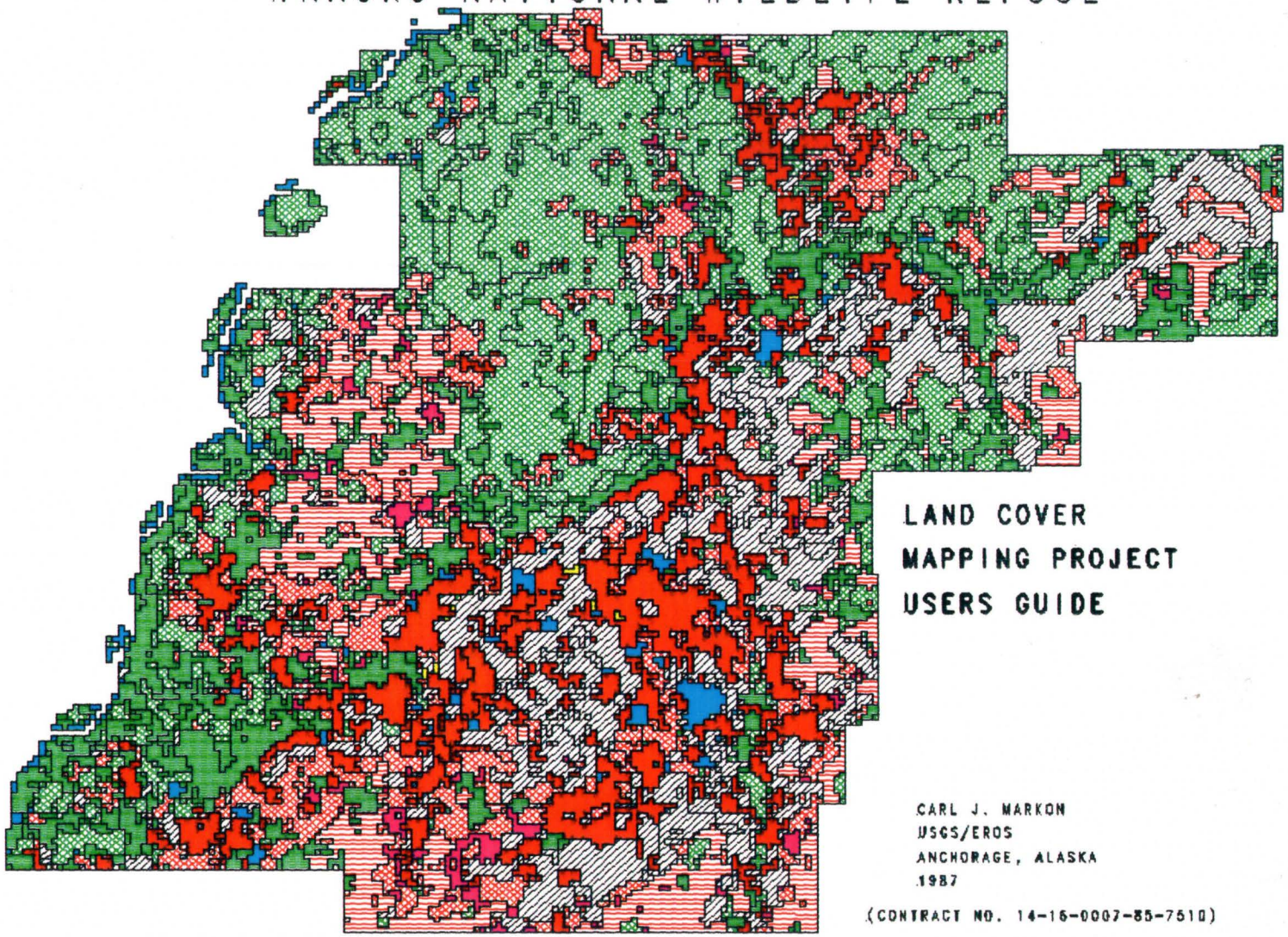
INNOKO NATIONAL WILDLIFE REFUGE



LAND COVER MAPPING PROJECT USERS GUIDE

CARL J. MARKON
USGS/EROS
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INNOKO NATIONAL WILDLIFE REFUGE
LAND COVER MAPPING PROJECT
USERS GUIDE

INTRODUCTION

Section 1002 of the Alaska National Interest Lands Conservation Act of 1980 (ANILCA, 1980) requires the Secretary of Interior to conduct a continuing study of fish, wildlife, and habitats on the Innoko National Wildlife Refuge (INWR). Included in this study is a determination of the extent, location, and carrying capacity of fish and wildlife habitats.

Title III of ANILCA established the INWR which contains approximately 3,500,000 acres. Section 304 of the Act requires the Secretary of Interior to "prepare, and from time to time revise, a comprehensive conservation plan" for the refuge. Before developing a plan for the refuge, the Secretary shall identify and describe--a) the populations and habitats of the fish and wildlife resources of the refuge; b) the special values of the refuge as well as any other archeological, cultural, ecological, geological, historical, palentological, scenic, or wilderness value of the refuge; c) areas within the refuge that are suitable for use as administrative sites or visitor facilities...; d) present the potential requirements for access with respect to the refuge...; and e) significant problems which may adversely affect the populations and habitats of fish and wildlife identified and described..." (ANILCA, 1980). Vegetation, water, and terrain (elevation, slope, and aspect) are the components of habitat and can be used in the determination of the above requirements.

