California FORESTRY Note

State of California
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NO. 96 JUNE 1985

CASPAR CREEK WATERSHED STUDY - **NORTH FORK PHASE**

JACKSON DEMONSTRATION STATE FOREST
STATUS AND PLANS 1983-1990

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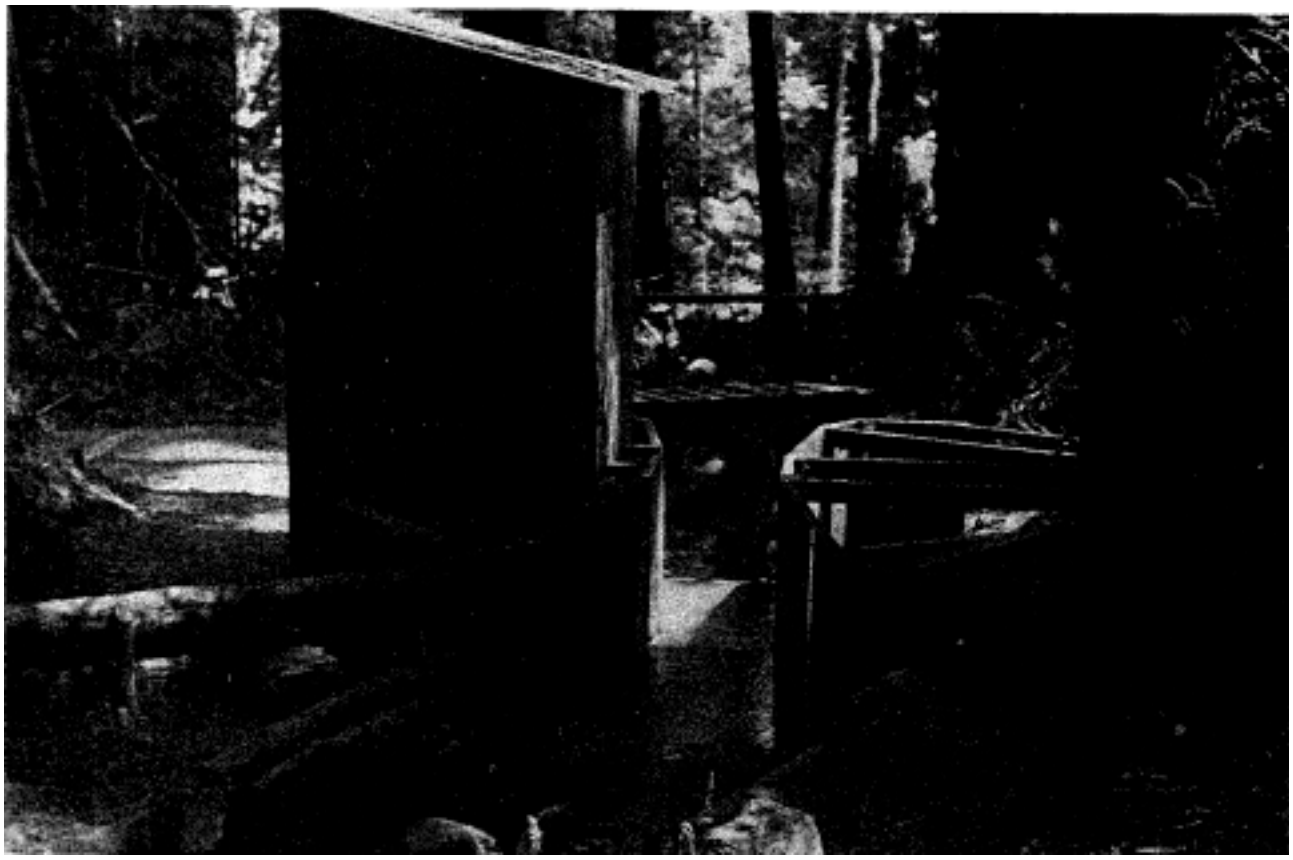

Figure 1. Parshall flume in the I watershed of the North Fork of Caspar Creek used to gauge stream and sediment discharge.

