Entiat Experimental Forest Metadata Report (ENT)

Wenatchee, Washington

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Research Area Information

Entiat Experimental Forest.....ENT

Entiat Experimental Forest

Research Area Information

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Site Watershed URL

www.fs.fed.us/pnw/wenlab/entiat_exp_forest/hydrostudy

Site Map URL

www.fs.fed.us/pnw/wenlab/entiat_exp_forest/hydromap

Publications

Twenty-five manuscripts on the Entiat Experimental Forest were published after the 1970 fire. Following are abstracts of these papers. Bowles, David S.; Riley, Paul J.; Shih, George B. An Application of the Utah State University Watershed Simulation Model To The Entiat Experimental Watershed, Washington State. Utah Water Research Laboratory, College of Engineering, Utah State University, Logan, Utah. October 1975; PRWG126-1. To study the effects of a forest fire on runoff characteristics, the Utah State University Watershed Simulation Model (USUWSM) was applied to three small drainage areas in the Entiat Experimental Forest, located within the Wenatchee National Forest of central Washington. Pamplet. 1975. Operation Pheniox. Summarizes the efforts of scientists at the Forest Hydrology Laboratory in Wenatchee, Washington, after the 1970 wildfire in the Entiat Experimental Forest. Focus changed from harvest effects on water yield and temperature to effects of wildfire and salvage logging. Berndt, H. W. 1971. Early effects of forest fire on streamflow characteristics. Portland, OR: Pacific Northwest Forest and Range Experimental Station; PNW-RN-148. 9p. A comparison of streamflow records from three small mountain streams in north-central Washington before, during and after a severe forest fire showed three immediate effects of destructive burning: 1) flow rate was greatly reduced while the fire was actively burning, 2) destruction of vegetation in the riparian zone reduced diurnal oscillation of flow rates, and 3) flow rates quickly increased to points above protracted normal depletion rates but to varying degrees. No drastic immediate change in stream temperature was noted. Fowler, W. B.; Tiedemann, A. R. 1980. Phenological relationships of Spiraea betulifolia Pall. And Apocynum androsaemifolium L. Northwest Science. 54(1): 17-25. The phenology of two widespread understory species was examined at three elevations during two seasons, 1972 and 1973. Occurrence of several identified phonological phases related well to the accumulated temperature at the site but poorly to calendar date or soil moisture content. Phenological phases of transplant stock form high to low elevation and the reverse followed native plants at the site in the case of Spiraea, but were seemingly insensitive to local control in the high to low transplants of Apocynum. Fowler, W. B.; Anderson, T. D.; Helvey, J. D. 1988. Changes in water quality and climate after forest harvest in central Washing-

