Satellite imagery classification, Port Fourchon, 2022

Website: https://www.bco-dmo.org/dataset/947958
Data Type: Other Field Results
Version: 1
Version Date: 2025-01-03

Project
» CAREER: Integrating Seascapes and Energy Flow: learning and teaching about energy, biodiversity, and ecosystem function on the frontlines of climate change (Louisiana E-scapes)

Contributors	Affiliation	Role
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Abstract
This dataset contains habitat classifications based on satellite imagery downloaded from Google Earth, representing the locations of sites sampled during the Fall 2022 drop sampling season. The imagery includes geospatial coverage of estuarine and adjacent terrestrial habitats, providing detailed landscape features such as vegetation type, water bodies, and land use around each sampling site. The spatial resolution of the satellite imagery allows for precise analysis of habitat variables at multiple scales. The satellite imagery used to classify the habitats in this dataset was taken in 2022 within 1 year of our sampling timeframe. The imagery was analyzed to extract environmental variables, such as land-water ratios, vegetation coverage, and proximity to habitat edges. These variables are crucial for defining habitat characteristics and exploring their relationship to species abundance. The primary purpose of this dataset is to investigate how habitat scale influences models linking species abundance to landscape metrics. This information is particularly useful for researchers studying estuarine ecosystems, landscape ecology, and habitat management. Data collection and interpretation were conducted by Herbert Leavitt, Dr. James Nelson, and Alex Thomas, with affiliations at the time of sampling being with the University of Louisiana at Lafayette.

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Coverage

Location: Marshes surrounding Port Fourchon, Louisiana.
Spatial Extent: **N**:29.164671 **E**:-90.149744 **S**:29.092646 **W**:-90.269831
Temporal Extent: 2022-09-23 - 2022-09-29

Dataset Description

Dataset Includes a shapefile. Data uses EPSG 4326 projected to WGS 1984 Web Mercator (auxiliary sphere). Attribute table includes seven columns:

FID, Id, and gridcode are identical and identify objects in the dataframe

Shape: Data type
Shape_Leng: Aggregated perimeter length of all polygons that share given Class_name in meters

Shape_Area: Aggregated area of all polygons that share given Class_name in square meters
Class_name: name of the habitat class. Habitat classes defined as follows:

- Water: Open water areas
- Mangrove: Land covered in mangrove vegetation
- Saltmarsh: Land covered in Saltmarsh vegetation
- Manmade: Artificial structures like houses, port facilities, and dredge berms
- Mud Flat: Regions of water that appear to be particularly shallow based on satellite imagery. This class was merged with water in the final analysis.

Methods & Sampling

Satellite images taken in 2022 of the entire port were selected from google earth, georeferenced and clipped to the study area. The satellite image had a resolution of 2.8 x 3.3 meters per pixel.

Data Processing Description

We estimated habitat cover by classifying satellite imagery in ArcGIS Pro (3.3.0). We used ArcGIS Pro's Image Classification Tool to segment the satellite image into habitat types based on supervised training data.

Training data was provided by drawing polygons around regions dominated by *Spartina* marsh and mangrove trees. We trained the model to classify regions water and artificial structures in the same manner. We used a support vector machine algorithm to classify the satellite image and made manual corrections where necessary.

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

CAREER: Integrating Seascapes and Energy Flow: learning and teaching about energy, biodiversity, and ecosystem function on the frontlines of climate change (Louisiana E-scapes)

Website: http://www.nelsonecolab.net/career

Coverage: Saltmarsh ecosystem near Port Fourchon, LA

NSF Award Abstract:
Coastal marshes provide a suite of vital functions that support natural and human communities. Humans frequently take for granted and exploit these ecosystem services without fully understanding the ecological feedbacks, linkages, and interdependencies of these processes to the wider ecosystem. As demands on coastal ecosystem services have risen, marshes have experienced substantial loss due to direct and indirect impacts from human activity. The rapidly changing coastal ecosystems of Louisiana provide a natural experiment for understanding how coastal change alters ecosystem function. This project is developing new metrics and tools to assess food web variability and test hypotheses on biodiversity and ecosystem function in coastal Louisiana. The research is determining how changing habitat configuration alters the distribution of energy across the seascape in a multitrophic system. This work is engaging students from the University of Louisiana Lafayette and Dillard University in placed-based learning by immersing them in the research and local

restoration efforts to address land loss and preserve critical ecosystem services. Students are developing a deeper understanding of the complex issues facing coastal regions through formal course work, directed field work, and outreach. Students are interacting with stakeholders and managers who are currently battling coastal change. Their directed research projects are documenting changes in coastal habitat and coupling this knowledge with the consequences to ecosystems and the people who depend on them. By participating in the project students are emerging with knowledge and training that is making them into informed citizens and capable stewards of the future of our coastal ecosystems, while also preparing them for careers in STEM. The project is supporting two graduate students and a post-doc.

The transformation and movement of energy through a food web are key links between biodiversity and ecosystem function. A major hurdle to testing biodiversity ecosystem function theory is a limited ability to assess food web variability in space and time. This research is quantifying changing seascape structure, species diversity, and food web structure to better understand the relationship between biodiversity and energy flow through ecosystems. The project uses cutting edge tools and metrics to test hypotheses on how the distribution, abundance, and diversity of key species are altered by ecosystem change and how this affects function. The hypotheses driving the research are: 1) habitat is a more important indirect driver of trophic structure than a direct change to primary trophic pathways; and 2) horizontal and vertical diversity increases with habitat resource index. Stable isotope analysis is characterizing energy flow through the food web. Changes in horizontal and vertical diversity in a multitrophic system are being quantified using aerial surveys and field sampling. To assess the spatial and temporal change in food web resources, the project is combining results from stable isotope analysis and drone-based remote sensing technology to generate consumer specific energetic seascape maps (E-scapes) and trophic niche metrics. In combination these new metrics are providing insight into species’ responses to changing food web function across the seascape and through time.

This project is jointly funded by Biological Oceanography and the Established Program to Stimulate Competitive Research (EPSCoR).

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
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