ratios were consistently higher on low producing sites. Leaf production made up from 15 to 29 percent and 26 to 36 percent of the total stubble production on high and low producing sites, respectively.

Crude protein content was found to be significantly related to site potential and fertilization practices. Cereal aftermath on low producing sites will contain higher levels of crude protein unless nitrogen fertilizer is applied to the high producing sites. Although less stubble is produced on the low sites, a higher proportion of leaf material is available for animal use. Leaf and chaff were consistently higher in crude protein than culms. Digestibility was not affected by any of the parameters measured.

SEDIMENT POTENTIALS AND HIGH INTENSITY STORMS ON RANGELANDS

J. C. Buckhouse and J. L. Mattison

A number of rangeland ecosystems are found distributed across eastern Oregon and the Great Basin states of the western United States. In this paper we intend to use central Oregon's Bear Creek Watershed as an example of the kinds of sediment production one might expect under a number of these ecosystems.

DESCRIPTION OF THE AREA

The Bear Creek Watershed, in central Oregon 40 miles east of Bend, covers approximately 131,000 acres in the southwestern corner of Crook County. Bear Creek is a tributary of the Upper Crooked River drainage, with runoff storage in the Prineville Reservoir. The area has a semiarid climate with most precipitation occurring during winter and spring. High intensity summer convectional storms also occur. The mean annual precipitation is approximately 10 inches.

The vegetation types are dominated by various combinations of western juniper, big sagebrush and the bunchgrasses, Idaho fescue, bluebunch wheatgrass, and Sandberg bluegrass. A mixed forest managed for ponderosa pine is found in the higher elevations. Bare ground often comprises more than 40 percent of the ground cover in the nonforested areas. Sheet, rill, and gully erosion are extensive in several locations and streambank erosion occurs along nearly 75 percent of Bear Creek's main channel.

The soils in this watershed reflect a volcanic origin, either basalt or associated proclastic materials. Marine sedimentary clays from the Clarno and John Day formations occur scattered throughout the area.

The majority of the watershed is in public ownership, with the Forest Service managing the mixed forest in the eastern sector and the Bureau of

Land Management administering the juniper shrublands in the middle and western sectors. Private ownership is scattered but occurs predominately in the southeastern portion and in the bottomlands along Bear Creek and its tributaries.

The Bureau of Land Management has classified the Bear Creek Watershed as one of the most critical areas in the Prineville District because of the high percentage of bare ground cover and the sediment loads it contributes to the Prineville Reservoir.

METHODS

The macroplot design was used for vegetation sampling and incorporated four transects with 10 microplots per transect for frequency sampling. Shrub density and intercept cover and tree cover also were measured within the macroplot and the cover components within the sediment plots were estimated. Soils were generally described and then verified by BLM soil scientist, Darwin Jeppesen.

Sediment production was obtained, using a Rocky Mountain Infiltrometer to simulate a high intensity rainstorm (4 inches per hour) and collecting the rainfall and runoff. From the runoff containing the sediment, a sample was taken to represent an average amount of material per unit of runoff. The sediment plots were located systematically around the perimeter of the macroplot, with six replications of three observations used to describe a vegetation-soil unit. In forest and bare ground areas where observation plot was essentially the same in ground cover, only three replications were used. The vegetation-soil units that are similar in potential vegetation and soil comprise the Ecologic Land Unit.

During the summers of 1975 and 1976, we applied these high intensity 28-minute storms to 468 different sediment plots. These plots were located with seven ecological land unit classifications and were further refined into 10 tentative habitat types based on an association table developed from vegetation and soils field data.

RESULTS AND DISCUSSION

Table 1 shows the relationships between the ecological land units and their associated sediment potentials. It also demonstrates how a clearer picture can be obtained by following the ecological classification to a finer resolution.

