An Inventory of Rangeland Brush Control Projects from ERTS-1 Space Imagery

KIRK McDANIEL, DILLARD H. GATES, ROGER FINDLEY, AND GLEN MILLER

Highlight: *Shrub-brush manipulation projects have had major ecological and economic impacts upon the 9,136 square miles of public and private rangeland in Malheur County, Oregon. Analysis of imagery from the Earth Resources Technology Satellite (ERTS-1) indicated that space-acquired data used in conjunction with field data, holds a potential for identifying, classifying, inventorying, and monitoring these changes occurring on rangeland areas.*

An estimated 160,000 acres of private rangeland in Malheur County, Ore., have been altered by brush control projects since 1967.[1] Many of these projects have been cooperative cost-share arrangements between private land owners and the Agricultural Stabilization and Conservation Service. Field records kept by the Bureau of Land Management, Vale District, estimate 536,000 acres of federal rangeland in Malheur County have been affected by brush control projects since 1957.[2] Approximately 313,152 acres of this public land was treated from 1962 to 1969 when the BLM was allocated nearly $13,615,000 for rehabilitation and improvement of rangeland within the Vale District (Godfrey, 1971).

Control of undesirable brush on both private and public lands in Malheur County has been achieved primarily by mechanical techniques (plowing) and chemical means (aerial application of herbicides). Fire, either started accidentally or under a controlled management plan has also been effective for control of sagebrush. The objective of this study was to use space-acquired imagery from the Earth Resources Technology Satellite (ERTS-1) to identify the type and location of these brush control projects and to inventory the treated acreage.

Procedure

Five overlapping 9" x 9" ERTS–1 photo frames (scale 1:1,000,000) cover Malheur County. For purposes of mapping, black and white transparencies, both positives and negatives, including spectral bands 4, 5, 6, and 7 were used. These spectral bands, recorded by a multispectral scanner aboard ERTS-1, refer to electromagnetic energy detected in four visible spectral bands from 0.5 to 1.1 micrometers. Each of these spectral bands provides unique information about various land areas. For example, contrast in natural vegetation appears most distinctive on band 5 imagery, while areas treated by cultural improvement practices are generally easiest to detect from band 7 imagery. In addition, color reconstituted photo images were produced using a composite of spectral bands 4, 5, and 7. All imagery interpreted was taken between the months of July to October, 1972.

Land units where brush control projects were interpreted as being implemented were outlined on separate acetate overlays placed over the ERTS-1 photo frames. The units delineated were examined for a unique image characteristic or signature and then classified according to one of the following brush control improvement classes:

a) *Mechanical control* – straight edges, sharp squared corners, nearly level topography (smooth, uniform texture in and around the treated area).

b) *Chemical control*– straight outer margins with some irregular edges, squared to rounded corners, generally hilly topography resulting in rougher photo texture, often darker contrast than mechanical and fire treatments because of less total vegetation removal (Fig. 1).

c) *Fire control* – irregular margin pattern, few straight edges, very dark color first year after burn, usually much lighter color in succeeding years (Fig. 1).

To verify the accuracy in mapping and classifying delineated land units, a ground truth field check was made along a preselected route through parts of Malheur County. Records were kept on the accuracy in mapping and identifying treatments which could be seen along this route.

With knowledge gained from the ground truth field trip, some earlier interpretations were revised and final interpretations completed. Then by using a dot-grid count (1,156 dots/square inch or 138 acres/dot), an inventory was made to measure the acreage altered by each of the brush control projects.

