The water quality impacts of using pumps to control drainage in coastal agriculture and waterfowl impoundments

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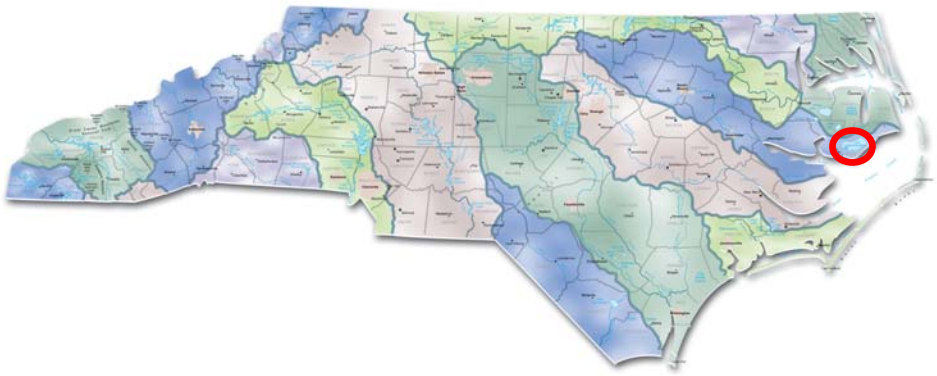
Lake Mattamuskeet



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Where is the grass?

- Submerged aquatic vegetation has disappeared in most of Lake Mattamuskeet
- Linked to decreases in water quality
  - Nitrogen
  - Phosphorus
  - Suspended sediment
  - Chlorophyll *a*
  - pH
- Two major land uses: agriculture and waterfowl impoundments

Big Picture Goals

- Restore the submerged aquatic vegetation in the lake
- Maintain economically important agriculture industry and waterfowl viewing/hunting
- Engage the community in the restoration process

Waterfowl Impoundments

- Two types
  - Moist soil management
  - Agricultural crop production
- Filled with water between September and November
- Drained in February or March

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Drainage Water Management

- Flat topography
- Near sea level
- Pumps used to maintain drainage or fill waterfowl impoundments

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Research Questions

- Does the moist soil management unit contribute to the eutrophication of Lake Mattamuskeet? (Winton et al., 2016)
- What hydrologic conditions lead to large exports of nutrients from the impoundments?
- Do the nutrient dynamics and nutrient flux of agricultural drainage water managed by pumps differ from land that is gravity drained?

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Monitoring Sites

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Monitoring Design

- Isolated by a berm
- Inflow and outflow controlled by pump
- Flow
- Water quality
- Water table

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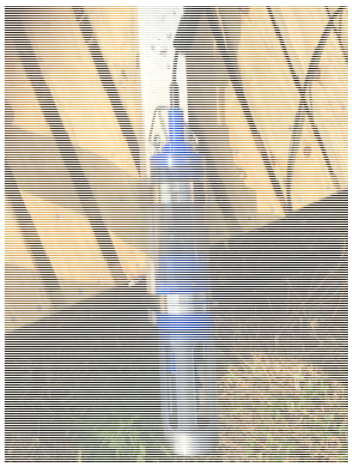
Flow Monitoring

- Water level
  - Internal
  - External
- Flow meter

Water Quality Monitoring



- UV-Visual spectrometer
- Multi-parameter sonde
  - pH
  - Dissolved oxygen
  - Temperature
  - Conductivity
- Automatic water quality sampler

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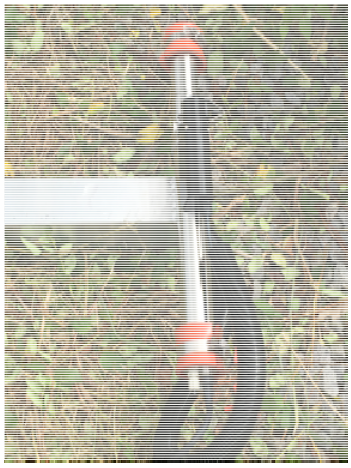
Water Quality Monitoring

- Absorption spectrum measured every 30 minutes
- Coinciding samples collected for lab measurement
  - NO_3-N, TDN, NH_4-N, PN
  - DOC
  - PO_4-P, TDP
  - TSS



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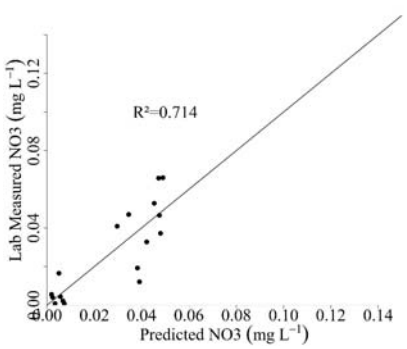
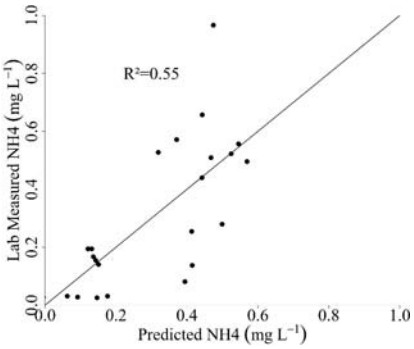
Partial Least Squares Regression

- PLSR used to relate absorption spectra to laboratory measured concentrations
- Calibration with minimum Root Mean Square Error of Prediction (RMSEP) applied to long term data
- Does not mean that the absorbance of each parameter is measured

Preliminary Data!

