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FOURTH BI-MONTHLY PROGRESS REPORT
UNIVERSITY OF ALASKA
ERTS PROJECT NO. 110-2
April 5, 1973

A. TITLE OF INVESTIGATION: Identification of Phenological Stages and Vegetative Types for Land Use Classification

B. PRINCIPAL INVESTIGATOR/GSFC ID: C. Ivan Branton/UN 641

C. PROBLEMS IMPEDING INVESTIGATION:

The Color Display Unit (CDU) being built by Interpretations Systems Incorporated, Lawrence, Kansas, has not yet been delivered to Project 1. We have experienced difficulty identifying multispectral signatures in digital data because of uncertainties in geographical locations of features on the computer printouts.

D. PROGRESS REPORT:

1. Accomplishments during reporting period.

Computer listings of MSS digital data for three CDU displays have been color-coded for signature analysis. Those scenes represent an area of 2,250 mi^2 in the Matanuska Susitna Valley scene 1049-20505. A large number of feature signatures have been identified on those printouts. A selected group of signatures (Appendix C) are ready for validity checks and predictive power testing on the computer. Signatures were identified by locating known geographical features on the printouts when compared to NASA aircraft data, existing maps and ground truth collected during the 1972 summer period. The original signatures were too broad for automated data processing. To insure distinctions among vegetative types, signatures were refined by selecting only those which occurred most frequently.

Indexing and filing of all 183 ERTS scenes received at the Palmer data library was completed. Image descriptor forms were completed for scenes of value to our project.

Eight selected scenes have been projected on the color additive viewer and photographed using six different filter combinations. The exposed film has been sent to Project 1 for photo processing.

Since ERTS data are proving useful to the Alaska Federal-State Land Use Planning Commission, we have been cooperating with that group. They and we have agreed to jointly purchase a Bausch & Lomb Zoom Transfer Scope which will be extremely valuable for ERTS data analysis. This represents a considerable contribution to our ERTS program from funds not supplied by the NASA contract.

While on other business, Dr. McKendrick visited with ERTS investigators from Lockheed Electronics, Oregon State University, the University of Idaho, Kansas State University and Kansas University in order to compare ERTS data processing techniques and to become more familiar with the overall program. In addition he attended the remote sensing session of the 26th annual meeting of the Society for Range Management. While in Lawrence, Kansas, he acquired firsthand experience with the CDU under construction by Interpretations Systems Incorporated and their VP-8 image analyzer. With the latter instrument he obtained 75 color slides of density sliced displays from the 1049-20505 scene.

We met with Project 3 personnel, traded data analyzing progress reports and agreed to the need for a uniform vegetation classification scheme between projects 2 and 3. The agreement insures that the two groups will use identical terminology and vegetative classifications so that vegetative types from different sections of Alaska can be compared and correlated with other environmental information such as soil, ground water, and climatic data.

Our project personnel attended the surveying and mapping convention in Anchorage and learned firsthand of the capabilities of the Bausch and Lomb Zoom Transfer Scope. We also attended a remote sensing session at the Project 1 Geophysical Institute, on March 21, which included reports on the ERTS-1 symposium and on the current program status in order to update university personnel.

2. Plans for next reporting period.

We will either acquire 1:250 k scale color transparencies of photos from the CAV or project those slides at that scale onto a rear projection screen in order to begin developing vegetation overlays of the Matanuska Susitna Valleys and western Kenai Peninsula. Color prints (8" x 10") of portions of those scenes will be purchased and used to correlate tonal differences with vegetative classification, identified by observing from light aircraft and other forms of ground truth information.

Further meetings dealing with classification of Alaskan vegetation are planned when Project 3 personnel comes to Palmer for meetings with the Soil Conservation Service.

We will catalog and utilize suitable scenes as soon as they begin arriving from the 1973 season. Refined MSS digital signatures will be validated, and their selective powers for automated data processing will be tested by requesting symbol-coded printouts from computer compatible CDU tapes for scene 1049-20505. Digital signatures identification and refinements will continue on 1049-20505. If our techniques and signature identification proves effective we expect to begin digital processing ERTS data on the Kenai and Peters Creek transects.

E. SIGNIFICANT RESULTS:

A number of MSS digital signatures have been identified and have been grouped into 13 classifications. We are now ready to test the signatures

with the computer. Appendix A contains listings of our refined MSS digital reflectance signatures for various physical features. Appendix B is a summary of the MSS digital signatures shown in Appendix A. Appendix C groups the summary of MSS digital signatures into 13 classifications, providing data to be tested in the computer program developed by Project 1 personnel.

