# LACIE ADP/PI JOINT CASE STUDY

## 1.0 Purpose

The purpose of this Joint Case Study is to train Automatic Data Processing (ADP) analysts to process ERTS imagery of 5 x 6 nm sample segments using training fields provided by photo interpreters and to estimate wheat acreage in the segment. This exercise will also serve to evaluate and test current LACIE ADP procedures. It is expected that a number of improvements to these procedures will be identified during this analysis.

## 2.0 Organizations

The ADP students will be organized into teams consisting of three or perhaps four ADP analysts. Associated with each ADP team will be one or two PI students. The PI students will provide the ADP teams with necessary training field information to allow the ADP teams to analyze the study site. The ADP teams will work as a group in analyzing the test site.

## 3.0 Description of Analysis

Each ADP team will temporally analyze four passes of the registered ERTS imagery from a 5 x 6 nm area in Delisle, Canada. The passes analyzed will be imagery taken during the pre-emergence phase, the green phase, the mature phase, and the post harvest phase. To allow an assessment of the analysis results, a 2 x 10 mile ground truth area lying across the 5 x 6 nm study site will also be classified, and wheat acreage estimated. Ground truth information will not be available until the analysis is complete. One analysis will be performed on each of the four phases. Each ADP team will receive training field information and appropriate ERTS imagery data, one phase at a time in the normal sequence and will complete the required analysis before proceeding to the next phase. Each ADP team will be provided with twenty hours of ERIPS console time (five-four hour sessions) to complete the analysis of the data.

The following is a summary of the analysis to be performed on each phase:

- Pre-emergence phase - The photo interpreters will provide training fields for wheat and non-wheat and delineate non-crop areas (designated other fields) for exclusion from the analysis results. Each ADP team will analyze the pre-emergence ERTS data on the ERIPS system and estimate the number of acres of wheat in the study area and the ground truth area.

(NASA-CR-140344) LACIE ADP/PI JOINT CASE STUDY: ADP ANALYSIS GUIDELINES (Lockheed Electronics Co.) 42 p HC $3.75 CSCL 05B

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- o Green phase - The photo interpreter will provide refined training fields for wheat and non-wheat. Each ADP team will analyze the ERTS data and estimate the number of acres of wheat in the study area and the ground truth area.

- o Mature phase - The photo interpreters will provide refined training fields for wheat and non-wheat. Each ADP team will analyze the data and estimate the number of acres of wheat and non-wheat in the study area and the ground truth area.

- o Post-harvest phase - The photo interpreters will provide training fields for harvested wheat, non-harvested wheat, and non-wheat. Each ADP team will analyze the data and estimate the number of acres of harvested wheat and non-harvested wheat in the study site and the ground truth area.

The photo interpreters will provide each ADP team with the following information at each phase to use in performing their analysis:

- o One copy of a polaroid photograph of the study site (taken of the color IR image) with training fields outlined and field numbers shown.

- o A transmittal sheet identifying training fields in terms of their field number, present crop class, field type, crop status, and field coordinates. This information will be in a coded form.

- o A Temporal Crop Interpretation sheet providing a temporal history for each field. For each field, the class of the crop and the status of the crop in the field will be noted for current and previous passes.

At each of the four crop phases, each ADP team will take the field definitions provided by the photo interpreters and perform an initial evaluation (i.e., do field boundaries lie inside the training fields?). If no problems with the training fields are noted, the study site (ground truth area) will be analyzed using the procedure shown in the flow diagrams of Attachment 1.

## 4.0 Data

Four ERTS passes are available for Delisle, Canada, which fall within the four-crop phase windows. Dates for the passes and some general comments are as follows:

- o Pre-emergence - A June 8, 1973, pass (ERTS pass number 1320) will be analyzed. This will be channels 5 through 8 on the registered image tape. Site is cloud free.

- o Green phase - An August 1, 1973, pass (ERTS pass number 1374) will be analyzed. This will be channels 1 through 4 on the registered image tape. Site is cloud free.

- o Mature phase - An August 19, 1973, pass (ERTS pass number 1392) will be analyzed. This will be channels 13 through 16 on the registered image tape. The site is cloud free.

- o Post-harvest phase - A September 7, 1973, pass (ERTS pass number 1411) will be analyzed. This will be channels 9 through 12 on the registered image tape. The site is cloud free.

The quality of the data is generally good. Two or three channels have a few striped lines. This should not significantly affect acreage estimates, but could cause problems if a stripe lies across a training field. The passes are registered with an accuracy of approximately 2 or 3 pixels or less. This may cause problems with training fields if the training field verticies lie near the field boundaries. It may also cause some pixels which lie near field boundaries to be misclassified or thresholded.

## 5.0 Results Expected from Each LEC/ADP Student

Each LEC student will be expected to document the results of the analysis. The report prepared by each student will serve two purposes. First, it will be used by LEC management in evaluating the progress of the student. Second, the reports will be used by senior analysts to evaluate the LACIE ADP procedures, and improve them.

Each LEC student will be expected to make recommendations in the report.

Sections III, IV, V, and VI should be individual work. The report will have the following outline:

I Introduction

Discuss the objectives of the report and the case study. Describe the content of the report that follows.

II Description of Delisle, Canada, Area and the Data

Describe the Delisle, Canada, area. Present a map, describe the soil, vegetation, climate, crop calendar, etc. (see Attachment 2). Describe the ERTS data used. Do not spend too much time in documenting this type information.

III Analysis Approach

Describe the analysis procedure you used on each phase. Show a flow diagram indicating steps in the analysis. Discuss what you hoped to accomplish at each step (if it is not obvious).

IV Results of Analysis

Discuss the results you obtained at each step of the analysis. Include filled out "Data Analysis Summary" sheets (see Attachment 3) for each of the four phases. An example of a completed "Data Analysis Summary" sheet is shown in Attachment 4. Show classification character maps of 5 x 6 nm study site and the 2 x 10 mile ground truth area. Discuss problems encountered in the analysis and their solutions.

V Summary of Results and Conclusions

Summarize results from the analysis and discuss your interpretation and conclusions.

VI Recommendations

Make recommendations for improvements in the LACIE ADP procedure.

The reports should be addressed to C. E. Clouse.

# FLOW CHARTS FOR PROCESSING DELISLE, CANADA, DATA

The procedure shown in the flow charts that follow consist of the following basic steps:

(a) Pre-emergence phase

1. Load June 8, 1974, ERTS data (ch. 5-8).
2. Display image of Delisle area.
3. Enter field verticies for the 5 x 6 nm Delisle study area.
4. Enter field verticies for the 2 x 6 mile Delisle ground truth area.
5. Enter verticies for PI defined training fields and designated other areas.
6. Randomly select thirty test fields within the 2 x 10 mile Delisle ground truth. (The class identify of these fields will be provided at the end of the joint case study at which time the student will be able to evaluate his classification performed against ground truth.)
7. Compute statistics for the training classes.
8. Cluster the wheat fields and obtain statistics for the wheat subclasses.
9. Cluster the non-wheat fields and obtain statistics for the non-wheat subclasses.
10. Classify the 5 x 6 nm study area, the 2 x 10 mile ground truth area, all training and test fields, and all designated other areas.
11. Obtain a classification summary and a microfiche classification character map.
12. Save fields and statistics.

(b) Green phase - Processing of the green phase consists of approximately the same steps as outlined for the pre-emergence phase. Differences are the following:

1. Load June 8, (Channels 5-8) and August 1 (channels 1-4) ERTS data.
2. Update training fields as required by PI.
3. Check test fields to make certain that field boundaries have not changed since the June 8 pass.
4. Classify area using the June 8 and the August 1 ERTS data.

