THE NASS DELTA PROJECT:

1991-92 Rice and Cotton Acreage

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OBJECTIVE: Use Landsat TM digital data to increase the precision of rice and cotton acreage estimates in the Mississippi River Delta Region.

WHY: Substantial amounts of the Nation's rice and cotton acreage fall in localized areas of the Mississippi River Delta Region. The NASS area frame used for major crops' estimates is less efficient for localized versus widespread crops. The roughly North/South orientation of this Region is especially suited to data acquired from polar orbiting satellites.

HARDWARE:

- DEC MicroVAX 3500 with (3) Vaccelerator Boards
- Rented Time on a CRAY Supercomputer (DoE, Idaho Falls)
- 386 and 486 PC's - Analysts
- 386 PC's Attached to Point Mode Dig. Stations
- 386 PC with Video Scanner Station
- RJE (HASP) Connection (CRAY & MMDS)
- Ethernet Thinwire LAN

SOFTWARE:

- PEDITOR System (PASCAL, In-house, Modular)
- PCVISION Scanner Package
- Minor Use of Commercial Text Editors

OVERVIEW / GOALS

INPUTS:

- June Agric. Survey (JAS) Sample Segments (Avg. 640 Acres)
- Landsat TM Digital Data
- Area Sampling Frame (ASF) Boundaries

OUTPUTS:

- August Acreage Estimates - Rice and Cotton
- December Acreage Estimates - Major Crops, End of Season
- February County Estimates - Major Crops
- Color Coded County Theme Maps (from Classification)
- JAS Segment Quality Control
- Input for Future ASF Construction

Area Sampling Frame Overview

- States Stratified According to Land Use & % Cultivation
- Approximately 16,000 Samples (Known as Segments) Selected
- Selected Segments are Rotated Out of Sample (20% per Year)
- Segment Sizes Vary by Strata, Agric. Strata (>15%) = 640 ac.
- Sampled Segments Visited/Enumerated Annually in June
- Aerial Photographs (Non Current) Used for Quality Control

SAMPLE LEVEL PROCEDURES

- Segment Field Boundaries Digitized, Fields Labelled by Cover
- Register TM Scenes to USGS Map Base
- Locate Segments in Scenes for Training the Classifier
- Select & Pack Pixels by Cover Type (Supervised Approach)
- Cluster Pixels Within Cover Type, Combine Statistics
    - Modified ISODATA Clustering With Splitting Options
- Maximum Likelihood Classification of All Segments/Fields
- Tabulate Results by Segment

GROUND INPUTS FOR TRAINING

STATE & YEAR	STRATA	PERCENT CULTIVATION	SAMPLE SIZE* 1991	1992
Arkansas ('91)	11	80 - 100	120	-
	12	51 - 79	22	-
	20	15 - 50	23	-
Arkansas ('92)	11	76 - 100	-	144
	21	15 - 75	-	18
Mississippi ('91-'92)	11	76 - 100	49	48
	12	51 - 75	32	17
	20	15 - 50	61	38
Louisiana ('92)	13	51 - 100	-	141
	20	15 - 50	-	38

* Number of 640 Acre Segments in Coverage Area

LANDSAT IMAGERY SPEC'S

Thematic Mapper Coverage Requirements:

- 12 Scene Locations in 1992, 9 Scene Locations in 1991
- Multitemporal (2 date, 14 channel, full resolution) if avail.

