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APWS Implementation Plan

Nov 2, 2010

APWS Implementation Plan

U.S. EPA Office of Research and Development

Ecosystem Services Research Program (ESRP)

Placed Based Studies: Albemarle Pamlico Watershed Study (APWS) Implementation Plan

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APWS Implementation Plan

The mission of the APWS is to develop ecosystem services science to inform watershed decisions in the Albemarle-Pamlico watershed and estuary. Over the next three years (2011-2014), the study will apply analysis of six ecosystem services (food and fiber, clean water, stable climate, flood/storm protection, recreation, and biodiversity) to watershed decisions related to water quality, water quantity, and wetlands. The APWS will examine tradeoffs or synergies among services, and seeks to understand how ecosystems can be managed sustainably for ecosystem protection and economic benefit.

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Goal 1 - Methods Development: *develop methods to quantify ecosystem services, as well as drivers and pressures to the system. This will be accomplished through mapping and monitoring projects.*

Goal 2 – Forecasting: *to relate changes in drivers and stressors to changes in ecosystem services, with a focus on nitrogen. This will involve empirical and mechanistic modeling informed by mapping and monitoring, and the linkage of models within modeling frameworks.*

Goal 3 – Decision Support: *to understand how management decisions alter services, and use services science to inform watershed management decisions. For this goal, decision alternatives developed with stakeholder input and decision support tools, including the MIMES approach and Bayesian belief networks, will be developed and applied to some or all of the watersheds within the system.*

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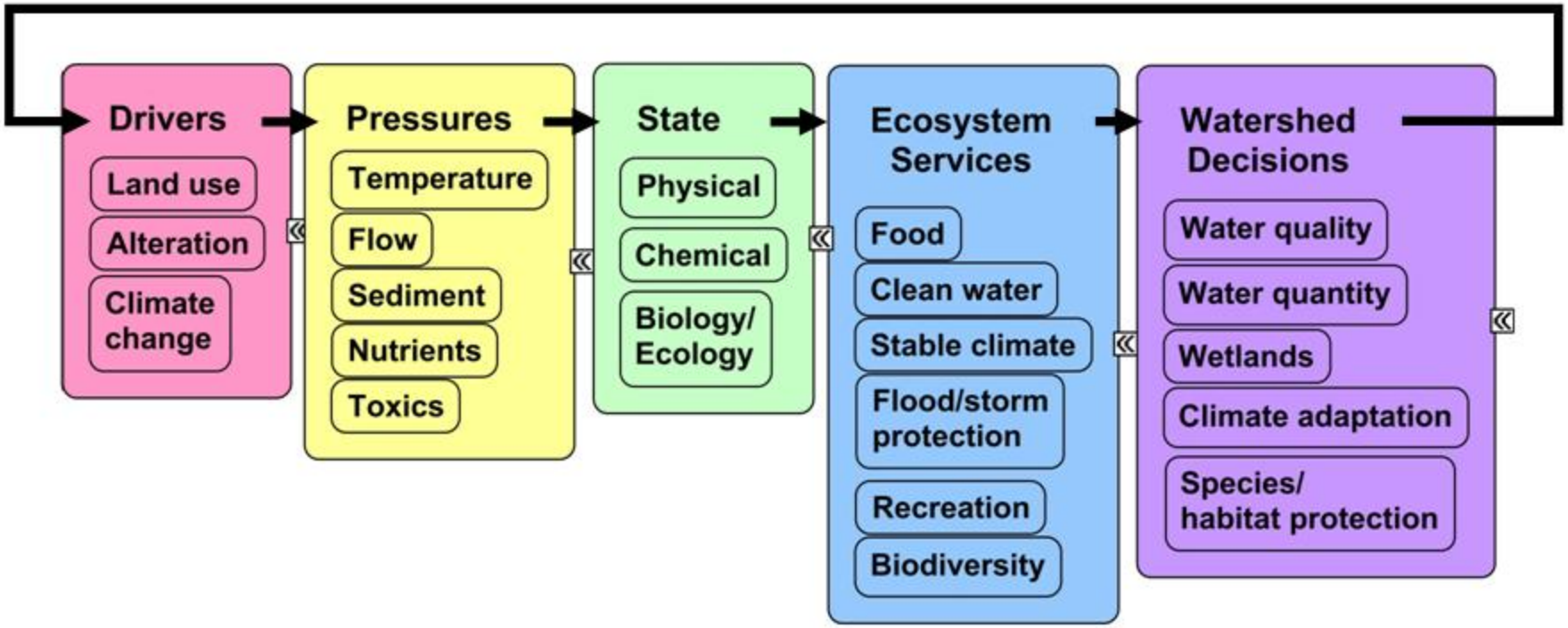
Conceptual Model