(c) Mature phase - The mature phase processing is essentially a repeat of the green phase processing. The only difference being that three passes of data are now being used, i.e., the June 8 pass (ch. 5-8), the August 1 pass (ch. 1-4), and the August 19 pass (ch. 13-16).

(d) Post harvest phase - Processing of the post harvest phase is again a repeat of the processing for the previous phases with two important differences.

1. All processing is accomplished using all four ERTS passes (ch. 1-16).
2. The PI's provide training fields for wheat which have been broken into two groups - harvested wheat training fields, and non-harvested wheat training fields.
3. Compute class statistics for harvested wheat, non-harvested wheat, and non-wheat.
4. Cluster and obtain statistics for three classes - harvested wheat, non-harvested wheat, and non-wheat.
5. The Delisle area will then be classified into these three classes.

Each ADP team will have five four-hour sessions on an ERIPS console to process all four phases. A team should expect to complete the processing for the first crop phase by the end of the second session on the ERIPS console and a crop phase each session thereafter.

The flow charts that follow sketch the processing steps for each crop phase and give important parameters.

## FLOW CHART FOR PRE-EMERGENCE PHASE

Sign on and go to LOAD. Load ERTS data for pre-emergence phase - June 8 data, tape no. 5410. Load all channels, all of the image.

↓

Go to IMAGE DISPLAY and display Delisle image. Use magnifications = 2, initial line = 65, initial pixel = 118.

↓

Go to FIELD SELECTION and enter verticies for the 5 x 6 nm Delisle study site and the 2 x 10 mile ground truth area. Designate both as TEST fields.

| | Vertice | 1st | 2nd | 3rd | 4th | 5th |
|---|---|---|---|---|---|---|
| 5 x 6 nm | line | 116 | 116 | 233 | 233 | 116 |
| study site | pixel | 140 | 340 | 340 | 140 | 140 |
| 2 x 10 mile | line | 230 | 189 | 141 | 188 | 230 |
| ground truth | pixel | 143 | 128 | 399 | 415 | 143 |

↓

Enter verticies for PI defined training fields* and "Designated Other"** fields. Enter the "Designated Other" fields as TEST fields.

↓

*Suggestion - Use only one or two symbols for field names. The field overlay capability in IMD will not label fields on the image screen with long names.

**Designated Other areas are fields that the PI has determined not to be wheat (forest areas, swamp land, etc.). These are areas to be excluded from analysis.

Using the cursor*** outline 30 randomly selected test fields in the 2 x 10 mile ground truth area.

↓

Generate a FIELD DEFINITION report and obtain a hard copy.

↓

Go to STATISTICS and compute statistics for all training fields and training classes. Generate a statistics summary report and hard copy. Go to CLUSTERING. Using all channels, cluster all wheat classes. On Menu 1802, set; maximum number clusters = 10, strip generation parameters = 5, percent = .8, sep = 1, STDMAX = 3.5, DIMIN = 3.5, NMIN = 30, ITMAX = 5, split/combine sequence = SC. Check the boxes entitled ITERATIVE, STATISTICS, and CLASS STATISTICS VECTORS from the second column. On Menu 1804 check the boxes corresponding to the wheat class names.

↓

After clustering is completed, on Menu 1803, obtain a DETAILED REPORT and a DISTANCE TABLE report.

↓

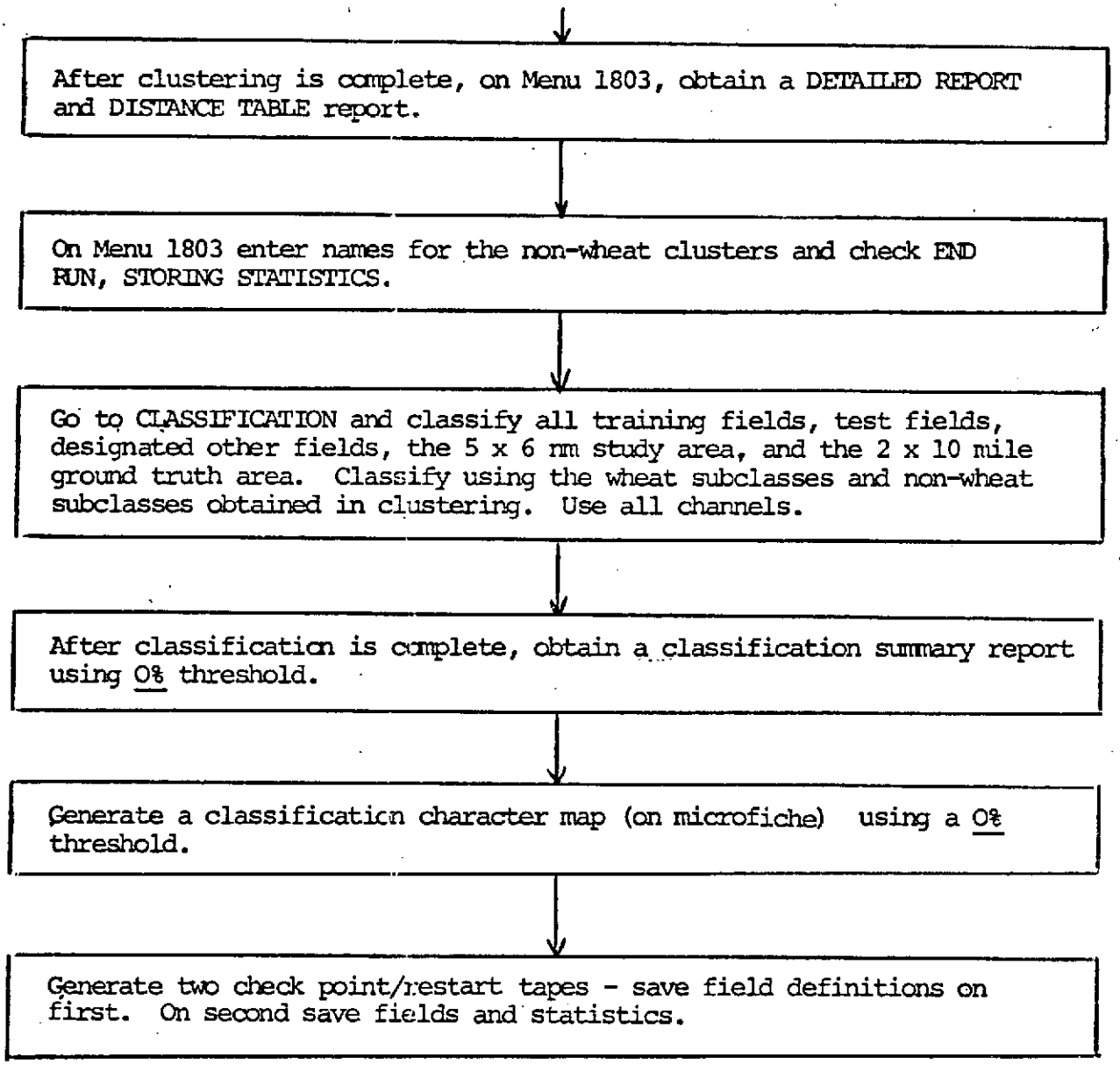
On Menu 1803, enter names for wheat clusters and check END RUN, STORING STATISTICS.