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ABSTRACT - The California Department of Forestry and U.S. Forest Service, Pacific Southwest Forest and Range Experiment Station have been conducting a paired watershed study on Jackson Demonstration State Forest for 24 years. The South Fork watershed phase of the study involved monitoring the impacts of road construction (1967) and selective tractor logging (1971-1973) on water and sediment discharge. The present North Fork phase of the study uses an extensive network of flumes with pumping samplers to monitor the impacts of clearcutting a portion of the North Fork utilizing upper slope road construction and cable yarding techniques. Principle objectives are to identify sediment sources through the watershed and evaluate the magnitude and movement of sediment. "Cumulative" effects of logging will be a specific concept tested as clearcutting progresses from the headwaters to the weir.

South Fork Phase-History/Objectives

Caspar Creek, a part of the California Department of Forestry's Jackson Demonstration State Forest has been the site of an ongoing paired watershed study since 1962. The project is a cooperative study between the California Department of Forestry and the U.S. Forest Service, Pacific Southwest Forest and Range Experiment Station. Humboldt State University and the California Department of Fish and Game have also been involved in the past.

Two similar watersheds, the North and South Forks of Caspar Creek (1195 and 1047 acres respectively) comprise the study area. Both drainages were clearcut and burned in the late 1800's resulting in well stocked stands of young growth redwood, Douglas-fir, grand fir, western hemlock and bishop pine.

In 1962, a rectangular weir with a 120 degree v-notch was constructed at each fork. Continuous hydrologic data including streamflow, precipitation, suspended sediment and bedload measurements have been collected to the present time.

The North Fork watershed was chosen as a control because of its younger stand age. The two forks were then calibrated over a five year period. The calibration process is necessary in a paired

watershed experiment to develop a predictive relationship between the control and treated watersheds thereby allowing treatment effects to be assessed. In 1967, main and spur haul roads were constructed in the South Fork and the watershed was selectively logged using tractor yarding during the period 1971-73. Road construction was followed by a four year monitoring period to evaluate the impacts of the treatment. Logging effects were monitored for five years beginning in the fall of 1971.

The objective of the South Fork study was to assess the impacts caused by the management practices on streamflow, sedimentation and erosion. These management practices were those common to northwestern California and as allowed by the forest practice regulations in effect at that time.

For additional background information and results of the South Fork study phase through 1976, refer to (Krammes and Burns, 1973), (Tilley and Rice, 1977), (Rice, Tilley, and Datzman, 1979), and (Ziemer, 1980).

North Fork Phase-Objectives/Study Plan

In this phase of the study, the above variables will be monitored again. The study will also emphasize research into sediment transport mechanisms from source areas through the watershed channel network. Understanding these basic processes may allow modeling of watershed responses to various management practices at some future date.

Specific objectives are:

1) to contrast logging conducted under the current forest practice regulations with logging conducted under the regulations in use prior to the Z'berg-Nejedly Forest Practice Act of 1973.

2) to estimate the erosion and sediment impact of the harvest in the North Fork.

3) to evaluate "cumulative" effects of logging from headwaters to weir.

4) to evaluate the attenuation of sediment "pulses" downstream (sites J-K and D-E are to be used primarily).

5) to identify the relative importance and magnitude of different geomorphic sites (e.g. inner gorge, channel bank, ridge) and logging related sites (e.g.' tractor/cable yarded areas, roads) in relation to sediment production.

Achieving the above objectives requires that sampling schemes and precision estimates of measured variables be developed and-evaluated. Calibrating procedures must also be developed that will utilize both data from a recently cut control watershed and from pretreatment-posttreatment monitoring on the North Fork. .

The physical monitoring plan for this phase of the study involves gauging and instrumenting the stream channel at twelve new points. Eight of the twelve stations are located on subwatershed channels with the remaining four on the main channel. The stations have been placed so that the subwatersheds within the North Fork can be "nested" for the purpose of tracking sediment through the system. The existing weirs used in the South Fork phase will also be used in this phase for comparative purposes.

