

CROPLAND DATA LAYER FOR THE STUDY OF MISSISSIPPI FORESTS

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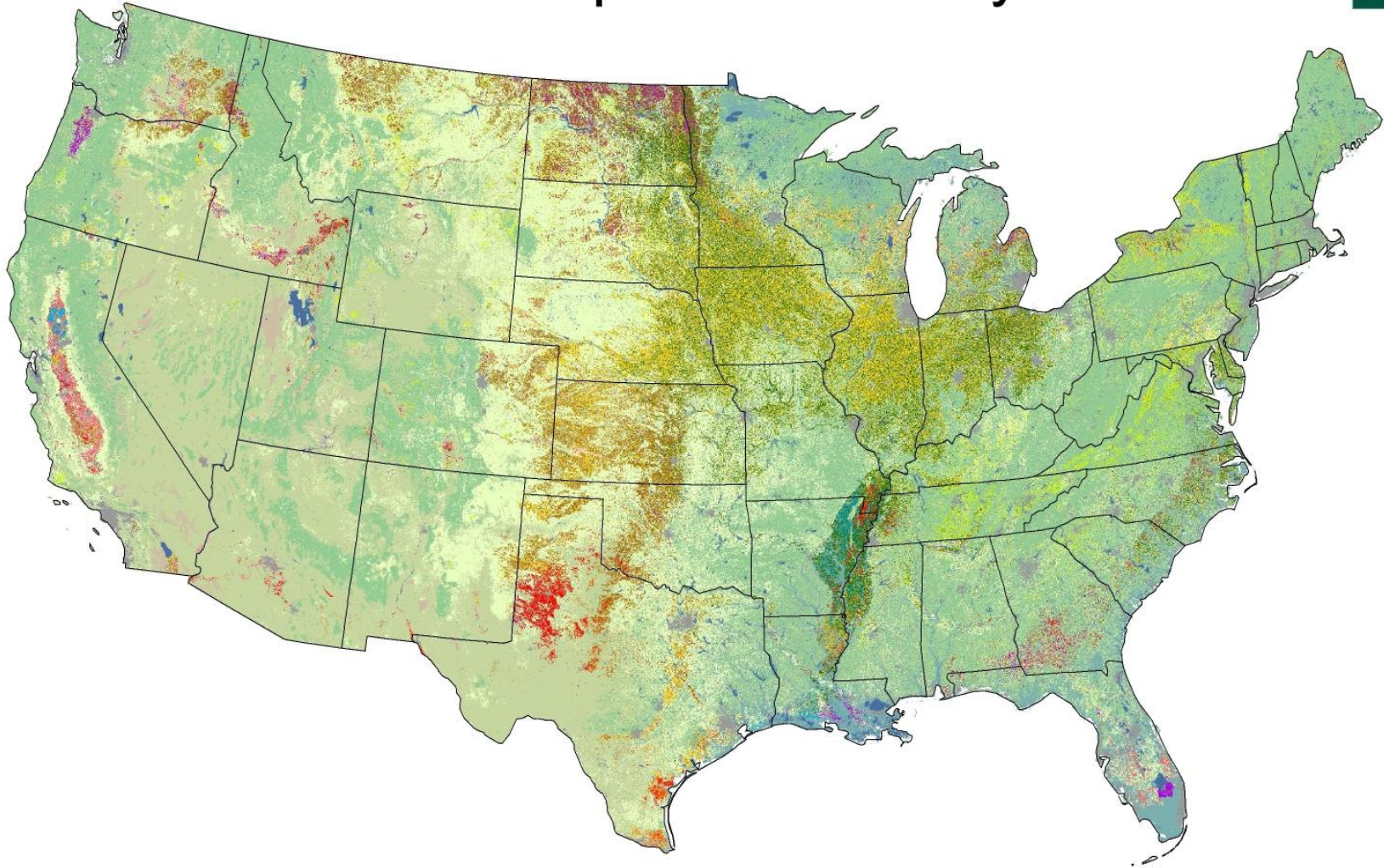
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2009 Cropland Data Layers



Land Cover Categories (by decreasing acreage)