The U. S. Fish & Wildlife Service (USFWS) has the responsibility for collecting the resource information to address the research, management, development and planning requirements identified in Section 304. Because of the brief period provided by the Act for collecting the resource data, data collection, habitat mapping, and habitat assessment, the USFWS in cooperation with the U. S. Geological Survey's EROS Field Office, used digital Landsat multispectral scanner data (MSS) and digital terrain data. A computer assisted digital analysis of Landsat MSS data was used because coverage by aerial photographs was incomplete for much of the refuge and because the level of detail, obtained from the analysis of Landsat data, is adequate to meet most USFWS research, management and planning needs. Relative cost and time requirements were also factors in the decision to use the digital analysis approach.

OBJECTIVES

The primary objectives of the mapping project were to:

1) produce digital land cover/terrain classifications for the INWR, using digital Landsat and terrain data.

2) provide registered Landsat data for the entire study area defined as the INWR.

3) provide other derivative products and output products as required.

The primary objectives of this user guide are to give a brief discussion of the methodology used and describe the different types of data products produced.

AREAS OF COVERAGE

The INWR consists of approximately 3 million acres of land and water in west central Alaska. The northwest and southeast latitude/longitude coordinates of the mapped area are 64 30'/161 00' and 62 00'/156 00' respectively. The entire study area covers roughly 2.5 degrees of latitude and 5 degrees of longitude. Portions of two Landsat scenes (Table 1) were required to provide complete coverage of INWR and the surrounding areas (Figure 1).

METHODOLOGY

A computer compatible tape (CCT) was obtained for each Landsat scene covering refuge lands. The Landsat scenes were radiometrically and geometrically corrected (registered to a 50-meter Universal Transverse Mercator [UTM] grid) and mosaicked together. Training blocks (sample areas containing representative land cover types) were selected for field study, and training statistics were derived from them. Figure 2 shows the location of the training blocks used in this study. A modified clustering technique was used to generate initial spectral classifications, using the EROS Field Office computer system (HP-3000) and IDIMS software (ESL 1981).

Table 1.--Landsat scene identification for the
for the Innoko National Wildlife Refuge.

SCENE	ID NUMBER	DATE	PATH/ROW
A	22410-21144	8/28/81	82/15
B	22410-21151	8/28/81	82/16

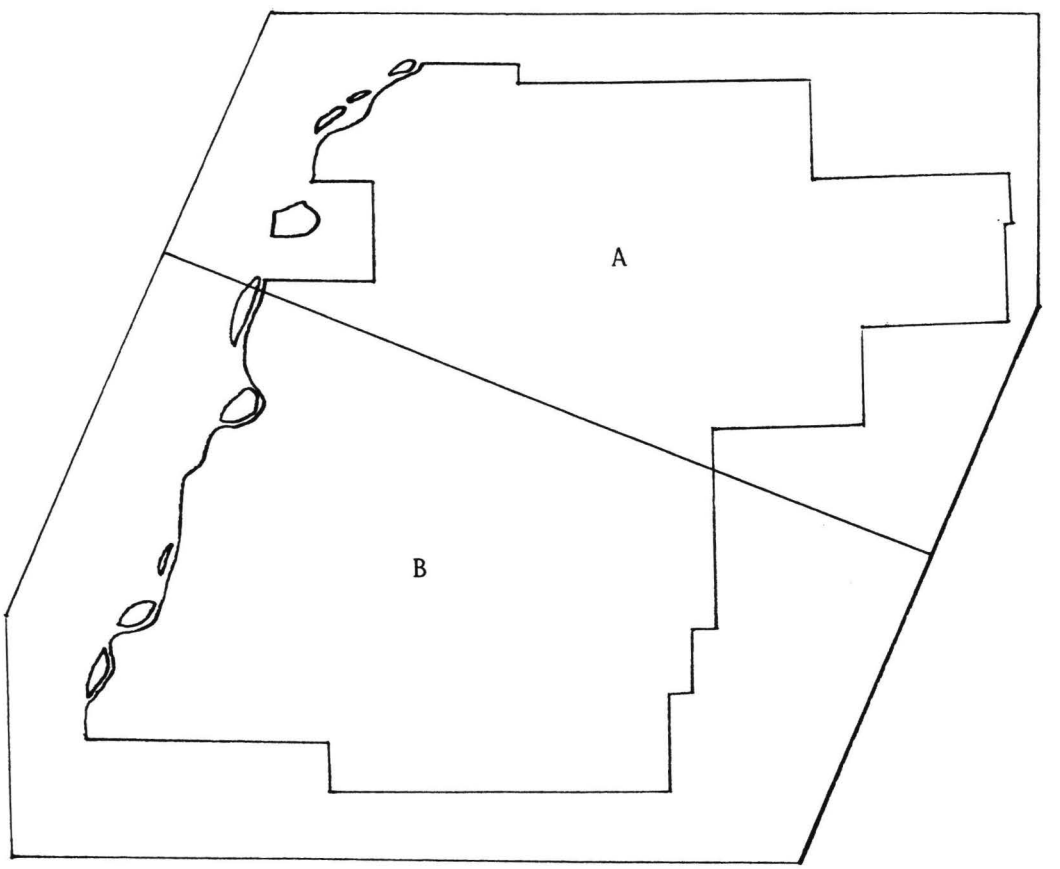

Figure 1.--General location of the Landsat scene coverage used to map the Innoko National Wildlife Refuge.

