The Impact of Texas Coastal County Land Cover on Hypoxia Levels in the Gulf Coast

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Abstract

This project will analyze the relationship between land cover in Texas coastal counties and hypoxia, or dissolved oxygen, levels in the Gulf of Mexico. Utilizing GIS, we aim to understand land cover changes in Texas coastal counties from 2021 to 2023 and corresponding changes in hypoxia levels in the Gulf of Mexico during this time frame. The analysis will examine spatial data from 2021 and 2023 of the Gulf of Mexico and Texas, focusing on urban areas, agricultural land, coastal wetlands, and freshwater wetlands.

Background

Hypoxia refers to areas of water with dangerously low levels of dissolved oxygen. These hot spots can form what is known as “dead zones”. Dead Zones can be lethal to marine life and affect biodiversity, fisheries, and the economy. These zones occur due to nutrients entering the ocean from urban areas, agricultural areas, and wetlands. Urban and agricultural development can increase runoff from rivers and streams that eventually lead into the ocean. The presence of Wetlands can help reduce the amount of nutrients that make it to the ocean. Texas Coastal Counties and their land coverage type, can have significant influence on hypoxia measurements in the Gulf of Mexico through the freshwater discharge and nutrient loading.

Objective

- Use GIS to analyze 2021–2023 land cover change in Texas coastal counties.
- Compare the changes in land coverage types with dissolved oxygen levels in the Gulf of Mexico.
- Identify the potential relationship between land coverage type and measured hypoxia levels

Data

Data Set & Data Source:

- 2021 National Land Coverage Data by USGS
- 2023 National Land Coverage Data by USGS
- 2021 Gulf of Mexico Hypoxia Levels by NOAA
- 2023 Gulf of Mexico Hypoxia Levels by NOAA

Intended Purpose:

- Visualize urban development, agricultural, and wetland land coverage types to in Texas coastal counties
- Utilize GIS to quantify land coverage type changes from 2021 to 2021
- Visualize dissolved oxygen levels in the Gulf of Mexico in tandem with the NLCD map’s
- Identify spatial relationships between types of land coverage in Texas coastal counties and hypoxia levels in the Gulf Coast.

Method

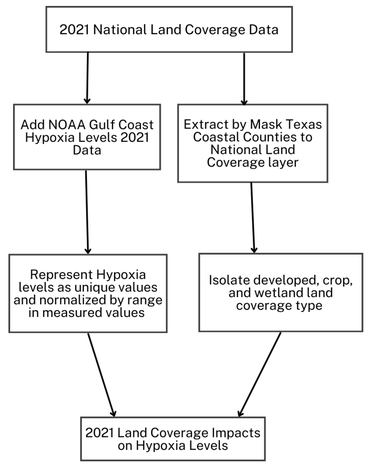


Figure 1a

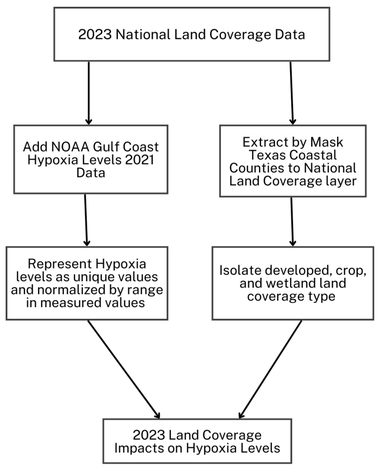
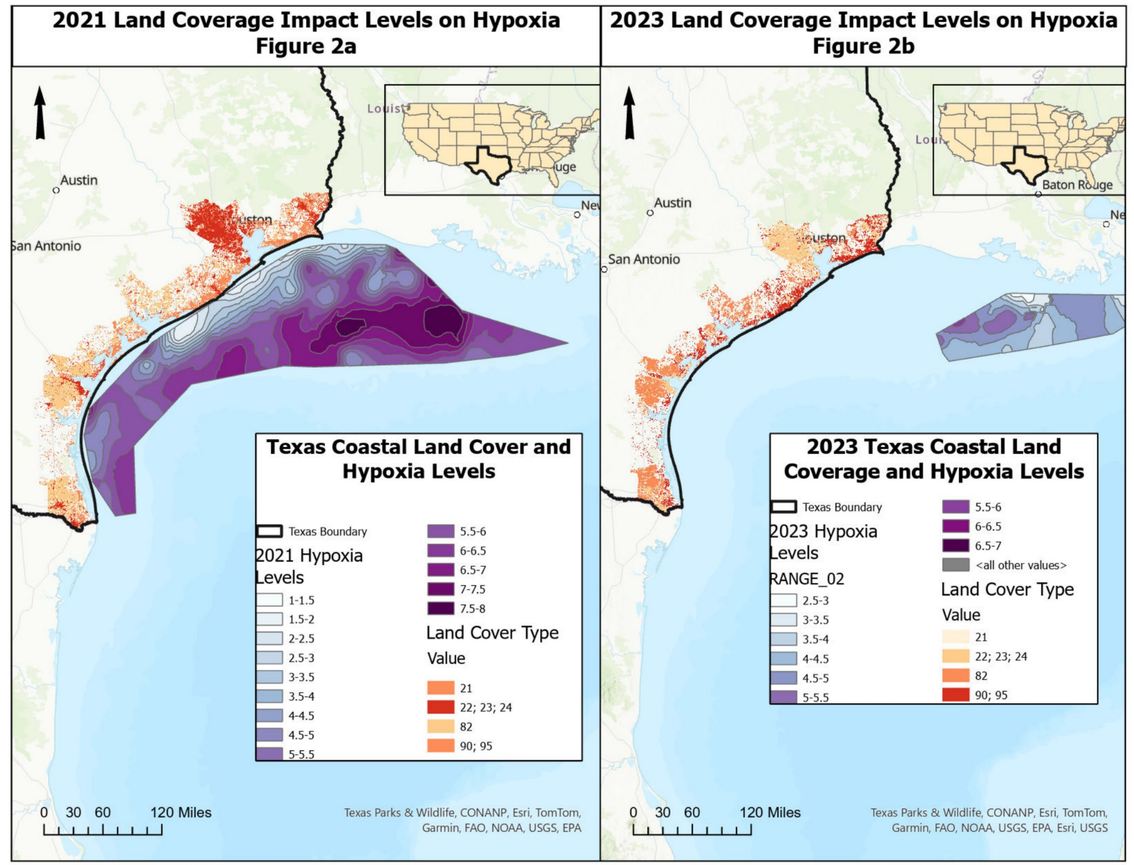


Figure 1b

Result



Conclusion

The Gulf Coast has a dead zone that is along the entire Texas coastline in 2021, while the dead zone moved east towards Louisiana in 2023. In 2023, there were higher amounts of wetlands present in the Texas Coastal Counties compared to the land coverage in 2021. The increase in healthy wetlands improved the water quality off of the Texas Gulf Coast. In the most southern counties, there is a high concentration of urban development and cropland that is in close proximity to high levels of dissolved oxygen. Compared to 2023 when there is a higher amount of wetlands in the area and no significant measured levels of hypoxia, the high concentration of cropland and urban development contribute to the high amount of hypoxia levels in 2021. Less concentrated areas of urban development in 2023 is also a contributor to decreased amounts of dissolved oxygen in the Texas Gulf Coast. Our analysis concludes that there is a relationship between high dissolved oxygen levels in the Gulf Coast and urban and agricultural land coverage in Texas coastal counties. There is also a relationship between wetlands in Texas coastal counties and low levels of dissolved oxygen levels in the Gulf Coast.