Assessment of inundation extent and quality in the Atchafalaya Basin Floodway System (ABFS) from 1983-2008 using Landsat Imagery

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Outline

· Introduction to the Atchafalaya Basin Floodway System (ABFS)
· Importance of Defining Water Distribution in the ABFS
· Landsat TM Classification
  · Land-water
  · Turbid / Non-turbid water
  · Other categories
· Applications of Classification Maps
Atchafalaya Basin Floodway System (ABFS)

- Flood Control
- Navigation
- Commercial Fishing
  - Finfish and Shellfish
- Recreation
  - Fishing, General
- Invaluable Habitat
- Timber
- Oil and Gas
- Regional Impact
  - Nutrients, sediments, contaminants, carbon sequestration, nitrogen fixation
Some challenges to effective decision making in the ABFS:

- Isolated research studies
  - Temporally, spatially, topically and institutionally
- Incomplete basic data layers
  - Hydrology, elevation, land cover, land change, water quality
- Many stakeholders
Atchafalaya Basin Floodway System (ABFS)
Total Assessment:

Geospatial approach to integrating research and management information in the basin

Initial Questions:

- Where does water flow?
- How long does it stay there?
- What is the quality of the water?
- What management projects can be done? Where? Do they work?
- Where are critical fisheries habitats?
- Where has the land changed?
- Where hasn’t the land changed?
- How do processes in the ABFS relate to coastal processes?
Distribution and Condition of WATER

Defines Quantity and Quality of Habitat for:
- Fish
- Shellfish
- Mammals
- Vegetation

Drives Geomorphology - Defining Past, Current and Future Configuration

Affects Measurements of other Variables - e.g. Elevation, Soils

Influences Phenology of Resource Availability

Defines Flooding Impact
Using Landsat to capture spatial data:

- Landsat 4, 5, and 7 data available from 1983–present
- 16 day repeat cycle
- 30 m pixel resolution
- 6 spectral bands in visible and infrared
- Large scene capture area (184x185 km)
- Entire ABFS available in one scene
  - (Path 23; Row 39)
Finding Water in the ABFS using Landsat

- 1983-2008
- Cloud-Free
- Leaf-Off (Dec-Mar)
- 28 Images
- Classify each Image for:
  - Land
  - Open Turbid
  - Open Swamp
  - Flooded Turbid
  - Flood Swamp
  - Aquatic Vegetation
- Multi-temporal Analysis

USGS
**TM Classification**

Each 30m Pixel (6 TM bands, 3 TCap bands)

- **Land**
- **Water**
- **AqVeg**

- **Turbid**
  - **Flooded**
  - **Open**

- **Non-Turbid**
  - **Flooded**
  - **Open**

**Whole Image**

X 28 Images
Classification of Water in the AFBS

Sum Land-Water Classifications At Many River Levels (1983-2008)
Evaluating Turbid Water Distribution

Ground truth turbidity:
11 Feb 2002

Landsat (bands 4,3,2):
2 Feb 2002
Effectiveness of Turbid Water Classification

The diagram shows a box plot for different classes of turbid water. The x-axis represents the class categories: Aq Veg, Flooded Blackwater, Flooded Turbid, Open Blackwater, and Open Turbid. The y-axis represents the Surface Turbidity (NTU) ranging from 0 to 100. Each class has a different range and distribution of turbidity levels, as indicated by the box plot.
Classification of Turbid Water in the AFBS

Sum Turbid Water Classifications At Many River Levels
Classification of Non-Turbid Water in the AFBS

Sum Non-Turbid Water Classifications At Many River Levels
Classification of Aquatic Vegetation in the AFBS

Sum Aquatic Vegetation Classifications At Many River Levels
Data Layers for Total Assessment

CURRENT:

• Base TM Imagery (1983-present)
• Imagery classified into land and 5 water classes (1983-present)
• Spatial persistence maps of water categories
• Regression relationships for predictive mapping
• Water quality data (1998-present)
• Historical extent of Grand Lake
• Lidar QA
Some Applications for Water Distribution Maps

- Define the seasonal extent and quality of fish habitats.
- Forecast and hindcast hydrologic regime experienced by tree seedlings under various flooding scenarios.
- Use turbid water map to target sediment sampling for areas receiving more or less sediment.
- Identify effectiveness of sediment management projects.
- Use non-turbid water map to identify potential areas of mercury methylation.
- Target optimal data collection time and location.
- Interpretation of existing research/data
- Identify areas that will be seasonally suitable for Black Bears
- Track hydrology under certain conditions (post-hurricane).

Application: Identify Optimal Black Bear Denning Habitat

Dry Habitat during Denning Season

Dry Habitat during Denning Season that is Core