Appendix D is a bar graph portraying the digital MSS reflectance signatures for 13 dominant physical features of scene 1049-20505. Signature separation of features are more easily identified when data are plotted because it shows that separations among density ranges increase with longer wave lengths. That explains in part why most physical features are more easily recognized visually in bands 6 and 7 than in bands 4 and 5. It also explains why bands 4 and 5 proved difficult to density slice compared to bands 6 and 7. Similar difficulties have been encountered with interpreting computer printouts of bands 4 and 5 because density ranges are compressed in those bands. Certain features are more difficult to separate than others. The graph in Appendix D shows in which bands signature separation for feature identification is most likely to occur. Thus the MSS signature information has proven valuable for both digital or visual data processing.

F. PUBLICATIONS:

None

G. RECOMMENDATIONS:

We strongly recommend obtaining more ground truth data from other areas not covered by NASA aerial photography. We plan to utilize light aircraft after first obtaining color prints or color transparencies of color additive viewer projections from selected ERTS scenes. With color images in hand when flying over areas of interest, we will be able to

appropriately classify and relate the tonal differences that are now recognized but unidentified.

H. CHANGES IN STANDING ORDER FORMS:

None

I. ERTS IMAGE DESCRIPTORS FORMS:

Image Descriptor forms have been completed only for selected ERTS scenes which will be of value to our project. These are attached.

J. DATA REQUEST FORMS:

Bulk digital tapes have been requested for scenes 1033-21020, 1049-20505, 1049-20512, 1066-20451, 1066-20453, 1103-20520, 1104-20565 and have been received at Project 1 Geophysical Institute.

MOST PROBABLE
MULTISPECTRAL REFLECTANCE SIGNATURES

APPENDIX A

Scene No. 1049 - 20505 Channel No. 2

CDU File No. 341, 351, 361, 371

Strips 3 & 4

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.6	0.7 - 0.8	0.8 - 1.1
I. CLOUDS				
Cloud (above Eagle River)	27-68	25-68	31-64	18-33
Cloud (1/2 mi. west old Seward Hwy)	27-49	21-61	24-57	9-23
II. WATER RESOURCES				
A. Clear Lakes				
Coves Lake (W. edge Cook Inlet)	18-19	12-13	9-11	2-6
Lake (between Birchwood & Eagle River)	22-25	11-15	10-11	2-3
Lake Beth	18-19	11-12	8-11	2-3
Small lake below Beth Lake	17-19	11-12	9-11	2-3
Lake west of Beth Lake	17-20	11-12	7-9	2-3
Otter Lake	18-20	10-11	7-9	2-3
6 mile lake	17-19	10-11	7-11	2-4
Campbell Lake (No. II)	19-20	12-13	16-17	6-7
Lake Beebe	18	10-11	10-12	2-4
Sundi Lake	19-20	11-12	9-11	3-4
Sand Lake	19-20	10-11	8-10	2-3

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.7	0.7 - 0.8	0.8 - 1.1
Lake Hood	21-23	13-14	9-11	2-3
Connors Lake	19-20	11-12	8-11	2-3
Spenard Lake	20-22	12-14	8-11	2-3
Meadow Lake	19-20	12	13-16	7-9
Jewell Lake	19-20	11-12	8-9	2-3
Delong Lake	19-21	11-12	8-12	2-3
Birch Lake	25-26	21-22	18-20	6-7
B. Muddy Salt Water				
Campbell Lake (muddy)	23-25	16-19	11-13	2-3
Cook Inlet	27-30	20-23	15-18	4-6
Turnagain Arm	26-28	20-22	14-17	3-5
C. Silty River Water				
Eagle River	18-19	11	19-23	11-12
III. BARE GROUND				
Goose Bay (mud flats)	23-25	15-18	17-23	7-11
Eagle River mud flats	20-23	13-18	15-18	6-15
Mud flats in Turnagain Arm (S. of Campbell Lake)	23-26	17-19	14-17	5-6
Mud flats (mouth of Ship Creek)	23-25	17-19	16-18	6-8
Bare ground (N. of Elmendorf)	26-27	20-21	19-21	6-8
Escarpment (on Turnagain Arm)	24-27	19-20	25-30	15-19

