INTERACTION BETWEEN CLIMATE, TOPOGRAPHY, VEGETATION, AND SNOWCOVER IN SEMI-ARID MOUNTAIN CATCHMENTS

Danny Marks
USDA Agricultural Research Service,
Northwest Watershed Research Center

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Abstract

Mountainous regions in the semi-arid Western US are snow-dominated with little or no summer precipitation. Wind and topographic structure control snow deposition, causing tremendous spatial heterogeneity in the distribution of the snowcover and the delivery of melt water across mountain catchments. This in turn leads to heterogeneity in vegetation cover where some areas within these catchments can sustain forest development, while others have only limited vegetation cover. Snow is scoured from exposed areas and deposited in either large drifts that develop in the lee of exposed ridges, or in forested areas that develop just below the drift zones. Forest structure alters energetics by reducing wind, increasing shading and slowing the melt process. In general in mountain catchments, forested areas catch and store more snow than open or exposed areas, shade and protect that snow from solar and sensible energy, and delay snowmelt to late spring or even early summer, providing moisture for vegetation, streamflow and further forest development. Open, exposed areas of mountain catchments catch less snow, and that snow melts earlier than in forested areas. Once a forest stand is established in a mountain catchment, the symbiotic relationship between the forest and snow deposition allows sustained forest growth. This relationship is, however, very sensitive to minor changes in climate conditions. Small changes in precipitation and temperature can alter the delivery of water to the system. To better manage forest and water resources in mountain regions, it is important to understand the coupling between forest structure, climate, and snowcover.