Agriculture

- Pasture/Grass
- Corn
- Soybeans
- All Wheat
- Other Hays

- Fallow/Idle Cropland
- Alfalfa
- Cotton
- Other Crops
- Sorghum

- Vegetables/Fruits/Nuts
- Other Small Grains
- Rice

Non-Agriculture

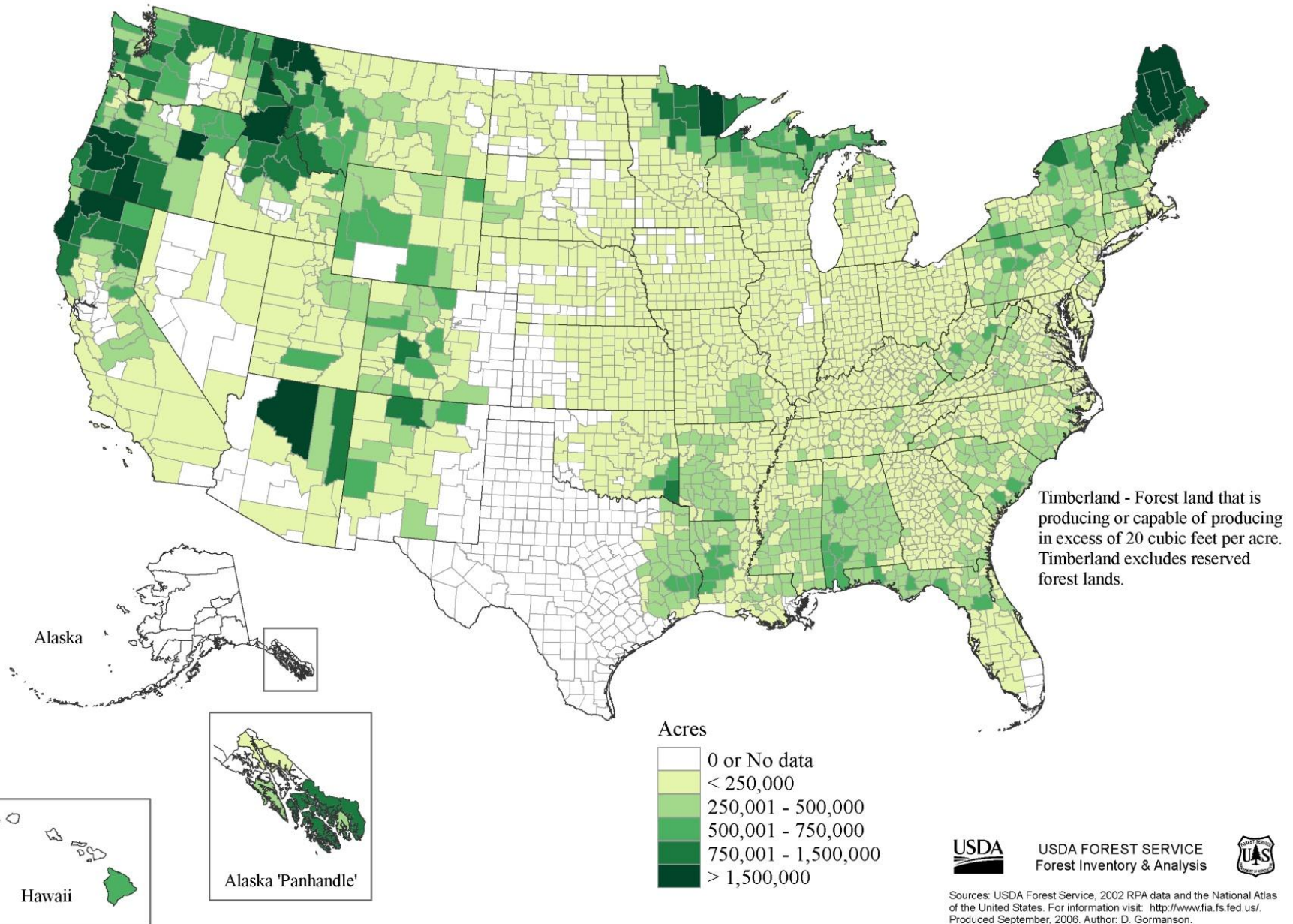
- Woodland
- Shrubland
- Urban/Developed
- Wetlands
- Water

- Barren
- Perennial Ice/Snow

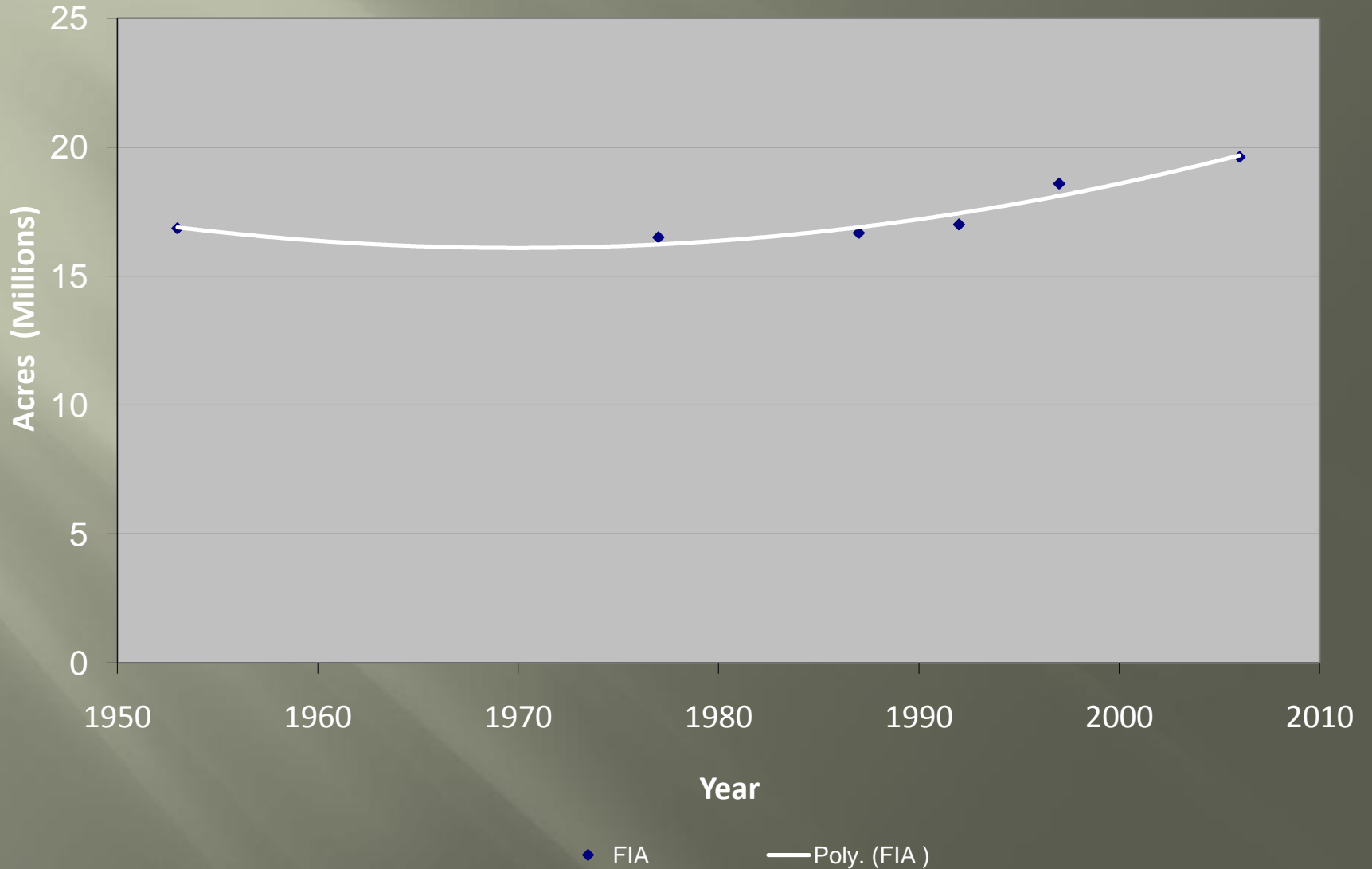
Introduction

- Mississippi is a major forest products state with 2006 to 2008 timber harvest value of \$600 million per year, and a total production value of \$1.16 billion per year (Mississippi State University estimates).
- The main emphasis of the Cropland Data Layer CDL program is row crops, but this study was undertaken to investigate possible forest applications.
- Since 2006, the (CDL) has used annual satellite imagery and a See5[®] decision tree method to categorize Mississippi land cover. Annual crop training data was from the USDA-Farm Service Agency (FSA) with additional training data from the most recent National Land Cover Database (NLCD, 2001).
- Multitemporal post classification analysis of pixel changes of the raster CDL products shows the recent forest harvested acres and forest renewal.