Acquisitions Used:

Path	Row(s)	Type	Date Spring	Date Summer
		1991		
22	36-37	Unitemporal	n/a	7/31
23	35-38	Multitemporal	4/1	8/23
24	35-36	Unitemporal	n/a	8/14
24	37	None Usable *	n/a	n/a
		1992		
22	36-37	None Usable *	n/a	n/a
23	35-36	Multitemporal	5/5	6/22
23	36-37	Multitemporal	5/5	7/24
23	37-39	Unitemporal	5/5	n/a
24	36-39	Multitemporal	4/26	8/16

* None Even Partially Usable

STATISTICS FILE CHARACTERISTICS
1991 AND 1992 COMBINED

Cover Type	# Groups Used: Unitemporal	# Groups Used: Multitemporal
Rice	0 - 25	8 - 38
Cotton	9 - 29	5 - 89
Soybean	4 - 32	4 - 37
Idle Cropland	8 - 26	4 - 34
Perm.Pasture	3 - 42	3 - 16
Woodland	22 - 40	8 - 43
Overall*	97 - 192	111 - 220

* Other Covers Sometimes Included in Overall:
Sorghum, Winter Wheat, Sugar Cane, Corn, Alfalfa, Hay, Oats, Other Crops, Waste, Water, Grass, Farm, Non-Ag, Fallow, Unknown, Clouds, Crawfish (Ponds)

CLASSIFICATION ACCURACY
(KAPPA COEFFICIENTS)

CROP	STATE	YEAR	UNITEMPORAL	MULTITEMPORAL
Rice	AR	1991	66.50	71.05
	MS	1991	n/a	77.93
	AR	1992	n/a	74.25,81.21,83.33
	MS	1992	56.55	89.18
	LA	1992	36.28	81.73,87.50
Cotton	AR	1991	69.92	73.35
	MS	1991	72.00	68.39
	AR	1992	n/a	73.82,77.11,87.29
	MS	1992	53.30	72.48
	LA	1992	65.51	79.47,79.05
Overall	AR	1991	47.04	61.20
	MS	1991	47.32	57.76
	AR	1992	n/a	64.81,69.25,72.56
	MS	1992	47.59	58.27
	LA	1992	43.81	62.47,68.86

ANALYSIS AND ESTIMATION STEPS

- Linear Regression Analysis to Determine Estimator Parameters
- Identify Outliers, Investigate/Select Priors vs. No Priors
- Maximum Likelihood Classification of Full Scenes
  - Full Resolution, 14 channel if available
  - Using Selected Prior Probabilities (inc. Equal/No)
- Apply X's to Make Estimates by Crop and Analysis District
  - Deliver to respective State Offices
  - Deliver to NASS Agricultural Statistics Board
- Calculate County Estimates, create text/Dbase/Lotus files
- Print Color County Theme "Maps"

REGRESSION R-SQUARED SUMMARY

CROP	STATE	1991 RANGE	1992 RANGE
Rice	AR	.936 - .994	.842 - .982
	MS	.919	.638 - .997
	LA	n/a	.860 - .995
Cotton	AR	.930 - .940	.970 - .991
	MS	.903 - .995	.814 - .976
	LA	n/a	.931 - .981

STATE LEVEL ESTIMATION

CROP	YEAR	STATE	D.E. CV(%)	REGR. CV (%)	RE
Rice	1991	AR	10.1	5.4	3.9
		MS	21.5	15.5	3.9
	1992	AR	6.8	4.1	3.2
		MS	22.8	19.1	1.5
		LA	13.5	8.4	3.8
Cotton	1991	AR	11.3	8.7	2.2
		MS	10.5	5.4	4.3
	1992	AR	10.4	2.6	21.0
		MS	10.2	6.6	3.0
		LA	10.4	3.0	12.1

NASS DELTA PROJECT: FUTURE PLANS

- Recent FY93 Budget Cuts Have Reduced This Years Project
  - Continue with Arkansas Only in 1993
  - Establish "Prototype" Remote Sensing System
- Improve Ground Truth Input and Other Pre-Regression Steps
  - Digital Edit of Previous Year's Field Boundaries (80%)
  - Incorporate USGS DLG files for registration/calibration
  - Apply Smoothing &/or Edge Detection for Classification
- Investigate Crop Condition Assessment Measures (AVHRR)
- Coordinate/Apply Outputs with NASS GIS & ASF Construction
- Begin Research on Radar Applications