↓

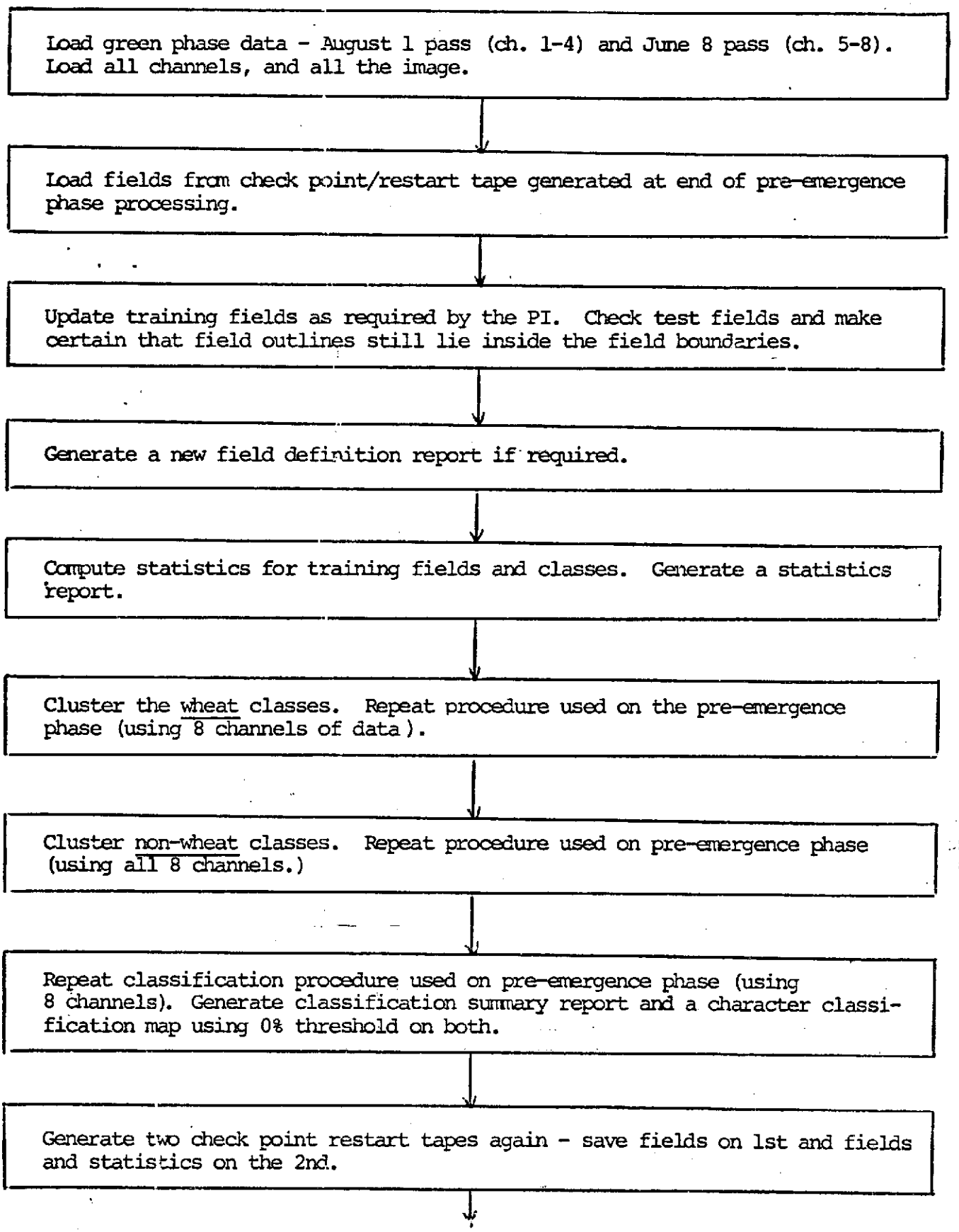
In clustering, return to Menu 1801 and enter names of all non-wheat classes. On Menu 1802 set; maximum number clusters = 20, strip generation parameter = 5, percent = .8, sep = 1, STDMAX = 3.5, DIMIN = 3.5, NMIN = 30, ITMAX = 8, split/combine sequence = SC. Check the boxes entitled ITERATIVE, STATISTICS, and CLASS STATISTICS VECTORS from the second column. On Menu 1804 check the boxes corresponding to the non-wheat classes.

↓

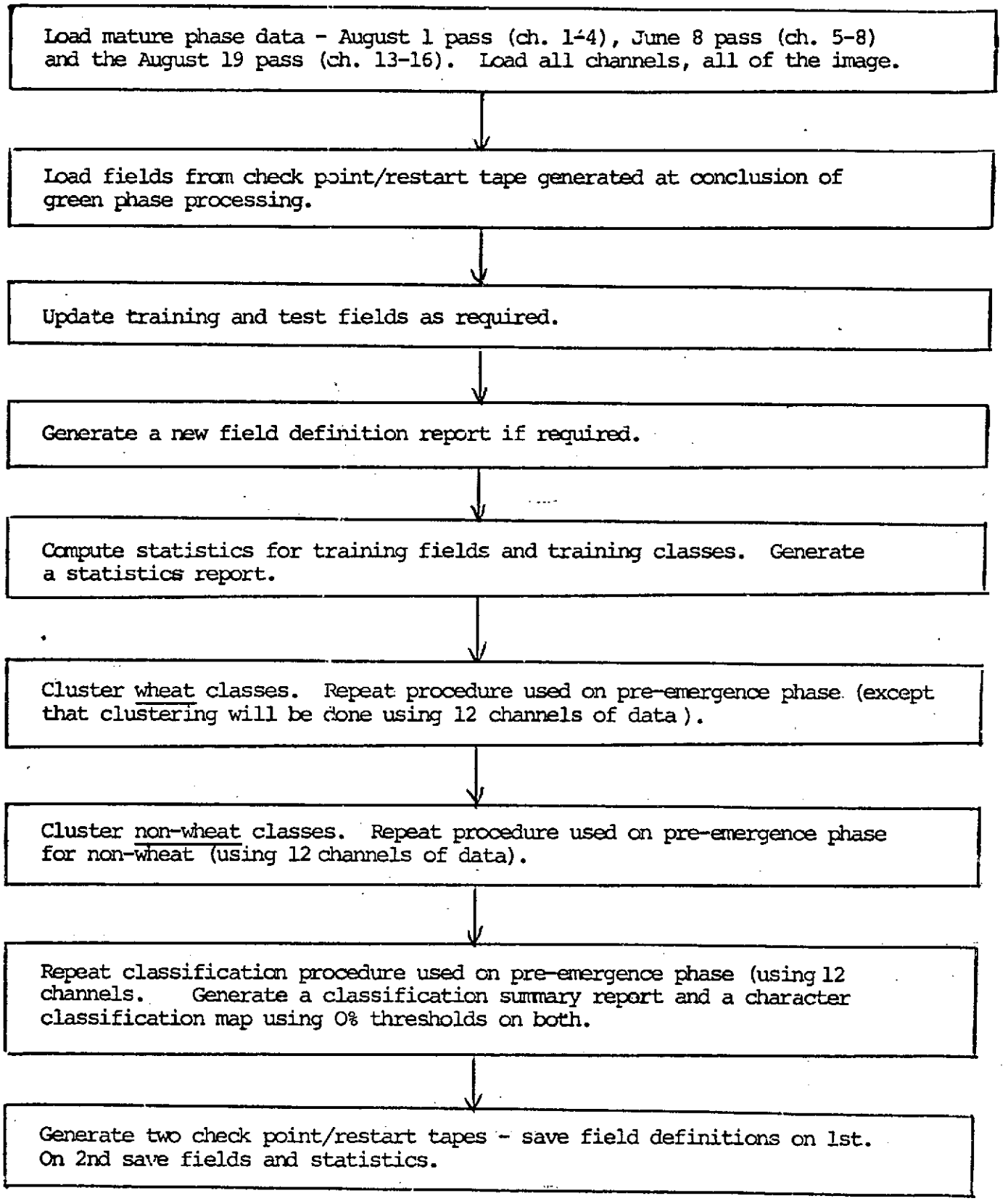
***Suggestion - Keep field outlines at least two pixels inside the field boundaries. This will ensure that test field outlines will not lap over into adjacent fields on later passes due to mis-registration error.