Area of Timberland



Total Forest Acres in Mississippi



Use of the National Land Cover Data Base Sampling Tool

The screenshot displays the ERDAS IMAGINE 9.1 software interface. The main window, titled "Viewer #1 : 090701_276_44d_45ad_48ab_ms.img (:Layer_4)(:Layer_3)(:Layer_2)", shows a satellite image of a landscape with a river and surrounding terrain. The interface includes a menu bar (Session, Main, Tools, Utilities, Help) and a toolbar with various tool icons (Viewer, Import, DataPrep, Composer, Interpreter, Catalog, Classifier, Modeler, Vector, NLCD, Radar, VirtualGIS, Stereo).

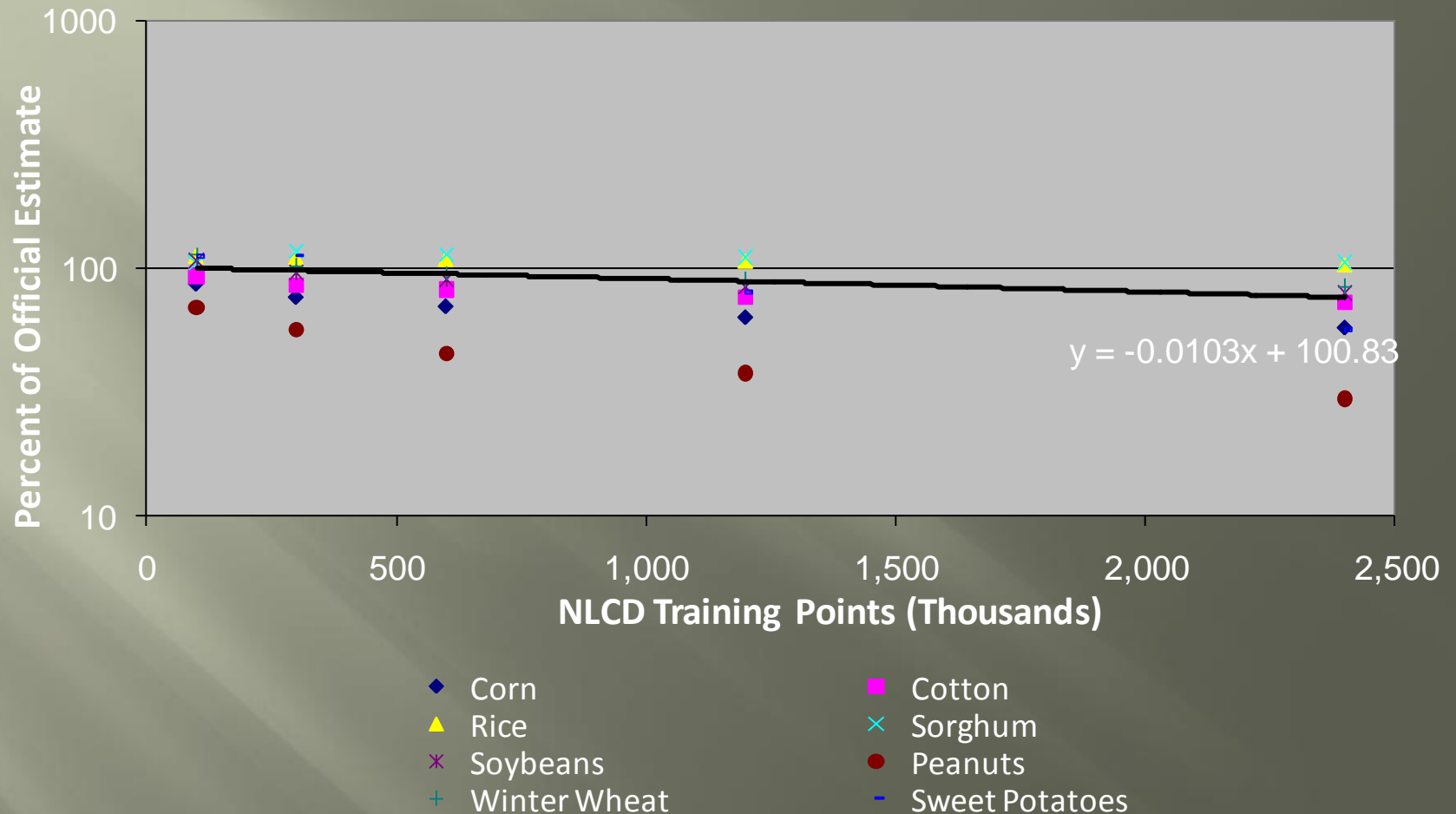
Overlaid on the main window is the "NLCD Mapping ..." dialog box, which contains several buttons: Percent Calculation..., NLCD Sampling Tool..., Cubist Classifier..., See5 Classifier..., Accuracy Assessment..., Smart Eliminate..., Cubist Info, See5 Info, and Close.

Below the NLCD Mapping dialog is the "NLCD Sampling Tool v2.01" dialog box. It is configured with the following settings:

- Independent Variables:** A list of files including "090420_276_45bd_rms.img", "15_090808_023_32_33_34_3", "modis_16-day-ndvi_081031", "modis_16-day-ndvi_090101", "modis_16-day-ndvi_090202", "modis_16-day-ndvi_090423", "ned_elevation_mississippi", and "independentvariables_922".
- Independent file list:** A list of file paths starting with "f:/fred see5/fred_ms2009_9".
- Dependent Variable (*:img):** "ms09_clu_sep15_training70".
- Ignore values:** "0, 5, 58, 59, 62, 63, 87, 92".
- Sampling Method:** "Stratified" with a "Minimum Sample" of 5.
- Output Name File (*:names):** "run2_925_fsa_a_se".
- Training Data File (*:data):** "run2_925_fsa_a_se".
- Validation Data File (*:test):** "run2_925_fsa_a_se".
- Sampling Method:** "See5" is selected.

