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

Randall Etheridge¹, Brian Hinckley², Michelle Moorman³

¹East Carolina University, Department of Engineering, Center for Sustainability
²East Carolina University, Department of Biology
³U.S. Fish and Wildlife Service, Lake Mattamuskeet National Wildlife Refuge

Lake Mattamuskeet
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

Drainage Water Management

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

Monitoring Sites
Monitoring Design

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

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

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
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
Nutrient Dynamics
Nutrient Dynamics

![Graph showing nitrate and water level dynamics over time.](image1)

Nutrient Dynamics

![Graph showing TDN and water level dynamics over time.](image2)
Future Work

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

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