ton State. Portland, OR: Pacific Northwest Research Station; PNW-RP-388. 12p. Chemical output of nitrate, calcium, magnesium, sodium, potassium and organic nitrogen were determined on a grams-per-hectare-per-day basis for five treatment watersheds and a control watershed. Water samples were collected from April to October during 3 pretreatment and 3 posttreatment years (1978 to 1983). Except for increased calcium and sodium in several streams, regression equations comparing treatment with control showed no significant difference for pretreatment and posttreatment output. Output generally declined in the posttreatment years. Cyclic changes in output from these and other streams in the eastern Cascade Range in Washington appeared to occur regardless of treatment and were probably related to precipitation. Mean maximum air temperature increased during the post-treatment period in all the small watersheds, but stream temperatures were relatively unaffected. Helvey, J. D. 1972. First-year effects of wildfire on water yield and stream temperature in north-central Washington. Proceedings, National Symposium on Watersheds in Transition. American Water Resources Association: 308-312 Flow was measured from three forested watersheds, each containing about 2 square miles of drainage area, for 9 years before a severe wildfire destroyed the vegetation. Flow records from two larger streams were used as control data for determining 1st-year effects of the fire on water yield and stream temperature. Water yield increases, which ranged from 2.7 to 4.1 inches and averaged 3.5 inches, apparently came during snowmelt and during the summer months. During late summer when streams were exposed to direct insolation, maximum daily stream temperature was increased by as much as 10° F. No temperature changes were detected during the winter when stream channels were covered with snow. Helvey, J. D. 1974. Watershed behavior after forest fire in Washington. Proceedings of the Irrigation and Drainage Division Specialty Conference; Fort Collins, CO. American Society of Civil Engineers: 403-422. Fire burns many acres of valuable forested land in the West almost every year. One of the worst years on record was 1970, when more than 120,000 acres (485.6 km^2) in north-central Washington alone were burned over. Included in this area was the Entiat Experimental Forest, where hydrologic measurements began in 1959. Although the fire on the experimental area caused considerable loss to planned research, it has provided a unique opportunity to evaluate some effects of deforestation on the water resource and other watershed values. The effects of the fire on water yield and on stream temperatures during the first post-fire year have been reportes. The objectives of this paper are to review the first year results, to add recent findings on water yields, and to present information on soil movement and channel cutting since the fire. Helvey, J. D.; Tiedemann, A. R.; Fowler, W. B. 1976. Some climatic and hydrologic effects wildfire in Washington State. Proceedings, Annual Tall Timbers Fire Ecology Conference No. 15; Portland, OR. Tallahassee, FL: Tall Timbers Research Station: 201-222. Before the fire on the Entiat Experimental Forest in August 1970, one main objective of research on the Forest was to document changes in quantity, quality and timing of runoff after timber harvest. The present objective is to determine changes in these hydrologic values after wildfire. Instead of planned reduction of vegetation by logging, which was to involve no more than one-third of each watershed at one time, practically all the vegetation of the three watershed on the Forest was destroyed within a few hours. For the first time in the Northwest, detailed hydrologic data were available

from an area undisturbed by man and probably not burned by wildfire in the past 200 years. In this paper, we compare pre-fire and post-fire data to determine changes in annual yield, chemistry and temperature of water. In addition, some information is presented on air and soil temperature changes. Another symposium paper by Tiedemann and Klock gives a detailed description of the watersheds and fire. Helvey, J. D.; Fowler, W. B.; Klock, G. O.; Tiedemann, A. R. 1976. Climate and hydrology of the Entiat Experimental Forest watersheds under virgin forest cover. Portland, OR: Pacific Northwest Forest and Range Experimental Station; PNW-GTR-42. 18 p. Climatic and hydrologic measurements were made on three watersheds, each containing approximately 2 square miles (5.18 km^2) in drainage area, for 9 years under natural forested conditions. This paper describes the watersheds with respect to soils and geology, morphology, vegetation, precipitation and other climatic parameters and flow, sediment, temperature and chemistry of streams during this period. Helvey, J. D. 1980. Effects of a north-central Washington wildfire on runoff and sediment production. Water Resources Bulletin. 16(4): 627-634 Runoff was measured from a 564-ha catchment located on the Entiat Experimental Forest for years before a severe wildfire in 1970 destroyed the mixed conifer vegetation. Runoff records form the Chelan River (2,393km^2) were used as control data for determining changes in water yield during the seven years following the fire. The first post-fire year was a period of transition in whi

USGS Harvest URL

http://gce-lter.marsci.uga.edu/harvest/usgs/ent_lter.txt

Meteorlogical Stations

Weir Gauge #18.....18
Weir Gauge #2.....2
Weir Gauge #7.....7
Weir Gauge #8.....8

Weir Gauge #18

Meteorological Station

Elevation (meters; a.m.s.l.) 1280
Begin Date..... 18/SEPT/1973
End Date..... 02/DEC/1977

Weir Gauge #2

Meteorological Station

Elevation (meters; a.m.s.l.) 1341
Begin Date..... October 1960
End Date..... Aug 1976

Precipitation

Begin Date..... October 1960
End Date..... Aug 1976
Summary Interval ..... Monthly
Instrumentation Description
Unknown
Methods Description
Field collection, data aggregation, and quality assurance methods
Sensor History
Unknown
Calibration History
Unknown

Weir Gauge #7

Meteorological Station

Elevation (meters; a.m.s.l.) 914
Begin Date..... 01/OCT/1960
End Date..... 30/SEPT/1975

Precipitation

Begin Date..... 01/OCT/1960
End Date..... 30/SEPT/1975
Data Logger Sampling Interval..... Daily
Summary Interval .....Daily

