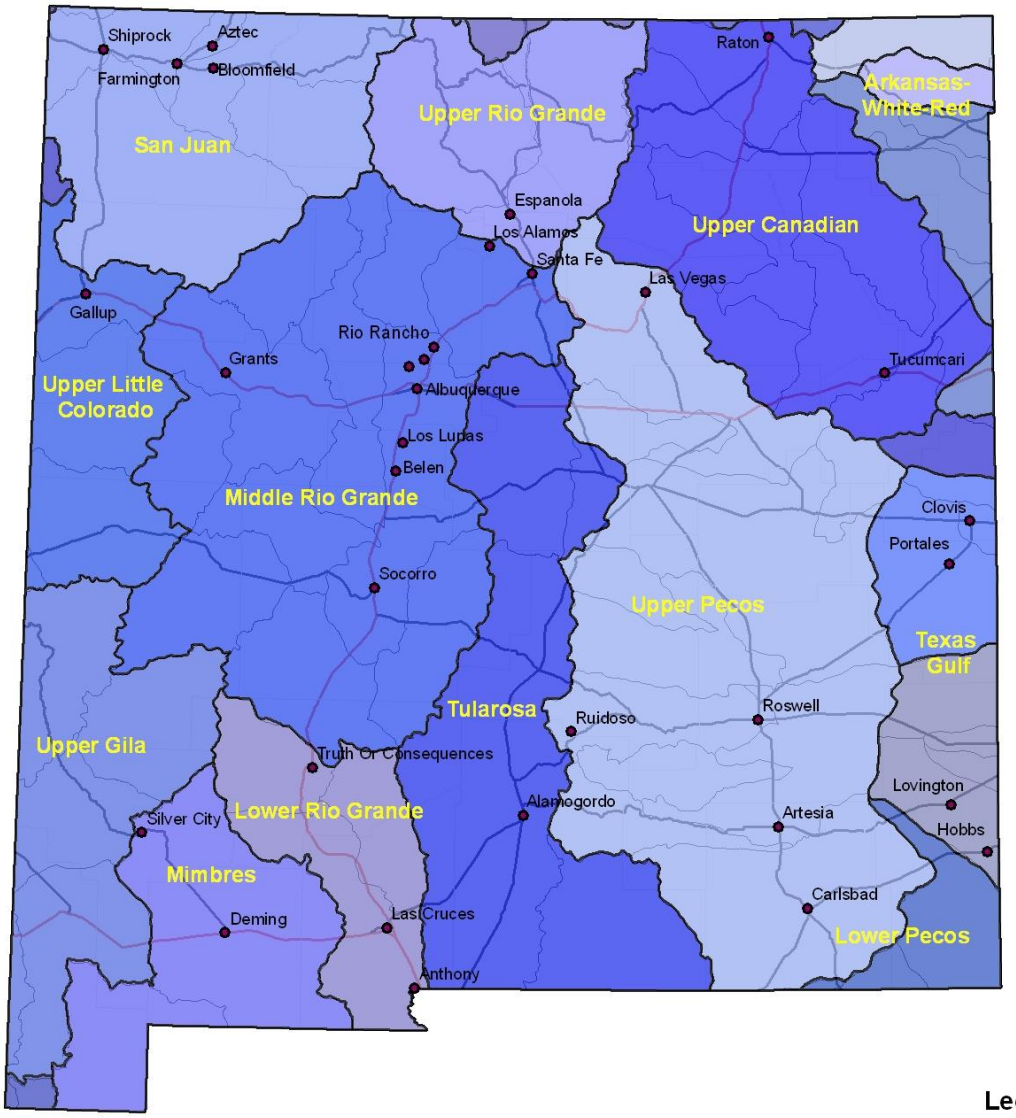
A watershed is a land area that is drained by a single stream, river or drainage network of stream channels and includes all the land within the entire drainage area. Watersheds range in size from a few acres to drainages that are thousands of square miles. For example, the Rio Grande Watershed originates in the San Juan Mountains of southern Colorado, covers 1.9 million acres in New Mexico and culminates in Texas. The state's five main watersheds are the Pecos, San Juan, Gila, Rio Grande, and Canadian, all of which can be divided into smaller sub-drainages.

