

Remote Sensing and Wildlife Management: Using Object Based Image Analysis for the Detection of Nesting Laughing Gulls

Capstone Project Proposal by Ben Martini

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PennState



Presentation Overview

I. Project Background

- A. Airport Wildlife Management
- B. Laughing Gulls and JFK
- C. Remote Sensing and Wildlife

II. Proof-of-Concept Project Review

- A. Study Area and Data Sources
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Wildlife Management: A Crucial Part of Aircraft Safety



Laughing Gulls at JFK: A Unique Management Problem

- Species of interest to New York State
- **1988-1990: Majority of all Bird Strikes at JFK were Laughing Gulls**
 - Laughing Gull Hazard Management Plan Developed
- Aerial Surveying began in 1997
 - **Goal:** Monitor impact on nesting colony



Survey Methodology: Manual Surveys - 1997-2017

- Used Panchromatic Aerial Photos
- Nests circled on overlaid clear sheets
- Triennial Ground truthing survey
- **Manual Methodology Issues:**
 - Time Consuming
 - Prone to Human Error



Survey Methodology: GIS Based Survey - 2018

- 2018 Survey: ArcGIS Pro used to digitize nests
 - Improved the workflow for finding nests
 - Simplified calculating the total number of nests



A big step, but still leaves room for improvement...

Object Based Image Analysis: A Potential Solution

- Remote Sensing techniques have long been used to study wildlife
- **Object Based Image Analysis - A Promising New Tool for the Wildlife Field**



Project Goals and Objectives

Project Goals

- Improve the efficiency and effectiveness of the laughing gull nest survey at Joco Marsh.
- Contribute to the body of research about applying remote sensing and object-based image analysis techniques to the field of wildlife management

Project Objectives

- Develop a comprehensive object-based image analysis methodology that builds upon the current methodology used to find laughing gull nests in aerial imagery at JFK Airport.
 - Develop a Rules Based Expert System for nest extraction in eCognition
- Design and Develop a Software Tool that automates the execution of the entire workflow

Proof-of-Concept: A Chance to Develop and Test the Proposed Capstone Project Methodology



Study Area



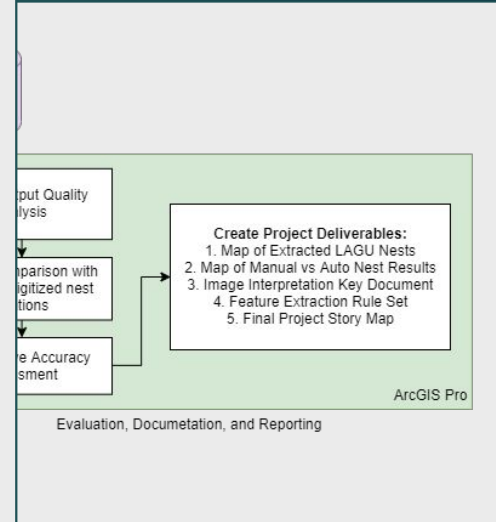
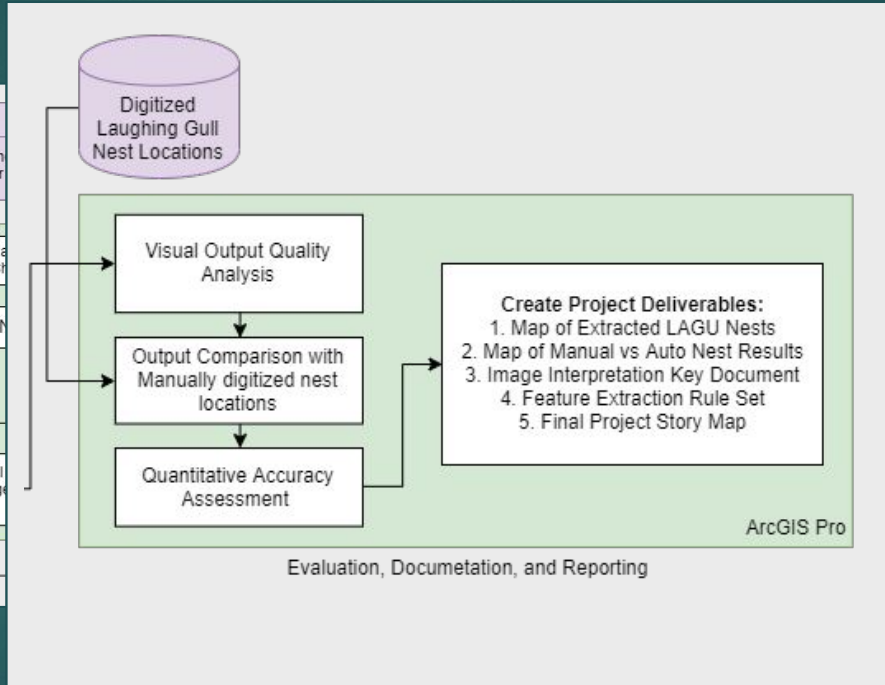
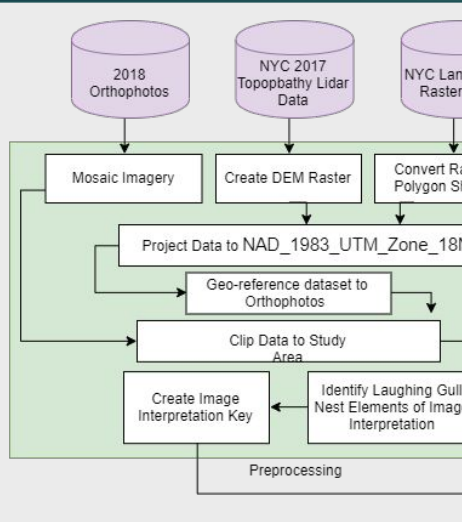
Product of the Somerset Study Area