Sensor History

: Until 1972, the only precipitation site was near the Burns creek weir at 914 meters elevation. Monthly totals were read from October 1960 until October 1, 1962 when daily records began. A recording gage was maintained at this site until 1979, but the records have many gaps caused by clock stoppage. The records end September 30, 1972 at the Burns weir and Gage #18 at 1280 meters elevation was used for the records until December 2, 1977 but were read as monthly totals. After 1972, storage gages were installed at several locations. Gages at the upper elevations (about 7000 feet) were serviced only once each year, but a more frequent schedule was used for those at lower elevations. Data from each site are recorded for the dates between observations. Data from a recording gage at Pope Ridge is recorded here also. Monthly precipitation from the watersheds, Pope Ridge, Lake Wenatchee, Leavenworth, and Stehekin are included to indicate regional precipitation amounts and the variation from year to year. A total of 12 storage gages and 4 recording gages were maintained at various sites throughout the experimental forest. Four of these gages were snow storage at high elevation and twelve were rain and snow gages. The gages are identified by number. A brief description follows of their locations. These gages are also identified on the site topographic map. #1: At 2134 m on ridge between McCree and Brennegan watersheds on Fourmile Ridge. #2: At 1341 m ridge between McCree and Brennegan watersheds. #3: At 1524 m on McCree Creek near headwaters. #4: At 1554 m on ridge between McCree and Burns watersheds. #5: At 1036 m above McCree channel by road 5501. #6: At 1219 m on ridge between McCree and Burns watersheds. #7: At 914 m at Burns weir. #8: At 1402 m at Fox weir. #9: At 1067 m on McCree Creek just below forks. #10: 1311 m on Burns Creek above spur road 610. #11: At 1189 m on ridge bounding the west edge of Burns watershed. #14: At 2134 m on Fourmile Ridge between Fox and Burns watershed. #15: At 2134 m at headwaters of Fox watershed. #16: At 2134 m at north edge of Fox watershed. #17: At 1829 m in Lake Creek basin, north-northwest of Fox Creek. #18: At 1280 m on ridge between Fox and Burns watershed.

Calibration History

Not available at this time.

Weir Gauge #8

Meteorological Station

Elevation (meters; a.m.s.l.) 640
Begin Date..... 5-OCT-1970
End Date..... 11-MAY-1972

Precipitation

Begin Date..... 5-OCT-1970
End Date..... 11-MAY-1972
Summary Interval .....Daily

Watershed

Burns Watershed ..... Burns
Fox Watershed ..... Fox
McCree Watershed ..... McCree

Burns Watershed

Watershed Spatial Characteristics

Area (hectares) 564

Aspect (degrees azmuth) 205

Maximum watershed elevation (meters; a.m.s.l) 2155

Watershed Ecological Characteristics

Mean annual radiation (Megajoules per square meter per day) .. The annual radiation index is 50.7%. Computed by the methods of Lee (1963; Riley et al., 1966) and defined by him as “the ratio between the daily total of potential insolation on that surface to the total of potential insolation which would be received on a surface that is constantly normal to the sun’s rays during the possible daylight hours.”

Slope (Percent) 50

Channel length (meters) 4938

Channel length description

perennial

Drainage density (km/km2) 1.29

Mean snowpack description

70% of the average annual precipitation falls as snow.

Watershed Descriptions

Pre-treatment vegetation

Between 550-920m elevation the overstory consisted of ponderosa pine (Pinus ponderosa Dougl.) and the understory consisted of bitterbrush (Purshia and Ridentata) and bluebunch wheatgrass (Agropyron spicatum). Between 920 -1675m elevation the overstory consisted of Douglas-fir (Pseudotsuga mensiesii) and the understory consisted primarily of snowbrush ceanothus (Ceanothus velutinus), willow (salix spp.), Oregon boxwood (Pachistima mysinites) and pinegrass (Calamagrostis rubescens). Dense thickets of lodgepole pine (Pinus contorta Dougl.) were common. Above 1700m, whitebark pine (Pinus albicaulis Engelm.) was a common stand component. Redcedar (Thuja picata Donn) was frequently encountered along streams (J. D. Helvey; W. B. Fowler; G. O. Klock; A. R. Tiedemann. 1976). Climate and Hydrology of the Entiat Experimental Forest Watersheds Under Virgin Forest Cover. USDA Forest Service General Technical Report PNW-42).

