HYDROLOGIC RESPONSE FOLLOWING RANGELAND IMPROVEMENT PRACTICES IN EASTERN OREGON[1/]

J. C. Buckhouse and D. A. Bolognani

It is of interest and importance to natural resource managers to understand the hydrologic response of various range improvement practices as they are commonly implemented in eastern Oregon. As a consequence, this study was conducted during the summer of 1980 to establish the changes in infiltration and potential sedimentation in the Oregon Range and Resource Evaluation Project work area of eastern Oregon (Bolognani, 1982).

METHODS

A modified Rocky Mountain infiltrometer was used to simulate 28-minute high intensity rainfall events of about five inches per hour. This rate of rainfall was chosen since it approximates the kind of high intensity, summer thunderstorms which hit the area occasionally. It is estimated that a storm of this magnitude would have a return frequency of about 75 years.

The simulated storms were programmed to last 28 minutes, with rainfall and runoff being collected after an initial three minutes and thereafter at five-minute intervals. A composite sample of the runoff was also collected to determine the potential rate of sediment production associated with the storm.

Sixteen natural resource units sampled by Gaither (1981) and subjected to various improvement practices (seeding, herbicide spraying, mechanical brush control, and certain combinations of two or more practices) were studied.

1/ This work was sponsored and funded by the U.S. Forest Service Range Evaluation Project. Particular thanks are given to Jon Skovlin and Reed Sanderson of the USFS Range Evaluation Team.

RESULTS AND DISCUSSION

On six of nine mountain grassland ecosystems which had been reseeded, the control (untreated) area was either not different or had significantly higher infiltration rates for the entire rainfall period than did the treated areas. Interestingly, the controls also generally had higher potential sediment losses. The controls lost significantly more sediment in all cases except three, and in two of these there were no significant differences. Thus, only one treated site exhibited significantly higher potential sediment loss than did the controls. Average potential sediment loss on the control area was .50 T/A compared to .28 T/A on the treated areas.

On the sagebrush ecosystem sampled, where sagebrush had been mechanically removed and the area seeded, the treated area had significantly lower infiltration rates. Nevertheless, the potential sediment loss was lower on the treated areas (.65 T/A in the treated area compared to 1.74 T/A in the control).

On a ponderosa pine overstory with elk sedge understory, higher infiltration rates and lower potential sediment rates were noted in one treatment case (0.02 T/A treatment site vs. 0.06 T/A untreated site) and with lower infiltration rates and higher sediment rates in another. In the latter case, two subsamples were taken. On the subsample where no seed catch occurred, phenomenally high (5.67 T/A) sediment production was noted. On the area where some revegetation had occurred (27 percent cover), the sediment production rate was 0.09 T/A.

A ponderosa pine - bunchgrass ecosystem demonstrated significantly higher infiltration under the treatment conditions. Potential sediment was not significantly different in either case (0.03 T/A under the control and 0.02 T/A under the treatment).

Untreated larch ecosystems had significantly higher infiltration rates than did the treated areas. This was coupled with correspondingly lower potential sediment rates in the control areas ($<$0.01 T/A) compared to the treated areas (0.13 T/A).

SUMMARY AND CONCLUSIONS

A complex interaction of factors influences the infiltration and potential sediment production values which are associated with any particular wildland site. The factors of soil compaction, standing vegetation, and litter seem to be of particular importance. Although interactions among these factors affect both infiltration and sediment production, it appears that sediment production is the more sensitive of the two end products.

Any disturbance which compacts the soil, either through the direct traffic of machinery or through the forces of raindrops, reduces infiltration. Conversely, any practice which increases the standing vegetation and litter decreases sediment production. Therefore, the relative hydrologic balance of a rangeland improvement technique depends on several factors:

(1) How severe was the soil disturbance as a result of this practice? (The more severe, the greater the compaction and the less the infiltration).

(2) How successful was the "catch" of planted or released vegetation following the practice? (The more successful, the lower the sediment production).

(3) How long ago was the practice implemented? (The effects of compaction ameliorate over several years--established vegetation may thicken or thin as the years pass, depending on the adaptability of the species and subsequent management).

LITERATURE CITED

Bolognani, D. A. 1982. Simulated storm runoff characteristics between natural and altered ecosystems in the Oregon Range Validation Area. M.S. Thesis. Oregon State University, Corvallis, Oregon. 58 p.

Gaither, R. E. 1981. Storm runoff characteristics of various plant communities within the Oregon Range Validation Area. M.S. Thesis. Oregon State University, Corvallis, Oregon. 153 p.