The bottom of the screen shows the Windows taskbar with the Start button and several open applications: Microsoft Po..., Run 2, ERDAS IMA..., and Viewer #1 : 09...

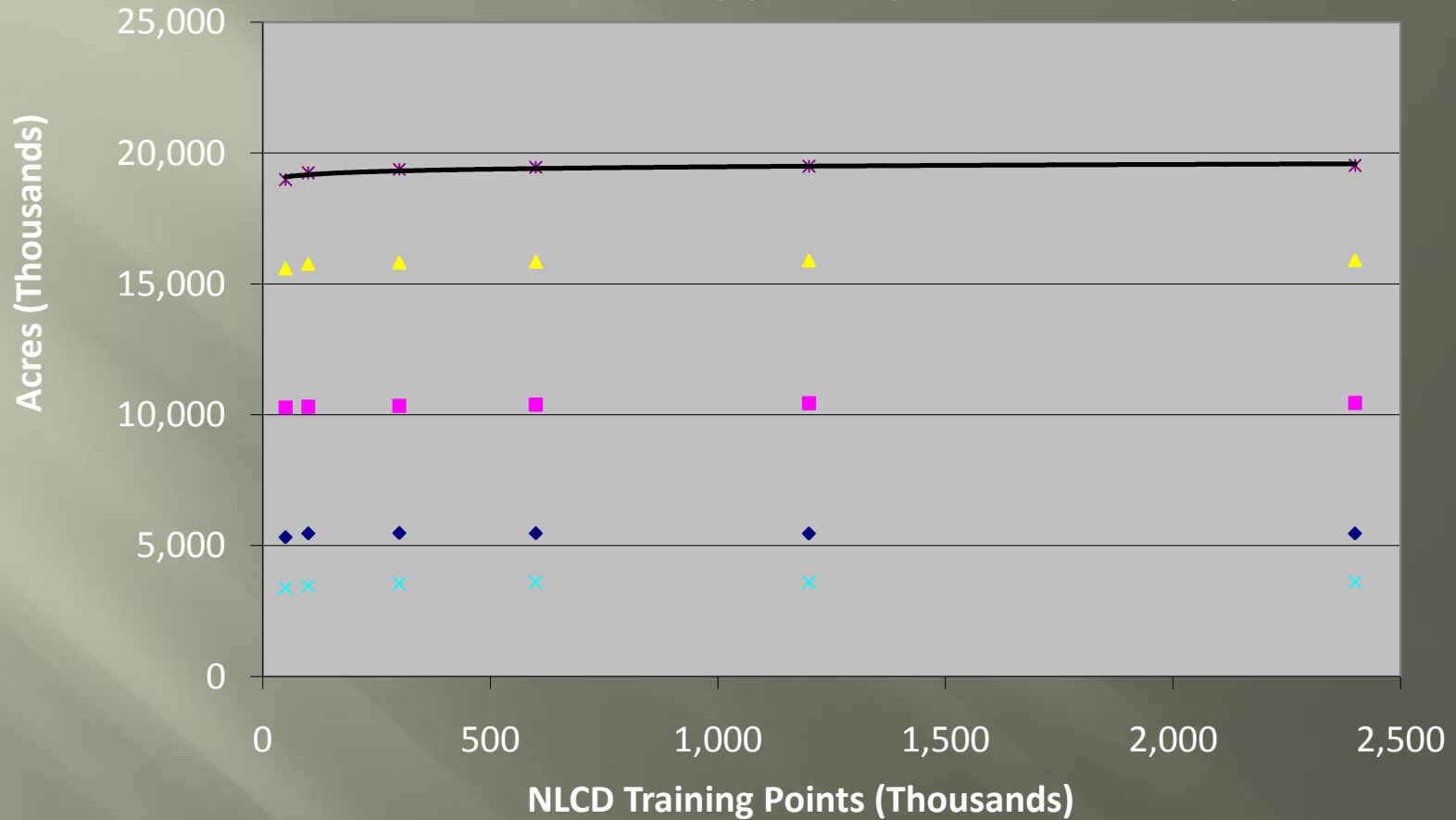
Crop Accuracy vs. Level of NLCD Training 2007 Mississippi Cropland Data Layer



As the NLCD training points are decreased the accuracy for crops approaches 100 percent.

Forest Acres at Increasing NLCD Training Points

2007 Mississippi Cropland Data Layer



◆ Pine Forest

▲ Total Pine and Mixed Forest

✱ Total All Forest

■ Mixed Forest

× Emerging Forest

— Log. (Total All Forest)

