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E7.5-10.3.7.6
CR-143238

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104600-40-L
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Subcontract #1 Prime NAS9-13332

(E75-10376) [RECOGNITION MAP ANALYSIS AND CROP ACREAGE ESTIMATION] Progress Report, May 1975 (Environmental Research Inst. of Michigan) 7 p HC $3.25 CSCL 05B G3/43 N75-29518 Unclas 00376

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Skylab Support
Progress Report, May 1975

The following report serves to report progress for May 1975 on Subcontract #1 of contract NAS9-13332. The financial reports for this contract are being submitted under separate cover.

The objective of this subcontract is to support the Skylab EREP effort of Michigan State University by: 1) performing standard recognition processing and producing recognition maps and area counts, 2) assisting in the analysis and interpretation of the recognition maps and other extracted information, 3) further developing and adapting, for use on Skylab EREP data, methods for estimating proportions of unresolved objects, and 4) applying proportion estimation techniques to one frame of EREP data to determine to what extent the accuracy of crop acreage estimates is improved.

Progress on this contract was impeded for much of May by ERIM's relocation to different facilities. [ERIM has purchased a large laboratory-office building in Ann Arbor and the organization is relocating to the new site.] During the period from May 8 to May 26 the ERIM computer facility was being moved and reestablished in the new building and consequently was closed during this period. Work after May 8, therefore, concentrated on those analysis tasks that did not require the use of the computer.

During this reporting period, we began to study the relationship between recognition accuracy and the number of sections used for training. Since only center field pixels were used for training, only a small percentage of the pixels within a section were useable.

As reported last month, a training procedure was developed using all 40 sections from the Northern half of the ground truth area. These forty sections were ranked using a random number scheme, and training was repeated using the first 20 sections and the first 10 sections on the list, respectively. The training procedure followed was the same as described in last month's report except we did not try to reduce the number of spectral signatures obtained from the cluster procedure. To reduce the number of SDOs

used for classification we followed the procedure outlined last month for choosing the best n channels where the decrease in the probability of misclassification between using n and n+1 channels became less than 0.05. The SDOs used for each training set are given below.

Training Set	SDOs	Total No. of SDOs
40 Secs.	2, 8, 10, 12, 15, 17, 18	7
20 Secs.	2, 8, 10, 12, 14, 15, 17, 18	8
10 Secs.	2, 10, 12, 14, 15, 17	6

Since we omitted the step that reduced the number of spectral signatures, the 20 section training set contained more signatures than the 40 section training, 19 versus 15. However, the 10 section training set had the fewest spectral signatures, 13.

The number of ground cover classes represented by the spectral signatures decreased as the number of sections used for training decreased. Selecting the training sections on a random basis meant that some ground covers were no longer represented by the training signatures. The 40 section training set included seven ground cover classes, corn, grass, soybeans, trees, brush, alfalfa and bare soil. The 20 section training set contained only five ground cover classes omitting soybeans and alfalfa, and the 10 section training set did not have a signature for trees leaving only four ground cover classes.

Tables I and II display the results of recognition over all field center pixels for the 20 section and 10 section training sets. The 19 signatures of the 20 section training set consist of 4 corn, 2 trees, 2 brush, 2 bare soil, and 9 grass signatures. The 13 signatures from the 10 section training set include 4 corn, 2 brush, 2 bare soil, and 5 grass signatures.

Figure 1 gives the recognition results for the four classes included in all three training sets. Bare soil recognition improves with a decrease in the number of sections used for training. Grass recognition accuracy improves for the 20 section training versus the 40 section, but the 10 section training set gives much reduced accuracy when compared to either

