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NINTH BI-MONTHLY PROGRESS REPORT
UNIVERSITY OF ALASKA
ERTS PROJECT 110-7
JANUARY 31, 1974

A. TITLE OF INVESTIGATION: Application of ERTS-1 imagery to the study of caribou movements and winter dispersal in relation to prevailing snowcover

B. PRINCIPAL INVESTIGATOR/GSFC ID: Peter C. Lent/U682

C. PROBLEMS IMPEDING INVESTIGATION: None

D. PROGRESS REPORT:

1. Accomplishments during the reporting period: A discriminate analysis was carried out on a portion of scene 1407-20371 for the following features: recent fire (within 5 years) areas, mature closed spruce forest, alluvial gravel, lakes, potholes, silty rivers, and clear streams. This analysis indicated band 7 density as the most useful single variable overall in the discrimination and results in Table 1 were obtained using only band 7. Incorporation of band 5 data significantly improved results (table 2) but addition of bands 4 and 6 did not improve results in the gravel, burn, or forest classifications. Therefore, a classification scheme based on bands 5 and 7 was formulated and applied to MSS digital tape data. Each pixel was classified and shown on the printout as either burn (b), forest (f), gravel (g), lake (l), river (r), or unknown (blank).

In the resulting output, 53% of the total area was classified into "known" categories and 47% as unknown. Analysis of the output revealed that a substantial amount of the area classified as unknown is shown as lakes on the USGS map prepared in 1956. Additionally, the output indicated a number of "new" lakes which are not present on the 1956 USGS map. Several plausible explanations exist but it is apparent that there is a relatively high rate of lake formation and disappearance in this area. Some of these are readily explained by river channel changes but other "new" lakes do not seem to have been formed as the result of a shift in stream channels. Because the Yukon Flats is an important waterfowl production area, further analyses of this type should be of interest and value to waterfowl biologists.

Within our own sphere of analytic interest, the mature forest stands are suitable winter caribou range whereas recently burned areas are not suitable for caribou. Dr. George Scotter of the Canadian Wildlife Service used pellet density as an index of utilization and found moose utilization maximal 11 to 30 years after burning whereas caribou utilization was insignificant during the first 50 years. Winter caribou utilization was maximal in mature forested areas which had not burned for 120 or more years (Scotter 1970). Millions of acres burn each year in Alaska and Canada and it has been suggested by some (e.g. Scotter 1970, Leopold and Darling 1953) that fire has played an important role in the decline of North American caribou populations. Conversely,

other biologists (Bergerud 1969, Skoog 1968) seriously disagree with the former but, until now, there has been no timely, cost effective means of annually monitoring the extent of wildfires on extensive and remote caribou and moose range. Our analysis indicates the discriminations involved are not particularly difficult with ERTS data.

In a similar multiband analysis of scene 1375-21002, the scheme in Table 3 is being applied to the digital tape product. In this scheme, the "water" categories correspond more to approximate depths than the descriptive hydrologic feature labels. For example, "S" indicates water depth of 2/3 meter or less, "I" indicates depth of about 1 meter, "R" indicates depths of 1 to 2 meters, and "D" indicates depths of approximately 2 meters or more.

The analysis will be a supervised classification and the anticipated small percentage of misclassifications involving bare mountain rock (k) and cloud shadow will be manually corrected on the output. Printer distortion will be eliminated through development of a new program, thus reducing overall output distortion to the .3% or less which is inherent to the original digital tape product. Therefore, resulting output will be a direct feature mapping at roughly 1:15,000 scale. This will eliminate the necessity for correcting distortion with a Zoom Transfer score or other optical device. This program eliminates the requirement for scale reduction described in the previous analysis for wildfire burns.

Three other techniques for map production were also applied to the same portion of scene 1375-21002. These techniques are direct visual interpretation of a 9.5" band 6 positive transparency, direct visual interpretation of a 9.5" color composite transparency, and VP-8 analysis of a 9.5" band 6 positive transparency. Careful examination of Table 3 clearly indicates that certain discriminations are not possible without use of all four bands. However, the purpose of using all four techniques is to make comparative cost and effectiveness evaluations which will be submitted in the final report.

Scene 1375-20595 is currently being analysed for caribou trail systems and selected habitat types on the Alaskan Arctic coastal plain. A printout of digital tape data was produced and feature areas for use as training sets have been identified by Dr. Robert LeResche of the Alaska Department of Fish and Game. Preliminary indications are that bands 6 and 7 will be the ones most useful in this analysis.