Pre-treatment description

Pre-fire vegetation described by Klock (1970): Vegetation destroyed by the fire was

almost entirely virgin forest. Ponderosa pine (Pinus ponderosa Laws.) was the main species with Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) as the main associated species. Stocking densities ranged from medium to poor. Common understory species were snowbrush ceanothus (Ceanothus velutinus Dougl.) bitterbrush (Purshia tridentate (Pursh) DC.), grouse whortleberry (Vaccinium scoparium Leib.) and pinegrass (Calamagrostis rubescens Buckl.).

Soil description

Choral soils occupy 55%, rampart 30% and rockland and rockland outcrops 15% of the watershed area (Iritani and Meyer, 1967). Soils grade from a fine sandy loam to coarse sandy loam to a depth of 0.6096 meters and are then underlain by pure pumice to bedrock. In choral soils bedrock lays 2.438-4.572 meters and in rampart soils 1.829-2.438 meters below the surface.

Geology description

: Klock (1971). Baserock in the watershed is an extensive formation known as the Chelan batholith, a Mesozoic intrusive granodiorite with biotite and hornblende as accessory minerals. A medium coarse-grained massive rock, the gray granodiorite weathers deeply where exposed. Since glaciation, the area has been periodically covered by volcanic ash and pumice, mostly originating from Glacier Peak (Fryxell, 1965) approximately 33 km west/northwest of the study area.

Treatment History

Burns Creek along with Fox and McCree Creeks were all virgin watersheds until 1970 when a stand replacing wildfire burned through all three watersheds. Burns Creek watershed experienced 95% intense, 3% medium and 2% light burn. Rehabilitation treatments were as follows: Fox - No treatment, watershed was left as roadless, pristine control. Burns - Seeded with a grass mixture and fertilized with 250lb/acre ammonium sulfate. McCree - Seeded with a grass mixture and fertilized with 105lb/acre urea. Other rehabilitation work included extensive channel clearing below the gaging stations on the lower end of Burns and McCree and some sediment dams and trash racks installed. A main haul road at the 1,066m elevation across McCree and Burns and a road at the 1,372m elevation across McCree were constructed during the summer of 1971. A total of 4.5 miles of system road and 2.1 miles of temporary road were constructed in the Burns watershed. Logging was initiated on these two watersheds in late fall of 1971. Logging systems used were helicopter, tractor over a snowpack, and jammer from main haul roads over a snow pack. Some tractor logging occurred on bare slopes under 30% and on slopes up to 40% over snow. On March 17, 1972 unseasonably warm weather hastened snowmelt from a record high snowpack initiating a number of mass soil movements in both burned and unburned and roaded and roadless watersheds mostly below the 1,067 meter elevation. McCree Creek experienced a debris torrent that scoured the channel to a depth of 4.57 meters and destroyed the gaging station. During some unknown period in the spring of 1972, snow avalanches occurred on both Burns and Fox. The avalanche on Burns was minor but the one on Fox moved considerable fallen timber and debris into the stream channel. The extent of the damage was not discovered until May 1972. About mid-day on June 9, 1972 a high intensity convective storm struck the upper reaches of Fox Creek depositing 33.53mm of rain in 2 hours at the 1,996 meter elevation between Fox and Burns triggering a channel

scour event on Fox Creek that deposited a couple of thousand cubic meters of debris including large logs on the alluvial fan at the mouth of Fox Creek. The Fox gaging station and the raingage located 15.24 meters above the channel near the gaging station were destroyed. On June 10, 1972 another high intensity convective storm occurred and was centered over the headwaters of Burns, McCree and Fox Creeks at the 2,134m elevation. In McCree the channel was previously scoured during the March 1972 event yet the event in June transported logs and debris that collected and filled behind the 1524m high road fill at the lower road crossing. In Burns the instruments were removed from the gaging station the evening before the storm in anticipation of a possible intense storm. The gaging station escaped serious damage and only minor sediment movement occurred in the Burns watershed. Fox Creek, a pristine watershed experienced high runoff volumes, further channel scouring and deposition on the alluvial fan and in the Entiat River. (Klock, Glen O.; Boyer, Donald E. A Hydrologic Survey of the Entiat Flood Disaster, June 9-10, 1972. Pacific Northwest Forest and Range Experimental Station).