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.7	0.7 - 0.8	0.8 - 1.1
Bare ground (N. of Otter Lake)	22-24	18-19	16-19	6-7
Bare ground (S. of Tudor Road)	26-28	20-22	23-26	9-11
Gravel Pit (W. of Sand Lake)	28-30	20-25	18-22	6-7
Small gravel pit (on O'Mally Road)	26-27	21-22	29-33	8-10
Gravel pit (W. of Jewell Lake)	26-28	21-23	19-21	7-9
IV. MAN MADE FEATURES				
Dump (Turnagain Arm)	27-28	22-25	25-31	9-12
Cleared area around Anchorage International	24-27	18-21	24-33	9-15
Elmendorf (runways)	22-25	16-20	22-25	8-13
Anchorage International (runways)	26-28	18-22	21-24	8-10
Subdivision (S. edge of Campbell Lake)	24-28	15-21	23-25	10-13
Military installation	35-43	35-41	26-34	13-14
Ft. Richardson	24-26	15-20	16-23	6-11
Elmendorf threshhold	35-46	32-40	26-35	12-14
General development (in Elmendorf area)	24-30	16-25	17-25	7-11
Metropolitan Anchorage	25-33	16-26	20-28	8-12
mixed with birch and spruce Urban area (S. of O'Mally Rd.)	24-27	19-22	17-24	7-11
(w/ intermixed birch & spruce) Birch Lake housing development	21-27	13-21	23-28	11-13
Trailer court (Sand Lake Road)	27-28	22	23-25	9-11
Radio tower (S. of Campbell Lake)	23-24	19-20	28-30	15-16

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.7	0.7 - 0.8	0.8 - 1.1
Old & new Seward Highways	26-28	19-21	23-25	9-12
Glenn Hwy.	19-21	20-21	26-28	11-15
Sand Lake Road	24-26	18-20	24-28	9-12
V. NATURAL VEGETATIVE TYPES				
A. Wet Types				
Wet muskeg in Eagle River mud flats	18-20	12-14	9-13	3-8
Wet muskeg (S. of Eagle River)	17-18	10-12	12-13	4-6
Large muskeg (E. of Birch Lake housing develop.)	20-22	13-15	21-23	10-13
Muskeg (Between Campbell Lake & Seward Hwy)	21-22	13-15	21-23	13-17
Muskeg (Junction Tudor Rd. & old Seward Hwy)	22-24	15-17	20-24	11-14
Muskeg (between O'Mally Rd. & Campbell Lake)	21-22	14-15	22-24	11-13
Muskeg (in Campbell Creek area)	22-24	15-17	16-25	11-13
Muskeg (between Lake Hood & Cook Inlet)	22-24	16-18	21-24	9-11
Muskeg (W. edge Cook Inlet)	19-21	12-13	22-28	11-15
Muskeg (between Birchwood & Eagle R.)	17-19	11-13	17-20	8-10
Muskeg (between Otter L. & 6 Mile Lake)	17-19	11-12	15-21	9-10
(Chester Creek area) Muskeg & mixed birch & spruce	19-23	12-15	20-24	12-16
Tidal flats (grassland type)	21-23	12-14	26-33	18-22
B. Grass Types				
Grass field (No. II SW of Sand Lake)	23-24	15-16	26-33	16-19

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.7	0.7 - 0.8	0.8 - 1.1
Clearing (S. of Anchorage International)	23-24	15-17	24-28	11-16
Grass field (W. of Sand Lake)	22-25	15-17	28-30	14-18
C. Birch				
Birch (1 mile W. of Jewell Lake)	21-22	12-13	28-30	18-20
Birch (S. of Eagle River)	17-19	11-13	21-26	13-15
Birch (in gravel pit area S. of Sand Lake) (poor representative)	25-26	15	25-28	17-19
Birch (between Birchwood & Eagle River)	19-20	12	21-28	16-17
Birch (W. edge Cook Inlet)	21-22	12-13	31-33	19-20
Birch (N of Eagle River)	19-25	11-13	28-30	18-19
D. Birch-Spruce				
Birch-spruce mixed type (W. of Otter Lake)	17-19	11-12	19-23	11-13
Birch-spruce mixed type(between Birchwood & Eagle River)	17-19	11-12	23-29	16-18
Birch-spruce (N. of dump-Turnagain Arm)	20-22	12-14	22-26	11-14
Spruce-birch mixed type (Between Ft. Richardson & Elemendorf)	19-21	12-14	21-26	11-14
Spruce-birch mixed type (S. of Delong Lake)	21-22	12-14	20-23	11-12
E. Spruce				
(N. of Eagle River) Black spruce intermixed w/ muskeg	17-20	11-13	19-23	10-11
Spruce type (N. edge Conners Lake)	20-21	12-13	15-17	6-7