During the past summer, we obtained ground truth data on vegetation, pellet density, browse index, and soils at eleven different areas large enough for use as training sets in connection with ERTS MSS digital data. These field data have been punched on IBM cards in appropriate format for analysis by existing Forest Service programs. In cooperation with the Institute of Northern Forestry these card decks have been forwarded to the Forest Service computer facility at Portland, Oregon and analysis is currently underway. The primary objective of this analysis is to evaluate particular vegetation types in terms of habitat value to specific species. In this regard, our utilization indices for each area are based on pellet density for caribou, moose, hare, and ptarmigan as well as browsing indices for caribou, moose and hare.

2. Plans for the next reporting period: The three alternate feature mapping techniques described above will be applied to a portion of scene 1407-20371.

Feature enhanced displays of caribou trail systems (scene 1375-20595) will be set up on the CDU and evaluated by Dr. Robert LeResche provided the CDU becomes functional before our project termination date.

A comparative cost and effectiveness evaluation for the four feature mapping techniques used will be prepared.

TABLE 1
Linear Discrimination Based
on Band 7

	Number of Cases Classified into Group							
Group	Lake	Pothole	Stream	River	Gravel	Burn	Forest	% correct
Lake	33	4	2	0	0	0	0	85%
Pothole	12	3	13	0	0	0	0	11%
Stream	2	9	13	0	0	0	0	54%
River	17	15	3	0	0	0	0	0%
Gravel	0	0	0	0	20	2	0	91%
Burn	0	0	0	0	0	28	4	88%
Forest	0	0	0	0	0	0	57	100%

TABLE 2
Linear discrimination based on bands 5 and 7

	Number of cases classified into group							
Group	Lake	Pothole	Stream	River	Gravel	Burn	Forest	% Correct
Lake	33	6	0	0	0	0	0	85%
Pothole	12	13	3	0	0	0	0	46%
Stream	0	5	16	3	0	0	0	67%
River	0	0	3	32	0	0	0	91%
Gravel	0	0	0	0	22	0	0	100%
Burn	0	0	0	0	0	31	1	97%
Forest	0	0	0	0	0	1	56	98%

TABLE 3

Multiband Classification Scheme for
Scene 1375-21002

Features	Density Ranges			
	Band 4	Band 5	Band 6	Band 7
Open Spruce Forest (F)	21-24	14-19	25-28	13-17
Low Density Spruce (O)	19-24	14-19	29-32	12-18
Eriophorum Tussocks (E)	22-23	15-18	30-35	19-20
Upland Shrub community (willow) (L)	17-21	11-16	31-36	19-20
Riparian willow (W)	25-29	20-22	23-30	14-15
WATER Shallow Lakes (S)	16-32	20-27	9-18	1-4
WATER Streams (I)	17-20	10-15	9-22	3-8
WATER Rivers (R)	22-27	14-19	10-18	3-7
WATER Deep Lakes (D)	16-20	8-11	6-8	0-3
Bare Mountain Rock (K)	22-33	20-29	11-22	5-12
Alluvial Gravel (G)	29-35	25-30	23-29	9-13
Unmelted Snowbanks (A)	20-23	15-20	37-44	21-25
Clouds (C)	27+	22+	36+	21+
Upland Shrub Community (Birch) (B)	24-26	11-16	31-36	19-20

Literature Cited:

Bergerud, A. T. 1969. The caribou have returned. Ecology 50: 940-941.

Leopold, A. S. and F.F. Darling. 1953. Wildlife in Alaska. Ronald Press Company, New York. 129 pp.

Scotter, G. W. 1970. Wildfires in relation to the habitat of barren ground caribou in the taiga of northern Canada. Proc. Ann. Tall Timbers Fire Ecology Conf. Edmonton, Alberta

Skoog, R. O. 1968. Ecology of the caribou (*Rangifer tarandus granti*) in Alaska. Unpublished Ph.D. thesis, Univ. of Calif., Berkeley, Calif.

E. SIGNIFICANT RESULTS:

A multiband classification scheme was applied to ERTS MSS digital tape data in a portion of the Yukon Flats area. Primary analytic objectives of mapping the extent of recent wildfire burns and mature forest were realized illustrating application to moose and caribou biology. Additionally, the analysis indicated the presence of new lakes as well as disappearance of lakes present in 1956. Because this is an important waterfowl production area, similar analyses may have significant application potential to waterfowl biology for rapid updating of habitat information. Further field confirmation of this finding is required.

F. PUBLICATIONS: None

G. RECOMMENDATIONS: None

H. CHANGES IN STANDING ORDER FORM: None