# USING LAND USE AND LAND COVER CHANGE DATA TO OBSERVE TRENDS IN DECREASED WATER QUALITY IN UPPER ESCAMBIA BAY AND BLACKWATER BAY CAUSED BY INCREASED DEVELOPMENT

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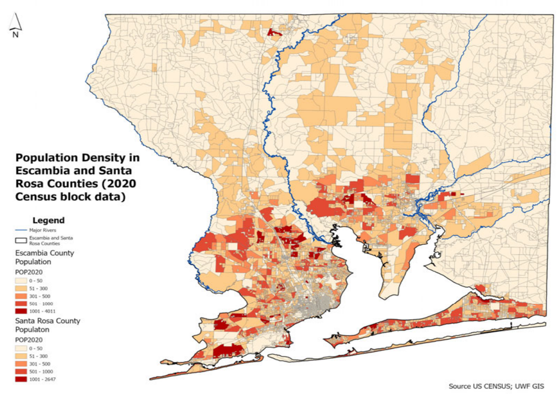
## ABSTRACT

As the global population increases, rapid urbanization in coastal environments is a topic of concern for many coastal communities. Estuarine systems are particularly susceptible to the negative impacts development can have on the pivotal nutrient balance of the ecosystem. Traditional methods, such as in-situ sampling have previously been used to identify a decline in water quality, exhibiting a positive correlation of nutrient loading and coastal development on that decline. Conversely, landscape indicators (e.g, percent impervious, buffer width) are another method used; employing geospatial mapping techniques to identify the impact of land use and land cover change (LULC) variability on water quality. However, within the study area, there has been limited study of how the outcomes of these two methodologies might overlap and complement one another. This study will seek to identify any trends that might arise linking in-situ water quality sample data to geospatially analyzed data in the areas adjacent to Upper Escambia Bay and Blackwater Bay located in Northwest Florida. Findings from the study will ideally be used to promote the use of more sustainable development activities in the future and support adaptive management strategies for improved water quality.

## RESEARCH OBJECTIVES

Understanding how increased development and population within coastal communities can affect estuarine water quality is helpful in adaptive management planning and can lead to addressing critical environmental concerns. By observing the relationship land use and land cover change has with water quality, this study seeks to meet the following primary objectives:

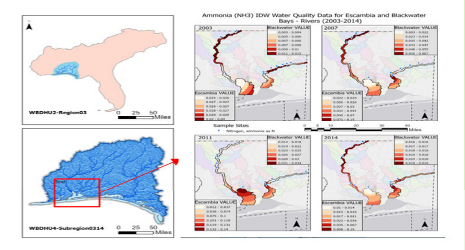
- Analyze water quality data for Upper Escambia Bay, Blackwater Bay, Escambia River, and Blackwater River in 2003, 2007, 2011, and 2014;
- Evaluate spatiotemporal trends in LULC over a period of 2001- 2016;
- Determine the relationship of water quality and the trends in land cover change;
- Determine the relationship between landscape indicator variables, LDI and LULC
- % cover, and water quality; and
- Evaluate next steps to inform future adaptive management in study area.




## STUDY SITE

### Pensacola Bay Watershed

- Located in Alabama and Florida, covers approximately seven thousand (7,000) square miles;
- Drowned river estuary system made up of Escambia Bay, Blackwater Bay, East Bay, Santa Rosa Sound, and Pensacola Bay spans approximately 187 square miles (NWFWMD, 2017);
- Shallow, low energy system that is primarily dominated by riverine influx from the Escambia, Blackwater, Yellow, and East Bay Rivers (Murrell et al., 2009).




HUC2; HUC4; Interpolation of water quality data for Ammonia in 2003-2014.

### ➢ Upper Escambia Bay/Escambia River

Located within the northwestern quadrant of Pensacola Watershed, is the Upper Escambia Bay. Historically, this area has been well known for its abundance of oysters, fisheries, and benthic organisms along with providing many other ecological services such as boating, recreational and commercial fishing, swimming, and storm protection. However, over the last decade there has been sharp decline in viable oyster habitat and individuals. Escambia River is the largest river overseen by the Northwest Florida Water Management District (NWFWMD). Escambia River spans from Pike County, Alabama, to Upper Escambia Bay, covering 240 miles, and has a drainage area of more than 4,200 mi2 with just 10% found within Florida (NWFWMD, 2017).

### ➢ Blackwater Bay/Blackwater River

Further east within the northeast quadrant of the Pensacola Watershed is Blackwater Bay, primarily fed by Blackwater River. This bay lies adjacent to the historical Old Bagdad area, rich with a history in recreational and commercial fishing. Blackwater River is approximately 60 miles long and has an average depth of 2.5 feet. Its origin is located near Bradley, Alabama, and terminates at its tidal portion near Bagdad, Florida, at Blackwater Bay.

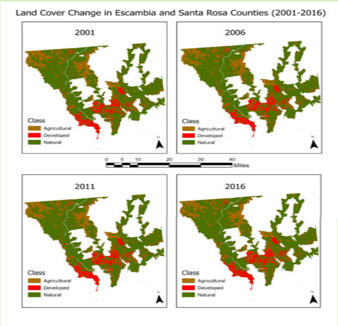
## METHODS

Data collection began with a search for waterbodies within the two counties meeting the following criteria: not attaining the water quality standards for nutrients, adjacent to coastal communities experiencing rapid development, and not previously studied using the same techniques to quantify impact. Then EPA's Water Quality Portal (WQP) archived data from EPA STORET data and USGS National Water Information System (NWIS) data was filtered for the following:

- nutrient of concern equaling one or more of the following: total nitrogen, organic nitrogen, ammonia, nitrate, nitrite, Kjeldahl nitrogen, total phosphorus, and orthophosphate;
- WBIDs North Escambia Bay (548AA), Judges Bayou (493A), Judges Bayou tidal (493B), Blackwater River tidal (24AB);

and concluded with only seventeen (17) sites of which only twelve (12) had useable data. It was clear that a wider search would be needed. This expanded my search upstream into Escambia and Blackwater Rivers within Florida's borders and provided a more complete dataset both temporally and spatially. Decennial Census data (block scale) was then reviewed to help determine the best way to approach LULC classes and total area.

- ➢ Using NLCD data for 2001, 2006, 2011, and 2016, changes in land cover for the area were determined;
- ➢ Within ArcGIS Pro, water quality data for 2003,2007, 2011, and 2014 with interpolated to exposed spatial and temporal trends in nutrient levels.




Land Cover Change in Escambia and Santa Rosa Counties (2001-2016).

## NEXT STEPS

- Finalize LULC results for the period of study;
- Land cover data expected to be analyzed at a three (3) classes:
  - Residential,
  - Agricultural,
  - Natural;
- Compare methodology of past studies to observe impact on water quality by adjacent development methods;
- Finalize interpolation data and interpret trends that surface;
- Develop adaptive management strategies to offer as education for local communities being impacted by rapid development induced water quality decline.
- Complete final draft and present final thesis defense.

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