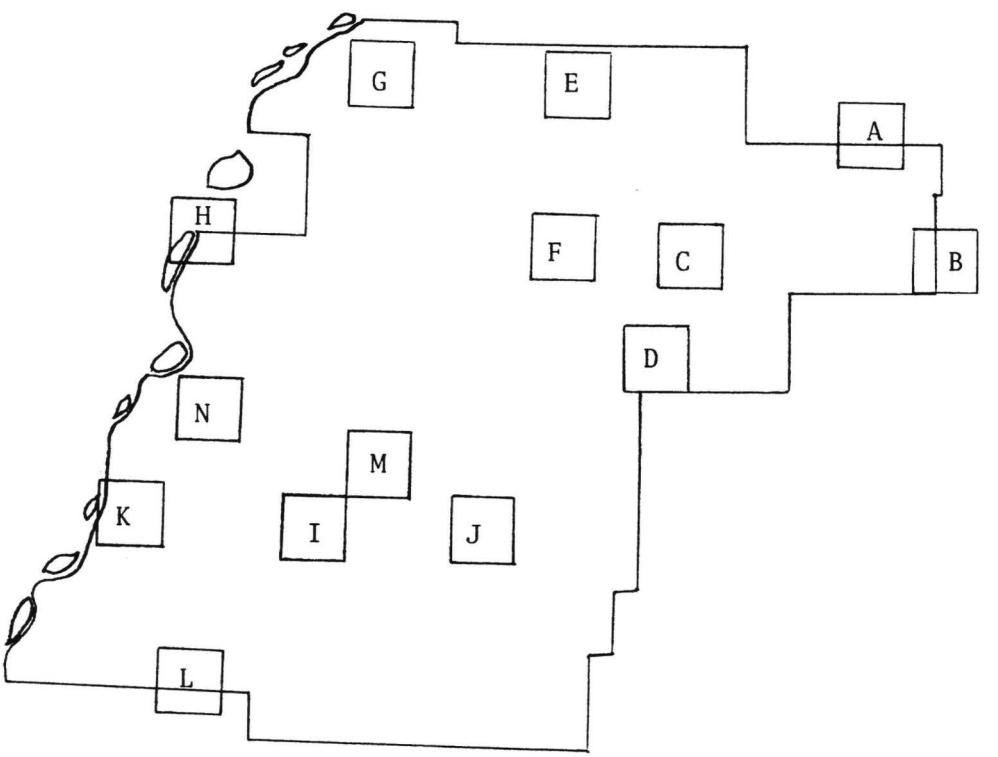

Figure 2.--Location of training blocks used to collect field data and develop training statistics for Landsat scene classification.

Field data on vegetation cover, structure, and composition were collected in each training block to identify land cover types corresponding to computer-derived spectral classes. Final land cover classifications, designated by USFWS personnel, were produced after applying stratification techniques to improve classification accuracy. Land cover classifications were merged with digital terrain data derived from 1:250,000-scale USGS quadrangles to improve classification accuracy and to make possible the production of additional resource data products displaying topographic variables such as elevation, slope, and aspect, either singularly or in combination. The specific procedures used in producing land cover/terrain classifications and output products are detailed in Appendix A. A schematic diagram of the mapping process is shown in Figure 3.

USFWS personnel worked with EROS personnel to conduct the digital analysis required to produce land cover classifications for the refuge and coordinated with USFWS Information Resource Management personnel to ensure that the digital data were compatible with the USFWS geobased information system.

PRODUCTS

The following products were produced for the mapping project:

1) Hard copy ink jet plots of the land cover classification of the refuge and surrounding areas at scales of 1:250,000 and 1:63,360.

2) Acreage estimates for each land cover type in the refuge.

3) Computer tapes of all raw and registered Landsat scenes.

4) Computer tapes containing land cover and terrain data classifications.

5) Computer tapes of resampled land cover and terrain data.

6) Elevation, slope, and aspect ink jet plots of the refuge and surrounding areas at a 1:250,000 scale.

7) This users guide.