Succession description

No data available.

Comparison description

The control watershed weir, Fox, is located 3.22 km west of the Burns weir. Fox, a pristine roadless watershed, experienced severe channel scouring as a result of the 1972 events. Serious erosion was minimal in Burns and McCree in areas logged by helicopter and tractor over snow. Fire rehabilitation after the 1970 fires appeared to be very effective in reducing erosion.

Fox Watershed

Watershed Spatial Characteristics

Area (hectares) 473

Aspect (degrees azmuth) 237

Maximum watershed elevation (meters; a.m.s.l) 2164

Watershed Ecological Characteristics

Mean annual radiation (Megajoules per square meter per day) .. The annual radiation index is 50.7%. Computed by the methods of Lee (1963; Riley et al., 1966) and defined by him as “the ratio between the daily total of potential insolation on that surface to the total of potential insolation which would be received on a surface that is constantly normal to the sun’s rays during the possible daylight hours.”

Slope (Percent) 50

Channel length (meters) 6340

Channel length description

5,182 perennial, 1,158 intermittent

Drainage density (km/km2) 1.30

Mean snowpack description

70% of the average annual precipitation falls as snow.

Watershed Descriptions

Pre-treatment vegetation

Between 550-920m elevation the overstory consisted of ponderosa pine (Pinus ponderosa Dougl.) and the understory consisted of bitterbrush (Purshia and Ridentata) and bluebunch wheatgrass (Agropyron spicatum). Between 920 -1,675meter elevation the overstory consisted of Douglas-fir (Pseudotsuga mensiesii) and the understory consisted primarily of snowbrush ceanothus (Ceanothus velutinus), willow (salix spp.), Oregon boxwood (Pachistima mysinites) and pinegrass (Calamagrostis rubescens). Dense thickets of lodgepole pine (Pinus contorta Dougl.) were common. Above 1700m, whitebark pine (Pinus albicaulis Engelm.) was a common stand component. Redcedar (Thuja picata Donn) was frequently encountered along streams (J. D. Helvey; W. B. Fowler; G. O. Klock; A. R. Tiedemann. 1976). Climate and Hydrology of the Entiat Experimental Forest Watersheds Under Virgin Forest Cover. USDA Forest Service General Technical Report PNW-42).

Pre-treatment description

Pre-fire vegetation described by Klock (1970): Vegetation destroyed by the fire was almost entirely virgin forest. Ponderosa pine (Pinus ponderosa Laws.) was the main species with Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) as the main associated species. Stocking densities ranged from medium to poor. Common understory species were snowbrush ceanothus (Ceanothus velutinus Dougl.) bitterbrush (Purshia tridentate (Pursh) DC.), grouse whortleberry (Vaccinium scoparium Leib.) and pinegrass (Calamagrostis rubescens Buckl.).

Soil description

Choral soils occupy 55%, rampart 30% and rockland and rockland outcrops 15% of the watershed area (Iritani and Meyer, 1967). Soils grade from a fine sandy loam to coarse sandy loam to a depth of two feet and are then underlain by pure pumice to bedrock. In choral soils bedrock lays 8-15 feet and in rampart soils 6-8 feet below the surface.

Geology description

: Klock (1971). Baserock in the watershed is an extensive formation known as the Chelan batholith, a Mesozoic intrusive granodiorite with biotite and hornblende as accessory minerals. A medium coarse-grained massive rock, the gray granodiorite weathers deeply where exposed. Since glaciation, the area has been periodically covered by volcanic ash and pumice, mostly originating from Glacier Peak (Fryxell, 1965) approximately 33 km west/northwest of the study area.

