WATERSHED CONSIDERATIONS IN LAND RESOURCE PLANNING

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Watershed management can be defined as the science and art of controlling the quantity, quality, and timing of streamflow from a land basin while protecting and enhancing products of the land. Consequently, there are many activities and intensities of use which have a corresponding effect upon the environment of an area.

This paper focuses primarily on the drier regions of the West and deals only with principal uses of these lands.

Rangeland watershed management can be described in terms of a water balance equation like this: $SRO = P - I - ET \pm \Delta S$ where

SRO = surface runoff
P = precipitation
I = infiltration
ET = evaporation and transpiration (evapotranspiration)
ΔS = change in soil moisture storage

Since we generally are unable to alter P, we must look to other parts of the equation to influence the amount, quality or the timing of the discharge of streamflow. Any of the several land uses which affect these variables therefore will affect SRO.

For example, infiltration generally is enhanced by dense vegetative cover, by roots which bind and provide organic matter to the soil, and by certain microbes or soil organisms which "work" the soil and make it friable. On the other hand, anything that compacts the soil, be it mechanical or flesh and bone, usually decreases infiltration. Soil temperature and moisture levels play an important ameliorating role, however. A dry soil compacts less than a wet one. A tightly frozen soil is much less subject to compaction than an unfrozen one. To enhance infiltration, consider logging or grazing the area during the winter months when the ground is frozen and avoiding it during the early spring when it is both wet and unfrozen.

Evapotranspiration reductions vary according to elevation and climate. A hot, dry climate may be subject to far more evaporative loss than it is to transpirational loss. This is especially true if the plants growing there have adapted themselves to methods of transpirational reduction. An example of such an adaptation would be the ability of sagebrush to drop its ephemeral leaves, retaining only the smaller, more water-efficient persistent leaves, during times of soil moisture stress. On the other hand, at cooler, higher elevations, the physical evaporative process may be much less important than the transpirational process.

In the first example, an attempt to "save" water by cutting or grazing vegetation would be counterproductive since it would

simply expose more soil surface to direct sunlight and increase the evaporative loss. In a wetter situation, however, the removal of certain overstory species could provide additional water for streamflow.

One generally finds that vegetation manipulation in arid and semi-arid regions does not increase streamflow, but that it may "release" available water for another purpose. For example, a juniper removal project or a sagebrush eradication program and subsequent grass planting are not likely to result in more water in the John Day River. However, it may be beneficial in increasing the herbaceous production several fold.

There is a great deal of interest and concern about water quality as it is impacted by land usage. In the arid and semi-arid West, this concern often seems to focus on livestock grazing in riparian zones. The volume of research in this area is skimpy (Meehan and Platts, 1978). From the few scientific and observational studies available, it is clear that abusive grazing can cause deterioration of streambank physiognomy, an increase in water temperatures, and an increase in bacterial and sediment load. However, what is less certain is what degree of use these areas are able to withstand and what managerial techniques are available for ameliorating these effects.

In a multi-disciplinary study funded by the Pacific Northwest Forest and Range Experiment Station, Range and Wildlife Habitat Laboratory, USFS, La Grande, Oregon, a number of grazing seasons and systems are being evaluated for these kinds of things. It is somewhat early to predict what the ultimate outcome from this study will be, but experience has convinced me that riparian zones are complex and rather resilient. I suspect that with proper grazing management, taking advantage of season of use, intensity of use, and animal behavior or preferences, it should be possible to design a prescription of grazing management for any riparian zone which will enable the manager to maintain the productivity of all the resources which emanate from this zone.

Literature Cited

Meehan, W. R., and W. S. Platts. 1978. Livestock grazing and the aquatic environment. J. Soil and Water Cons. Vol. 33:274-278.