What are the Parts of a Watershed?
A watershed is a network of surface streams, underground water flows, and other water bodies.
Surface streams that flow year-around are called **perennial** streams. **Intermittent** streams only flow part of a year, typically in response to snowmelt. **Interrupted** streams are those that disappear underground only to reappear downstream. **Ephemera**l streams flow only in response to precipitation. **Washes**, similar to ephemeral streams, are dry streambeds in the desert that flow only after significant rainfall, usually associated with monsoonal activity. An **arroyo** is "a watercourse that conducts an intermittent or ephemeral flow, providing primary drainage for an area of land of forty acres or larger, or a watercourse which would be expected to flow in excess of one hundred cubic feet per second as the result of a 100 year storm event" (New Mexico Drainage Ordinance). (Note: a 100 year storm event is one which has a 1 percent chance of occurring in any given year.) Any one stream or watershed includes some or all of these aforementioned components.

Other parts of the watershed collection system include:
- Surface and subsurface water source areas. Their location is not always obvious, but understanding their function is important.
- Riparian and wetland areas, including cienegas.

Another type of water delivery system that should be protected so as not to impede, pollute, or alter the flow of water, is the acequia, or water ditch system, used in agricultural irrigation to move water from streams and rivers to the fields. These could be earthen ditches, lined with cement, or even partially conveyed by pipe.

Watersheds of New Mexico



Miles
0 25 50 100 150

Legend

Counties

Highways

TYPE

Interstate

U.S.

Cities

EMNRD NEW MEXICO STATE FORESTRY

Datum: NAD83 Projection: UTM Zone 13N
No warranties are made regarding the accuracy of this data.
Produced by NM EMNRD Forestry Division, Timber Forester

New Mexico Forest and Watershed Health
A clearinghouse for forest and watershed restoration efforts throughout New Mexico

Why Protect Water Quality?

Human and animal communities depend on good quality water for their livelihoods. Damage to streams and increased sedimentation degrade water quality and aquatic habitat. Sediment is fine particles of soil, sand, and pebbles that may be carried by ephemeral, intermittent, or perennial stream channels and later deposited when the flow slows or stops, conceivably in an eddy or where a stream enters a lake or pond. Sediment-laden water is unsuitable for human consumption, recreational purposes, and many industrial applications. Downstream users of water also incur costs, including reduction in reservoir and irrigation ditch capacity and damage to irrigation pumps. Important water quality considerations in addition to sediment levels are conductivity, dissolved oxygen (DO), pH, turbidity, total suspended solids (TSS), and temperature. Poor harvesting methods can affect all of these factors, thus impacting aquatic habitat and overall water quality.

What Can Go Wrong in a Watershed?

Timber harvesting, road building, and site preparation can affect the quality and quantity of water flowing through a watershed. Wildland fires can also lead to erosion. Roads, skids trails, and landings can act as man-made stream channels carrying sediment when improperly planned, located, or constructed.

Poor timber harvesting practices can cause excessive disturbance of vegetation and topsoil, which will limit filtering capacity and affect surface water infiltration. Runoff generally increases in speed and volume as it flows down slope and when concentrated can tear away soil, destroy roads, load streams with sediment, damage stream-banks, and degrade or even destroy aquatic habitat.

BMP Minimize the number of roads constructed in a watershed through comprehensive road planning, recognizing intermingled ownership, and foreseeable future uses.

BMP Plan landings and skid trails in the proper location. Landings should be relatively flat and have undisturbed ground vegetation as a buffer to any drainage. Skid trails should be more cross slope than up/down slope, properly waterbarred and seeded when no longer in use. See the Roads section (page Error! Bookmark not defined.**) for more information on road construction and closure.**

BMP Establish soil moisture and wetland limitations for equipment operation and vehicle use.

BMP Restoration of the watershed to a level of resiliency that will reduce the potential for non-point source pollution (i.e. riparian buffers, restoration of native species).

BMP Safety equipment should be used and precautions taken to prevent starting fires during harvesting or road construction.

