E72-10179
CR-128326

Progress Report

August 20, 1972 - October 19, 1972

Crop Identification and Acreage Measurement Utilizing ERTS Imagery 013

Principle Investigator

Donald H. Von Steen AG 328

N73-10358

(E72-10179) CROP IDENTIFICATION AND ACREAGE MEASUREMENT UTILIZING ERTS IMAGERY Progress Report, 20 Aug. - 19 Oct. 1972 D.H. VonSteen (Department of Agriculture) 19 Oct. 1972 13 p CSCL 08B G3/13

Unclas 00179

Equipment

The specification for the data acquisition system (microdensitometer) was submitted to the Office of Management Services (OMS) in mid-August. According to Department regulations, a system such as the one requested has to be cleared through the Office of Information Systems (OIS) and the GSA. Our first attempt to get OIS clearance has been returned requesting more detailed specification. New specifications are being prepared and will be submitted around the first of November. It now appears that it will be around the first of May 1973 before we can expect delivery.

In the meantime, we are making arrangements to have some of the aerial photography scanned. This will enable us to look at one State or at least make necessary preparation for analyzing the data and be ready when we do receive our microdensitometer system.

E D P

In order to get classification software running as soon as possible, it was decided to implement the easier programs and software packages first.

1. The first software package implemented was a new version of the Statistical Analysis System (SAS) from North Carolina State University. This new version has a discriminant analysis program in it that makes it possible to classify points experimentally. SAS is now running under block batch and Time Sharing Option (TSO) operating systems.

2. The LARSYS program and discrimination has been received from Purdue. The analysis routines and the library routines have been removed from the tape. We are having some difficulty getting the decks properly broken up into program modules via software programs.

3. We have requested the Penn State Classifier from Dr. Yates Borden. It is hoped that this classification program will be easier to implement than LARSYS. If this appears true, we will implement the Penn State Classifier first.

Photography and Digital Tapes

The Exhibits and Figures on the following pages show the photo and digital tape acquisition status.

Hass 70mm color Infra Red, Infra Red, Black and White high altitude aerial photography has been received from the South Dakota Remote Sensing Institute for mid-August flights. These flights covered the flight lines in South Dakota, Kansas, and Missouri and allowed virtually 100 percent coverage of segments and test sites in the flight lines.

Exhibit 1

The following high altitude aerial photography has been received from NASA:

STATE	PHOTOGRAPHY	DATE
Idaho	Vinten 70mm Color I.R., I.R., B&W (2 filters)	8/11/72
Kansas	RC 8 (6" focal length, 9.5" photo)	
	Color I.R. and Color	8/18/72
	ZEISS (12" focal length, 9.5" photo)	
	Color I.R.	8/18/72
	HASS 70mm B&W, Infra Red	8/18/72
	The RC-8 film affords coverage of all the designated segments and additional training sites in the flight line. The Zeiss film affords coverage of 92 percent of the segments and 73 percent of the additional training sites in the flight line.	
Missouri	ZEISS (12" focal length, 9.5" photo)	
	Color I.R.	8/28/72
	The Zeiss film affords coverage of 64 percent of the segments and 70 percent of the additional training sites in the flight line.	

We are expecting South Dakota photography and RC-8 coverage of Idaho and Missouri.

Exhibit 2

The following ERTS system corrected (bulk) imagery has been received from NASA:

State	I.D. Number	Center Point Coordinates	Date Picture Exp.	Date Received
South Dakota	1005-16431 (RBV)	N44-56/W96-07	7/28/72	8/21/72
	1007-16545 (RBV)	N44-31/W99-09	7/30/72	8/31/72
	1025-16545 (MSS)	N44-60/W98-58*	8/17/72	9/22/72
	1025-16551 (MSS)	N43-34/W99-31*	8/17/72	9/22/72
	1043-16550 (MSS)	N44-29/W99-14*	9/4/72	10/12/72
Kansas	1005-16454 (RBV)	N36-24/W99-06	7/28/72	8/21/72
	1007-16563 (RBV)	N38-50/W101-12*	7/30/72	8/31/72
	1008-17021 (RBV)	N38-53/W102-38	7/31/72	8/31/72
	1025-16565 (MSS)	N37-60/W101-20*	8/17/72	10/5/72
	1025-16571 (MSS)	N36-34/W101-57*	8/17/72	10/5/72
	1026-17024 (MSS)	N37-45/W103-03	8/18/72	10/2/72
	1043-16570 (MSS)	N37-22/W101-45*	9/4/72	10/6/72
Missouri	1034-16052 (MSS)	N37-22/W88-44*	8/26/72	10/6/72
	1034-16055 (MSS)	N35-56/W89-12*	8/26/72	10/6/72
Idaho	1036-17583 (MSS)	N43-04/W115-33*	8/28/72	10/6/72
	1036-17585 (MSS)	N41-39/W116-05	8/28/72	10/6/72