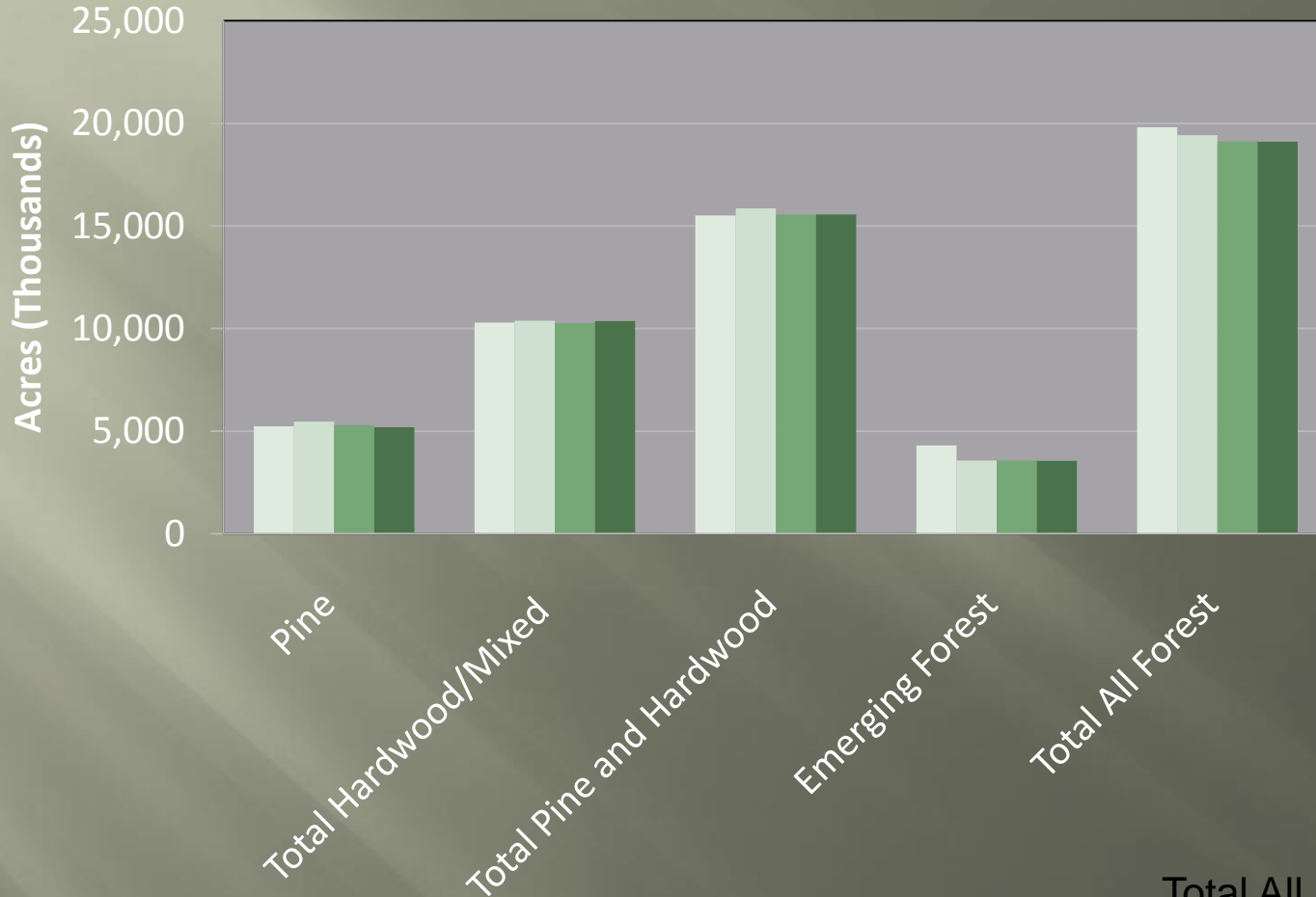
The measured forest acres vary only slightly over a wide range of NLCD training point inputs.

2007 Mississippi Cropland Data Layer Forest Acres at NLCD Training Levels

Category	NLCD Training 50,000-2,400,000 (6 Levels)		NLCD Training 100,000-2,400,000 (5 Levels)	
	Mean Acres	%RSD	Mean Acres	%RSD
Total Pine	5,442,162	1.11	5,466,591	0.15
Total Hardwood/Mixed	10,367,661	0.68	10,385,625	0.59
Total Forest	15,809,823	0.73	15,852,216	0.37
Emerging Forest	3,533,889	2.55	3,564,286	1.60
Total All Forest	19,343,712	1.06	19,416,502	0.58

Omitting the results obtained using the lowest level of NLCD training points causes the mean acres to increase slightly and the percent relative standard deviation to improve considerably.

Mississippi Forests (CDL 2006-2009)



Forest Type

2006 2007 2008 2009

Total All Forest 2006-2009
Mean (Percent RSD)
19,365,617 (1.72)

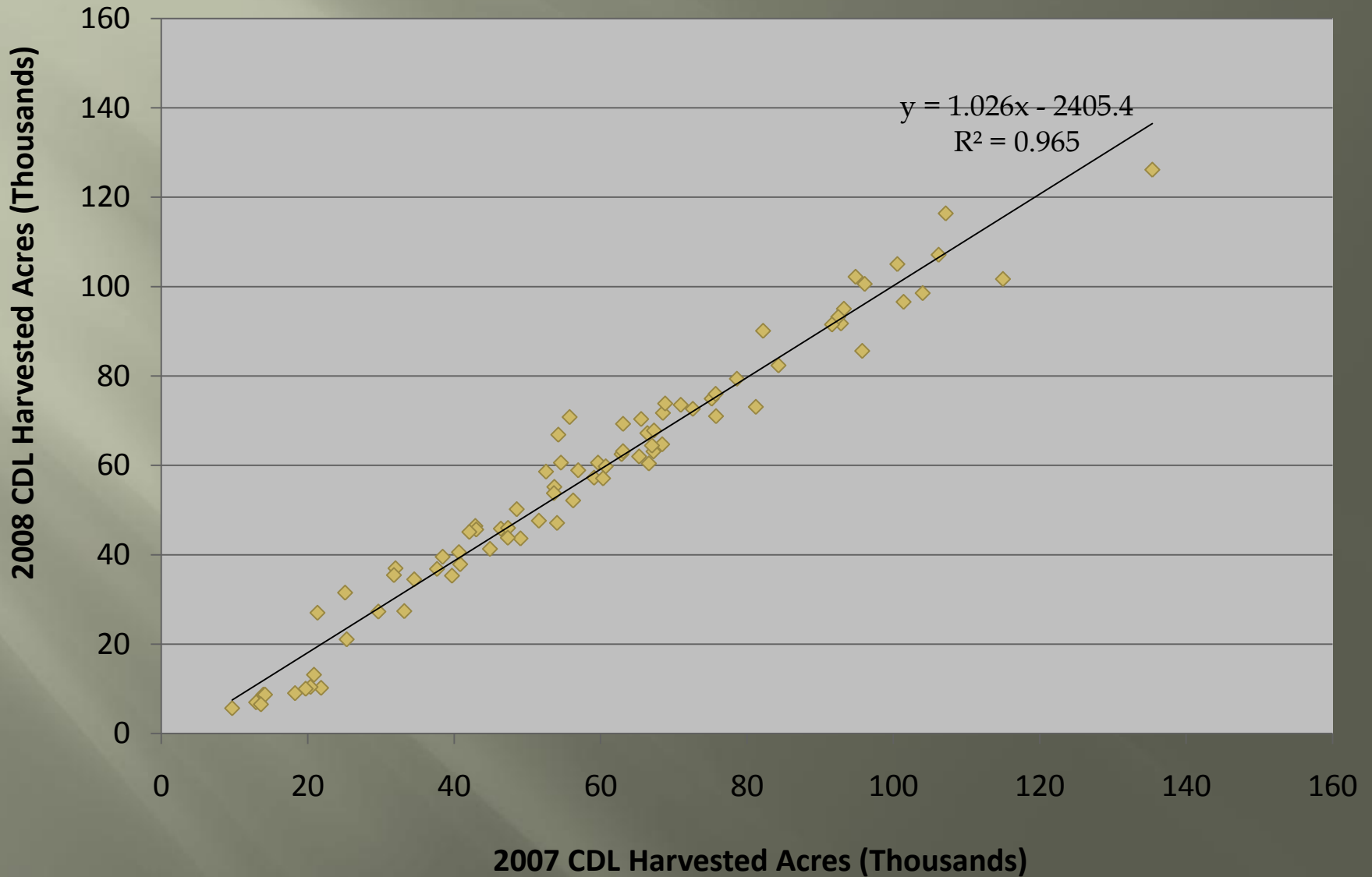
Pine Harvest and Net Gain (Loss) 2006-2009 Cropland Data Layers