Treatment History

Fox along with Burns and McCree were all virgin watersheds until 1970 when a stand replacing wildfire burned through all three watersheds. Following the fire, Burns and McCree watersheds received various treatments that included grass seeding and fertilization. Fox received no treatment and was left as a roadless, pristine control. On March 17, 1972 unseasonably warm weather hastened snowmelt from a record high snowpack initiating a number of mass soil movements in both burned and unburned and roaded and roadless watersheds mostly below the 1,067m elevation. McCree Creek experienced a debris torrent that scoured the channel to a depth of 4.57 meters and destroyed the gaging station. During some unknown period in the spring of 1972, snow avalanches occurred on both Burns and Fox. The avalanche on Burns was minor but the one on Fox moved considerable fallen timber and debris into the stream channel. The extent of the damage was not discovered until May 1972. About mid-day on June 9, 1972 a high intensity convective storm struck the upper reaches of Fox Creek depositing 33.53mm of rain in 2 hours at the 1,996 meter elevation between Fox and Burns triggering a channel scour event on Fox Creek that deposited a couple of thousand cubic meters of debris including large logs on the alluvial fan at the mouth of Fox Creek. The Fox gaging station and the raingage located 15.24 meters above the channel near the gaging station were destroyed. On June 10, 1972 another high intensity convective storm occurred and was centered over the headwaters of Burns, McCree and Fox Creeks at the 2,134meter elevation. In McCree, the channel was previously scoured during the March 1972 event yet the event in June transported logs and debris which collected and filled behind the 15.24 meter high road fill at the lower road crossing. In Burns the instruments were removed from the gaging station the evening before the storm in anticipation of a possible intense storm. The gaging station escaped serious damage and only minor sediment movement occurred in the Burns watershed. Fox Creek, a pristine watershed experienced high runoff volumes, further channel scouring and deposition on the alluvial fan and in the Entiat River. (Klock, Glen O.; Boyer, Donald E. A Hydrologic Survey of the Entiat Flood Disaster, June 9-10, 1972. Pacific Northwest Forest and Range Experimental Station).

Succession description

Relationship with control watershed (e.g., similarities, dissimilarities, physical distance between control and experimental weirs and met stations, any disturbance that occurred in “control” watershed: The control watershed weir, Fox, is located 3.22 km west of the Burns weir. Fox, a pristine roadless watershed, experienced severe channel scouring as a result of the 1972 events. Serious erosion was minimal in Burns and McCree in areas logged by helicopter and tractor over snow. Fire rehabilitation after the 1970 fires appeared to be very effective in reducing erosion.

McCree Watershed

Watershed Spatial Characteristics

Area (hectares) 514

Aspect (degrees azmuth) 210

Maximum watershed elevation (meters; a.m.s.l) 2149

Watershed Ecological Characteristics

Mean annual radiation (Megajoules per square meter per day) .. The annual radiation index is 50.7%. Computed by the methods of Lee (1963; Riley et al., 1966) and defined by him as “the ratio between the daily total of potential insolation on that surface to the total of potential insolation which would be received on a surface that is constantly normal to the sun’s rays during the possible daylight hours.”

Slope (Percent) 50

Channel length (meters) 6126

Channel length description

perennial

Drainage density (km/km2) 1.63

Mean snowpack description

70% of the average annual precipitation falls as snow.

Watershed Descriptions

Pre-treatment vegetation

Between 550-920m elevation the overstory consisted of ponderosa pine (Pinus ponderosa Dougl.) and the understory consisted of bitterbrush (Purshia and Ridentata) and bluebunch wheatgrass (Agropyron spicatum). Between 920-1,675 meter elevation the overstory consisted of Douglas-fir (Pseudotsuga mensiesii) and the understory consisted primarily of snowbrush ceanothus (Ceanothus velutinus), willow (salix spp.), Oregon boxwood (Pachistima mysinites) and pinegrass (Calamagrostis rubescens). Dense thickets of lodgepole pine (Pinus contorta Dougl.) were common. Above 1700 meters whitebark pine (Pinus albicaulis Engelm.) was a common stand component. Redcedar (Thuja picata Donn) was frequently encountered along streams. (J. D. Helvey; W. B. Fowler; G. O. Klock; A. R. Tiedemann. 1976). Climate and Hydrology of the Entiat Experimental Forest Watersheds Under Virgin Forest Cover. USDA Forest Service General Technical Report PNW-42).