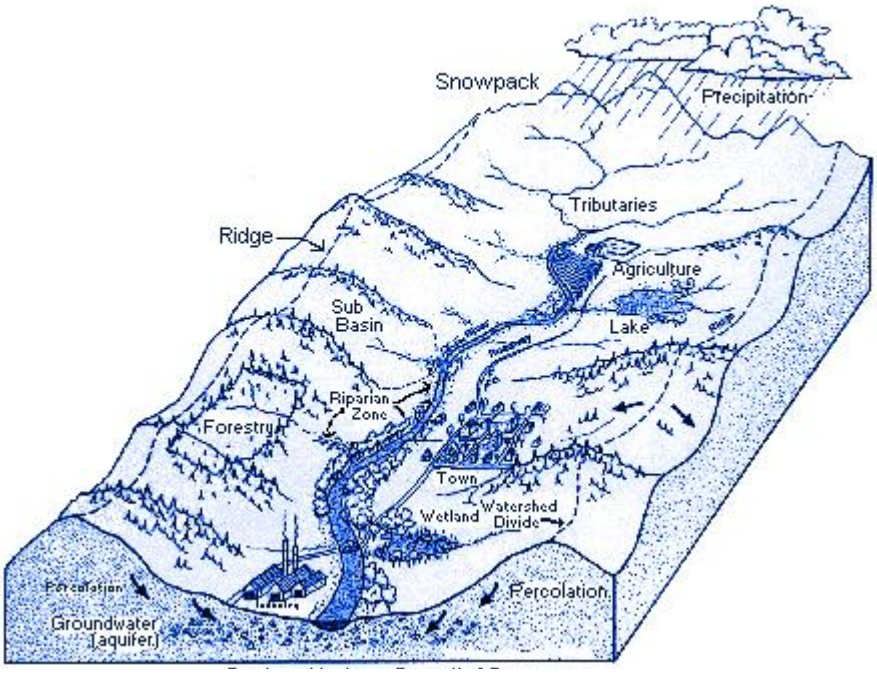


Figure 1 Watershed parts. Produced by the Lane Council of Governments, Lane County, Oregon

(from Forest Stewardship Bulletin #10, Penn State University 1997)

Forested Watersheds

Forests make excellent watersheds chiefly because their soils usually have a high infiltration capacity. They are capable of quickly absorbing large amounts of water. Therefore, rainstorms or melting snow in woodlands produce relatively little surface runoff with the associated problems of erosion (detachment and movement of soil) and sedimentation (the deposition of soil). Turbidity is the term applied to water that has reduced clarity due to suspended sediments. Turbid water looks cloudy. Generally, the water flowing through streams in stable forests has very low turbidity.

Trees contribute to the high infiltration capacity of forest soils. When tree roots remove water from soil pores, space is created for additional water to be stored. Forest soils also have a great deal of pore space. The abundance of organic matter from decaying plant parts creates a well-structured soil in which the individual soil particles tend to form aggregates (small clumps of soil stuck together). This clumping of soil particles produces large, interconnected pores between the aggregates. Water poured on the surface of such soils quickly disappears into the pores. Microorganisms, insects, small animals, and growing tree roots also contribute to soil aggregation (and consequently more pore space)

by moving and mixing soil. These actions put soil particles in contact with each other, increasing the likelihood that soil particles will clump together, resulting in large pores through which water can easily drain. The litter layer, which consists of leaves and bits of wood in various stages of decay on the forest floor, helps maintain healthy populations of soil organ-isms. By shielding the soil from the elements, the litter layer provides soil organisms with a less-hostile, more-stable environment.

Even in the winter, when forest soils may be frozen, they can maintain a high infiltration capacity. Concrete frost, a solid impermeable layer of soil and ice, rarely forms in forest soils. The litter layer insulates soil from extreme cold. Also, because the loose forest soils have high amounts of organic matter and large pores, the frost penetrating such soils is of a more porous, granular, or honeycomb nature, permitting water to percolate through.

The forest vegetation also protects the soil's infiltration capacity. Raindrops falling on exposed soil may have enough energy to break up soil aggregates. Individual soil particles are then easily eroded and washed into soil pores, clogging them and preventing rainwater absorption. When such conditions occur, water tends to flow over the soil surface, increasing the chance of erosion. But in a forest, rain is intercepted by the forest canopy, by the leaves of shrubs or small trees in the understory, and by the organic litter layer covering the forest floor, reducing the force with which rain falls on the soil. Soil pores remain unclogged, allowing infiltration.