Those photographs designated with * were considered satisfactory for ordinary scene corrected (precision) color photography and computer compatible 9-track digital tapes. These have not yet been received.

Idaho

Rough Outline of ERTS Coverage

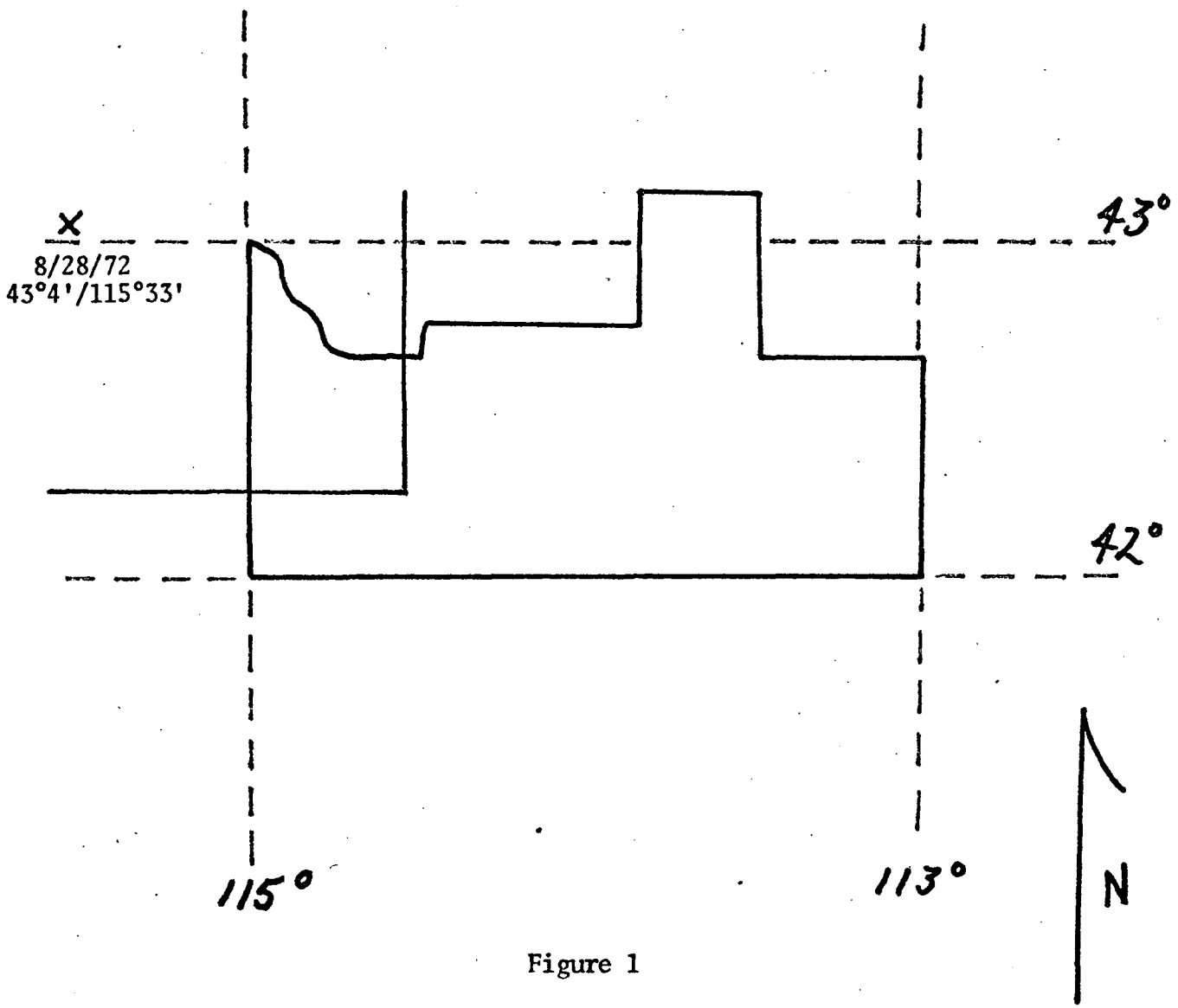

Figure 1

Missouri

Rough Outline of ERTS Coverage