After clustering is complete, on Menu 1803, obtain a DETAILED REPORT and DISTANCE TABLE report.
On Menu 1803 enter names for the non-wheat clusters and check END RUN, STORING STATISTICS.
Go to CLASSIFICATION and classify all training fields, test fields, designated other fields, the 5 x 6 nm study area, and the 2 x 10 mile ground truth area. Classify using the wheat subclasses and non-wheat subclasses obtained in clustering. Use all channels.
After classification is complete, obtain a classification summary report using 0% threshold.
Generate a classification character map (on microfiche) using a 0% threshold.
Generate two check point/restart tapes - save field definitions on first. On second save fields and statistics.

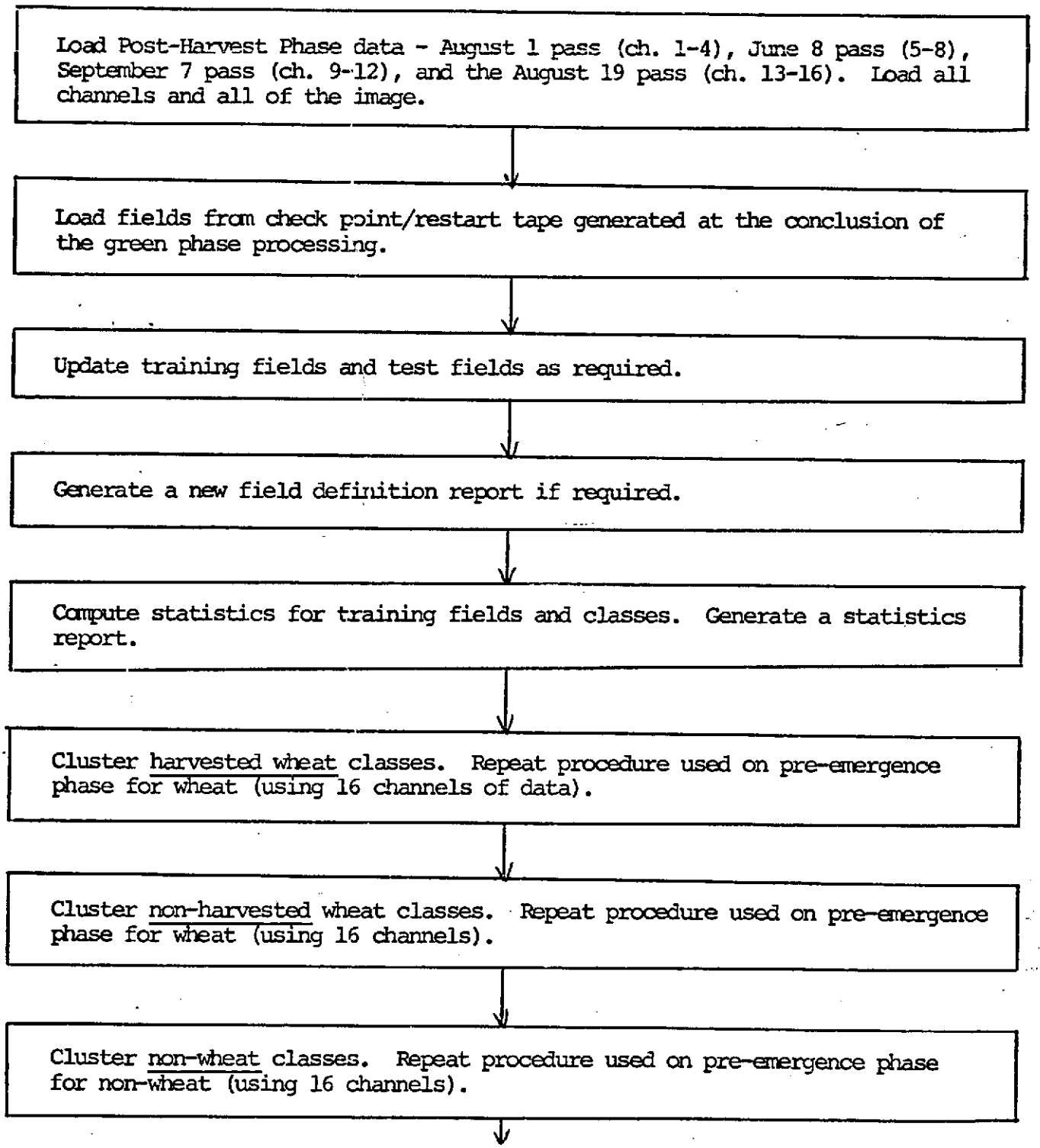
## FLOW CHART FOR GREEN PHASE PROCESSING

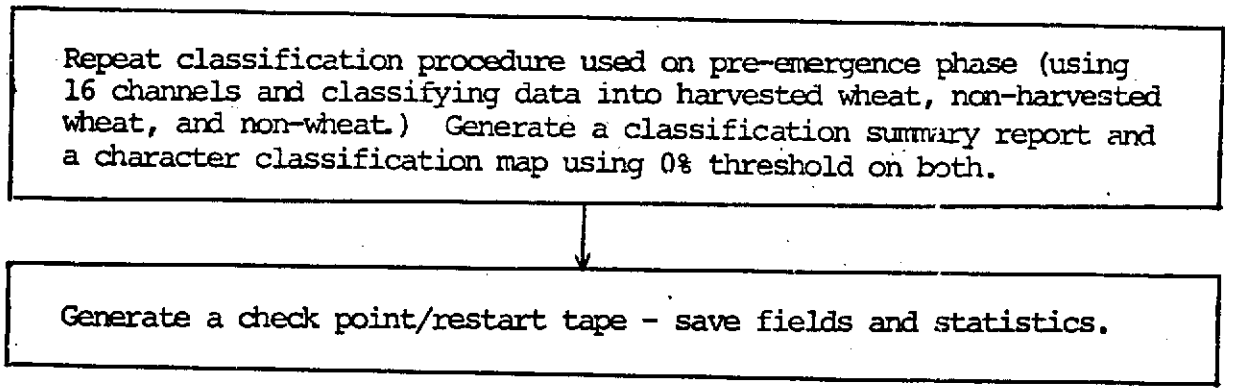


## FLOW CHART FOR THE MATURE PHASE PROCESSING



## FLOW CHART FOR THE POST-HARVEST PHASE




Repeat classification procedure used on pre-emergence phase (using 16 channels and classifying data into harvested wheat, non-harvested wheat, and non-wheat.) Generate a classification summary report and a character classification map using 0% threshold on both.
Generate a check point/restart tape - save fields and statistics.

