An Interdisciplinary Analysis of Multispectral Satellite Data for Selected Cover Types in the Colorado Mountains, Using Automatic Data Processing Techniques

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MONTHLY PROGRESS REPORT

JUNE 1975

A. Overall Status and Progress to Date

After a set of spectral-information (spectral) classes have been developed, there are two methods of reducing the spectral classes to informational classes. One method is to pool the statistics for all spectral classes within each information class before classifying the data. The second method is to group the spectral classes for each information class after classifying the data.

There are advantages to each method. By pooling the statistics before classifying, the number of classes are reduced, therefore reducing the amount of computer time required to classify the data. Although grouping classes after classifying will require additional computer time to do the classification, the classification accuracy should be higher when classes are grouped rather than pooled. By pooling statistics, the separability between the classes used to classify is reduced. This is caused by the combining of spectral classes that are spectrally separable (if training was properly done), thus causing bimodal distributions and increasing the variances.

The objective of this study was to determine the effects, in terms of computer classification time and classification accuracy, of pooling and grouping. The training statistics used to make the comparisons was developed from SL-2 S-192 data over the San Juan Mountains of southwestern Colorado. A modified clustering[1] analysis technique was used to obtain the spectral-informational classes. Table 1 is a list of the spectral-information classes and how they are reduced to two levels of informational classes. Four S-192 channels were used for all classifications (Ch. 2, 7, 9, 11). These were selected as having the highest average transformed divergence for the 32 spectral classes.

The Granite Peaks test site was classified using the 32 spectral classes, the 10 forest cover type information classes, and the seven Level 2 information classes. From these three classifications an evaluation of the classifications was accomplished using the test fields selected and reported in the October, 197 Monthly Report. For each classification, test field results were obtained at both informational levels. The results are summarized in Table 2. As a further comparison, a second classifier (ECHO) was also used to classify the test site.

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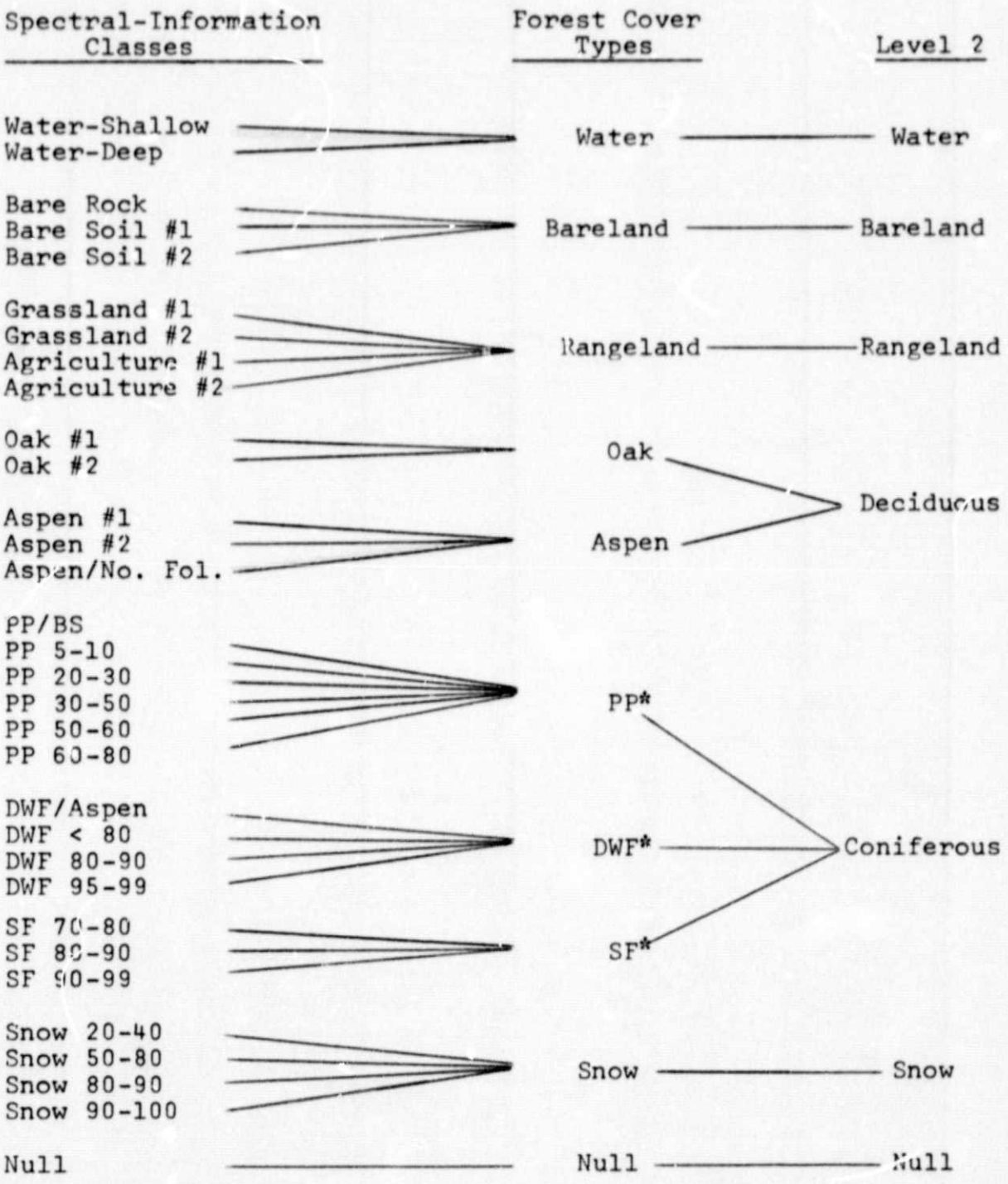
[1]Fleming, M. D., J. S. Berkebile and R. M. Hoffer "Computer-Aided Analysis of LANDSAT-1 MSS Data: A Comparison of Three Approaches, Including a 'Modified Clustering' Approach", presented at the Purdue Symposium on Machine Processing of Remotely Sensed Data, June 3-5, 1975, Purdue University, W. Lafayette, IN.