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Future directions for the APWS

Includes a focus on additional pressures (flow alteration, toxic chemicals), research designed to inform more types of management decisions (air quality, climate adaptation, and species/habitat projection), and better links to valuation and markets.

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Phase 1: Reactive Nitrogen Centric

An early focus of the APWS is to provide the information and tools needed to inform management decisions for reactive nitrogen (Nr) within the Albemarle-Pamlico watershed and understand their consequences on ecosystem processes, functions and services (Nr includes all biologically, chemically, and radiatively active nitrogen compounds in the atmosphere and biosphere: ammonia (NH_3) and ammonium (NH_4^+), nitric oxide (NO), nitrogen dioxide (NO_2), nitric acid (HNO_3), nitrous oxide (N_2O), and nitrate (NO_3^-), and organic compounds such as urea, amines, and proteins).

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1. ASSESSMENT. Develop methods to quantify ecosystem services, as well as drivers and pressures to the system.

- Develop indicators for ecosystem services, and Identify and map the provisioning of key ecosystem services different APW ecosystem types.
- Assess the condition of ecosystem services provided by wetlands and coastal waters, future landscape development, and restoration and protection strategies at a variety of geographic and temporal scales.

2. FORECASTING. Relate changes in drivers and stressors to changes in ecosystem services, with a focus on nitrogen

- Provide the scientific basis and Nr load-response relationships needed to evaluate ecosystem services provided by estuaries and coastal wetlands.
- Quantify and account for the combined and cumulative effects of point and non-point sources of Nr to the AP watershed and airshed.

3. DECISION SUPPORT. Understand how management decisions alter services, and use services science to inform watershed management decisions.

- Examine tradeoffs or synergies among services
- Measure and predict the economic and societal costs and benefits of management actions and seek to understand how we can manage ecosystems sustainably for ecosystem protection and economic benefit.