MOST PROBABLE
MULTISPECTRAL REFLECTANCE SIGNATURES APPENDIX A

Scene No. 1049-20505 Channel No. 1

CDU File No. 441, 451, 461, 471

Strips 1 & 2

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.6	0.7 - 0.8	0.8 - 1.1
I. CLOUDS:				
Clouds over Wolverine Lake area	30-76	30-76	30-66	20-35
Clouds south of Chickaloon	30-127	30-127	30-127	20-54
Heavy cloud bank between Lazy Mountain and Friday Creek	30-127	30-127	31-125	25-63
Cloud over Butte area	30-127	30-127	33-107	21-55
Clouds over Pioneer Peak	30-79	30-79	30-69	24-38
Heavy cloud bank N. of Eklutna Lake	30-127	30-127	31-127	25-58
Clouds on ridge between Eklutna River and Thunderbird Creek	30	25-75	31-79	23-41
Clouds on ridge between Thunderbird Creek and Peters Creek	30-79	25-55	33-66	22-32
II. CLOUD AND MOUNTAIN SHADOWS:				
Cloud shadows between Pinnacle Mt. and Lazy Mt.	17-19	9-11	10-14	3-7
Cloud shadow - Lazy Mt. area	19-21	10-11	11-17	4-7
Cloud shadow over Butte area	16-18	9-11	8-14	3-8
Cloud shadows in Goat Creek	18-21	9-13	12-17	5-9
Mountain & cloud shadow #1	18-19	10-11	10-15	3-8
Mountain & cloud shadow #2	16-18	8-11	7-13	2-6

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.7	0.7 - 0.8	0.8 - 1.1
Mountain & cloud shadows #3	16-18	8-12	8-15	3-7
Shadow of Twin Peaks	17-19	9-12	7-14	1-5
Eklutna River Canyon Birch & spruce (mostly shaded)	17-18	10-11	13-17	7-9
Thunderbird Creek shadowed area	18-21	11-15	14-33	6-16
Creek shadowed areas south of Eklutna Lake	18-19	10-12	14-18	7-9
Shadowed section - Knik River	17-19	10-11	7-9	1-3
III. WATER RESOURCES:				
A. Shallow Clear Ponds				
Farm pond by captured lake	16-18	9-10	8-12	2-6
Small lake (shallow) Lazy Mt.	18-18	10	8-9	2-4
B. Muddy or Silty Lakes				
Small lake north of Swan Lake	19-22	12-16	9-11	2-6
Swan Lake (muddy)	20-29	14-21	9-13	2-3
Eklutna Lake	32-35	23-25	11-13	2-3
C. Silty River Water				
Upper Knik River	26-28	16-22	12-17	3-5
Lower Knik River	26-28	18-21	13-19	4-6
Matanuska River	16-18	20-22	16-19	4-7
Lake captured by Matanuska River (silty)	24-26	13-15	16-18	3-6

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.7	0.7 - 0.8	0.8 - 1.1
D. Other Water Resources				
Palmer sewage treatment facility	21-22	15-18	17-19	6-8
Shadowed section Knik River	18-20	10-11	7-9	1-3
IV. MANMADE FEATURES:				
Palmer townsite (mixed everything)	23-26	19-22	22-28	9-13
Palmer airport	23-26	17-19	24-30	11-16
2 farmsteads on Springer System	36-40	32-34	39-49	17-23
Palmer sewage treatment facility	21-22	15-18	17-19	6-8
V. BARE GROUND:				
Bare gravel in Matanuska River bed	26-27	21-22	18-20	7-9
Fallow (small field south of airport)	19-21	14-15	17-18	7-9
Fallow field N of Knik River	20-21	15-16	16-19	7-9
VI. FIELD CROPS:				
Potatoes #1 south of airport	20-22	13-14	28-40	16-26
Potatoes #2 small field	21-22	13-14	37-44	25-27
Oats-barley & peas (Hamilton's)	21-22	12-14	44-47	25-30
Brome field NE of Palmer	22-24	14-17	35-44	19-24
Brome south edge of airport	19-21	13-15	18-19	9-10
Timothy field north of Palmer	22-25	19-21	26-28	14-16
Timothy and quackgrass field (Hamilton's)	24-25	20-22	26-30	15-18

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.7	0.7 - 0.8	0.8 - 1.1
Grass field N. of Knik River	22-25	18	25-26	11-12
VII. NATURAL VEGETATIVE TYPES:				
A. Wet Types				
Small muskeg - Lazy Mt. (mostly Calamagrostis)	18-19	11-12	16-18	9-11
Muskeg #1 west of Swan Lake	20-22	13-15	26-28	13-16
Muskeg #2 adjoining Swan Lake	23-26	15-17	26-32	17-18
B. Birch				
Open stand of birch with understory of Calamagrostis	19-20	11-12	28-30	14-17
Birch south of airport	21-22	12-14	25-26	12-18
3 birch stands west edge of Matanuska riverbank	19-20	11-12	28-25	13-18
Birch stand between pond and river	19-20	11-12	26-28	16-19
C. Birch-Willow-Alder Mixed Types				
Birch-willow & cottonwood mixed type on Matanuska River island N.of Palmer	19-20	11-13	24-28	12-16
Birch and willow on island in Matanuska R.	19-22	12-14	23-28	10-16
Islands in Knik River birch, alder, willows and sedge - wetland	19-22	11-12	22-26	10-15
Willow & cottonwood on island in Matanuska River east of airport	22-23	14-16	22-24	10-12
D. Birch - Cottonwood				
Birch-cottonwood mixed type between N. runway and river	19-22	12-14	28-30	14-18
Cottonwood - birch mixed type S. Matanuska riverbank by bridge	18-20	11-12	23-28	12-16
Cottonwood, birch mixed type along E. bank of Matanuska River	18-19	11-12	26-28	14-17