# II/ADP JOINT CASE STUDY

## DELISLE

## SASKATCHEWAN, CANADA

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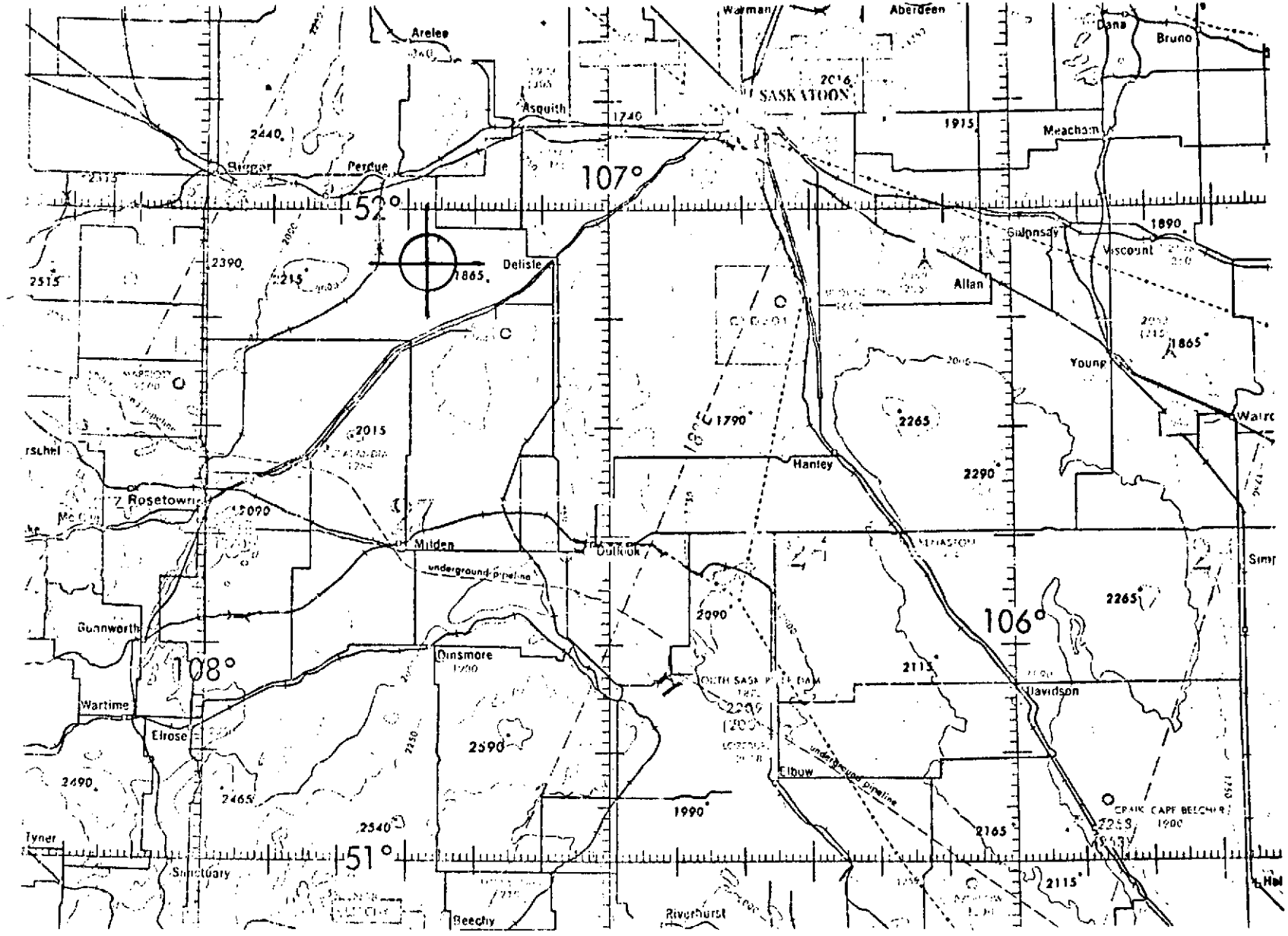


Figure 1.1 - LOCATION MAP: DELISLE, SASKATCHEWAN



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## 1.1 Physical

### 1.1.1 General

Delisle is located approximately 60 miles north of Swift Current and 30 miles Southwest of Saskatoon at an elevation of about 1800 feet. Topography can best be classed as flat to slightly rolling with moderate to little local relief. Higher elevations are generally to the west of the site, Though some isolated high ground is scattered throughout the area. These isolated areas of high ground are in all probability a result of glaciation which the area received during the Pleistocene. Local drainage is northward to the North Saskatchewan River.

### 1.1.2 Soils

Soils belong to the Chernozem group which develop under tall and mixed grasses in temporate to cool, sub-humid climate. Appearance of the soil landscape is characterized by the dark greyish-brown color in cultivated fields, spotted with light grey lime patches and dark grey soldmetzic soils. Soil texture is medium to heavy with most surface soils being silty loam or sandy clay loam. Drainage is adequate except in local flat or depression areas. The local name applied to soil in the study area is Elstow.

### 1.1.3 Climate

The site is located in a transition zone between a steppe climate and a continental sub-artic climate according to the Köppen-Geiger system of climate classification. Overall, the area is characterized by great extremes in temperature between summer and winter seasons and by comparatively low annual precipitation. Summer temperatures above 37.8°C (100°F) and winter temperatures below -45.5°C (-50F) have been recorded. In all seasons, frequent wide variations in temperature occur, both between day and night and from day to day. Precipitation averages between 12 to 20 inches annually. Wide variation in the amount of precipitation occurs from year to year, with extremes of from 7 to over 25 inches having been recorded at one station. During winter, most precipitation is in the form of snow, and the ground remains frozen for a period of four to five months or longer. Approximately one-half of the total precipitation falls between June and August. The growing season is short, warm to hot, with bright sunny weather.

Definitive information on first and last dates of killing frost, average maximum and minimum temperatures, etc., are lacking since meteorological data for Saskatchewan are incomplete and include comparatively few long-time records.

The following information for Delisle can only be considered as very approximate. Precipitation averages 14.3 inches annually with 9.0 inches of the total falling between May

and September. On the average, one hundred (100) days are completely frostfree.

Study Aids: ACIC. ONC E16
Hixon, S. B., Wheat in Canada. 1974.
Mitchell, J., Soil Survey of Southern Saskatchewan. 1944.
Strahler, A. N., Physical Geography. 1969.

## 1.2 Agriculture

### 1.2.1 Field Size

Fields are rectangular in shape and are generally oriented in a north-south direction. Size will vary according to the desires of the individual owner. Generally, fields are 264 feet wide, and extend for a quarter or half section or longer.

### 1.2.2 Agricultural Practices

Practices involve surface tillage and minimum tillage rather than plowing. Spring tillage is most effective because stubble generally retains winter snows. Wind shelters and strip cropping also increase the snow retention.

Strip cropping of a quarter section (160 acres) is practiced extensively with wheat and summer fallow as a safeguard against wind erosion. The strips are commonly 264 feet (80.5 meters) wide making 10 strips per quarter section with each strip commonly extending for a half (or quarter) mile in length; 5 "dark" and 5 "light" strips are not unusual for quarter sections which have no prominant streams or other disruptive features. Other strips can be 2 to 4 times as wide, but still tend toward a half mile (or integer of a half mile) in length. Irrigation is not extensive within the area under study, being applied principally to vegetables and row crops at the present. Spring wheat, as far as is known at the present, is not irrigated; however, the possibility cannot be disregarded.

### 1.2.3 Crops

Within the study area, a variety of crops are grown. These include, besides wheat, oats, barley, alfalfa, alfalfa broome, flax, rape, rye and various grasses. In addition, some fields are in fallow or pasture each year.

Study Aids: Hixon, S. B., Wheat in Canada. 1974.
Huttonson, M. Y., Wheat-Climate Relationships and the Use of Phenology in Ascertaining the Thermal and Photo-Thermal Requirements of Wheat. 1955.
Mitchell, J., Soils Survey of Saskatchewan, 1972. 1972.