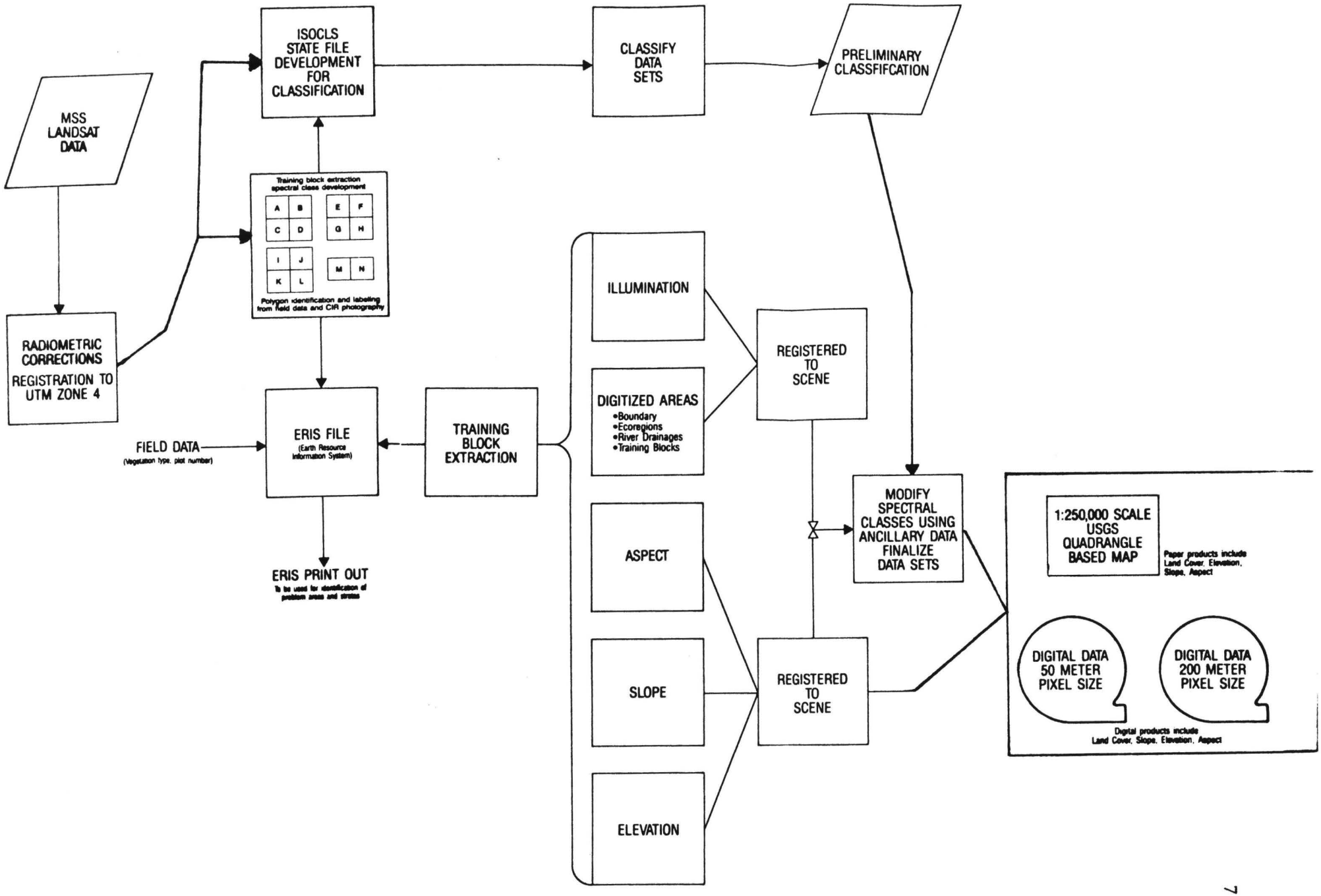

Figure 3.--Schematic diagram of the mapping process used to produce the land cover classification of the Innoko National Wildlife Refuge.

PRODUCT DESCRIPTIONS-HARD COPY

LAND COVER CLASS DESCRIPTIONS

Based on information acquired in the field, discussions with USFWS personnel, and Landsat spectral discrimination, six major land cover classes were recognized: Forest, Scrub, Dwarf Scrub and Related Vegetation, Herbaceous, Scarcely Vegetated, and Water. Included in these major classes are 21 subclasses (Table 2). A complete description of each of the major classes and subclasses can be found in Talbot and Markon (in preparation).

Acreage estimates for each land cover class within the refuge were summarized and are listed in Table 3. Final hard copy land cover maps were produced in the form of Applicon ink jet plots at scales of 1:250,000 and 1:63,360. Map collar information on the 1:250,000 scale products included: map title, a list of vegetation classes, locational diagram of the map with respect to the refuge, scale bar, and latitude/ longitude tick marks. Collar information on the 1:63,360 scale maps included: map title, vegetation classes, scale bar, and the 15 minute USGS quadrangle name (Table 4). On all maps each land cover class was depicted on the map as a color. The color scheme used was based on input from USFWS and USGS/EROS personnel.

TERRAIN CLASS DESCRIPTIONS

Terrain class maps were produced from the elevation, slope, and aspect digital data at a 1:250,000 scale. Elevation classes were broken into the following catagories (in meters): 0-30, 31-61, 62-122, 123-183, 184-244, 245-305, 306 and higher. Slope classes were broken into 0-10%, 11-20%, 21-40%, 41-60%, and 61% and higher. The aspect classes were broken into eight directions: north, northwest, west, southwest, south, southeast, east, and northeast. All of the maps contained the water classes and the aspect map contained the 0-2% slope class. Collar information included: map title, scale, locational diagram, map legend, latitude/longitude, and tick marks. Acreage estimates of each elevation, slope, and aspect class within the refuge are listed in Tables 5, 6, and 7 respectively.