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.7	0.7 - 0.8	0.8 - 1.1
E. Birch - Spruce				
Spruce-birch mixture; Lazy Mt. Clark Wolverine Road	18-19	10-11	17-18	9-11
Birch-white spruce SW of airport	18-19	11-12	24-26	13-15
Birch-white spruce mixed type below Springer System	18-20	11-12	23-26	12-15
Birch-spruce mixed type N. of Knik River	18-19	10-13	12-18	6-8
Eklutna River canyon (mostly shaded) birch - spruce mixed	17-18	10-11	13-17	7-9

MOST PROBABLE
MULTISPECTRAL REFLECTANCE SIGNATURES

APPENDIX A

Scene No. 1049-20505 Channel No. 1

CDU File No. 342, 352, 362 & 372

Strips 3 & 4

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.6	0.7 - 0.8	0.8 - 1.1
I. CLOUDS				
Clouds west edge, Little Susitna	30-127	30-127	40-68	30-45
Cloud (flats)	34-120	25-127	40-100	23-39
Cloud by Rabbit Slough	25-49	20-56	30-61	20-37
II. CLOUD & MOUNTAIN SHADOWS				
Cloud shadow Hyer Road and new highway	18-19	9-11	12-16	5-7
Cloud shadow (flats)	16-18	9-11	10-12	4-6
Twin peak mountain & cloud shadow	16-18	9-11	10-20	3-10
Eklutna Mountain shadow	15-18	8-9	8-13	3-4
III. WATER RESOURCES				
A. Clear & Shallow				
Kings Lake (shallow water)	16-19	11-12	12-15	4-8
McLeod Lake	16-17	10-11	7-9	1-3
Duck pond (gravel pit by highway)	21-22	11-12	6-9	1-2
Shallow lake no drainage out	18-19	11-13	12-16	4-5

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.7	0.7 - 0.8	0.8 - 1.1
B. Clear & Deep				
Kings Lake (deeper water)	17-18	8-10	7-9	2-4
High ridge Lake (clear)	16-18	9-10	7-10	1-5
Cottonwood Lake	16-18	9-11	7-8	2-4
Finger Lake	16-18	9-11	7-8	1-3
Wasilla Lake	17-19	9-11	7-9	1-3
Unnamed lake between 4-corners & Brasil Springs	16-18	9-11	8-11	2-5
Mirror Lake (clear & deep)	18-19	10-11	8-10	1-3
Long Lake (clear)	16-18	9-10	7-10	1-3
Baird Lake (clear)	16-18	9-10	7-11	2-5
Edmond's Lake (clear & deep)	18-25	10-13	8-17	2-6
Matanuska Lake	17-18	8-9	6-8	1-3
Johnson Lake	16-18	8-10	7-10	2-3
IV. SILTY WATER				
Matanuska River above Palmer (muddy)	27-29	21-23	16-19	5-7
Cook Inlet (deeper water)	26-28	20-21	13-18	4-6
V. BARE GROUND				
Gravel pit & stream bed - Eklutna	23-26	16-20	14-17	5-9
Matanuska River bed bare gravel	27-29	21-23	20-21	7-8
Fallow land (possibly new seeding mostly bare ground)	21-22	12-13	43-46	23-26

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.7	0.7 - 0.8	0.8 - 1.1
Mud flats	22-26	15-19	17-21	6-9
VI. MANMADE FEATURES				
Anchorage-Fairbanks Highway south of Wasilla Lake	22-24	16-19	25-29	13-15
Birchwood airstrip	22-26	15-20	18-20	8-9
VII. CULTURAL VEGETATIVE TYPES				
A. Oats				
Oats & peas (Vickaryous fields)	21-27	22-26	32-35	16-18
Oats-peas-barley (Vickaryous)	22-26	15-18	38-41	21-23
Oats, Hyer Road	22-26	16-20	35-41	19-23
B. Grass				
Brome, Hyer Road Mrs. Dunlap's old place	20-22	14-16	31-37	18-22
Brome field (Vickaryous)	22-23	13-15	42-45	25-28
Grass clearing on new highway	20-23	13-15	29-31	16-18
Grass fields at 4-corners	21-22	12-15	32-35	17-21
Grass clearing between Hyer Road & 4-corners	19-22	12-15	30-35	17-21
Grass fields (clearing)	21-23	12-15	30-37	16-20
C. Grass & Brush				
Low brush grass mixed type on go-back at 4-corners	19-20	13-14	30-35	18-20