Pre-treatment description

): Pre-fire vegetation described by Klock (1970): Vegetation destroyed by the fire was almost entirely virgin forest. Ponderosa pine (Pinus ponderosa Laws.) was the main species with Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) as the main associated species. Stocking densities ranged from medium to poor. Common understory species were snowbrush ceanothus (Ceanothus velutinus Dougl.) bitterbrush (Purshia tridentate (Pursh) DC.), grouse whortleberry (Vaccinium scoparium Leib.) and pinegrass (Calamagrostis rubescens Buckl.).

Soil description

Choral soils occupy 55%, rampart 30% and rockland and rockland outcrops 15% of

the watershed area (Iritani and Meyer, 1967). Soils grade from a fine sandy loam to coarse sandy loam to a depth of two feet and are then underlain by pure pumice to bedrock. In choral soils bedrock lays 8-15 feet and in rampart soils 6-8 feet below the surface.

Geology description

: Klock (1971) The baserock in the watershed is an extensive formation known as the Chelan batholith, a Mesozoic intrusive granodiorite with biotite and hornblende as accessory minerals. A medium coarse-grained massive rock, the gray granodiorite weathers deeply where exposed. Since glaciation, the area has been periodically covered by volcanic ash and pumice, mostly originating from Glacier Peak (Fryxell, 1965) approximately 33 km west/northwest of the study area.

Treatment History

): McCree along with Fox and Burns were all virgin watersheds until 1970 when a stand replacing wildfire burned through all three watersheds. Rehabilitation treatments were as follows: Fox - No treatment, watershed was left as roadless, pristine control. Burns - Seeded with a grass mixture and fertilized with 250lb/acre ammonium sulfate. McCree - Seeded with a grass mixture and fertilized with 105lb/acre urea. Other rehabilitation work included extensive channel clearing below the gaging stations on the lower end of Burns and McCree and some sediment dams and trash racks installed. A main haul road at the 1,066m elevation across McCree and Burns and a road at the 1,372m elevation across McCree were constructed during the summer of 1971. Logging was initiated on these two watersheds in late fall of 1971. Logging systems used were helicopter, tractor over a snowpack, and jammer from main haul roads over a snow pack. Some tractor logging occurred on bare slopes under 30% slope and on slopes up to 40% over snow. On March 17, 1972 unseasonably warm weather hastened snowmelt from a record high snowpack initiating a number of mass soil movements in both burned and unburned and roaded and roadless watersheds mostly below the 1,067 meter elevation. McCree Creek experienced a debris torrent that scoured the channel to a depth of 4.57 meters and destroyed the gaging station. During some unknown period in the spring of 1972, snow avalanches occurred on both Burns and Fox. The avalanche on Burns was minor but the one on Fox moved considerable fallen timber and debris into the stream channel. The extent of the damage was not discovered until May 1972. About mid-day on June 9, 1972 a high intensity convective storm struck the upper reaches of Fox Creek depositing 33.53mm of rain in 2 hours at the 1,996 meter elevation between Fox and Burns triggering a channel scour event on Fox Creek that deposited a couple of thousand cubic meters of debris including large logs on the alluvial fan at the mouth of Fox Creek. The Fox gaging station and the raingage located 15.24 meters above the channel near the gaging station were destroyed. On June 10, 1972 another high intensity convective storm occurred and was centered over the headwaters of Burns, McCree and Fox Creeks at the 2,134m elevation. In McCree the channel was previously scoured during the March 1972 event yet the event in June transported logs and debris that collected and filled behind the 1,524m high road fill at the lower road crossing. In Burns the instruments were removed from the gaging station the evening before the storm in anticipation of a possible intense storm. The gaging station escaped serious dam-

age and only minor sediment movement occurred in the Burns watershed. (Klock, Glen O.; Boyer, Donald E. A Hydrologic Survey of the Entiat Flood Disaster, June 9-10, 1972. Pacific Northwest Forest and Range Experimental Station).