Table 2.--Land cover classes.

CLASS	CLASS CODE
Background	0
Closed Needleleaf	1
Open Needleleaf	2
Needleleaf Woodland	3
Mixed Forest	4
Broadleaf Forest/Tall Scrub	5
Lowland Scrub	6
Subalpine Scrub	7
Dwarf Shrub - Graminoid Tussock Peatland	8
Dwarf Shrub - Graminoid Peatland (Flat Bog)	9
Dwarf Shrub - Raised Bog with Scattered Trees	10
Prostrate Dwarf Shrub Tundra	11
Erect Dwarf Shrub Heath (Subalpine)	12
Upland Burn Regeneration	13
Alluvial Graminoid Marsh	14
Dwarf Shrub - Graminoid Marsh	15
Graminoid Bog	16
Graminoid Tussock Dwarf Shrub Peatland	17
Scarcely Vegetated Floodplain	18
Scarcely Vegetated Scree	19
Clear Water	20
Sedimented Water	21

Table 3.--Acreage estimates for each land cover class in the Innoko National Wildlife Refuge.

	CLASS	ACRES REFUGE	PERCENT %	ACRES WILDERNESS	PERCENT %	TOTAL ACRES
1.	CLOSED NEEDLELEAF	302073.62	95.22%	15150.69	4.78%	317224.32
2.	OPEN NEEDLELEAF	466140.43	90.33%	49885.59	9.67%	516026.02
3.	NEEDLELEAF WOODLAND	77483.13	86.81%	11773.51	13.19%	89256.63
4.	MIXED FOREST	145674.83	86.80%	22159.57	13.20%	167834.40
5.	BROADLEAF FOREST/TALL SCRUB	310424.23	83.18%	62774.12	16.82%	373198.35
6.	LOWLAND SCRUB	175423.95	71.71%	69188.73	28.29%	244612.69
7.	SUBALPINE SCRUB	3331.47	76.39%	1029.77	23.61%	4361.24
8.	DWARF SHRUB - GRAMINOID TUSSOCK PEATLAND	221107.06	62.00%	135543.89	38.00%	356650.95
9.	DWARF SHRUB - GRAMIMOID PEATLAND	117558.39	33.56%	232763.20	66.44%	350321.59
10.	DWARF SHRUB - RAISED BOG WITH SCATTERED TREES	153534.95	48.12%	165537.02	51.88%	319071.98
11.	PROSTRATE DWARF SHRUB HEATH	45.71	65.49%	24.09	34.51%	69.80
12.	ERECT DWARF SHRUB HEATH	263.16	64.16%	147.02	35.84%	410.18
13.	UPLAND BURN REGENERATION	182293.22	62.46%	109552.48	37.54%	291845.70
14.	ALLUVIAL GRAMINOID MARSH	22003.90	34.60%	41583.17	65.40%	63587.07
15.	DWARF SHRUB GRAMINOID MARSH	190100.84	42.18%	260599.18	57.82%	450700.02
16.	GRAMINOID BOG	4095.62	20.18%	16197.14	79.82%	20292.76
17.	GRAMINOID TUSSOCK DWARF SHRUB PEATLAND	62886.55	50.63%	61325.52	49.37%	124212.07
18.	SCARCELY VEGETATED FLOODPLAIN	931.55	100.00%	0.00	0.00%	931.55
19.	SCARCELY VEGETATED SCREE	364.47	99.33%	2.47	0.67%	366.94
20.	CLEAR WATER	60551.49	50.49%	59364.81	49.51%	119916.31
21.	SEDIMENTED WATER	5025.93	100.00%	0.00	0.00%	5025.93
	TOTALS	2501314.51		1314601.99		3815916.50

Table 4.--Listing of 15 minute USGS quadrangles used for the 1:63,360-scale land cover maps.

HOLYCROSS.C1	OPHIR.C2
HOLYCROSS.D1	OPHIR.C3
HOLYCROSS.D2	OPHIR.C4
HOLYCROSS.D3	OPHIR.C5
IDITAROD.C4	OPHIR.C6
IDITAROD.C5	OPHIR.D1
IDITAROD.C6	OPHIR.D2
IDITAROD.D4	OPHIR.D3
IDITAROD.D5	OPHIR.D4
IDITAROD.D6	OPHIR.D5
OPHIR.A4	OPHIR.D6
OPHIR.A5	UNALAKLEET.A1
OPHIR.A6	UNALAKLEET.A2
OPHIR.B3	UNALAKLEET.B1
OPHIR.B4	UNALAKLEET.B2
OPHIR.B5	UNALAKLEET.C1
OPHIR.B6	UNALAKLEET.C2
OPHIR.C1	UNALAKLEET.D1

Table 5.--Acreage estimates of each elevation class in the Innoko National Wildlife Refuge.