■ Pine Harvested

■ Net Gain

Total Harvested Acres 2007 vs. 2008 by Mississippi County

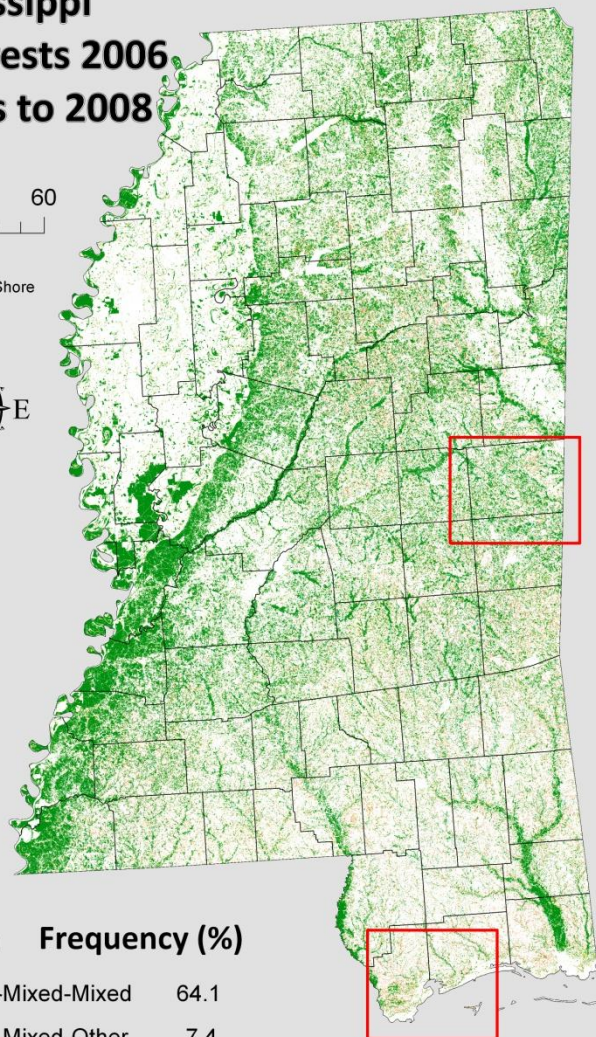


Pixel Changes for Mixed (Mainly Hardwood) Forests 2006-2008 Cropland Data Layers





Mississippi Mixed Forests 2006 Rotations to 2008

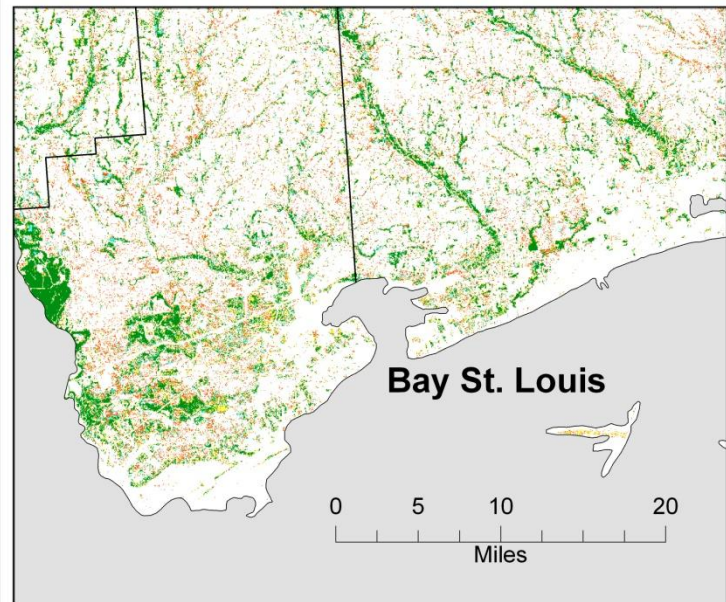
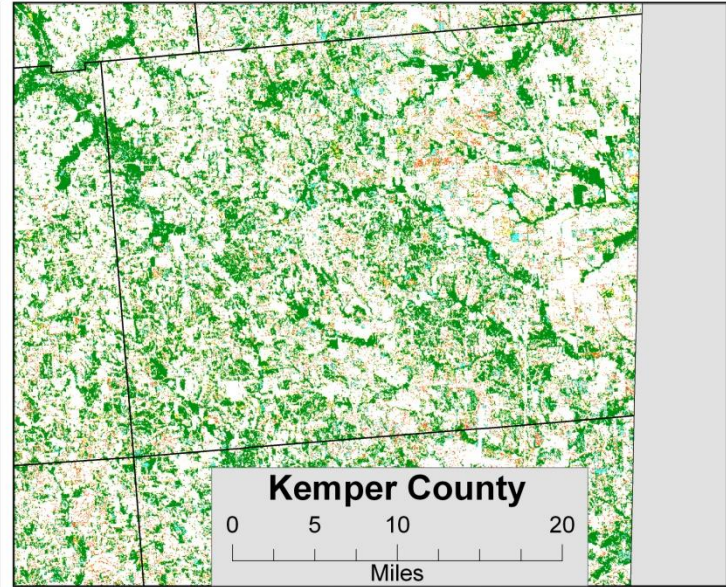
0 15 30 60
Miles

