Remote Sensing for Cropland Monitoring in Mississippi, 1999-2004

Fred L. Shore, Ph.D.
Mississippi Department of Agriculture and Commerce
Jackson, MS, USA
fred_shore@nass.usda.gov

Thomas L. Gregory
National Agricultural Statistics Service
Jackson, MS, USA

Rick Mueller
Research and Development Division
National Agricultural Statistics Service
Fairfax, VA, USA

Acknowledgements: Commissioner Lester Spell, Jr., D.V.M., MDAC, Dr. Joseph H. McGilberry, Director, Mississippi Cooperative Extension Service, James Brown, Mississippi Department of Transportation, and the USDA Field Enumerators in Mississippi were critical to the success of this project.
Colorado Harvested Winter Wheat Estimates

The Cropland Data Layer in Mississippi

- Based on USDA/NASS programs started in the 1970s and the LARSYS software from Purdue University.

- Mississippi cooperative project started in 1999 using the Peditor and RSP software programs of NASS

- A cooperative project of NASS, Mississippi State University, and the Mississippi Department of Agriculture and Commerce
Data Collection for the MS 2004 Cropland Data Layer

- June Agricultural Survey area frame sample selection of 356 segments by strata, generally 1 square mile per segment.

- June Agricultural Survey field observations.

- Landsat 5 satellite imagery scenes with little or no clouds.
The Mississippi Cropland Data Layer, 2004
HURRICANE KATRINA

Date: 30 Aug
Time: 4am
Wind speed: 50mph
Comparative Satellite imagery of power outages caused across the Gulf Coast region pre- and post-Hurricane Katrina (Image source: U.S. Air Force image)
Comparative Satellite imagery of power outages caused across the Gulf Coast region pre- and post-Hurricane Katrina.

(Image source: U.S. Air Force image)
Comparative Satellite imagery of power outages caused across the Gulf Coast region pre- and post-Hurricane Katrina
(Image source: U.S. Air Force image)
Comparative Satellite imagery of power outages caused across the Gulf Coast region pre- and post-Hurricane Katrina. (Image source: U.S. Air Force image)
Comparative Satellite imagery of power outages caused across the Gulf Coast region pre- and post-Hurricane Katrina.

(Image source: U.S. Air Force image)
After Katrina, Landsat 5 View
June Agricultural Survey
Segment Selection
Mississippi Data Collection
Segment Locator Map and Field Locations
Multi-Temporal Crop Signatures

• Computer processing using Peditor and RSP.

• Use of two Landsat scenes of different dates with 7 bands each.

• Use of the ground truth data from the June Agricultural Survey.

• Clustering the crop signatures and training the classifier.

• Classification of all scenes and making the mosaic.
Image Processing for MS CDL, 2004
2004 Acreage Estimates (Mean= 100.0, St. Dev. = 24.7)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Percent of Official NASS Estimate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton</td>
<td>100</td>
</tr>
<tr>
<td>Rice</td>
<td>108</td>
</tr>
<tr>
<td>Soybeans</td>
<td>121</td>
</tr>
<tr>
<td>Sorghum</td>
<td>151</td>
</tr>
<tr>
<td>Corn</td>
<td>50</td>
</tr>
<tr>
<td>Wheat</td>
<td>118</td>
</tr>
<tr>
<td>Sweet Potatoes</td>
<td>151</td>
</tr>
<tr>
<td>All Crops (mean)</td>
<td>100</td>
</tr>
</tbody>
</table>

Mississippi State-Wide Cropland Data Layer Acreage Estimation Results, 2004
Mississippi Major Crop Estimates, 1999-2004
Cropland Data Layer Value as Percent of the Official Estimate
Mean = 100.28, Standard Deviation = 7.09
Cropland Data Layer Indications vs. NASS Official Estimates in Percentages by Crop

Cotton, Mean = 101.9%, ST. Dev. = 5.4

Rice, Mean = 95.5%, ST. Dev. = 6.7

Soybeans, Mean = 103.5%, ST. Dev. = 9.1

Landsat Scene Date vs. Optimum Date (Delta Area)

Early Scene, Mean = 3.5 Weeks, ST. Dev. = 4.8

Late Scene, Mean = 1.9 Weeks, ST. Dev. = 2.2
The Basic Cropland Data Layer Presentation

Mississippi Delta 2004, Cropland Data Layer

CROPS
- Corn
- Cotton
- Rice
- Sorghum
- Soybeans
- Hay/Other Crops
- Fallow/Idle Cropland
- Trees/Pasture/Non-Ag
- Clouds
- Urban
- Water

USDA-NASS/MDAC/MSU
Map by Dr. Fred Shore
In the crescent moon-shaped part of northwestern Mississippi known as The Delta, cotton is usually planted in sandy soil along existing or ancient rivers and creeks.

Cotton crop rotations are used but high cotton prices can lead to the same land being used for cotton every year.
Crop Overlays by Priority

In the crescent moon-shaped part of northwestern Mississippi known as The Delta, cotton is the most profitable crop with rice second.

On an annual basis there are more acres planted to soybeans than any other crop. This overlay display shows good land for cotton and rice and land used for soybeans that could be used in rotation with rice.

Map shows satellite classification ranges from the Cropland Data Layer by Dr. Fred Shore.
Results

• The Cropland Data Layer for Mississippi vs. the official USDA-NASS estimate gave a 0.26% difference from the mean with a standard deviation of 7.5% for the major crops in this 6 year period.

• The optimum date of Landsat scene selection for the multi-temporal processing is less critical than previously thought.

• GIS presentations can be multiyear to allow better land use determinations.

• Further Cropland Data Layer information is available at www.mdac.state.ms.us and www.nass.usda.gov/ms/.