CLASS	ACRES REFUGE	PERCENT %	ACRES WILDERNESS	PERCENT %	TOTAL ACRES
1. 0 - 30 METERS	539817.04	49.63%	547800.71	50.37%	1087617.75
2. 31 - 61 METERS	1060851.08	69.91%	456580.90	30.09%	1517431.98
3. 62 - 122 METERS	645266.49	78.30%	178810.40	21.70%	824076.90
4. 123 - 183 METERS	111799.82	70.65%	46434.28	29.35%	158234.10
5. 184 - 244 METERS	53278.84	73.20%	19504.52	26.80%	72783.36
6. 245 - 305 METERS	20887.64	79.42%	5412.64	20.58%	26300.28
7. 306 METERS AND HIGHER	3840.49	84.69%	694.34	15.31%	4534.83
8. WATER	65577.43	52.49%	59364.81	47.51%	124942.24
TOTALS	2435741.41		1314602.61		3815921.44

Table 6.--Acreage estimates of each slope class in the Innoko National Wildlife Refuge.

	CLASS	ACRES REFUGE	PERCENT %	ACRES WILDERNESS	PERCENT %	TOTAL ACRES
1.	0 - 1%	1322636.94	60.11%	877610.86	39.89%	2200247.80
2.	2 - 10%	895309.11	74.33%	309172.69	25.67%	1204481.81
3.	11 - 20%	173597.29	75.73%	55623.78	24.27%	229221.08
4.	21 - 40%	42899.57	77.66%	12341.83	22.34%	55241.40
5.	41 - 60%	1278.72	72.58%	483.07	27.42%	1761.79
6.	61% AND HIGHER	17.91	80.56%	4.32	19.44%	22.24
7.	WATER	65577.43	52.49%	59364.81	47.51%	124942.24
	TOTAL	2501316.98		1314601.37		3815918.35

Table 7.--Acreage estimates of each aspect class in the Innoko National Wildlife Refuge

CLASS	ACRES REFUGE	PERCENT %	ACRES WILDERNESS	PERCENT %	TOTAL ACRES
1. NORTH	130149.79	73.65%	46561.53	26.35%	176711.32
2. NORTHEAST	122906.79	74.65%	41727.10	25.35%	164633.89
3. EAST	138937.14	77.56%	40203.14	22.44%	179140.28
4. SOUTHEAST	208465.01	79.75%	52921.79	20.25%	261386.80
5. SOUTH	89902.17	78.64%	24419.88	21.36%	114322.05
6. SOUTHWEST	132674.49	81.42%	30272.35	18.58%	162946.84
7. WEST	141553.27	66.43%	71527.50	33.57%	213080.76
8. NORTHWEST	148512.11	67.97%	69992.41	32.03%	218504.52
9. 0 - 1 % SLOPE	1322636.94	60.11%	877610.86	39.89%	2200247.80
10. WATER	65577.43	52.49%	59364.81	47.51%	124942.24
TOTALS	2501315.13		1314601.37		3815916.50

PRODUCT DESCRIPTIONS-DIGITAL

GENERAL

Digital data are stored at USGS/EROS on CCT's in either an IDTRANS or TRANSFER format. Digital data stored in the IDTRANS format are used at USGS/EROS for internal processing. The TRANSFER format is usually used when data are shipped to other U.S. government agencies or the private sector. Images are generally written on a TRANSFER tape with one image line per record and one image per file. Images may be band-by-band or line-by-line. If the data format is floating point, either a Hewlett-Packard 3000 or IBM format may be specified. Data may be read onto the tape at either 1600 or 6250 bits/inch (bpi). All data relating to this project have been delivered to USFWS at 1600 bpi using the Hewlett-Packard 3000 floating point format.

An attempt was made to standardize the pixel size and UTM origins of the data. For this project most, if not all, of the final data sets were produced at two different pixel sizes: 50X50 meter and 200X200 meter. Pixel sizes were predetermined by the USFWS prior to the finalization of the land cover classification. All of the data which has been transfered to the USFWS covered under the Interagency Service Agreement is summarized in Appendix B. This summarization contains image name, data type, number of lines and samples, UTM origins and pixel size.

LAND COVER

The land cover images contain up to 21 different classes (Table 2) and extend beyond the refuge boundary. The data is byte data. The lowest class, 0, is a background or fill class.

ELEVATION DATA

The digital elevation data were derived from digital terrain data created by the Defense Mapping Agency (DMA). The DMA generated the data by digitizing contour lines, spot elevations, and stream and ridge line data from the 1:250,000-scale USGS quadrangles. The contour intervals range from 50 to 200 feet. These data were then converted to a rectangular grid of values, producing elevation estimates spaced every 0.01 inches on each 1:250,000-scale map (approximately 200 feet on the ground). The data are integer data and can range in values from 0 to about 3000 meters. The data is recorded in one meter increments.

SLOPE DATA

The slope data were computed using the digital elevation data. Slope is computed as percent slope, i.e. units of rise per 100 units of run. The data is byte data and is recorded in one percent increments. Values can range from 0 to 255.