Map by Dr. Fred Shore

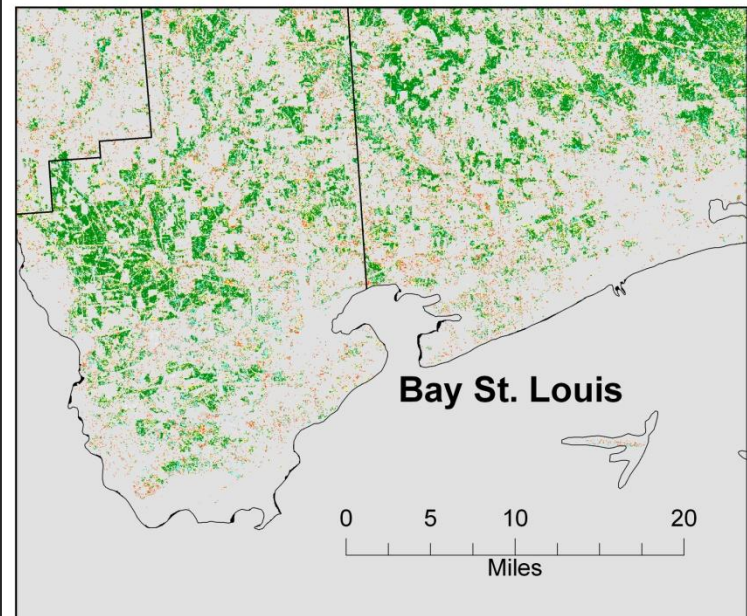
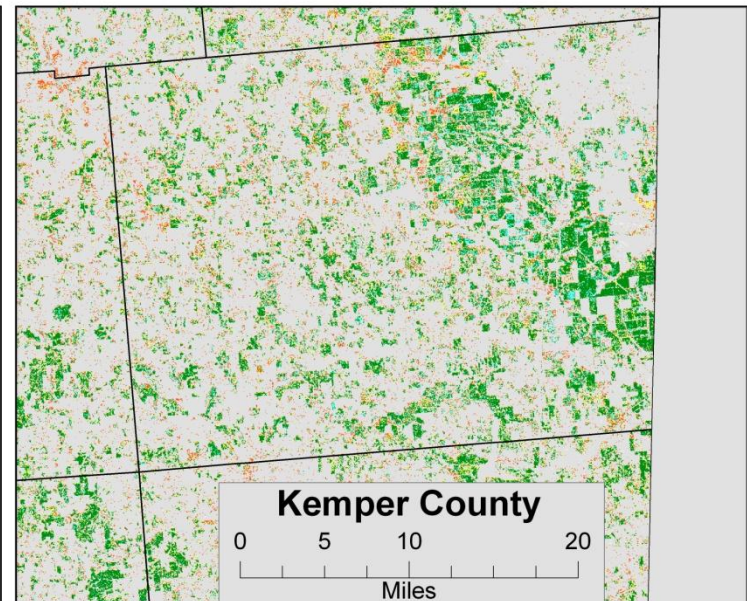
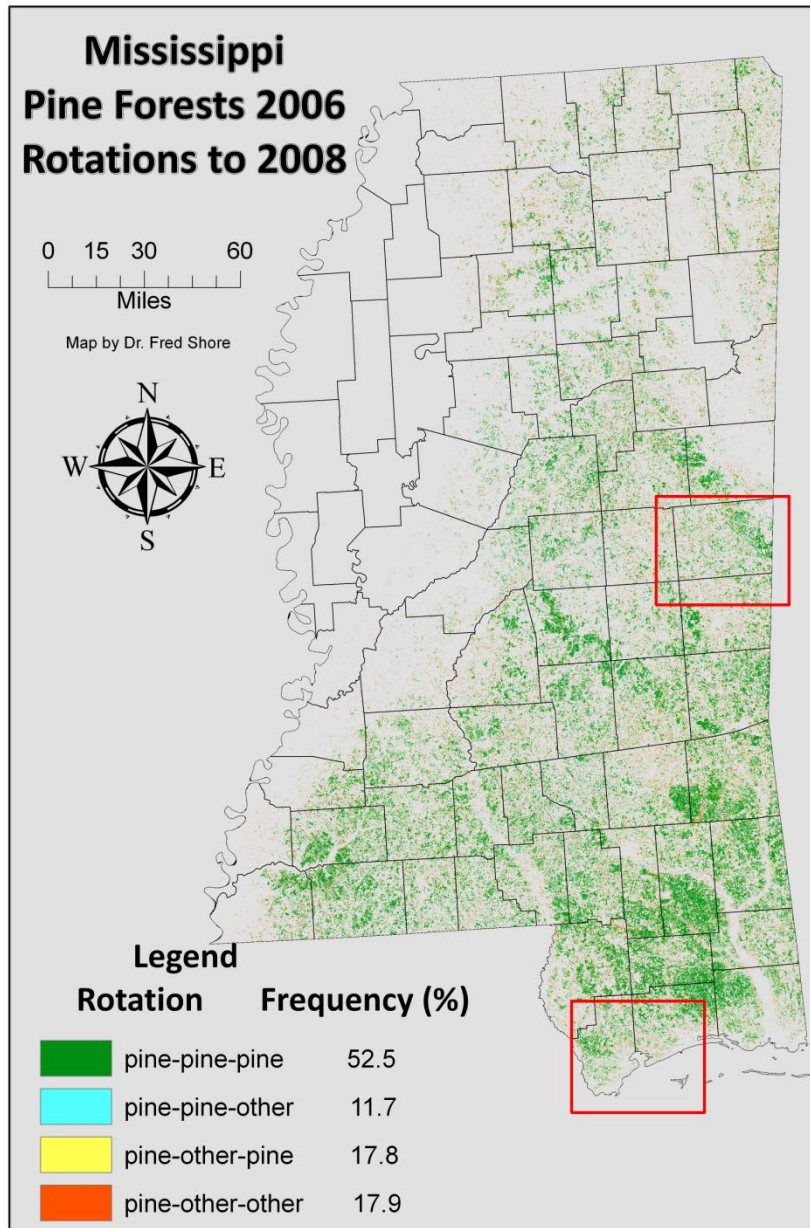


Legend

Rotation	Frequency (%)
 Mixed-Mixed-Mixed	64.1
 Mixed-Mixed-Other	7.4
 Mixed-Other-Mixed	17.0
 Mixed-Other-Other	11.5