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.7	0.7 - 0.8	0.8 - 1.1
VIII. NATURAL VEGETATIVE TYPES				
A. Wet				
Tidal flats	21-23	14-16	23-28	11-15
Flats - wetland type, sedge, Ca, ca, Sal, Myga, Po pa	19-21	14-15	21-24	11-14
Wet sedge & Calamagrostis type between Wasilla & Cottonwood Lake	19-20	11-13	30-31	16-17
Sedge & Calamagrostis - Low shrub muskeg type with inter-mixed black spruce S. Wasilla Lake	18-20	11-12	15-23	8-12
Muskeg type, sedge & Calamagrostis and low shrub	18-19	11-12	18-20	9-11
Calamagrostis & sedge around lake	18-19	10-14	18-19	9-10
Rabbit Slough, sedge, low shrub wet type	19-21	13-16	33-36	19-21
Muskeg between Eklutna & Knik River bridge	18-19	11-13	12-17	5-6
Large muskeg (North edge Cook Inlet)	18-19	11-15	8-12	2-5
Black spruce & muskeg W. of Mirror Lake	18-19	10-11	15-18	8-10
B. Dry Types (Grassland)				
Grassland type above timberline Little Susitna	21-23	14-17	33-40	21-26
Birch				
Birch below Cottonwood Lake	18-19	11-12	23-28	12-16
Spruce - Deciduous				
Spruce type-west edge Long Lake (Spruce Cottonwood type)	18-20	11-12	20-24	11-16
Cottonwood - west edge Long Lake (Spruce Cottonwood type)	18-20	11-12	20-24	11-16
Mixed birch-spruce type Location #1	18-19	10-11	22-25	12-14

PHYSICAL FEATURES	WAVE LENGTHS (Micrometers) 0.5 - 0.6	0.6 - 0.7	0.7 - 0.8	0.8 - 1.1
Mixed birch-spruce type Location #2	18-19	11-12	23-25	13-15
50% birch-spruce mixed type	18-19	11-12	21-26	11-15
Birch-spruce mixed type - E. of Wasilla Lake	18-20	11-12	25-28	12-15
Birch-spruce mixed type 75%-25% along raod N. of farm	18-19	11-12	22-26	11-15
Deciduous				
Alder & birch - brush type on steep Matanuska riverbank	20-23	12-15	35-37	17-22
Birch-alder-poplar dry ridge	19-20	11-13	31-35	18-20
Canyon mouth & valley floor of Little Susitna (cottonwood & alder)	19-21	12-14	23-27	12-17
Mixed birch - Poplar (Vickaryous)	18-20	12-15	24-28	14-16
Aspen - birch escarpment	19-20	12-13	31-35	20-21
Birch-aspen dry escarpment below Kings Lake	18-20	11-13	33-35	20-21
Birch-aspen mixed type	20-22	12-14	26-31	16-18

APPENDIX B

SUMMARY OF MOST PROBABLE MULTISPECTRAL REFLECTANCE SIGNATURES

Scene No. 1049-20505

CDU File No. 341, 351, 361, 371 Strips 3 & 4 Channel 2
CDU File No. 342, 352, 362, 372 Strips 3 & 4 Channel 1
CDU File No. 441, 451, 461, 471 Strips 1 & 2 Channel 1

PHYSICAL FEATURE	NUMBER OF SAMPLES CHECKED	WAVE LENGTHS (MICROMETERS) .5 - .6	.6 - .7	.7 - .8	.8-1.1
I. CLOUDS	13	30-127	30-127	33-127	22-63
II. CLOUDS & MOUNTAIN SHADOWS	16	16-21	9-12	7-15	2-8
III. WATER RESOURCES					
A. Clear, Shallow Lakes	10	16-19	10-12	8-12	1-6
B. Deep & Clear Lakes	27	16-20	9-12	7-12	1-6
C. Silty Lakes	4	20-27	14-21	9-13	2-5
D. Silty River Water	6	18-28	16-23	16-20	3-7
E. Inlet & Muddy Salt Water	4	26-30	20-23	13-18	4-6
F. Other - Sewage Treatment	1	21-22	15-18	17-19	6-8
IV. BARE GROUND					
A. Mud Flats	5	22-25	15-19	15-21	5-11
B. Fallow	3	19-22	12-16	16-19	7-9
C. Stream Beds & Gravel Pits	6	26-29	20-23	18-22	5-9
D. Natural Bare Ground & Escarpments	4	22-27	18-22	19-26	6-11
V. MANMADE FEATURES					
A. Airports	5	22-26	16-22	18-25	8-13
B. Highways	4	20-26	16-21	23-29	9-15
C. Trailer Courts & Housing Developments	5	21-28	20-30	23-28	9-13
D. Urban	8	23-27	16-25	17-28	7-13

