**Coastal South Carolina Water Resources**

*Isolated Wetlands Risk Assessment using NASA Earth Observations to Support Further Wetland Protections in Coastal South Carolina*

**Project Team**

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**Project Overview**

***Project Synopsis:***

Partnering with the non-profit Coastal Conservation League (CCL), the NASA DEVELOP team identified isolated wetlands in three coastal counties in South Carolina – Horry, Berkeley, and Jasper, and detected a 10-year Land Use Land Cover change analysis between 2015 and 2025. While isolated wetlands provide vital ecosystem services, they are being threatened due to development and land use change, and the recent legislation excluded them from federal protection. The team aimed to help CCL manage and protect isolated wetlands through creating identification and wetland change maps to advocate for more official protections of the isolated wetlands.

***Abstract:***

Following the 2023 Sackett v. EPA court case, the redefined definition of protected waters of the United States law excludes freshwater wetlands disconnected from navigable waterways. These now “isolated wetlands” are no longer federally protected and are vulnerable to future land cover changes. To understand threats to these newly vulnerable wetlands and potential community impacts, the Coastal Conservation League partnered with NASA DEVELOP to evaluate isolated wetlands in three South Carolina counties (Jasper, Berkley, and Horry). Using Landsat 8 and 9 data, spectral indices including the normalized difference vegetation index (NDVI), normalized difference moisture index (NDMI), and normalized difference water index (NDWI) were computed to assess vegetation health, moisture quantities, and water availability, respectively. The team then conducted wetland classification using these indices along with National Wetlands Inventory data. Following the new legal framework, the team categorized wetlands as either protected (connected) or unprotected (isolated) by analyzing their connectivity to navigable waterways from the United States Department of Transportation database and major rivers defined by the Hydrologic Unit Code 10. Lastly, the team derived a 10-year change detection map identifying wetland change from 2015 to 2025. Using Earth observations proved applicable in delineating isolated wetlands, but it can be improved using finer resolution imagery. Results showed that 48% of wetlands in the study area are isolated, with an overall 4-6% wetland decrease over the past decade. These results indicate a negative wetland loss trend that can inform state policy plans for protection.

***Key Terms:***

South Carolina, Coastal Conservation League, isolated wetlands, navigable waterways, remote sensing, random forest classification, change detection, 2023 Sackett v. EPA

***Application Area:*** Water Resources

***Study Location:*** Horry, Berkeley & Jasper County, SC

***Study Period:*** 2015 to 2025 (October to February)

***Community Concerns:***

* Variations in landscape from urban development and land use change are threatening natural isolated wetlands.
* Isolated wetlands provide vital ecosystem services such as flood mitigation, water quality improvement, wildlife habitat provisions, but they are not currently being protected by federal law.
* Unprotected isolated wetlands endanger the local ecological system and also puts the communities that reside around the wetland areas at risk of flooding.

***Project Objectives:***

* Map isolated wetlands within Horry, Berkeley, and Jasper Counties in South Carolina
* Assess 10-year wetland and land use changes between October 2015 and February 2025
* Support partners with geospatial information for outreach and decision making

**Partner Overview**

***Partner Organization:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **Contact** | **Partner Type** | **Sector** |
| **Coastal Conservation League** | Becky Ryon, North Coast Office Director | End User | Non-profit |

***Decision-Making Practices & Policies:***

The Coastal Conservation League, a nonprofit dedicated to preserving South Carolina’s Coastal Plain, relies on satellite imagery to track historical land cover and wetland changes. They analyze past data to understand wetland coverage trends and inform conservation efforts. The 2023 Sackett v. EPA ruling removed federal protection for wetlands not connected to navigable waters under the Clean Water Act, shifting regulatory responsibility to state and local governments. South Carolina’s home rule status allows counties to implement stronger wetland protections beyond state laws, giving local governments the authority to address gaps left by federal policy changes.

**Earth Observations & End Products Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameters** | **Use** |
| **Landsat 8 OLI** | Surface reflectance, Normalized Difference Vegetation Index (NDVI), Normalized Difference Moisture Index (NDMI), Normalized Difference Water Index (NDWI) | Landsat 8 OLI will be used to perform water and moisture indices (NDVI, NDMI, NDWI) and a supervised classification to spectrally separate isolated wetland areas from other land cover types. |
| **Landsat 9 OLI-2** | Surface reflectance, NDVI, NDMI, NDWI | Landsat 9 OLI-2 will be used to perform water and moisture indices (NDVI, NDMI, NDWI) and a supervised classification to spectrally separate isolated wetland areas from other land cover types. |

***Ancillary Datasets:***

* U.S. Fish and Wildlife Service National Wetlands Inventory – Wetland location viewer
* U.S. Census Bureau – Provides County Shapefile
* U.S. Department of Transportation – Denote large-scale Navigable Waterways
* South Carolina Department of Natural Resources Open Data – South Carolina Water Boundary HUCS 8, 10, 12
* Google Earth Pro – Supervised classification of separated wetlands

***Software & Coding Languages:***

* Esri ArcGIS Pro 3.4.2 – Image processing, isolated wetland classification, calculation of indices (NDVI, NDMI, NDWI), 10-year wetland change detection

***End Products:***

|  |  |  |
| --- | --- | --- |
| **End Product** | **Earth Observations Used**  | **Partner Benefit & Use** |
| **Isolated Wetland Identification Maps** | Landsat 8 OLI, Landsat 9 OLI-2 | Inventory of isolated freshwater wetlands left unprotected due to recent legislation will allow the partners to advocate for more official protections of the isolated wetlands. |
| **10-year Wetland Change Detection Map** | Landsat 8 OLI, Landsat 9 OLI-2 | The partner will use the change detection maps between 2015 and 2025 to understand the rate of change in isolated wetlands and their risk levels. Knowing how fast wetlands are changing and where the change occurs will help the partner inform government officials on management and protection plans. |

***Product Benefit to End User:***

Through the mapping of unprotected freshwater wetlands in the three counties of South Carolina, Coastal Conservation League aims to utilize an inventory of isolated freshwater wetlands left unprotected by the Clean Water Act due to recent legislation change. This will allow them to advocate for official protection of these communities. Through the 10-year change detection map, the partner will use it to understand the rate of change in isolated wetlands and their risk levels. Knowing how fast wetlands are changing and where the change occurs will provide the partner data that can be used as a call to action to policymakers.

***Project Continuation Plan:***

The partners will utilize the end products for the first term which are: isolated wetland identification maps, and the 10-year wetland change detection maps as scientific evidence for stronger wetland management and protection plans. Adding on to these end products, the next team will conduct predictive flood modeling using the handed off isolated wetland detection maps and the 10-year change maps to identify wetlands at risk from potential floods, using Hurricane Florence (2018) data for comparison. The team will also run a risk assessment which will incorporate factors like proximity to the coastline, urban areas, and agriculture to estimate future wetland changes. Results will be overlaid with socio-economic data to assess disproportionate risks associated with wetland loss.

**References**

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