Effects of Timber Harvesting

Cutting timber affects both water quantity and quality. Clearcutting (harvesting all trees) allows more water to flow to streams, because there are no leaves to intercept rain and snow (some of which would later evaporate) and roots no longer take water from the soil. Areas being considered for clearcutting should have a substantial ground layer of organic material to help minimize these effects. Much of the water taken into trees by their roots passes through the leaves into the atmosphere in a process called transpiration. Trees and other plants return water to the atmosphere through evapotranspiration.a combination of evaporation and transpiration. Evapotranspiration is an important process. During the growing season in a hardwood forest, as much as sixty percent of the rainfall is returned to the atmosphere through evapotranspiration.

The greatest problems do not occur as a result of the actual cutting of trees, but from moving them out of the forest, which re-quires the use of heavy equipment on a system of trails and roads. If the transportation system is not carefully designed and maintained, erosion on the watershed can be greatly in-creased, because roads account for the vast majority of sediment associated with timber harvesting.

In New Mexico, the severing of any tree stem requires compliance with the Forest Practices Guidelines. A permit issued by the Forestry Division is required if commercial species are to be harvested on more than 25 acres. Even if you are cutting less acreage, you should develop an erosion and sedimentation control plan and have it on site throughout the operation.

Protecting the Watershed

SKID TRAILS

Skidding is the process of dragging logs (usually with a rubber-tired tractor called a skidder) from the stumps to a central location, called a log landing, where they are loaded onto trucks and transported to the mill. The process can be very damaging to the soil surface. The weight of the skidder compacts the soil, reducing its infiltration capacity. Dragged logs scour the soil surface, plowing away the protective litter layer and the upper inches of soil. These gouges become channels through which water can flow at erosive velocities, carrying sediment to the streams. The following practices help minimize the damage from skidding. Keep well away from streams and never use streambeds, even dry ones, as skid trails. If streams (even seasonally dry ones) must be crossed, cross them at a right angle with temporary bridges or culverts.

LOG LANDINGS

If not properly located, log landings have the potential to get very muddy or allow large amounts of soil to wash away. Log landings create large areas of unprotected, exposed soil. Because of the skidders and trucks working there, the soil can also become extremely compacted. Therefore, it is crucial that water be kept from flowing through, or collecting in, the landing area.

ROADS

Most erosion and sedimentation problems are caused by the haul roads constructed for logging trucks to carry harvested trees from the forest. Problems can occur both during road construction and after the transportation system is in place. Road construction greatly disturbs forest soil. The protective litter layer is removed, the mineral soil below is compacted, and steep, potentially unstable cut-and-fill slopes are often created. Roadbeds increase surface runoff (by reducing infiltration) and also concentrate the runoff, creating favorable conditions for accelerated erosion.

Natural drainage patterns may be altered. Water that once flowed below the surface may be intercepted by road cuts. This formerly subsurface water now seeps from road banks. Road-stream crossing are an especially sensitive area. The presence of flowing water in a stream channel means any disturbance of the streambanks or bottom immediately sends sediment into the stream. To lessen these problems, a haul road system must be properly planned and designed. The shorter the better. Roads should be designed with grades of 2 to 10 percent. Some grade is needed to prevent water from collecting, but grades of more than 10 percent are hard on equipment and promote erosion.

Watershed Resources

Forest Practices Guidelines
http://www.emnrd.state.nm.us/FD/ForestMgt/ForestMgt.htm (at the bottom of the page is the Forest Practices Guidelines)

USDA Forest Service Watershed Forestry
http://www.fs.fed.us/spf/coop/programs/wf/index.shtml

Commercial Harvesting Requirements
http://www.emnrd.state.nm.us/FD/documents/19-20-4_NMAC_eff09142007.pdf

Forested Watersheds and Management (PA Envirothon website)
http://www.envirothonpa.org/documents/WatershedManagement.pdf

Watersheds in PA
http://www.greentreks.org/allprograms/ourwatersheds1/ourwatersheds1.asp

NRCS What is a Watershed? Publication PA-420 December 2005