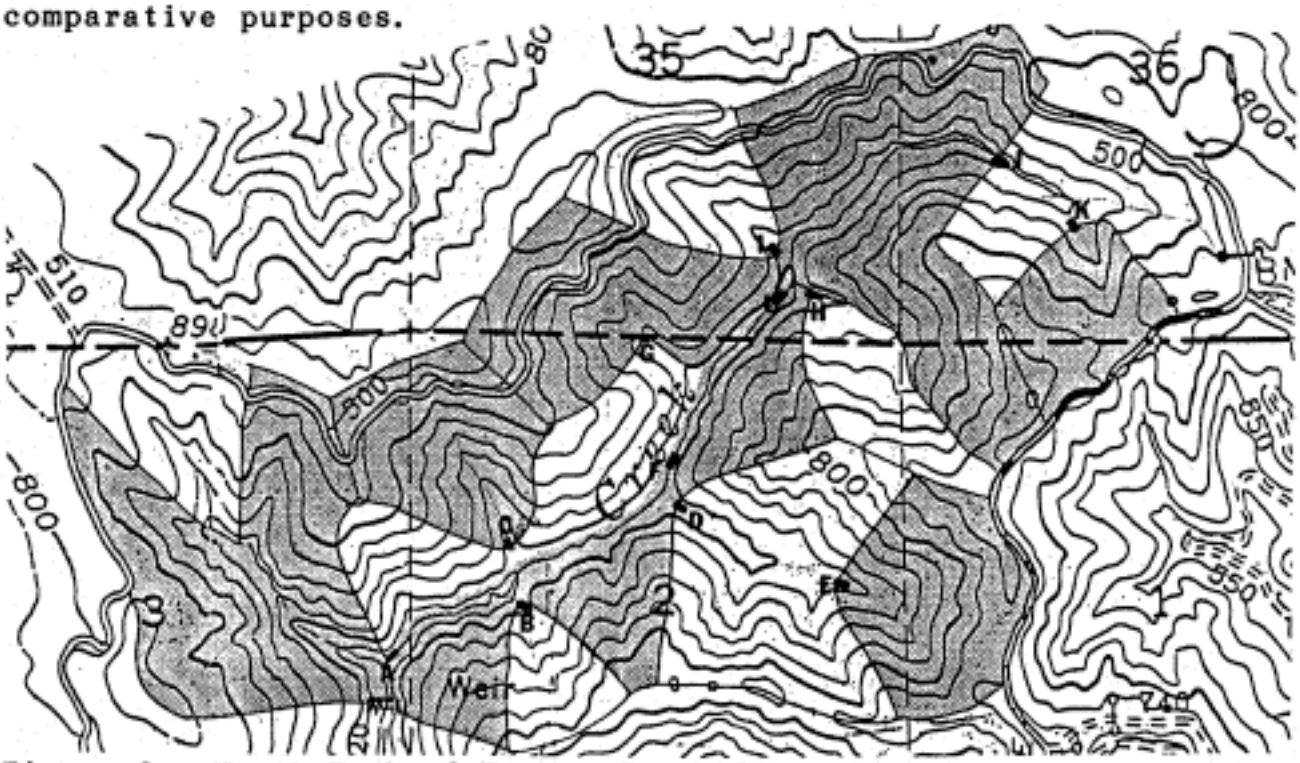

Figure 2. North Fork of Caspar Creek flume locations and cut units

Three of the main channel stations (A, F and L) are rated control sections. As used in this study, each is a section of channel which has been modified with a rigid structure of a known fixed dimension. The necessary relationship between discharge and depth can then be made through calibration procedures. All other stations use Parshall flumes (Figure 1.) for obtaining the streamflow and sediment data. These flumes are installed for the same reason as the rated sections but have the advantage of requiring little calibration to obtain accurate water discharge measurements. Parshall flumes were not used in the three main channel locations because of size and construction considerations.

Each station contains an instrument which makes a continuous hydrograph of the stream stage. Anew hardware/software system has been designed by the Pacific Southwest Forest and Range Experiment Station staff to incorporate "SALT" (selection at list time) sampling, also developed by the station statistician. This sampling scheme, which is similar to 3P sampling theory, enables the researcher to improve the statistical efficiency of the sampling. The state of the art hydrologic sampling equipment utilizes a microprocessor/controller into which the desired sampling equation is programmed. When the controller calculates the right time to take a sample, it pulses a small pumping sampler which then takes a water sample within the flume or rated section. An interface device to the controller and a cassette tape recorder are used to periodically "dump" the streamflow and sampling information stored in the controller. The cassette stored information is then transferred to the Station's main computer for data analysis. Batteries are the sole source of power as all the installations are far removed from any commercial power sources. [1]

An intensive stream channel survey has been done as part of this phase of, the study. The North Fork tributary channels and main channel were surveyed to provide detailed channel information which was recorded on a large scale map. Some of the attributes measured are channel depth/ width ratio, bed and bank material, channel slope and direction, and organic debris that intersects or lies in the channel. The maps will be updated each year to document natural changes as well as changes that can be attributed to management practices.