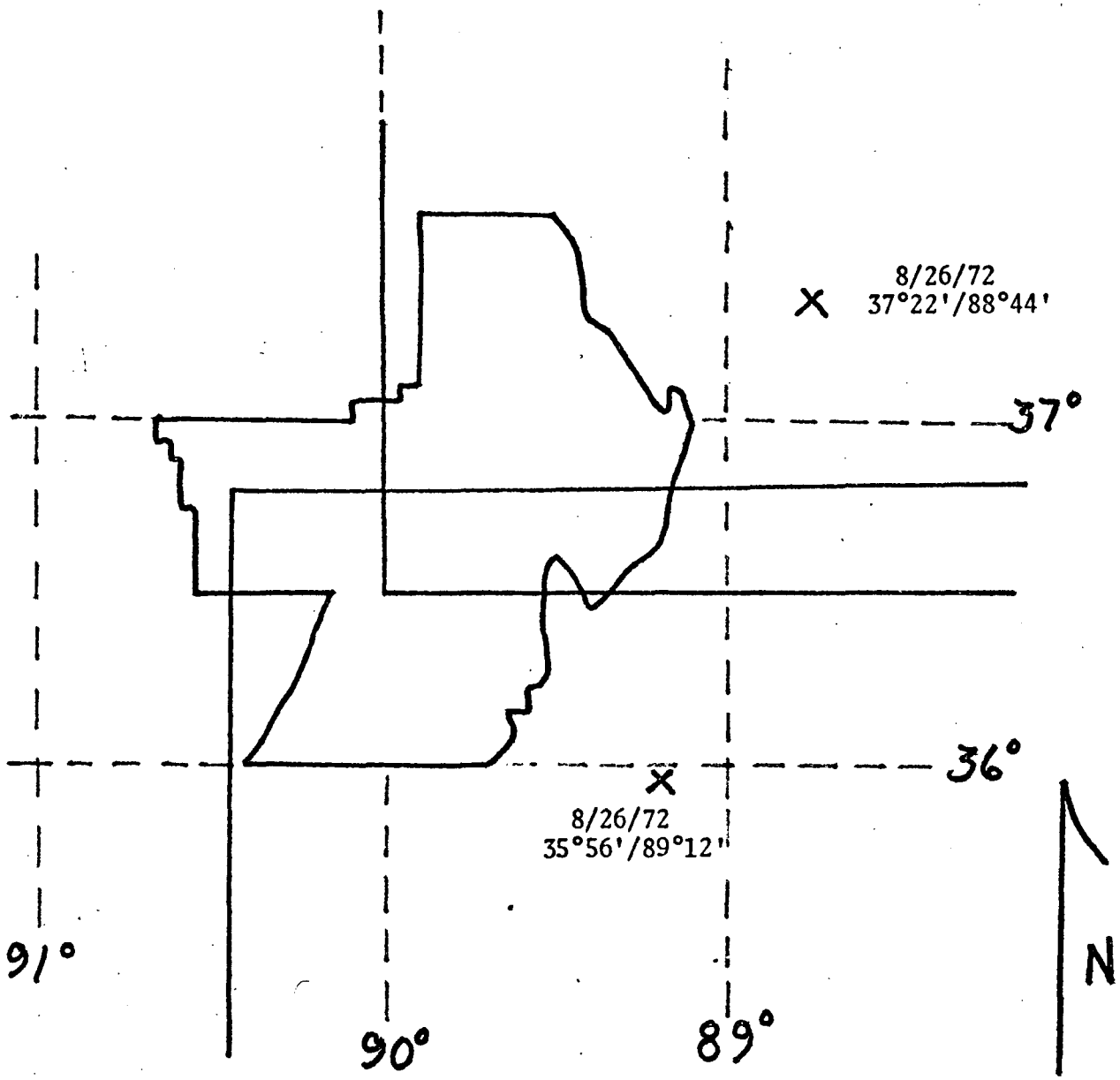

Figure 2

Kansas

Rough Outline of ERTS Coverage

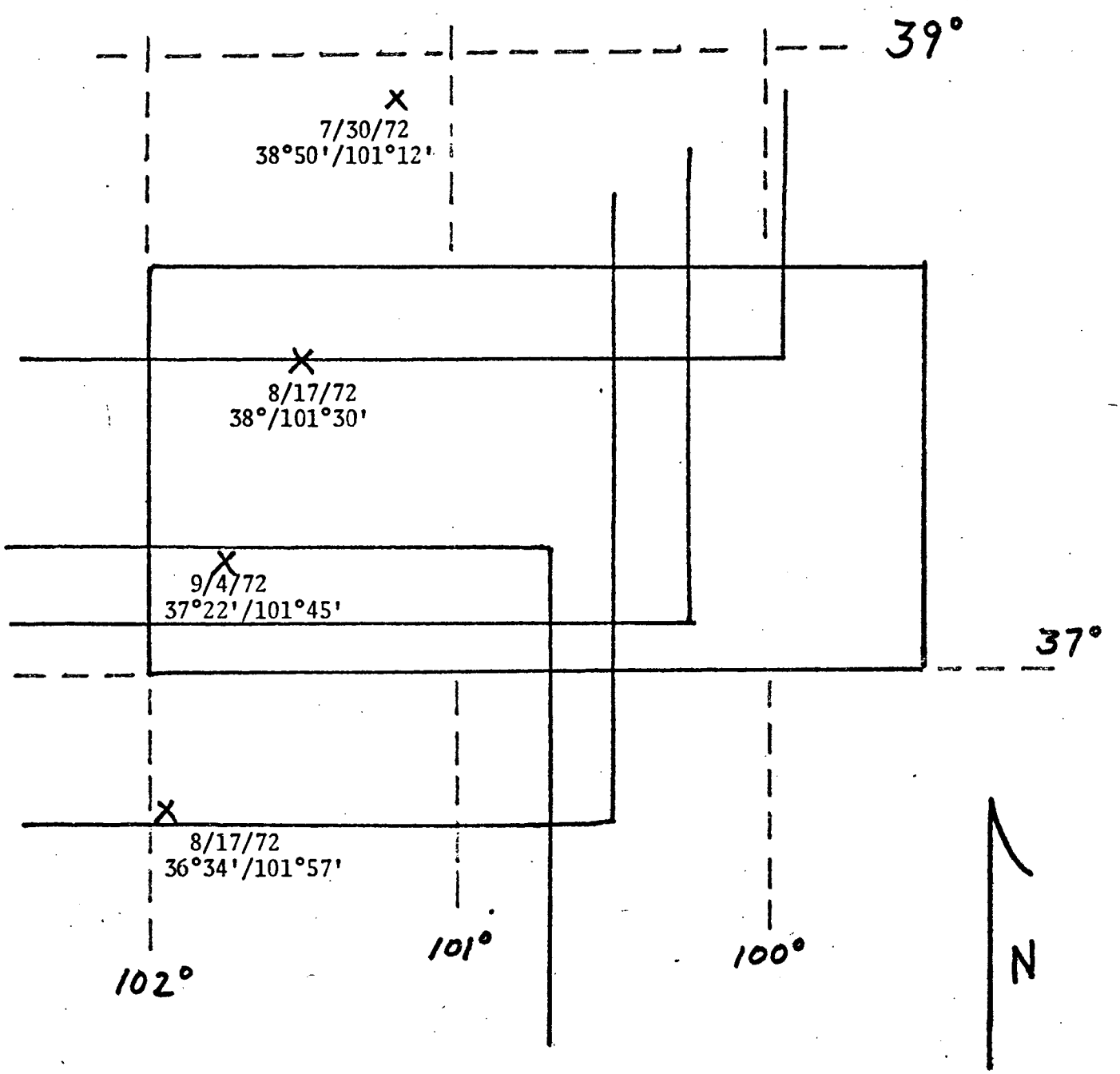

Figure 3

South Dakota

Rough Outline of ERTS Coverage

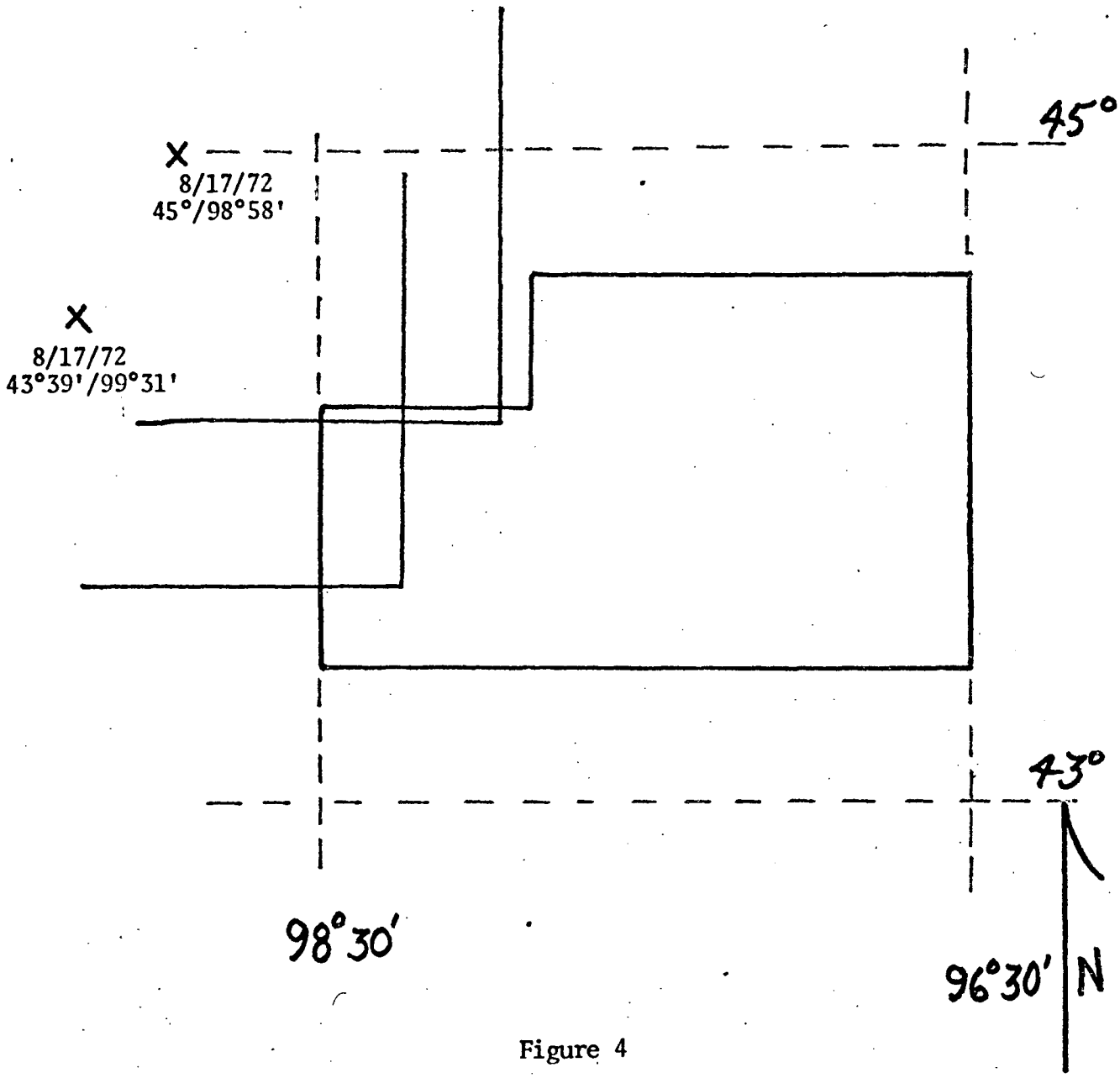

Figure 4

Ground Truth

Collection of the ground truth for updating the ground truth data base is now complete. We have data collected during last week of May or the first week of June for each segment of land included in the ERTS project. This data was collected during the regular June Enumerative Survey (JES) and serves as our data base. Update survey collections were made during August 7-11, September 11-15, and October 10-13. Plans have been made to summarize the segments data to give the direct expansion acreages of crops by test site along with corresponding standard deviations and coefficients of variation for each crop. Segment data collection costs are being collected for the enumerator's time and mileage required for update procedures.