Attachment 3

LOCKHEED ELECTRONICS COMPANY, INC.
AEROSPACE SYSTEMS DIVISION
16811 EL CAMINO REAL • HOUSTON, TEXAS 77058 • TELEPHONE (AREA CODE 713) 488-6048

Ref: 642-1405
Job Order 77-795
NAS 9-12200

TECHNICAL MEMORANDUM

# DATA ANALYSIS SUMMARY

By

C. Y. Chang

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Acting Supervisor
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Section

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September 1974

# DATA ANALYSIS SUMMARY

## A. SAMPLE SEGMENT LOCATION

COUNTRY _____ POLITICAL SUBDIVISION _____

STRATUM I.D. _____ CENTER COORDINATES _____

REFERENCE LANDMARKS _____

## B. DATA DESCRIPTION

REC. SEG. # _____ SIZE _____ # OF PASSES _____

BIOLOGICAL PHASES AND DATES OF PASSES:

PHASE _____ DATES _____ _____ _____ _____

PHASE _____ DATES _____ _____ _____ _____

PHASE _____ DATES _____ _____ _____ _____

PHASE _____ DATES _____ _____ _____ _____

REG. DATE _____ TAPE # _____ REG. REF. BASE _____

DATA QUALITY _____

_____

## C. HISTORICAL DATA

COLLECTION DATE _____ TYPES OF CLASSES _____

_____

WHEAT ACREAGE _____ OTHER ACREAGES _____

_____

## D. METEOROLOGICAL DATA

CROP CALENDAR _____

_____

OTHER MET INFO _____

## E. EXPERIMENT DESCRIPTION

PROC FACILITIES _____ PROC DATE _____ I/O TIME _____

STARTING TIME _____ ENDING TIME _____ CPU TIME _____

SOURCE OF TRAINING DATA:

TRAINING SEG ( ) TRAINING SEG # _____ DATE(S) OF ACQ. _____

TRAINING FLDS ( ) TRNG FLD DEFS GENERATED ( ) BIO PHASE _____ DATE _____

EXTERNAL STAT ( ) SOURCE OF STAT _____ DATE OF STORAGE _____

PREPROCESSING INFORMATION:

FEATURE SELECTION ( ) CLUSTERING ( ) CLUSTER CHAINING ( )

SUN ANGLE CORRECTION ( ) MEAN LEVEL ADJUSTMENT ( )

MODE OF PROCESSING _____ TYPE OF CLASSIFICATION _____

DEFAULT A PRIORI PROB USED ( )

SIGNATURE EXTENSION ( ):

LOCATION OF TRNG DATA _____

BIO PHASE OF TRNG DATA: PHASE _____ DATES _____; PHASE _____ DATES _____

PHASE _____ DATES _____; PHASE _____ DATES _____

DISTANCE BETWEEN TRNG DATA & REC SEG _____

# OF SAMPLES/CLASS IN TRNG DATA _____

_____

## F. CLASSIFICATION SUMMARY

1. FEATURE SELECTION SUMMARY

FEATURE SELECTION MODE _____

CHANNELS AVAILABLE _____

CHANNELS SELECTED _____

CHANNEL CORRESPONDENCE:

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REC SEG CHANNELS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| TRNG SEG CHANNELS | | | | | | | | | | | | | | | | |

SEP TABLE:

INTERCLASS SEP (FOR FINAL SELECTED CHS.)

FOR WITHOUT REPL CHS. -LINEAR COM., CASE ONLY

## F. CLASSIFICATION SUMMARY (Cont'd)

### 1. FEATURE SELECTION SUMMARY (Cont'd)

SEP TABLE (Cont'd):

INTRACLASS SEP (FOR FINAL SELECTED CHS.) _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

_____ _____ _____ _____ _____ _____ _____ _____ _____ _____

(FOR WITHOUT REPL. CHS. —LINEAR COM. CASE ONLY) _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

_____ _____ _____ _____ _____ _____ _____ _____ _____ _____

TOTAL SEP WITH ALL CHS. _____

TOTAL SEP WITH FINAL SELECTED CHS. _____ % OF ABOVE _____

TOTAL SEP WITH WITHOUT REPL. CHS. _____ % OF ABOVE _____

### 2. CLUSTERING SUMMARY

COLOR CLUSTER MAPS GENERATED (  )

PARAMETERS CHANGED FROM ADP PROCEDURE _____

_____

DETAILED CLUSTERING REPORT (  )

INTERCLUSTER DISTANCE TABLE (  )

## F. CLASSIFICATION SUMMARY (Cont'd)

3. STATISTICS SUMMARY

| CLASS | STAT. MODE | MOD. STAT. | SUBCLASS | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
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4. ERIPS CLASSIFICATION SUMMARY GENERATED (  )

5. CHARACTER MAP AND FIELD VERIFICATION OVERLAY FOR THIS SEGMENT GENERATED (  )

## F. CLASSIFICATION SUMMARY (Cont'd)

### 6. UNCORRECTED PIXEL PERCENTAGES SUMMARY

| SPECIES (%) | SPECIES A-PRIORI PROB. | CLASS (%) | %THRESHOLDED ACTUAL | %THRESHOLDED DESIRED | SUBCLASS (%) | |
|---|---|---|---|---|---|---|
| WHEAT_____ | $q_w$_____ | W1_____ | _____ | _____ | W11_____ | W12_____ |
| | | | | | W13_____ | W14_____ |
| | | | | | W15_____ | W16_____ |
| | | | | | W17_____ | W18_____ |
| | | | | | W19_____ | W110_____ |
| | | W2_____ | _____ | _____ | W21_____ | W22_____ |
| | | | | | W23_____ | W24_____ |
| | | W3_____ | _____ | _____ | W31_____ | W32_____ |
| | | | | | W33_____ | W34_____ |
| UNIDENTIFIABLE | | | | | | |
| _____ | $q_u$_____ | | _____ | _____ | | |

DO _____

DU _____

## F. CLASSIFICATION SUMMARY (Cont'd)

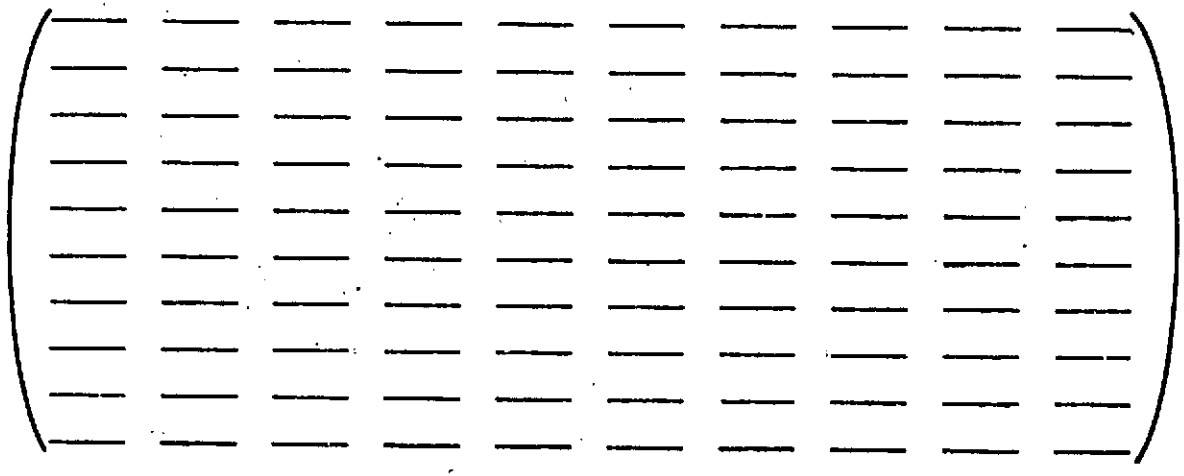
### 6. UNCORRECTED PIXEL PERCENTAGES SUMMARY (Cont'd)