Comparison description

Fox, a pristine roadless watershed used as the control, experienced severe channel scouring as a result of the 1972 events. Serious erosion was minimal in Burns and McCree in areas logged by helicopter and tractor over snow. Fire rehabilitation after the 1970 fires appeared to be very effective in reducing erosion.

Gauging Stations

Burns ..... Burns
Fox ..... Fox
McCree ..... McCree

Burns

Hydrologic Gauging Station

Elevation (meters; a.m.s.l.) 833.9
Begin Date..... 23-OCT-1959
End Date..... 30-SEPT-1977
Associated meteorological station

Gage #7 and Gage #18.

Stream Discharge

Data Logger Sampling Interval..... 15 minute
Summary Interval .....Daily
Data Accuracy (liters per second) .....Good

Fox

Hydrologic Gauging Station

Elevation (meters; a.m.s.l.) 621.8
Begin Date..... 25-OCT-1961
End Date..... 30-SEPT-1975
Associated meteorological station

A hygrothermograph was maintained in a standard Weather Bureau shelter near the Fox Creek weir. The clock stopped running for varying periods of time throughout the time of operation. When the instrument was operating, daily maximum and minimum temperature and humidity were read from the strip charts. The records show the annual cycles of air temperature and humidity at the lower elevations of the experimental watersheds. A Fisher-Porter recorder was used to measure water temperature at each weir site. The sensor was placed in the weir pond and temperature was recorded hourly. The records are summarized here as daily maximums and minimums. There is no record for Fox Creek after the weir was destroyed because the recorder was lost and not replaced.

History

Beginning in 1972, the combination of minimal vegetative cover and unusual precipitation amounts caused large increases in sediment production, and weir ponds

filled within a few hours. Huge debris torrents on Fox and McCree watersheds destroyed gauging stations on those streams. Burns weir survived, and with frequent cleaning and a temporary H-Flume downstream, the records were uninterrupted. Attempts to maintain continuous records on Fox and McCree watersheds were only partly successful. During the summer and autumn of 1972, a Parshall flume was placed in each stream at the original weir sites. Because of extremely high sediment production, records were not complete. In order to develop hydrographs for Fox and McCree watersheds during 1973, 1974 and 1975, flow was estimated from measured flow on Burns Creek for days when records were not available. Record quality, based on criteria used by the U. S. Geological Survey, is excellent until 1972 when sediment production increased dramatically. Records for Burns Creek are good for the period 1972 -1977 and they are fair to poor for Fox and McCree Creeks when segments of the hydrographs had to be estimated.

Weir Description

Records were collected at each watershed (Fox, Burns and McCree) with a sharp crested 120 degree V-notched weir. Water level was recorded by Fisher-Porter analog to digital instruments. Recorded stage values were converted to flow rates by computer using the standard rating formula for 120 degree weirs.

Stream Discharge

Data Logger Sampling Interval..... 15 minute

Summary Interval .....Daily

McCree

Hydrologic Gauging Station

Elevation (meters; a.m.s.l.) 643.1

Begin Date..... 01-NOV-1961

End Date..... 30-SEPT-1975

Associated meteorological station

Gage #2

History

Beginning in 1972, the combination of minimal vegetative cover and unusual precipitation amounts caused large increases in sediment production, and weir ponds filled within a few hours. Huge debris torrents on Fox and McCree watersheds destroyed gauging stations on those streams. Burns weir survived, and with frequent cleaning and a temporary H-Flume downstream, the records were uninterrupted. Attempts to maintain continuous records on Fox and McCree watersheds were only partly successful. During the summer and autumn of 1972, a Parshall flume was

placed in each stream at the original weir sites. Because of extremely high sediment production, records were not complete. In order to develop hydrographs for Fox and McCree watersheds during 1973, 1974 and 1975, flow was estimated from measured flow on Burns Creek for days when records were not available. Record quality, based on criteria used by the U. S. Geological Survey, is excellent until 1972 when sediment production increased dramatically. Records for Burns Creek are good for the period 1972 -1977 and they are fair to poor for Fox and McCree Creeks when segments of the hydrographs had to be estimated.

Stream Discharge

Data Logger Sampling Interval..... 15 minute

Summary Interval .....Daily