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THE ARID LAND ECOLOGY RESERVE

An Outdoor Laboratory¹

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Introduction

During the early 1940's the federal government pieced together from private and public lands, a large military reservation, which was to become a major site for the production of nuclear materials. The military reservation consisted of more than 600 m² of farmland and native desert rangeland and extended from the shores of the Columbia River to the summit of treeless Rattlesnake Hills. By the mid 1960's the demand for nuclear armaments had subsided. The Atomic Energy Commission re-evaluated its need for such a large piece of landscape in light of the proposed partial shutdown of the nuclear facility. At that time, a new state highway was constructed through the Reservation and in 1967 it was decided that the land south of state Highway 240, extending to the reservation boundary at the skyline of Rattlesnake Hills, would be set aside as an ecological research natural area. The area was named the Arid Land Ecology (ALE) Reserve.

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Site Description

The ALE Reserve consists of a shrub-grassland type of vegetation which is representative of the most arid portions of the Pacific Northwest. The

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reserve is an island of relatively undisturbed landscape in the midst of an expanse of cultivated fields managed under regimes of dryland or irrigated farming. The area is composed of 75,000 acres ranging in altitude from 500 ft to 3500 ft MSL. The entire area is fenced to exclude livestock and is closed to hunting and off-road travel. The long history of these latter two features, of course, is what makes the area scientifically valuable as an environmental laboratory.

Environment

Soils of the reserve range from sands to loams and consist of wind-blown or water-moved particles deposited over Columbia Plateau Basalt. Thickness of the soil mantle varies between essentially zero and bare rock at the summit of the Rattlesnake Hills to several hundred feet of alluvial material at lower elevations. The predominant aspect of the reserve is northeast although some local areas are nearly flat. Slope and elevation changes strongly influence local climate particularly total annual precipitation and temperature patterns. The general climate of the area is characterized by hot and dry summers with cold winters. Average annual precipitation is less than 7 inches with 80-90% occurring between October and March. Snowfall constitutes about 1/3 of the annual precipitation at low elevation and a greater proportion at high elevations. Temperature generally decreases with an increase in elevation, however, a strong inversion has been noted at times. Moisture, temperature, and soil are the major factors influencing the distribution of plants and animals.

Scientific studies

Scientific studies have been conducted on the ALE Reserve since 1965. Work has included studies on plant productivity and mineral relationships for communities occurring on abandoned fields as well as those in natural areas; studies of small mammal populations in natural areas as well as those purposefully disturbed by altering the type of vegetation or water relationships; and other studies on climatology and micrometeorology. Forty acres of land are currently under study as part of the International Biological Program's Grassland Biome Project.

Vegetation studies have shown that when an area is severely disturbed the concomittant change can be dramatic. Fire is devistating² to sagebrush whereas perennial grasses are not injured. Overuse by grazing livestock is a devistating² practice to perennial grasses but not shrubs. Plowing the surface soil is devistating² to nearly all native plant species; old cultivated fields predominantly support introduced annual weeds even after 25 years of abandonment and appear to be stable for perhaps a hundred years. The crop yield of annual grasses on abandoned fields is strongly dependent on the amount of moisture received between October and May but only to the limit of available soil nitrogen. Thus, during years of higher than average precipitation, high elevation fields produce less yield than low elevation fields because of the limitation of nitrogen, whereas, during other years high elevation fields produce greatest yields because of a moisture deficiency at low elevations.

Animal studies, concerned mostly with small mammal populations, have attempted to describe fluctuations in populations numbers in response to changes in environmental factors. During routine live trapping to discover

"who lives where" it was noted that during years of low plant yield the small mammal population were correspondingly small and conversely, during good years populations was relatively large. An experiment was designed to test the theory that these animals were responding to variability in seed production of the winter annual weed, cheatgrass.

One area of natural vegetation was sprinkler irrigated to artificially increase seed production, another area was treated with an herbicide to reduce seed production, and a third area was left as a comparison.

Preliminary results indicate that cheatgrass seed productivity is a controlling factor in the size of small mammal populations of the area.

Studies have also been conducted on the response of small mammal populations to large amounts of ionizing radiation. For this experiment a large number of pocket mice was captured in the field, brought to the laboratory and irradiated with gamma rays and returned to the original location. Results over a two year period indicate that native rodents are no more sensitive to radiation than laboratory strains even though the wild animal may be exposed to environmental stresses not found under laboratory conditions.

Concluding Remarks

The studies described above, and many others conducted on the ALE Reserve, are essentially basic science, i.e. no immediate practical application of results is expected. The studies are designed to take advantage of the very large piece of natural landscape which is available and to investigate the behavior of a relatively undisturbed system. The scientist must understand the undisturbed system before he can hope to

evaluate and predict the consequences of a severe disturbances. We must learn what kinds of biological impacts are likely to occur in response to environmental change and how permanent the damage might be to the entire system including man.

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