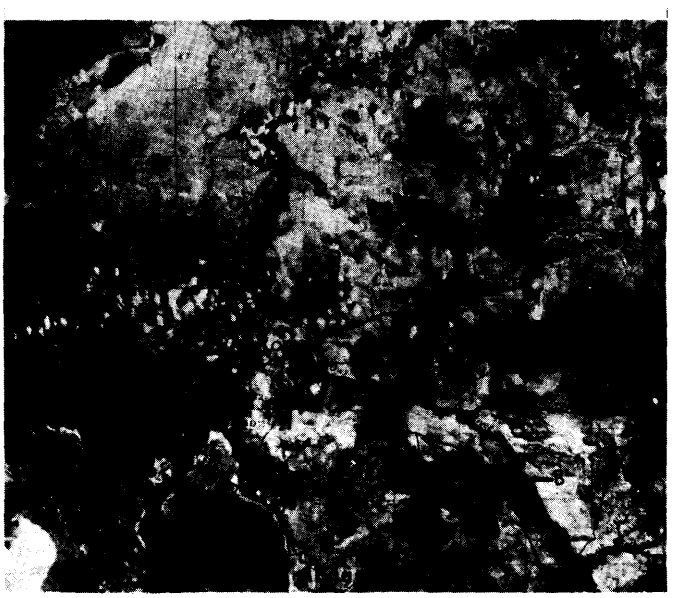

Fig. 1. *ERTS-1 photo taken over a portion of Malheur County, Oregon. Arrow A points to an area treated by aerial spraying. Arrow B points to a burned area.*

Authors are research associate, Department of Range Science, Texas A&M University, College Station; range specialist, US-AID, Washington, D.C.; rancher, Ontario, Oregon; and graduate research assistant, Department of Forest Management, Oregon State University, Corvallis. At the time of the research, McDaniel and Findley were graduate research assistants, Rangeland Resources Program, Oregon State University, Corvallis, and Gates was director of the Rangeland Resources Program there.

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[1] Personal communication with George Bain, Malheur County Extension Agent, and Jim Christian, Manager of Agricultural Stabilization and Conservation Service, Ontario office.

[2] Personal communication with Robert Sherve, Northern Area manager, Vale District of Bureau of Land Management.

Table 1. Brush control treatments (sites) as interpreted from ERTS-1 photo compared with correct identifications based on ground truth field checks.

Treatment method interpreted from ERTS-1 photo	Treatment method determined by field check				Total sites observed	Correctly identified from ERTS-1 photo (%)
	Mechanical	Chemical	Fire	Other		
Mechanical	7	1	1		9	74
Chemicl	1	3		3	7	43
Fire			2		2	100

Results and Discussion

A total of 56 different areas thought to be treated land units were interpreted on the images. Field records provided by the BLM and the Malheur County Extension Service showed that over the past 15 years about 150 different brush control projects have been conducted. Discrepancies between data collected from ERTS-1 imagery and field records can generally be attributed to three causes: (1) somc treated land units were too small to detect on the imagery (generally less than 150 to 350 acres in size); (2) several brush control projects were conducted in close proximity to each other, giving the appearance on the images of being a single treated land unit; and (3) some areas which should have been detected were simply overlooked due to low contrast between treated areas and adjacent untreated areas.

During the ground truth field check, three areas were noted which were improved but had not been previously identified from the photos. Two of these areas were treated after the summer 1972 ERTS-1 flight data and thus would not have been detected. The third area noted was a spray-release project which was later recognized on the imagery. From a total of 18 mapped areas checked, 15 (83%) were examples of some form of cultural improvement (Table 1). Two wild hay meadows and a sparsely vegetated silver sagebrush (*Artemisia cana*) flat were erroneously classified as treated areas. Considering errors made while classifying all delineated units, the accuracy of interpretation was 67%.

A total of 457,996 acres was estimated to occur within photo mapped areas by the dot-grid count. Field records kept by the BLM and the Malheur County Extension Service estimate 470,152 to 662,546 acres of private and public land have been treated in Malheur County since 1962. The lower estimate from the photos can largely be atrributed to two factors: first, the inability to identify smaller brush control projects; and secondly, areas treated by chemical methods, particularly using spray-release treatment, could not be identified satisfactorily as the treatments became older (approximately 7 years). Some exceptions were found, particularly if the area treated was large or vegetation reestablishment was retarded.

Conclusions

The results from this study indicated that ERTS-1 imagery used in conjunction with field data can be a useful tool for identifying and inventorying range brush control projects. The primary advantage of small scale space imagery is that it provides a comprehensive view of large land areas. As such, it holds a significant potential for gaining a greater perspective of land in and around such improvements. It seems possible that space-acquired imagery could assist land resource managers in the future for monitoring when and where such practices occur on lands under their jurisdiction.

Literature Cited

Godfrey, Erik Bruce. 1971. An economic evaluation of the range improvements administered by the Bureau of Land Management in the Vale District of Oregon. PhD Thesis. Oregon State Univ., Corvallis. 137 numbered leaves.