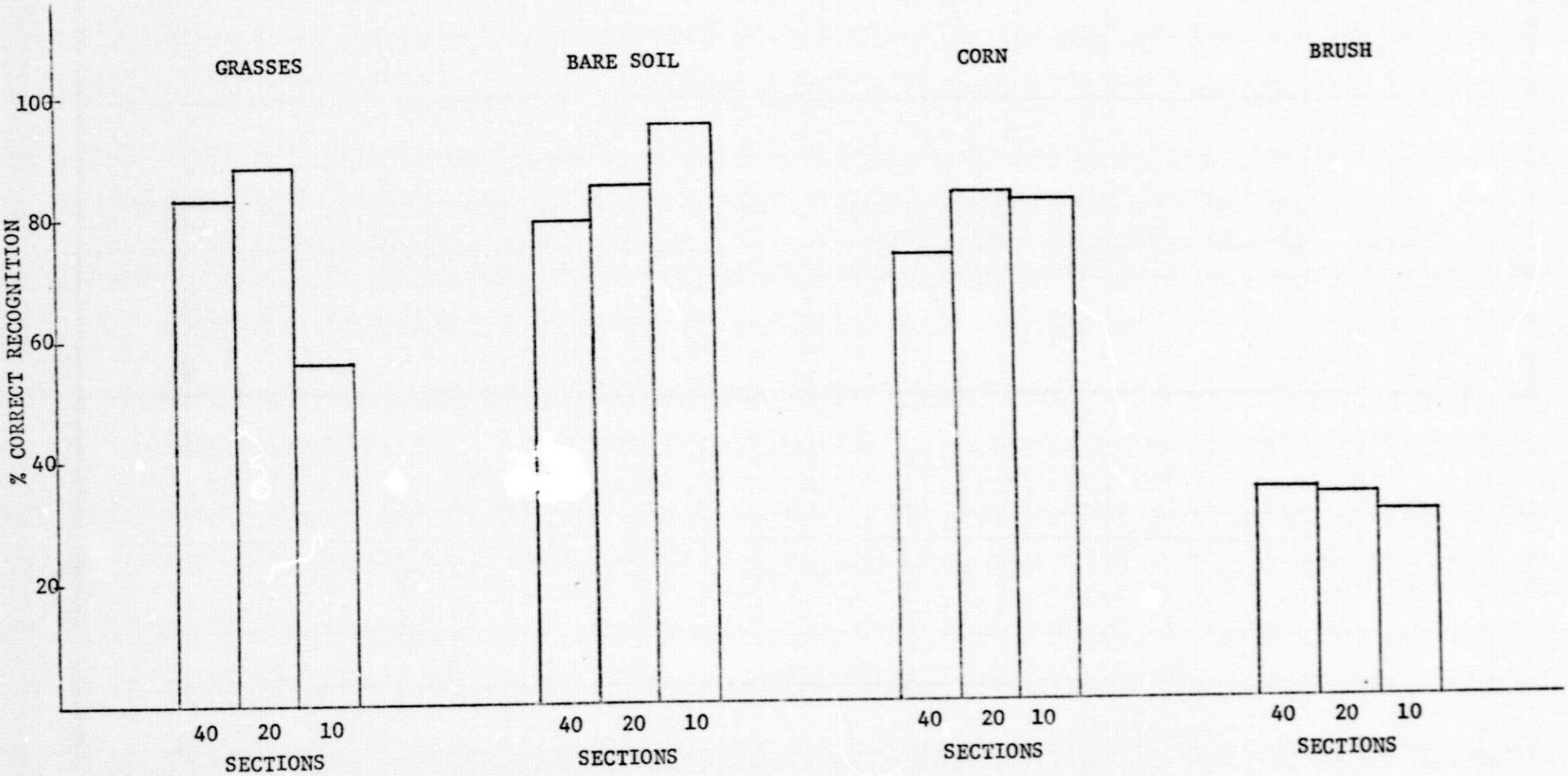
TABLE I.

GT CLASS	PIXELS	GRASS	B-SOIL	CORN	BRUSH	TREE	UNCL
GRASS	431	88.23	.46	7.66	1.62	.46	1.57
ALFALF	24	62.50	.00	33.33	.00	.00	4.17
B-SOIL	41	7.32	85.37	.00	.00	.00	7.32
CORN	379	11.34	.79	82.85	1.85	1.85	1.32
BRUSH	76	13.16	.00	42.11	32.89	5.26	6.58
SOY	19	5.26	.00	84.21	.00	10.53	.00
TREES	31	12.91	.00	29.03	6.45	45.16	6.45
STUBBL	63	79.36	9.53	4.76	.00	1.59	4.76
URBAN	72	31.95	13.89	45.83	.00	1.59	8.33
TOTAL	1136	46.65	4.93	39.44	3.61	2.64	2.73

TABLE II.

GT CLASS	PIXELS	GRASS	B-SOIL	CORN	BRUSH	UNCL
GRASS	431	56.38	26.22	15.78	1.62	.00
ALFALF	24	50.00	.00	41.67	4.17	4.17
B-SOIL	41	4.88	95.12	.00	.00	.00
CORN	379	10.29	2.91	81.53	2.64	2.64
BRUSH	76	6.58	2.63	61.84	19.54	9.21
SOY	19	21.06	.00	78.95	.00	.00
TREES	31	12.90	3.23	80.65	.00	3.23
STUBBL	63	63.49	20.63	9.52	4.76	1.59
URBAN	72	34.73	41.67	16.67	.00	6.94
TOTAL	1136	32.31	18.40	43.31	3.17	2.82

FIGURE 1. COMPARISON OF CORRECT RECOGNITION FOR FOUR GROUND COVER CLASSES USING 10, 20, and 40 SECTIONS FOR TRAINING



the 20 or 40 section sets. The increased accuracy with the 20 section training is probably due to the fact that there are 9 grass signatures compared to 5 for either the 40 or 10 section sets. The corn recognition accuracy also improved for the 20 section training set. The recognition accuracy for the 10 section training set was reduced compared to the 20 section but was still higher than when the 40 section training set was used for classification. These differences are due to fewer corn pixels being misrecognized as brush. However, the amount of brush incorrectly classified as corn increases with decreasing training size which also explains the steady decrease in brush recognition accuracy. Another reason why the 20 section signature set improves recognition accuracy for some ground cover classes may be the fact that was based on 8 classification SDOs as compared to 7 for the 40 section set and 6 for the 10 section set.

For the next reporting period, we plan to further analyze recognition results for field center pixels as well as calculating and analyzing recognition results over the entire section for all 40 sections using all three training sets.

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