

Aerial Image Analysis of Changes in Wetlands between 2019 and 2023 in the Barataria and Breton Sound Basins of Coastal Louisiana

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Loss of marshlands in the Mississippi Delta plain of Louisiana threatens the future of the region's economy, one which is heavily reliant on coastal wetland resources. This study builds on previous remote sensing investigations over the Barataria and Breton Sound Basins to make increasingly detailed assessments of changes occurring in coastal wetlands of southern Louisiana from both human extractive activities and repeated hurricanes. We set out to answer two scientific questions: 1. What are the bio-geophysical nature and the areal extent of changes in coastal shorelines and wetlands of the Barataria and Breton Sound basins over the past four years of intensive hurricane activity? 2. How have marshland/water boundaries in the probable impact areas of the Mid-Barataria and Mid-Breton sediment diversions recently changed in the landscape of water and wetland-covered patches? High-resolution ($< 1\text{-m}$ pixel size) imagery, acquired and processed by the United States Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP), was acquired from 2019 to 2023. Landscape metrics for ten equal-interval classes of NDWI were computed using the FRAGSTATS program. Class-level indices from FRAGSTATS were used to quantify the densities and spatial configuration of patches, providing a variety of metrics for the geometry, complexity, and aggregation levels of the wetland- versus water-covered patches across the study area. Analysis over the past four years (2019 to 2023) using the normalized difference water index (NDWI) from NAIP images revealed that there has been a widespread increase in relatively deep-water coverage (and corresponding losses of marshland coverage) since 2019 over most of the Barataria and Breton Sound Basins. Scouring of formerly shallow water cover and widespread erosion of brackish and fresh marshland shorelines followed the storm surges of Hurricanes Zeta (2020) and Ida (2021). There has been an extensive increase in relatively deep-water coverage (and corresponding losses of land coverage) since 2019 over most of the marshlands and shorelines of the Barataria and Breton Sound Basins in southeastern Louisiana. Heightened fragmentation of marshland edges and interior pond features based on patch metric analysis implied that different types of damage inflicted on coastal wetlands of southeastern Louisiana from tropical storms can be characterized using aerial remote sensing.