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EVALUATION OF ERTS-1 IMAGERY IN MAPPING AND MANAGING SOIL AND RANGE RESOURCES IN THE SAND HILLS REGION OF NEBRASKA

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ABSTRACT

Interpretations of high altitude photography of test sites in the Sandhills of Nebraska permitted identification of subirrigated range sites as well as complexes of choppy sands and sands range sites, units composing approximately 85% of the Sandhills rangeland. These range sites form the basic units necessary for the interpretation of range condition classes used in grazing management. Analysis of ERTS-1 imagery acquired during August, September and October, 1972 indicated potential for the identification of gross differences in forage density within given range sites identified on early season aerial photography.

1. INTRODUCTION

The major purpose of this investigation is to evaluate MSS imagery acquired by ERTS-1 of the Sand Hills region of Nebraska for application in: (1) delineating major soil mapping units and associated range sites. (2) estimating forage density and forage utilization on specific range sites, and (3) monitoring the development of center-pivot irrigation.

The Sand Hills region of Nebraska occupies the north-central one-third of the state and is centrally located in the Great Plains. The region is composed of approximately 20,000 square miles of eolian sand dunes interspersed with nearly level valleys, and is stabilized by native grasses or grasslike plants.

2. RESULTS

The project was specifically designed to utilize imagery acquired early during the growing season for the delineation of range sites and associated soil mapping units. High altitude, color infrared aerial photography obtained in early June, 1972 shows the unique dune patterns and the intense infrared reflectance of the sub-

irrigated valleys. Thus, aerial photography or satellite imagery obtained early during the growing season is of maximum value in interpreting soil patterns and range sites. Estimates of forage density were possible utilizing data obtained throughout the growing season.

Range sites for evaluation were selected along four major north-south transects established across the Sand Hills region. High altitude, color infrared aerial photography was first evaluated for recognition of range sites and associated soil patterns. Range sites are basic landscape units used in range management. Each site is a unique combination of soils and plant communities, and its management is based on current forage production relative to optimum forage production. Thus, site recognition is the first step in proper range management.

On the color infrared photography, three major range sites could be recognized. The choppy sands and sands sites make up 76% of the Sandhills and appeared as bluish-gray and white mottled patterns. Subirrigated sites, making up 11% of the Sandhills, appeared as predominantly red areas. Sandy sites, making up 7% of the Sandhills, appeared as predominantly blue areas.

Differences in forage density could also be recognized on the color infrared photography. Comparison of the first sandy site with a second sandy site which produces 50% less total biomass indicates an increase in photo density relative to an increase in forage density on the sites. Fenceline contrasts can also be seen, indicating forage density differences on the same site where a fence divides management practices.

Comparison of reflectance patterns of plant communities with soil mapping units defined in the field was accomplished by photographically reducing existing soil maps to the same scale as the photography. Soil mapping units associated with sands sites were combined on an overlay and superimposed over the color infrared photography. The overlay separates sands range sites and associated soils classified as Typic Ustipsamments from subirrigated range sites and associated soils classified as Aquic Haplustolls and Typic Haplaquolls.

Our success with high altitude color infrared photography suggested that a similar approach would apply to ERTS imagery, especially color composites. Band 5 of the multispectral scanner provided an initial indication in imagery obtained on August 17, 1972 that range sites could be recognized and forage density differences could be qualitatively distinguished on the sandy sites.

Our initial color composites using MSS bands 4,5 and 7 of the same area show very much the same information as band 5 with regard to site recognition and forage density. Color composites provide the added

dimension of infrared contrast in the red color of the subirrigated areas and in the ease of distinction of water bodies. Based on experience with high altitude aircraft color infrared photography, early season ERTS-1 imagery should be superior to August imagery for interpretations of range sites and associated soils. Soil-vegetation relationships appear the same in color composites of ERTS imagery as on the high altitude altitude aircraft color infrared photography.

An unexpected interpretation of ERTS-1 MSS imagery was discovered shortly after delivery of the first imagery for the Sand Hills region. Range fires which occurred in the spring of 1972 could be detected, but only with band 7 of the multispectral scanner. High altitude color infrared imagery detected the fire pattern which occurred on March 6, 1972 and destroyed forage, livestock, buildings and equipment valued at one million dollars, but color composites did not.

The area burned was approximately 30 miles long, 10 miles wide at its widest point and involved 76,460 acres. Utilizing the ERTS imagery, it was possible to locate the burned area and to rapidly and accurately measure the acreage burned. Wind erosion resulting in blowouts is evident on ERTS imagery. Thus, the imagery will provide a means for monitoring erosion problems in areas that are overgrazed or burned by range fires.

Center pivot irrigation has been developed recently in the Sandhills where topography and water supply permit. Individual systems are installed on sands or sandy sites to provide additional pasture or hay sources for the rancher. Unsuccessful systems indicate that careful selection of sites for development is necessary. ERTS-1 imagery provides data for the selection of sites for irrigation and for monitoring the development of center-pivot systems within the region.

The economic prosperity and ecological stability of the Nebraska Sand Hills region are related primarily to cow-calf operations which depend on proper management of the 20,000 square miles of grazing and hay land. It has been estimated that improved range management could provide a twenty percent increase in animal productivity, reflecting an approximate $10 million increase in return to ranchers. Interpretations of ERTS-1 imagery will be significant in developing this increase in productivity.