| SPECIES (%) | SPECIES A-PRIORI PROB. | CLASS (%) | % THRESHOLDED ACTUAL | % THRESHOLDED DESIRED | SUBCLASS (%) | | | |
|---|---|---|---|---|---|---|---|---|
| OTHER OR IOTHER 1 ___ | $q_0$ OR $q_{01}$ ___ | 01 ___ | ___ | ___ | 011 ___ | 012 ___ | | |
| | | | | | 013 ___ | 014 ___ | | |
| | | | | | 015 ___ | 016 ___ | | |
| | | | | | 017 ___ | 018 ___ | | |
| | | | | | 019 ___ | 0110 ___ | | |
| | | | | | 0111 ___ | 0112 ___ | | |
| | | | | | 0113 ___ | 0114 ___ | | |
| | | | | | 0115 ___ | 0116 ___ | | |
| | | | | | 0117 ___ | 0118 ___ | | |
| | | | | | 0119 ___ | 0120 ___ | | |
| IOTHER 2 ___ | $q_{02}$ ___ | 02 ___ | ___ | ___ | 021 ___ | 022 ___ | | |
| | | | | | 023 ___ | 024 ___ | | |
| IOTHER 3 ___ | $q_{03}$ ___ | 03 ___ | ___ | ___ | 031 ___ | 032 ___ | | |
| | | | | | 033 ___ | 034 ___ | | |
| IOTHER 4 ___ | $q_{04}$ ___ | 04 ___ | ___ | ___ | 041 ___ | 042 ___ | | |
| | | | | | 043 ___ | 044 ___ | | |
| IOTHER 5 ___ | $q_{05}$ ___ | 05 ___ | ___ | ___ | 051 ___ | 052 ___ | | |
| | | | | | 053 ___ | 054 ___ | | |
| IOTHER 6 ___ | $q_{06}$ ___ | 06 ___ | ___ | ___ | 061 ___ | 062 ___ | | |
| | | | | | 063 ___ | 064 ___ | | |

## F. CLASSIFICATION SUMMARY (Cont'd)

### 7. CONFUSION MATRIX SUMMARY

$E =$



| CLASS | SIZE | $\hat{p}$ | $\hat{q} = E^{-1}\hat{p}$ |
|---|---|---|---|
| | | | |
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## F. CLASSIFICATION SUMMARY (Cont'd)

8. EVALUATION SUMMARY

| ACQ DATE/PHASE | DAY PROCESSED/MODE | RUN # | ASSOC TRNG SEG # | ACQ DATES |
|---|---|---|---|---|
| | | | | |

| %W | %O | %T | %U | %DO | %DU |
|---|---|---|---|---|---|
| | | | | | |

EVALUATION _____

REASONS:

## G. MENSURATION SUMMARY

| | ESTIMATED WHEAT ACREAGE (%) | HISTORICAL WHEAT ACREAGE (%) | GROUND TRUTH WHEAT ACREAGE (%) | RELATIVE BIAS w.r.t. HISTORICAL WHEAT ACREAGE | ABSOLUTE BIAS w.r.t. HISTORICAL WHEAT ACREAGE | RELATIVE BIAS w.r.t GROUND TRUTH WHEAT ACREAGE | ABSOLUTE BIAS w.r.t. GROUND TRUTH WHEAT ACREAGE |
|---|---|---|---|---|---|---|---|
| RUN # ____ | | | | | | | |
| RUN # ____ | | | | | | | |
| RUN # ____ | | | | | | | |

Attachment 4

LOCKHEED ELECTRONICS COMPANY, INC.
AEROSPACE SYSTEMS DIVISION
15811 EL CAMINO REAL • HOUSTON, TEXAS 77058 • TELEPHONE (AREA CODE 713) 488-8888

Ref: 642-1405
Job Order 77-795
NAS 9-12200

TECHNICAL MEMORANDUM

# DATA ANALYSIS SUMMARY

By

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REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

September 1974



A SUBSIDIARY OF LOCKHEED AIRCRAFT CORPORATION

# DATA ANALYSIS SUMMARY

A. SAMPLE SEGMENT LOCATION

COUNTRY Canada POLITICAL SUBDIVISION Saskatchewan

STRATUM I.D. _____ CENTER COORDINATES _____

REFERENCE LANDMARKS _____

B. DATA DESCRIPTION

REC. SEG. # _____ SIZE 5 X 6 n. mi. # OF PASSES 4

BIOLOGICAL PHASES AND DATES OF PASSES:

PHASE Pre-emergence DATES June 8, '73 _____ _____ _____

PHASE Green DATES Aug. 1, 73 _____ _____ _____

PHASE Mature DATES Aug 19, 73 _____ _____ _____

PHASE Post-harvest DATES Sept 7, '73 _____ _____ _____

REG. DATE UNK TAPE # _____ REG. REF. BASE _____

DATA QUALITY all passes cloud free. Some data mis-registration. (2 or 3 pixels on pass xxx). Some data dropout in pass xxx.

C. HISTORICAL DATA

COLLECTION DATE XXXX TYPES OF CLASSES wheat, xxx, xxx, --

WHEAT ACREAGE XXX on 2 X 10 mi test site OTHER ACREAGES _____

## D. METEOROLOGICAL DATA

CROP CALENDAR Use Swift Current crop calender which is biologically one week later than Debisle's.

OTHER MET INFO

## E. EXPERIMENT DESCRIPTION

PROC FACILITIES ERIPS PROC DATE XXX I/O TIME

STARTING TIME XXX ENDING TIME XXX CPU TIME

SOURCE OF TRAINING DATA:

TRAINING SEG ( ) TRAINING SEG # DATE(S) OF ACQ.

TRAINING FLDS ( ✓ ) TRNG FLD DEFS GENERATED ( ) BIO PHASE Post-Har DATE Sep 7, '73

EXTERNAL STAT ( ) SOURCE OF STAT DATE OF STORAGE

PREPROCESSING INFORMATION:

FEATURE SELECTION ( ) CLUSTERING ( ✓ ) CLUSTER CHAINING ( )

SUN ANGLE CORRECTION ( ) MEAN LEVEL ADJUSTMENT ( )

MODE OF PROCESSING Semi-automatic TYPE OF CLASSIFICATION Multi-class

DEFAULT A PRIORI PROB USED ( )

SIGNATURE EXTENSION ( ):

LOCATION OF TRNG DATA

BIO PHASE OF TRNG DATA: PHASE DATES ; PHASE DATES

PHASE - DATES ; PHASE DATES

DISTANCE BETWEEN TRNG DATA & REC SEG

# OF SAMPLES/CLASS IN TRNG DATA

## F. CLASSIFICATION SUMMARY

### 1. FEATURE SELECTION SUMMARY

FEATURE SELECTION MODE No feature selection - used all channels.