ASPECT DATA

The aspect data were computed using the digital elevation data. Aspect is computed clockwise from north in degrees. The data are byte data with values from 0 to 180: 0 and 180 = north, east = 45, south = 90, and west = 135. Values increase in two degree increments.

ACKNOWLEDGEMENTS

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ANILCA, 1980. Alaska National Interest Lands Conservation Act, Public Law 96-487, 96th Congress, Washington, D.C.

ESL Incorporated, 1981. IDIMS Functional Guide, Technical Manual ESL-TM705. ESL Incorporated, Sunnyvale, California. Vol. I, 716 p., Vol. II, 319 p.

Talbot, S.S. and Markon, C.J., (in preparation), Vegetation mapping of Innoko National Wildlife Refuge using Landsat MSS data, U.S. Fish and Wildlife Service, Anchorage, Alaska.

APPENDIX A

PROCEDURES FOR LAND COVER CLASSIFICATION USING LANDSAT CCT'S

Preprocessing

1. Enter Landsat Data (CCT format) into IDIMS

2. Display and select Landsat subscenes

3. Perform radiometric corrections

   a. Destrip to correct for detector miscalibration
   b. Fix bad data lines

4. Perform geometric corrections

   a. Select control points from Landsat data and maps for image registration
   b. Digitize control points and map boundaries
   c. Generate transformations and rotate Landsat scenes
   d. Register Landsat image to 50 meter UTM grid

5. Produce strata mask for study areas

6. Digitize refuge boundaries

7. Mosaic and register DEM data

Image Training and Classification

1. Select training blocks for study area in each Landsat scene

2. Apply IDIMS clustering algorithm (ISOCLAS)

3. Produce statistics of the spectral classes within the training blocks

4. Produce photographic image of each Landsat training block and color coded cluster map

5. Prepare for field investigations

   a. Acquire aerial photographs of cluster blocks for annotation in field
   b. Develop strategy for aerial reconnaissance and on-the-ground investigations

APPENDIX A

6. Field verification

   a. Describe land cover type associated with each cluster class
   b. Collect auxiliary information when appropriate, e.g. wildlife habitat value, soils, quantitative plant description, etc.

7. Return to IDIMS and edit cluster statistics and pool and/or delete cluster classes

8. Produce preliminary classification based on edited cluster statistics

9. Evaluate preliminary classification based on edited cluster statistics

10. Post-classification refinement where necessary to improve classification accuracy. This step may be facilitated by several approaches, two of which are presented:

    a. Stratification based upon physiognomic, soil or other resource data

       (1) Digitize boundaries of strata
       (2) Produce and apply strata mask
       (3) Identify cluster classes for each strata
       (4) Combine classifications for all strata
       (5) Reclassify entire study area

    b. Merge DEM digital terrain data with Landsat data

       (1) Define control points for DEM
       (2) Generate transformation between latitude/longitude (DEM) and UTM grid
       (3) Register DEM to UTM grid
       (4) Generate slope and aspect data
       (5) Define strata based on combinations of elevation, slope, and aspect
       (6) Identify cluster classes within each strata

APPENDIX A

Generate Output Products

1. Generate digital tape file for classification of refuge 1:250,000 and 1:63,360 scale maps.

2. Produce acreage estimate for refuge or units within refuge area

3. Produce Applicon ink jet plots of final classification of the refuge area.

APPENDIX B

The following source data is relevant to all images listed below.

Coverage: Entire Refuge

UTM Northing	= 7110000	Number of Lines	= 1050
UTM Easting	= 420000	Number of Samples	= 1175
UTM Zone	= 4	Pixel Size (in meters)	= 200
		Tape Format	= IDTRANS

TYPE OF IMAGE	DATA TYPE	EROS FIELD OFFICE TAPE LOCATION	FILE
Landcover	Byte	1357	3
Elevation	Integer	1347	3
Slope	Byte	1347	5
Aspect	Byte	1347	4
Refuge Boundary	Byte	1347	7
Refuge Mask	*Byte	1347	2

*Solid

The following source data is relevant to all images listed below.

Coverage: Entire Refuge

Subsection to use	= 221 491	2941 3682	
UTM Northing	= 7098950	Number of Lines	= 2941
UTM Easting	= 444550	Number of Samples	= 3682
UTM Zone	= 4	Pixel Size (in meters)	= 50
		Tape Format	= IDTRANS

TYPE OF IMAGE	DATA TYPE	EROS FIELD OFFICE TAPE LOCATION	FILE
Landcover	Byte	1348	4
Elevation	Integer	1341	3
Slope	Byte	1341	2
Aspect	Byte	1341	1
Refuge Boundary	Byte	1344	2
Refuge Mask	Byte	1344	4

APPENDIX B

The following source data is relevant to all images listed below.

Coverage: Moose Study Area (SW Portion of Refuge)

Subsection to use	= 911 1 3290 2450		
UTM Northing	= 7064450	Number of Lines	= 3290
UTM Easting	= 420000	Number of Samples	= 2450
UTM Zone	= 4	Pixel Size (in meters)	= 50
		Tape Format	= IDTRANS

TYPE OF IMAGE	DATA TYPE	EROS FIELD OFFICE TAPE LOCATION	FILE
Landcover	Byte	1348	4
Elevation	Integer	1341	3
Slope	Byte	1341	2
Aspect	Byte	1341	1

The following source data is relevant to all images listed below.