Preliminary Calibrations





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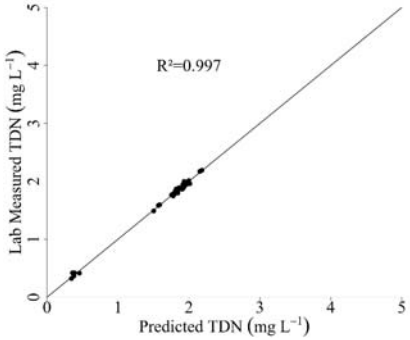
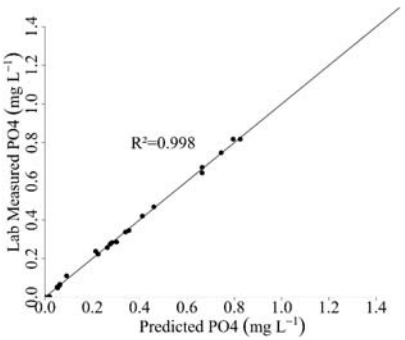
Preliminary Calibrations





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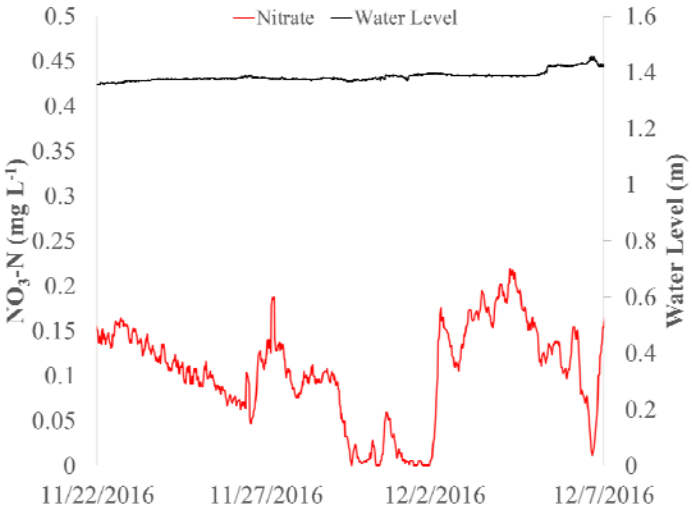
Nutrient Dynamics



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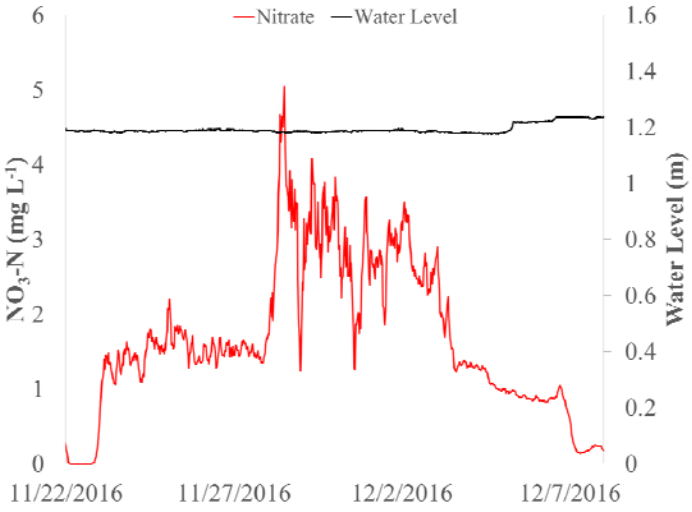
Nutrient Dynamics



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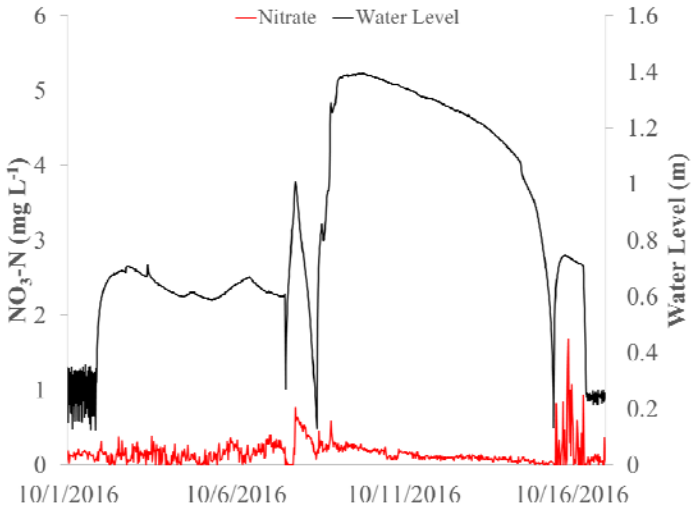

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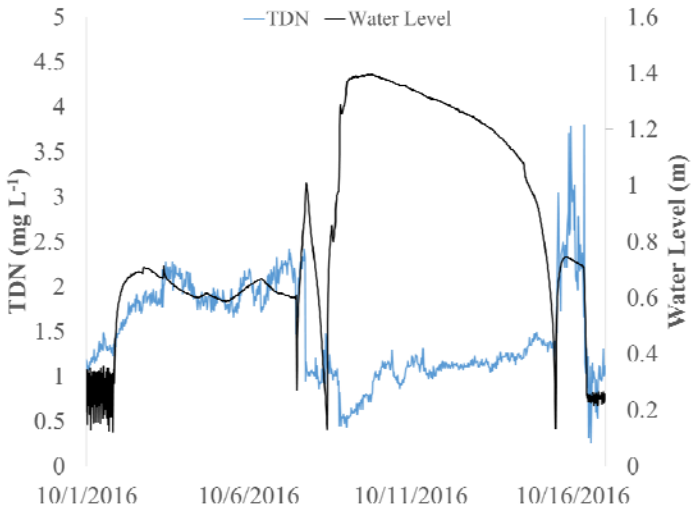

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Future Work

- Continue data collection
- Finalize PLSR calibrations
- Flow data → water balance → mass balance
- Link results to other lake research

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