North Fork Phase-Silvicultural/Harvesting Plan

Contrasted to the South Fork, this updated North Fork plan contains several major differences in harvesting and silvicultural techniques. A commitment made early in this phase of the watershed project was to monitor trends of forest land management techniques in the redwood region. Decisions regarding project objectives and techniques have been made with regard to these trends. The usefulness of the project to other forest landowners at the conclusion depends on the applicability of the treatment to all forest land under management. The long duration of the study (completion mid 1990's) requires predicting as accurately as possible the future types of management techniques.

[1]Design and operation information about this system is being made available by the Pacific Southwest Forest and Range Experiment Station to anyone needing these capabilities.

Since the first plan for silvicultural and harvesting activities was written in 1978, a larger percentage of forest land each year has been clearcut using cable yarding systems. Economic and regulatory considerations are probably the main reasons behind such trends. For the purposes of the study, our best prediction is that these trends will continue or at least maintain the frequency of use which they now occupy. To some extent, other harvesting activities on Jackson Demonstration State Forest have also started in this direction to better demonstrate and experiment with this silvicultural-harvesting system.

These events led to a joint decision by the two agencies to revise the original 1978 plan of using partial cutting. Instead, several clear cut units will be installed in the North Fork drainage.

The clearcut,units shown in Figure 2. were selected because they best met the research requirements to achieve the study plan objectives taking into consideration California Department of Forestry timber harvesting plan requirements and Jackson Demonstration State Forest silvicultural objectives. The Experiment Station staff initially selected those areas for treatment and controls which best fit their criteria. The Jackson Demonstration State Forest staff met with the Station personnel and worked out the logistics to achieve the study design. The preferred harvest design in the interests of the project objectives is to clearcut the desired volume in the shortest time (given adequate pre-logging data) using instrumented subwatersheds as cutting units.

A target figure of 60 percent of the volume in the North Fork watershed will be cut to approximate the percentage volume removed in the South Fork. Preliminary cruise information indicates there is approximately 135 million board feet in the watershed. The volume in the selected units is calculated to be approximately 75 million board feet. The planned design of cutting is to divide the clearcut units into four approximately equal size sales. The timing, and combination of units for sales will depend on our best logistical solution to the potential problem of simultaneous harvesting by two different purchasers. Road construction and usage in relation to yarding is critical in planning units that can be productively logged at rates which are assumed in the appraisal process. Conforming to legislative decree, each sale purchaser will be allowed two years to harvest all designated timber within each sale. The total harvest period will then require a minimum of three years with an overlap in the second year. The average volume cut per year is 25 million board feet which is close to the Jackson Demonstration State Forest annual cut. Such scheduling will allow most local purchasers to readily harvest each sale in a two year period, given the ability to winter log even with the high proportion of cable yarding.

Harvesting will be conducted in conformance with current forest practice regulations. This will necessitate leaving divider strips between some clearcut blocks and the consideration of water course protection measures for the various stream classifications.

The type and use of certain yarding systems need to be considered as part of the overall harvesting plan for the study. Integration of this aspect is critical to the successful harvesting of the designated clearcut units. Approximately 70 percent of the treated watershed will be cable yarded using a road system built on the major secondary ridges and upper slopes. Precise road locations will be dictated by locations of the best landing sites and slope gradient. As tractor yarding will be permitted above the road using the same landings, it is the intent to locate the road at elevations which will restrict the majority of tractor yarding to slopes of 30 percent or less. Road specifications will be predicated on the use of cable yarding along the whole road network.

winter operations are probable as roads will be rocked and the majority of the stand is to be cable yarded. After completion of logging in the clearcut units, some type of site preparation for planting will be done in each unit. This work may include burning, mechanical or hand clearing where needed for interplanting.

Future Silvicultural Treatment Considerations

Approximately 40 percent of the watershed will be left uncut at the end of the project monitoring period. If no other considerations enter into the planning process at this time, the remaining uncut acreage will be treated in a like manner. Calculation of total annual cut and integration with cutting on other areas of the forest will have an influence on when the remaining acreage in the north fork will be cut. Silvicultural consideration will also be given to those areas cut initially for precommercial thinning possibilities. Additional vegetation management techniques may be needed to control brush invasion and competition with the conifer reproduction. Commercial thinning of some of the clearcut units before the harvest cut may be a future silvicultural activity for demonstration and research.

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