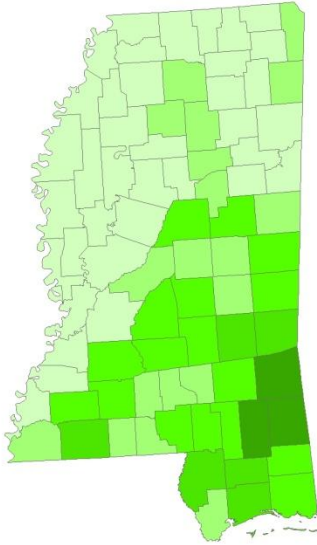
Pixel Changes for Pine Forests, 2006-2008



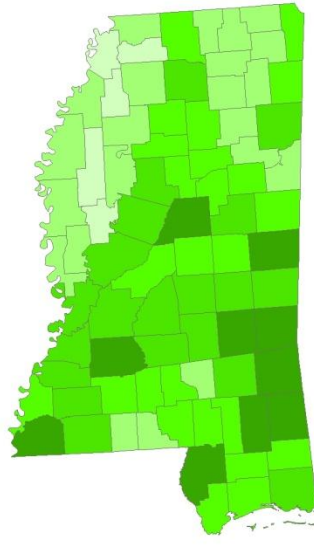
Normalized Range Maps

Normalized Range Maps

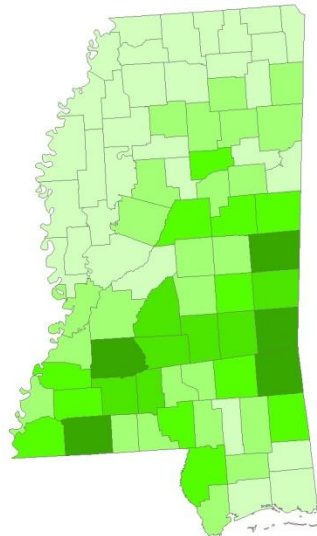
Pine Forests CDL 2006



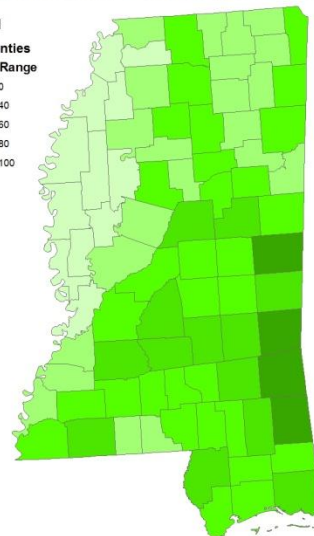
Pine/Mixed Forests CDL 2006



Stumpage 2007/2008 Average



Harvested Acres CDL 2007/2008 Average



Legend
MS Counties
Percent Range

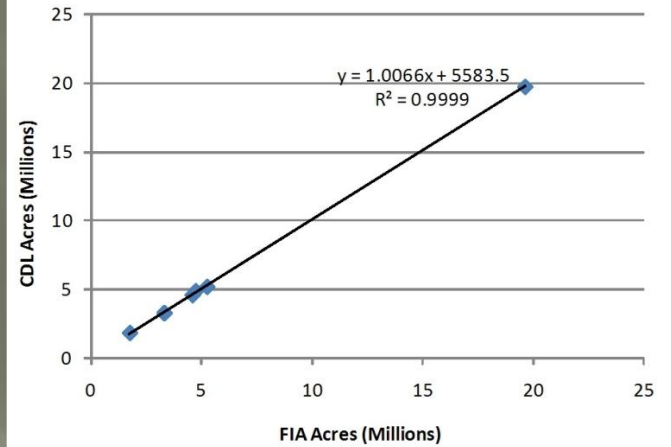
0-20
20-40
40-60
60-80
80-100

USDA Forest Inventory and Analysis (FIA) Comparisons

Forest Acreage Comparison 2006

CDL vs. FIA

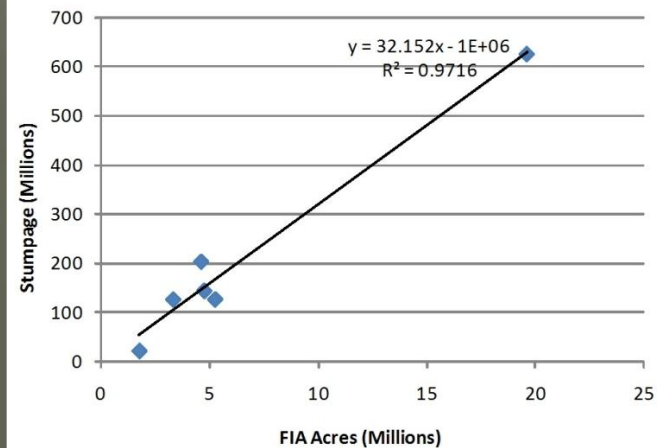
Survey Units 1-5 and State



Forest Stumpage 2007

vs. FIA Acreage 2006

Survey Units 1-5 and State



Conclusions

- The multitemporal classification of forests by the CDL with current imagery and training from the 2001 NLCD gave a mean of 19,365,617 acres with a percent relative standard deviation of 1.72 for Mississippi forests from 2006-2009.
- The CDL result of a 1.5 percent decrease in total harvested acres from 2007 to 2008 compares favorably to the harvest value decline of 8.3 percent for the same period of with much of the difference due to the lower prices in 2008. In 2009, the timber harvest value decreased to the lowest in the past 10 years with the CDL showing a decrease in harvested acres.
- The CDL pixel changes show Hurricane Katrina damages of forests in three ways : (1) with a higher emerging forest category in 2006, (2) increased renewal in 2007 vs. 2008 and 2009 losses, and (3) maps showing evident damage in southern Mississippi.
- Pine forest changes are significant with no change in 2006 to 2008 (a pine-pine-pine pixel result) representing only 52.5 percent of the total pine acreage in 2006.

Discussion

- This preliminary study shows that there are changes in forests detected by the CDL that may have future benefit in tracking property variations such as hurricane damage and theft losses.
- In the single year (2006) of comparability, the CDL and the USDA-Forest Inventory and Analysis (FIA) results for total acres of forest are almost identical.
- The ancillary benefit of the CDL for non-crop categories deserves further study.