Caspar Creek Experimental Watersheds (CSP)

Caspar Creek is the site of long-term research on the effects of timber harvest on streamflow, water quality, sedimentation, and aquatic life in the rainfall-dominated, forested watersheds of the north coast of California. Caspar Creek Experimental Watersheds were established in 1962 as a cooperative effort between the California Department of Forestry (CDF) and the United States Forest Service Pacific Southwest Research station (PSW). Study basins include the North Fork (484 ha) and the South Fork (424 ha), each with nested sub-basins; both are within the Jackson Demonstration State Forest administered by CDF. Hydrologic data collected here include streamflow, subsurface pipeflow, piezometric pressure, soil moisture tension, suspended sediment, turbidity, bedload transport, air and water temperature, precipitation, and solar radiation. Channel data include cross-section surveys, stream habitat typing, woody debris recruitment and riparian canopy evaluations, sediment storage, and pool condition. Hillslope data include landslide inventories, road evaluations, and vegetative condition. Various cooperators have undertaken benthic investigations, aquatic vertebrate and macroinvertebrate sampling, and water chemistry monitoring.

Site characteristics. Caspar Creek is typical of the redwood-dominated areas of the north coast of California. Winters are mild and wet, while summers are moderately cool and dry. About 90% of the average annual precipitation of 1200 mm falls during the months of October through April. Summer coastal fog is common. Snow is rare and rainfall intensities are low. The soils of the basins are well-drained clay-loams, 1 to 2 m in depth, and are derived from graywacke sandstone and weathered, coarse-grained shale of the Coastal Belt Franciscan Assemblage of Cretaceous age. They have high hydraulic conductivities, and subsurface stormflow is rapid, producing saturated areas of only limited extent and duration. The second-growth mixed conifer forest includes coast redwood (*Sequoia sempervirens*), Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), and tanoak (*Lithocarpus densiflorus*); red alder (*Alnus rubra*) grows along the mainstem South Fork but not along the North Fork.

Historic legacy. Caspar basin was first logged between 1860 and the mid-1890's and the effects of the early logging on channels and valley bottoms are evident today. The area was clearcut and burned before the large logs were dragged to stream channels by oxen and steam donkeys and washed to a downstream mill during floods augmented by releases from temporary log dams. To facilitate log-driving, obstructions such as woody debris, stumps, and bedrock knobs were removed from the valley bottoms. Today's channels are still incised from these

activities, gullied in upper reaches, and relatively free of large wood.

Research focus. Basin-scale, treatment-control experiments in Caspar Creek have been used to study the effects of forest practices on watershed processes. In the first experiment, the North Fork served as the control while the South Fork was treated: roads were constructed in 1967 and approximately two-thirds of the stand volume was selectively harvested and tractor-yarded from 1971 to 1973. Erosion was monitored on hillslope plots, while runoff, suspended sediment and accumulated bed material were measured at the outlet weirs. A period of recovery was allowed in order for relations in runoff and sediment yield between the Forks to stabilize and provide calibration for the next experiment in the North Fork.

In 1986, a new experimental phase was begun in the North Fork to investigate the cumulative effects of multiple disturbances on downstream resources. Thirteen new gaging stations were added within the North Fork watershed, and three subwatersheds were left as untreated controls. From 1989 to 1991 about 37 percent of the watershed was harvested, primarily by clear-cutting with skyline cable yarding. New road construction and tractor skidding were restricted to gently-sloping ridge top locations, and watercourses were protected by leave strips and equipment exclusion zones. This study pioneered methods for automatically collecting suspended sediment samples under program control based on real-time flow and turbidity measurements. The resulting suspended sediment records may be the most temporally and spatially detailed records of suspended sediment ever collected in a long-term study. Process studies focused on how logging affects erosion, rainfall interception, soil moisture, ground water, subsurface pipe flow, gully erosion, wood recruitment, stream channel sedimentation, and aquatic habitat.

Today much of the managed timber-producing area in the Pacific northwest has been logged at least twice and may have experienced heavy impacts from tractor logging and road construction. It is becoming crucial for landowners, regulatory agencies, and the public to understand the interactions between proposed future activities and prior disturbances. A third phase of Caspar Creek research is being initiated in the South Fork, and nine new flow gaging stations have been installed to examine the effects of re-entry and restoration on runoff and sediment production from forests that have previously been tractor-logged. Much remains to be learned about restoring impacted ecosystems and mitigating impacts from future harvests.

Figure Captions

1. North Fork Caspar Creek (foreground), 15 to 17 years after portions of the watershed were clear-cut logged.

2. 2. Apparatus for near-continuous monitoring of canopy throughfall. Water collected is routed to the barrel, where it is weighed by a load cell at 5-minute intervals.