Crop species, crop condition, and crop acreages were collected on additional fields outside the segment boundaries during the September Update Survey in addition to the regular segment data. These fields represent additional fields necessary to train the classifier for our test procedures and will not enter segment expanded crop acreage estimates.

A computer program was written to count the number of fields and give total acres by size group for the segments in each test site. Table 1 on the following page shows the results of the program.

It is correctly noted that 31.5 percent of the fields in Missouri, 15.2 percent of the fields in South Dakota, and 25.2 percent of the fields in Idaho are under 19.9 acres in size. Since satellite imagery gives only one point approximately every 8 acres and it has yet to be determined the number of points necessary to discriminate, there exists the possibility that we may not be able to classify a large portion of the total segment cropland from satellite imagery.

Table 1

Field description	Test site	Kansas	Missouri	South Dakota	Idaho
0-9.9	#Fields..	96	355	215	634
	Acres....	374.6	1,493.7	1,095.9	2,908.1
	%Total...	0.5	11.3	4.4	9.7
10.0-14.9	#Fields..	29	123	108	211
	Acres....	316.5	1,415.1	1,231.6	2,483.0
	%Total...	0.4	10.7	5.0	8.3
15.0-19.9	#Fields..	30	75	87	131
	Acres....	505.3	1,247.0	1,440.5	2,171.5
	%Total...	0.6	9.5	5.8	7.2
20.0-29.9	#Fields..	52	98	165	130
	Acres....	1,248.1	2,276.8	3,842.6	3,118.1
	%Total...	1.5	17.2	15.5	10.3
30.0-39.9	#Fields..	57	53	78	72
	Acres....	1,908.4	1,777.3	2,582.5	2,418.8
	%Total...	2.4	13.5	10.4	8.0
40.0-99.9	#Fields..	234	60	175	123
	Acres....	14,919.9	2,375.4	10,245.7	7,507.8
	%Total...	18.3	25.6	41.4	25.0
100.0-499.9	#Fields..	222	11	30	39
	Acres....	41,829.3	1,604.0	4,342.1	7,053.7
	%Total...	51.4	12.2	17.5	23.5
500.01	#Fields..	25	0	0	3
	Acres....	20,215.0	0.0	0.0	2,409.3
	%Total...	24.9	0.0	0.0	8.0
Total test site					
	#Fields..	745	775	831	1314
	Acres....	81,317.1	13,189.3	24,780.9	30,064.3

Data Analysis

A successful discriminate analysis on digitized data from densitometer readings of South Dakota Remote Sensing Institute aerial photography of Kansas was performed by William Wigton. The SAS program was used to discriminate between fields of corn, sugar beets, and alfalfa in Kansas. Two sets of fields were used. The first set of random densitometer readings made on corn, sugar beets, and alfalfa fields were used to train the classifier. The second set of fields were classified into one of the three crops by the SAS procedure using the parameters of set one. Two runs were made with the data. The first run was made where the classifier did not know the number of fields in each crop. Table 2 lists those results.

Table 2

From \ Into	Without A Priori Classification			
	Corn	Sugar Beets	Alfalfa	Accuracy
Corn	43	6	0	88%
Sugar Beets	1	9	0	90%
Alfalfa	20	0	28	58%

In the second run, we provided the classifier with the number of fields in each crop and then told the classifier to find the fields. The inclusion of the a priori information did not improve the classification. Table 3 lists those results.

Table 3

From \ Into	With A Priori Classification			
	Corn	Sugar Beets	Alfalfa	Accuracy
Corn	39	6	4	80%
Sugar Beets	1	9	0	90%
Alfalfa	16	0	32	67%

At this time, data analysis from MSS computer compatible tapes has been limited to developing a procedure for:

1. Locating the ground target area segments on the CCT tapes.

2. Extracting the data for these target areas from the tapes and rearranging it in a more useable form, and

3. Extracting the data for individual fields (minimum size greater than 10 acres) for statistical analysis.

A computer program for (1) has been written, compiled, and tested with an artificial deck. As of October 20, no flight tapes had been received from NASA so the program had not been tested on real data. A computer program for (2) has been written but has not been tested. No progress has been made at this time toward working out (3). Our immediate work plans for (3) are:

(a) To complete the testing now that ERTS data tapes are becoming available, and

(b) To develop procedures for identifying individual fields and for extracting that information from the tape.