PHYSICAL FEATURE	NUMBER OF SAMPLES CHECKED	WAVE LENGTHS (MICROMETERS) .5 - .6	.6 - .7	.7 - .8	.8-1.1
VI. CULTURAL VEGETATIVE TYPES					
A. Oats	4	21-26	15-20	35-41	19-23
B. Potatoes	2	20-22	13-14	28-40	20-26
C. Grassfields	14	20-25	12-15	26-44	15-22
D.(Go-Back) Grass & Brush	3	20-24	13-16	26-33	16-19
VII. NATURAL VEGETATIVE TYPES					
A. Wet Types					
(1) Tidal Flats	3	19-23	12-16	23-28	11-20
(2) Muskeg	23	17-24	11-15	20-26	8-13
B. Dry Types					
(1) Grassland Above Timberline	2	21-24	14-17	26-35	16-24
(2) Birch	11	18-22	11-14	23-28	12-19
(3) Birch, Spruce	16	18-22	10-14	21-26	11-15
(4) Spruce	2	17-21	11-13	17-21	8-10
(5) Birch, Willow & Alder	6	19-23	11-15	22-30	10-18
(6) Birch & Cottonwood	4	18-22	11-15	23-28	14-18
(7) Birch & Aspen	3	18-22	11-14	31-35	18-21

APPENDIX C

MSS REFLECTANCE SIGNATURES TO BE USED IN PROGRAMMING THE COMPUTER FOR AUTOMATED DATA PROCESSING

Scene No. 1049-20505

CDU File No. 341, 351, 361, 371	Strips 3 & 4	Channel 2
CDU File No. 342, 352, 362, 372	Strips 3 & 4	Channel 1
CDU File No. 441, 451, 461, 471	Strips 1 & 2	Channel 1

PHYSICAL FEATURE	NUMBER OF SAMPLES CHECKED	WAVE LENGTHS (MICROMETERS) .5 - .6	.6 - .7	.7 - .8	.8-1.1
I. CLOUDS	13	30-127	30-127	33-127	22-63
II. CLOUD & MOUNTAIN SHADOWS	16	16-21	9-12	6-15	5-8
III. WATER RESOURCES (CLEAR)	37	16-20	9-12	7-12	1-4
(SILTY)	14	20-28	16-23	14-17	2-6
IV. BARE GROUND	18	22-27	15-22	18-23	6-9
V. MANMADE FEATURES	22	21-27	16-25	18-28	10-13
VI. CULTURAL VEGETATIVE TYPES					
A. Small Grains (Oats)	4	21-26	16-20	35-41	19-23
B. Row Crops (Potatoes)	2	20-22	13-14	28-40	22-26
C. Grass & Mixed Grass Brush	19	22-25	12-15	26-35	15-21
VII. NATURAL VEGETATIVE TYPES					
A. Wet Types					
(1) Tidal Flats & Muskeg	24	17-24	11-15	21-25	11-19
B. Dry Types					
(1) Deciduous Forest	24	18-21	11-15	26-30	14-19
(2) Coniferous Forest	2	17-21	11-13	17-21	8-10
(3) Mixed Coniferous & Deciduous Forests	16	18-22	10-14	21-26	11-13

FOLDOUT FRAME 1

FOLDOUT FRAME 2

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 63 127

Appendix D

MSS Reflectance Signatures for 13 Dominant Physical Features: ERTS Scene 1049-20505

Band 4

- Clouds
- Cloud & Mnt. Shadows
- Water Resources (Clear) (Silty)
- Bare Ground
- Man made features
- Cultural Veg. Types (Small grains, oats) (Row Crops - Potatoes)
- Natural Veg Types: Grassland & Mixed Grass - Brush; Wet Types, Flats & Muskeg; Deciduous Forest; Coniferous Forest; Mixed Coniferous & Deciduous Forest

Band 5

- Clouds
- Cloud & Mnt. Shadows
- Water Resources (Clear) (Silty)
- Bare Ground
- Man made features
- Cultural Veg. Types: Sm. grains (oats); Row crops (potatoes)
- Natural Veg. Types: Grassland & Mixed Grass - Brush; Wet Types Tidal Flats & Muskeg; Deciduous Forest; Coniferous Forest; Mixed Coniferous & Deciduous Forest