It is apparent that the highest erosion is occurring in areas associated with western juniper. This seems to be particularly true in those instances where western juniper is invading into steppe areas. This may be related to one or more of several phenomena operating in juniper systems. It may be partially because of the nature of juniper's growth habit, with extensive laterial roots occuping a rather large land area surrounding the tree and therefore lower competition from other plants; and/or it may be because of an overgrazing and/or fire suppression history which has encouraged juniper invasion and discouraged other species.

Table 1. Mean sediment potentials for selected ecological land units and habitat types within the Bear Creek Watershed

Ecological land unit habitat type	Sediment production (pounds per acre)
MIXED FOREST	169
Douglas-fir/pinegrass h.t.	42
Ponderosa pine/Idaho fescue h.t.	295
LOW SAGEBRUSH	660
Low sagebrush/Idaho fescue-bluebunch wheatgrass h.t.	660
SANDY SHRUBLAND	700
Big sagebrush/needle-and-thread h.t.	700
ADOBELAND	700
Bluebunch wheatgrass-Sandberg bluegrass h.t.	700
BIG SAGEBRUSH	1,282
Big sagebrush/Idaho fescue-bluebunch wheatgrass h.t. without western juniper	815
Big sagebrush/Idaho fescue-bluebunch wheatgrass h.t. with invading western juniper	1,749
JUNIPER WOODLAND	1,459
Western juniper/big sagebrush/Idaho fescue-bluebunch wheatgrass h.t.	2,598
Western juniper/big sagebrush/Idaho fescue-bluebunch wheatgrass h.t. Thurber needlegrass phase	367
Western juniper/Thurber needlegrass h.t.	1,372
MIXED STEPPE	2,052
Western juniper/mountain big sagebrush/Idaho fescue h.t.	3,679
Mountain big sagebrush/Idaho fescue h.t.	425

CONCLUSIONS

Mean sediment potentials produced on ecological land units ranged from 169 pounds per acre in the mixed forest to 2,052 pounds per acre on the mixed steppe. Potential for soil loss in relation to intense rainfall was highly variable among habitat types, with means ranging from 42 to 3,679 pounds per acre. Our results indicate that with increasing ecological interpretation, including habitat type and range condition, a more reliable index of soil erodability can be developed.

REMOTE SENSING INVENTORY OF ELK HABITAT IN THE BLUE MOUNTAINS

D. A. Leckenby and D. L. Isaacson

An inventory of forest and grassland vegetation types that provide elk cover and forage was developed with remotely sensed data from the Blue Mountains. Elk habitat was measured by mapping cover and forage extent in two locations: 1) a northern area of 125,000 acres along the south fork of the Walla Walla River and around Jubilee Lake; 2) a southern area of 264,000 acres around Bridge Creek Flats and along the north fork of the John Day River. Fall herds occupying the management units containing the north and south study areas are estimated at 3,650 and 6,220 adult elk, respectively.

Forest and grasslands within both study areas are representative of elk-habitat classes found throughout the Blue Mountains. Mixed conifer is the most abundant tree-dominated resource class throughout these areas. Spruce-fir is of secondary extent in the north, lodgepole pine in the south. Bluebunch wheatgrass is the prevalent grass-forb resource class of elk winter ranges, but created grass-forb classes are prominent in logged areas of summer ranges. Elk use these and other resource classes primarily for either cover or forage depending on their extent, intermixture, and structure (tree height and canopy closures are structural qualities).

METHODS

The inventory first involved documenting actual use by elk of various habitats. Elk were tagged with radios, followed, and their activity was observed to record specific use of all habitats throughout the year. Temperature, wind, and other specific environmental conditions within the habitats were noted during use. Elk behavior was analyzed with habitat structure, plant composition, and weather conditions. Observed patterns of habitat use were compared with relationship published by Thomas *et al.* (1979)[1].

[1]Thomas, J. E., ed. 1979. Wildlife Habitats in Managed Forests - The Blue Mountains of Oregon and Washington. USDA Forest Agriculture Handbook No. 553.