CHANNELS AVAILABLE _____

CHANNELS SELECTED _____

CHANNEL CORRESPONDENCE:

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REC SEG CHANNELS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| TRNG SEG CHANNELS | | | | | | | | | | | | | | | | |

SEP TABLE:

INTERCLASS SEP (FOR FINAL SELECTED CHS.)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

(FOR WITHOUT REPL CHS. –LINEAR COM., CASE ONLY)

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

## F. CLASSIFICATION SUMMARY (Cont'd)

### 1. FEATURE SELECTION SUMMARY (Cont'd)

SEP TABLE (Cont'd):

INTRACLASS SEP (FOR FINAL SELECTED CHS.) _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

(FOR WITHOUT REPL. CHS. -LINEAR COM. CASE ONLY) _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

TOTAL SEP WITH ALL CHS. _____

TOTAL SEP WITH FINAL SELECTED CHS. _____ % OF ABOVE _____

TOTAL SEP WITH WITHOUT REPL. CHS. _____ % OF ABOVE _____

### 2. CLUSTERING SUMMARY

COLOR CLUSTER MAPS GENERATED ( ✓ )

PARAMETERS CHANGED FROM ADP PROCEDURE None

DETAILED CLUSTERING REPORT ( ✓ )

INTERCLUSTER DISTANCE TABLE ( ✓ )

## F. CLASSIFICATION SUMMARY (Cont'd)

3. STATISTICS SUMMARY

| CLASS | STAT. MODE | MOD. STAT. | SUBCLASS | | | | |
|---|---|---|---|---|---|---|---|
| Wheat | Cluster | No correction | W1 | W2 | W3 | | |
| Non-wheat | cluster | No correction | N1 | N2 | N3 | N4 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

4. ERIPS CLASSIFICATION SUMMARY GENERATED ( ✓ )

5. CHARACTER MAP AND FIELD VERIFICATION OVERLAY FOR THIS SEGMENT GENERATED ( ✓ )

## F. CLASSIFICATION SUMMARY (Cont'd)

### 6. UNCORRECTED PIXEL PERCENTAGES SUMMARY

| SPECIES (%) | SPECIES A-PRIORI PROB. | CLASS (%) | %THRESHOLDED ACTUAL | %THRESHOLDED DESIRED | SUBCLASS (%) | |
|---|---|---|---|---|---|---|
| WHEAT XXX | $q_w$ XXX | W1 XXX | 0% | 0% | W11 XXX | W12 XXX |
| | | | | | W13 XXX | W14 |
| | | | | | W15 | W16 |
| | | | | | W17 | W18 |
| | | | | | W19 | W110 |
| | | W2 | | | W21 | W22 |
| | | | | | W23 | W24 |
| | | W3 | | | W31 | W32 |
| | | | | | W33 | W34 |
| UNIDENTIFIABLE 0% | $q_u$ 0% | | | | | |

DO XXX

DU* 0%

$W11\,(XXX) \triangleq \dfrac{\#\text{ of pixels classified into } W11}{(117 \times 200) - \#\text{ of pixels in class DO fields}}$

$DO \triangleq \dfrac{\#\text{ of pixels in DO fields}}{117 \times 200}$



* Designated unidentifiable fields - these are areas covered by clouds.

## F. CLASSIFICATION SUMMARY (Cont'd)

### 6. UNCORRECTED PIXEL PERCENTAGES SUMMARY (Cont'd)

| SPECIES (%) | SPECIES A-PRIORI PROB. | CLASS (%) | % THRESHOLDED ACTUAL | % THRESHOLDED DESIRED | SUBCLASS (%) | | | |
|---|---|---|---|---|---|---|---|---|
| OTHER XXX OR IOTHER 1___ | $q_0$ OR $q_{01}$ XXX | 01 XXX | 0% | 0% | 011 XXX | 012 XXX | | |
| | | | | | 013 XXX | 014 XXX | | |
| | | | | | 015 ___ | 016 ___ | | |
| | | | | | 017 ___ | 018 ___ | | |
| | | | | | 019 ___ | 0110 ___ | | |
| | | | | | 0111 ___ | 0112 ___ | | |
| | | | | | 0113 ___ | 0114 ___ | | |
| | | | | | 0115 ___ | 0116 ___ | | |
| | | | | | 0117 ___ | 0118 ___ | | |
| | | | | | 0119 ___ | 0120 ___ | | |
| IOTHER 2___ | $q_{02}$ ___ | 02 ___ | ___ | ___ | 021 ___ | 022 ___ | | |
| | | | | | 023 ___ | 024 ___ | | |
| IOTHER 3___ | $q_{03}$ ___ | 03 ___ | ___ | ___ | 031 ___ | 032 ___ | | |
| | | | | | 033 ___ | 034 ___ | | |
| IOTHER 4___ | $q_{04}$ ___ | 04 ___ | ___ | ___ | 041 ___ | 042 ___ | | |
| | | | | | 043 ___ | 044 ___ | | |
| IOTHER 5___ | $q_{05}$ ___ | 05 ___ | ___ | ___ | 051 ___ | 052 ___ | | |
| | | | | | 053 ___ | 054 ___ | | |
| IOTHER 6___ | $q_{06}$ ___ | 06 ___ | ___ | ___ | 061 ___ | 062 ___ | | |
| | | | | | 063 ___ | 064 ___ | | |

7. CONFUSION MATRIX SUMMARY

$$E = \begin{pmatrix} N(1/1) & N(1/2) & N(1/3) & __ & __ & __ & __ & __ & __ & N(1/n) \\ N(2/1) & __ & __ & __ & __ & __ & __ & __ & __ & __ \\ __ & __ & __ & __ & __ & __ & __ & __ & __ & __ \\ __ & __ & __ & __ & __ & __ & __ & __ & __ & __ \\ __ & __ & __ & __ & __ & __ & __ & __ & __ & __ \\ __ & __ & __ & __ & __ & __ & __ & __ & __ & __ \\ __ & __ & __ & __ & __ & __ & __ & __ & __ & __ \\ __ & __ & __ & __ & __ & __ & __ & __ & __ & __ \\ N(n/1) & __ & __ & __ & __ & __ & __ & __ & __ & __ \end{pmatrix}$$

* N(1/3) is the number of training field pixels from class 3 being misclassified into class 1.

| CLASS | SIZE** | $\hat{p}$*** | $\hat{q} = E^{-1}\hat{p}$ |
|---|---|---|---|
| W1 | XX | XX | XX |
| W2 | XX | XX | XX |
| ____ | ____ | ____ | ____ |
| ____ | ____ | ____ | ____ |
| N1 | ____ | ____ | ____ |
| N2 | ____ | ____ | ____ |
| ____ | ____ | ____ | ____ |
| ____ | ____ | ____ | ____ |
| ____ | ____ | ____ | ____ |
| ____ | ____ | ____ | ____ |

** SIZE is the number of training field pixels for a class.

*** $\hat{p}$ is the percentage of pixels classified into a class in the 5X6 nm area.

## F. CLASSIFICATION SUMMARY (Cont'd)

8. EVALUATION SUMMARY

| ACQ DATE/PHASE | DAY PROCESSED/MODE | RUN # | ASSOC TRNG SEG # | ACQ DATES |
|---|---|---|---|---|
| | | | | |

| %W | %O | %T | %U | %DO | %DU |
|---|---|---|---|---|---|
| XX | X.X | 0% | 0% | XX | 0% |

EVALUATION Suitable for use in aggregation

REASONS:

## G. MENSURATION SUMMARY

| | ESTIMATED WHEAT ACREAGE (%) | HISTORICAL WHEAT ACREAGE (%) | GROUND TRUTH WHEAT ACREAGE (%) | RELATIVE BIAS w.r.t. HISTORICAL WHEAT ACREAGE | ABSOLUTE BIAS w.r.t. HISTORICAL WHEAT ACREAGE | RELATIVE BIAS w.r.t GROUND TRUTH WHEAT ACREAGE | ABSOLUTE BIAS w.r.t. GROUND TRUTH WHEAT ACREAGE |
|---|---|---|---|---|---|---|---|
| RUN # ____ | X | | | | | | |
| RUN # ____ | | | | | | | |
| RUN # ____ | | | | X X | | | X X |

E.W.A - G.T.W.A. (%)

$$\frac{E.W.A. - H.W.A}{H.W.A} \times 100\ (\%)$$