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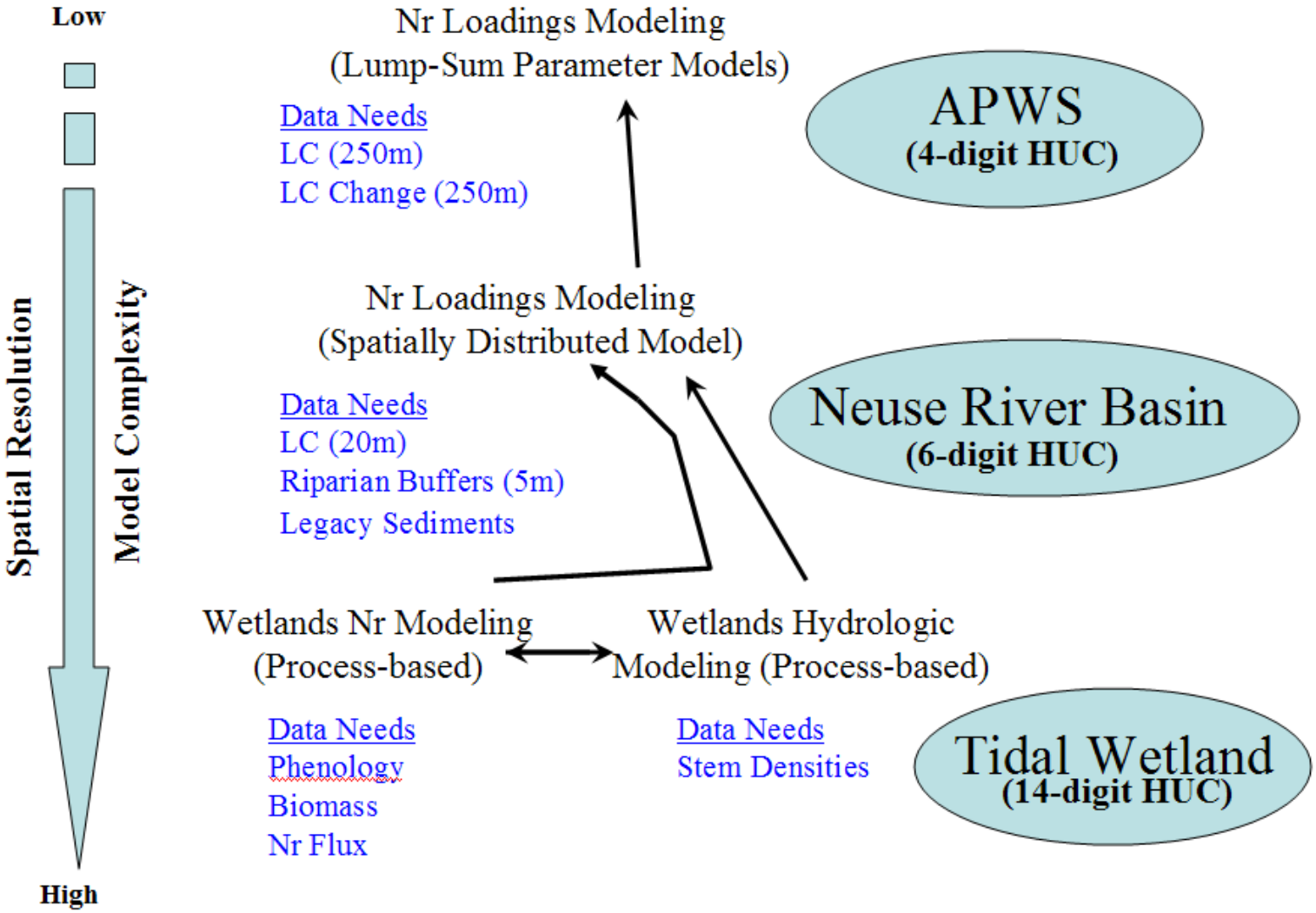
Wetland Data and Modeling Flow Chart



APWS Assessment

Air:

-Ambient NH_3

-N_2O

-NO_2

-Regional Scale Atmospheric Deposition

Land:

-Wetland delineation/characterization

-Tidal wetland Nr-flux characterization

-Belowground structure and denitrification in coastal wetlands

-APWS Land Cover Characterization and LC Change

-Remote Sensing of Agricultural Systems

Water:

-Riverine Functional Process ZonesN2O

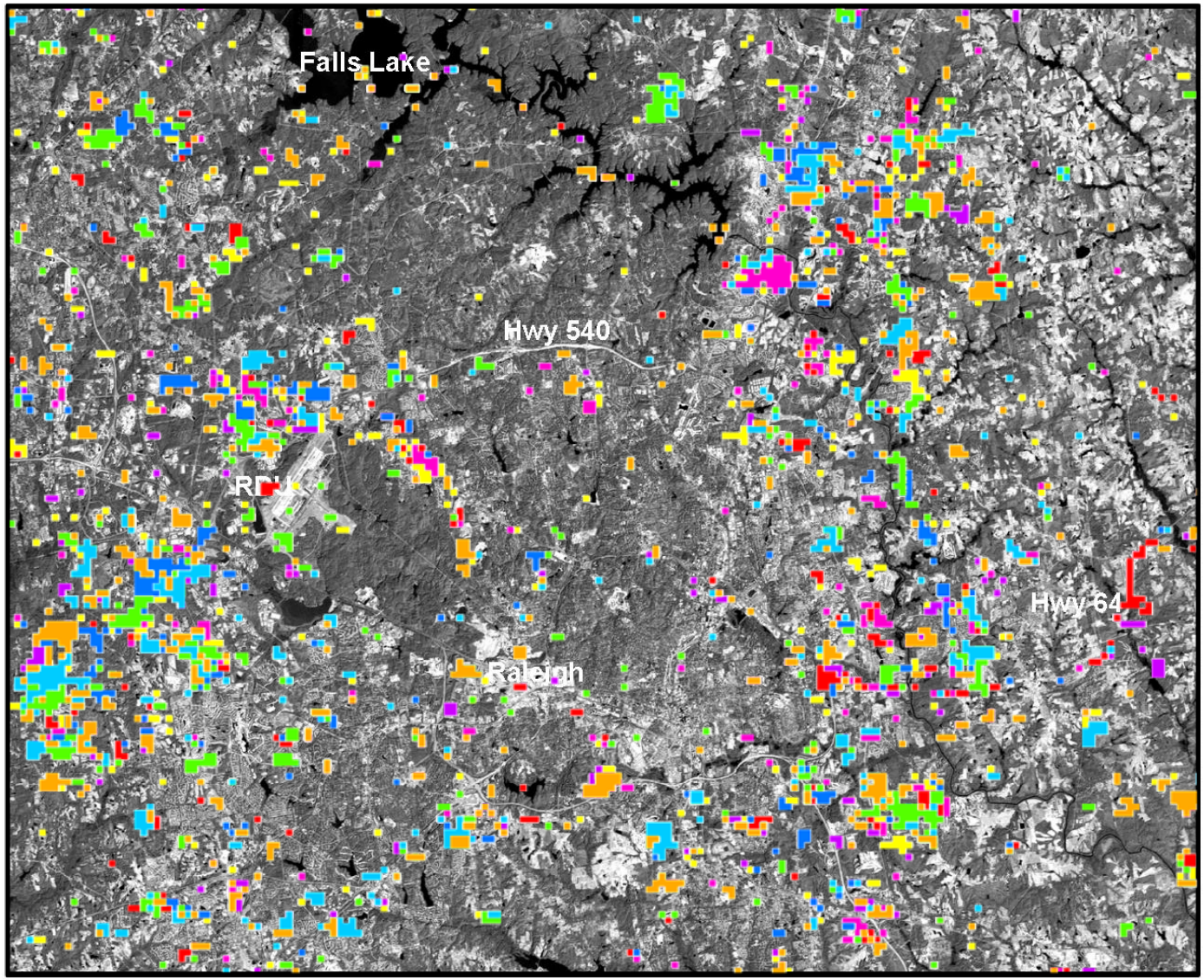
-Estuarine Chlorophyll a, Salinity, and Turbidity

-Estuarine Harmful Algal Blooms

MODIS Land-Cover Change

Raleigh, NC (2001- 2008)