Coverage: Northern Tier of the Refuge

Subsection to use	= 1 200 1700 4400		
UTM Northing	= 7110000	Number of Lines	= 1700
UTM Easting	= 430000	Number of Samples	= 4400
UTM Zone	= 4	Pixel Size (in meters)	= 50
		Tape Format	= IDTRANS

TYPE OF IMAGE	DATA TYPE	EROS FIELD OFFICE TAPE LOCATION	FILE
Landcover	Byte	1348	4
Elevation	Integer	1341	3
Slope	Byte	1341	2
Aspect	Byte	1341	1
Refuge Boundary	Byte	1344	2
Refuge Mask	Byte	1344	4

APPENDIX B

The following source data is relevant to all images listed below.

Coverage: Southern Tier of the Refuge

Subsection to use	= 1701 200 1700 4400		
UTM Northing	= 7025000	Number of Lines	= 1700
UTM Easting	= 430000	Number of Samples	= 4400
UTM Zone	= 4	Pixel Size (in meters)	= 50
		Tape Format	= IDTRANS

TYPE OF IMAGE	DATA TYPE	EROS FIELD OFFICE TAPE LOCATION	FILE
Landcover	Byte	1348	4
Elevation	Integer	1341	3
Slope	Byte	1341	2
Aspect	Byte	1341	1
Refuge Boundary	Byte	1344	2
Refuge Mask	Byte	1344	4

Arctic

TABLE 4. Acreage estimates for each land cover class in the refuge summarized by 1:250,000 USGS quadrangle.

CLASSIFICATION	FLX	BTI	SAG	MTM	DEM	PSM	ARC	TAB	CHA	CHR	COL	BKR	TOTAL
Closed Needleleaf	0	0	0	0	0	1,065	9,393	17,456	11	15,986	235,179	35,594	314,684
Open Needleleaf	0	0	0	0	5,227	3,552	79,976	202,921	228	192,328	755,590	135,265	1,375,087
Needleleaf Woodland	0	0	0	0	0	2,850	172,909	131,506	22,716	507,886	5,710	0	843,577
Mix Forest	0	0	0	0	0	0	0	0	0	0	177,933	37,742	215,675
Deciduous Forest/Tall Shrub	0	0	0	16,514	0	0	0	968	0	0	131,091	74,949	223,522
Alluvial Deciduous Scrub	0	0	0	1,963	353	531	574	11,245	0	0	256	0	14,922
Dry Prostrate Dwarf Scrub	1,415	431	4,751	268,672	352,433	109,245	488,165	568,287	32,418	46,317	22	0	1,872,156
Moist Prostrate Dwarf Scrub	8,090	30,094	111	281,199	402,614	914	5,750	25,989	23	145	15	0	754,944
Mesic Erect Dwarf Scrub	23	66	63,561	342,490	517,812	333,947	846,196	1,508,704	170,498	500,507	441,154	87,814	4,813,772
Very Wet Graminoid	1,540	1,546	862	1,067	3,282	4,499	0	1,604	0	0	0	0	14,400
Wet Graminoid	58,512	36,016	4,714	55,068	197,385	14,191	0	6	0	0	68	0	365,960
Moist/Wet Tundra Complex	11,521	36,350	237	227,150	230,301	209	2,723	0	0	0	0	0	508,491
Moist Graminoid Tussock	1,064	2,008	19,534	435,919	255,407	121,648	206,586	365,600	9,975	71,396	1,383	0	1,490,520
Barren Floodplain	13,079	5,868	5,803	29,420	58,567	16,817	4,897	5,223	389	341	3,929	253	144,586
Barren Scree	0	0	15,365	281,922	313,410	315,229	323,757	65,071	8,418	10,957	1,356	2,194	1,337,679
Scarcely Vegetated Floodpl.	6,550	536	5,000	31,127	15,690	14,847	28,282	20,789	32	5,179	2,951	166	131,149
Scarcely Vegetated Scree	0	0	26,914	398,403	274,384	180,501	672,335	272,054	8,528	17,496	25,885	4,611	1,881,111
Clear Water	10,074	3,190	376	8,774	7,472	4,327	28,128	4,732	53	8,594	19,044	1,919	96,683
Shallow Water	0	0	1,602	2,055	0	9,020	0	0	0	0	0	0	12,677
Offshore Water	23,253	37,999	0	16,178	32,659	0	0	0	0	0	0	0	110,089
Clouds/Snow/Ice	0	41	30,892	53,325	52,703	160,220	7,991	2,995	0	0	1,377	3,135	312,679
Shadow	0	0	74,578	263,466	176,589	614,196	392,669	164,075	13,669	2,705	373	11,613	1,713,933
Roads	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	135,121	154,145	254,300	2,714,712	2,896,288	1,907,808	3,270,331	3,369,225	266,958	1,379,837	1,803,316	395,255	18,547,296