Band 6

- Clouds
- Cloud & mnt. shadows
- Water Resources: Clear; (Silty)
- Bare Ground
- Man Made Features
- Cultural Veg. Types: Sm. Grains (oats); Row Crops (potatoes)
- Natural Veg. Types: Grassland & mixed Grass - Brush; Wet Types Flats & muskeg; Deciduous Forest; Coniferous Forest; Mixed Deciduous & Coniferous Forest

Band 7

- Clouds
- Cloud & mnt. Shadows
- Water Resources (Clear) (Silty)
- Bare Ground
- Man Made features
- Cultural Veg. Types: Sm. Grains (oats); Row Crops (Potatoes)
- Natural Veg. Types: Grassland & Mixed Grass - Brush; Wet Types; Tidal Flats & Muskeg; Deciduous Forest; Coniferous Forest; Mixed Coniferous & Deciduous Forest

24 (a)

24 (b)

FOLDOUT FRAME 2

FOURTH BI-MONTHLY PROGRESS REPORT
UNIVERSITY OF ALASKA
ERTS PROJECT NO. 110-
April 5, 1973

PRINCIPAL INVESTIGATOR: C. Ivan Branton

TITLE OF INVESTIGATION: Identification of Phenological Stages and Vegetative Types for Land Use Classification

DISCIPLINE: Agriculture/Forestry/Range Resources

SUBDISCIPLINE: Range Survey and Classification

SUMMARY OF SIGNIFICANT RESULTS:

During the last two months we have acquired multispectral reflectance signatures from computer printouts from scene 1049-20505. Those signatures have been grouped for 13 dominant physical features in the Matanuska Susitna Valley area of Alaska. The derived signatures will be validated and tested by requesting another symbol-coded computer printout for the same area. We expect ERTS imagery collected during late autumn and early spring will provide separations of signatures that are confounded in the 1049-20505 scene. Separating bogs and forests should be much improved when either snow covered or when grasses are brown.

We have photographed projections on the color additive viewer, each scene being projected with six different filter combinations. The products will be analyzed and those best suited used for producing color transparencies at a scale of 1:250 k for overlaying on standard quadrangle maps. Color prints will be processed for use in the field. By flying over areas of interest we will be able to appropriately classify vegetation and relate to tonal differences that are now recognized but unidentified.

From digital MSS signatures derived to date, we have identified which bands are the most powerful for automated classification of dominant physical features. Conversely we have also identified in which bands signature separation is most and least likely to occur.

We have found that separations among density ranges increase with longer wave lengths. This explains in part why most physical features are easier to recognize visually as well as density slice in bands 6 and 7 than in bands 4 and 5. Thus deriving MSS digital signatures has proven valuable to both digital and visual processing of ERTS data.

ERTS IMAGE DESCRIPTOR FORM

(See Instructions on Back)

NDPF USE ONLY
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ID

DATE March 15, 1973

PRINCIPAL INVESTIGATOR C. Ivan Branton

GSFC UN-641

ORGANIZATION University of Alaska 110-02

PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*				DESCRIPTORS
	River	Glacier	Lake	Mts.	
1063-20273 4	✓	✓	✓	✓	Highway
1063-20273 5,6,& 7	✓	✓	✓	✓	
1063-20280 4,5	✓	✓	✓	✓	Highway & Airport
1063-20280 6,& 7	✓	✓	✓	✓	
1064-20325	✓	✓	✓	✓	
1064-20325 4,5	✓	✓	✓	✓	Rural Area
1064-20331 4,5	✓	✓	✓	✓	Alaska Hwy.
1064-20331 6,& 7	✓	✓	✓	✓	
1066-20451 4,5,6,& 7		✓	✓	✓	Glacier
1066-20444	✓	✓	✓	✓	River Basins
1066-20442	✓	✓	✓	✓	
1066-20453	✓	✓	✓	✓	
1067-20491	✓			✓	
1069-21015				✓	
1069-21022	✓	✓		✓	Inlet
1071-21123	✓			✓	
1081-20281	✓		✓	✓	
1082-20333	✓	✓	✓	✓	
1088-21071	✓			✓	
1100-20335	✓		✓	✓	
1100-20342	✓	✓	✓	✓	
1102-20452	✓		✓	✓	
1103-20511	✓	✓		✓	
1103-20520			✓	✓	
1105-21012	✓			✓	
1105-21015	✓			✓	

*FOR DESCRIPTORS WHICH WILL OCCUR FREQUENTLY, WRITE THE DESCRIPTOR TERMS IN THESE COLUMN HEADING SPACES NOW AND USE A CHECK (✓) MARK IN THE APPROPRIATE PRODUCT ID LINES. (FOR OTHER DESCRIPTORS, WRITE THE TERM UNDER THE DESCRIPTORS COLUMN).

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GSFC 37-2 (7/72)

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