Landsat ETM+ Pan (15m) Backdrop



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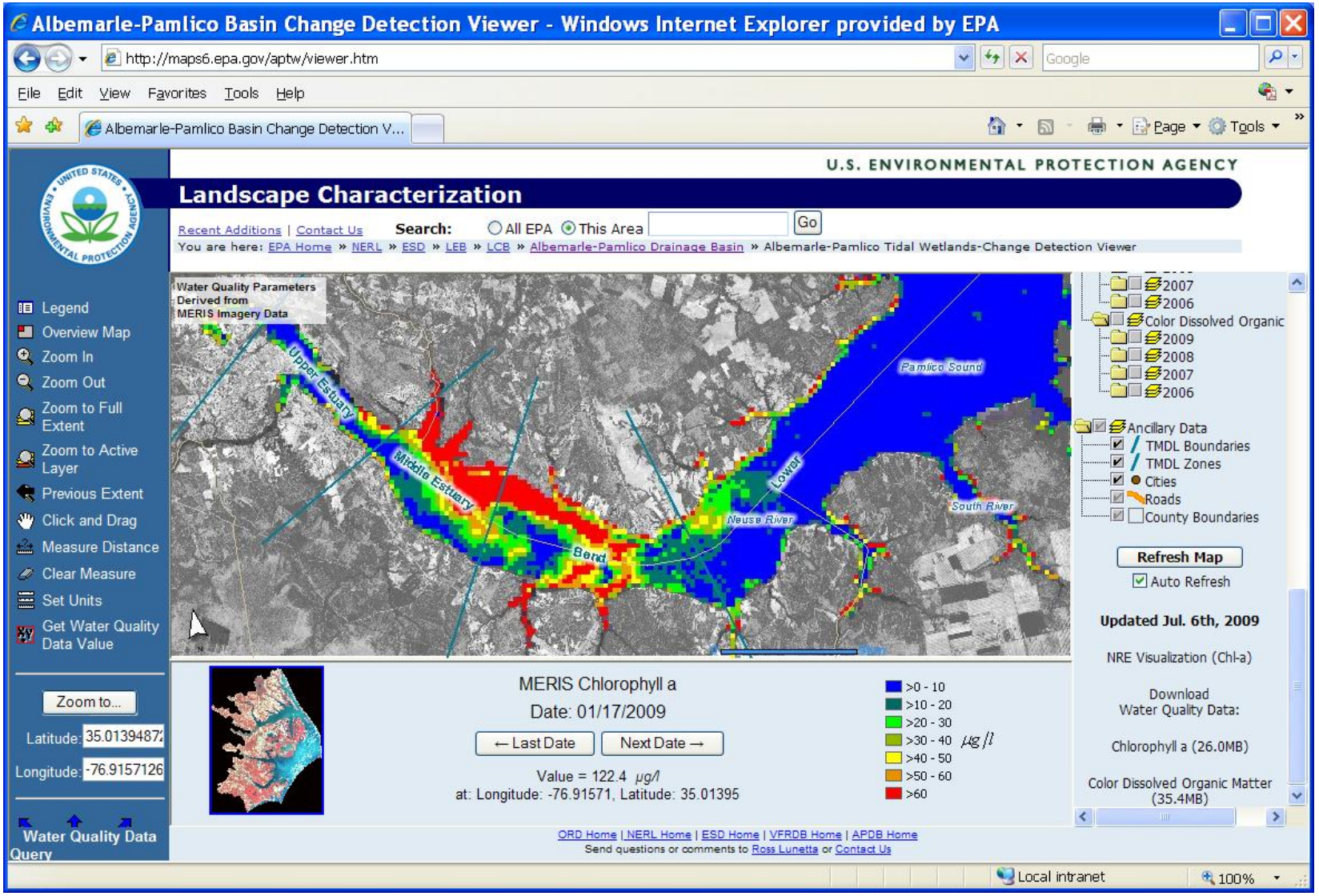

External Drivers

Climate, Nr, LU/LC

LCB: LU/LC Change MODIS NDVI, Landsat 8 (Lunetta, Worthy, Iiames)

Total Atmospheric Nr loads

Disturbance Regimes

Presses

Nutrient Loading Air, Water, Soil Quality

SLR & Warming

LCB: Water Loads Mill Pond retention ponds (Lunetta); CAFO ID (Pilant)

LCB: Atm deposition Season/Annual N dep rates (wet & dry) (Holland, Sickles, Baumgardner, Szykman)

CMAQ

Ecosystem Services

Supporting

Denitrification

LCB: Wetlands "N" Sucker, Hyperspectral, LSAR (Iiames, Williams)

TMDL

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