TABLE 1



*PP- Ponderosa Pine
DWF- Douglas/White Fir
SF- Spruce/Fir

TABLE 2.

ECHO & CLASSIFYPOINTS SL-2 S-192

Pooling vs. Grouping

Best 4 (Ch. 2, 7, 9, 11) SKYLAB

Number of Classes (Grouped)	Number of Classes (Pooled) 32 Spectral Classes	10 Forest Types	7 Level 2	
10	76.0	74.7	-	ECHO
	(71.0)	(68.7)	-	(*CLASSIFYPOINTS)
7	87.2	84.6	82.9	ECHO
	(85.0)	(82.6)	(80.5)	(*CLASSIFYPOINTS)
Total CPU Time For Classification (Seconds)	2266	998	791	ECHO
	(2869)	(961)	(701)	(*CLASSIFYPOINTS)

The results indicate that pooling statistics greatly reduces the amount of CPU time required to do the classification (from 2869 sec. to 701 sec. for classifypoints). Also, the drop in classification accuracy is not great at either level (76.0% to 74.7%) and (87.2% to 82.9%) the same trends are also evident for the ECHO classifier.

As indicated in the November Monthly Report, five distinct spectral classes of snow cover have been mapped in the Granite Peaks test site through a layered classification of the SL-2, S-192 MSS data. The spatial distribution of these snow cover spectral classes appeared to be closely related to the topography of the area. The digitized DMA topographic information was overlaid onto the SL-2 S-192 MSS data, in order to obtain an indication of the value of the topographic overlay data. The elevation data were combined with the results of the snow cover classification. In this manner, the area of each of the five spectral classes of snow cover was quickly determined as a function of elevation (using 100 meter elevation increments). These results are shown in Table 3. Further utilization of the digitized topographic information in conjunction with multispectral satellite data will be reported in the following monthly report.

B. Recommendations

None

C. Expected Accomplishments

Text material is in the process of being edited and the illustrations for the final report are being prepared.

D. Significant Results

None

E. Travel

R. M. Hoffer will present an invited paper entitled "Computer-Aided Analysis of SKYLAB Scanner Data for Land Use Mapping, Forestry and Water Resource Applications" (copy attached) at the 11th International Symposium in Space Technology and Science, Tokyo, Japan in July. In route to Tokyo, Dr. Hoffer will give a talk on the results of some of the SKYLAB work at a regional meeting of the American Society of Photogrammetry in Olympia, Washington on June 20, and at a special seminar at the University of Alaska in Fairbanks on June 22.

TABLE 3 -- Snowpack Area Within 100 Meter Elevation Increments

Elevation (Meters)	--------Spectral Class of Snow---------- 1	2	3	4	5	Total Area (hectares)
Above 3700	1179	2464	308	108	7	4066
3600-3700	400	1914	694	135	37	3180
3500-3600	129	1868	1858	517	61	4433
3400-3500	45	904	1858	1266	280	4353
3300-3400	13	378	1305	1417	812	3925
3200-3300	7	94	922	1258	1298	3579
3100-3200	6	22	529	793	1540	2890
3000-3100		6	213	433	1041	1693
2900-3000		1	38	188	535	762
2800-2900			4	54	289	347
2700-2800			1	13	147	161
2600-2700				1	95	96
Below 2600					79	79
Totals	1779	7651	7730	6183	6221	29564