Project Data Sources

- 2018 High Resolution Orthophotos of Joco Marsh
- NYC Land Cover Raster Data 6 in Resolution Dataset
- NYC Topobathymetric 2017 LiDAR Dataset
- 2018 Manually Digitized laughing gull nest locations



Proof-of-Concept Workflow



Extracting Laughing Gull Nests: Elements of Image Interpretation

Site

- Nests are found in locations that are above the tide line

Tone

- Nests made up of dead vegetation, light tan tone

Size

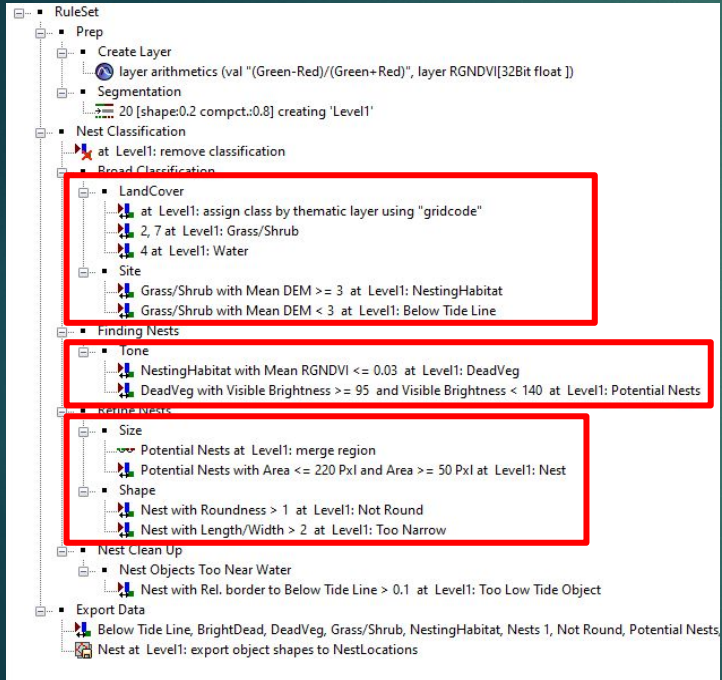
- Nests are typically ~1-2 Feet in Diameter

Shape

- Nests have a rounded shape from how they are built out from the central egg cup



Rule Set Development: Translating the Elements to eCognition



Feature Extraction Results: Qualitative Analysis



Feature Extraction Results: Quantitative Analysis

Class	No Nest	Nest	Total	User Accuracy	Kappa
No Nest	141	5	146	96.58%	0
Nest	42	43	85	50.59%	0
Total	183	48	231		0
Producer Accuracy	77.05%	89.58%		79.65%	0
Kappa	0	0	0	0	0.518814

Examining the Producer Accuracy

Lessons Learned from the Proof-of-Concept

- Feature Extraction Rule Set
 - Will require further refinement
 - Planned Improvements
 - **New Data Source**
 - **Advanced OBIA Techniques**
- Software Tool Implications
 - **Semi-automated** design focus



Still a major improvement over current survey methodology!

Next Steps:
From Proof-of-Concept to
Capstone Project



Anticipated Results

- **A well-designed software tool for extracting laughing gull nests from aerial imagery for use by the Port Authority of New York and New Jersey and USDA Wildlife Services**
 - Improved feature extraction results
 - Semi-Automated process
 - Potential for expansion to different species and imagery
- **Contribution to the body of knowledge regarding the value of object-based image analysis techniques to studying wildlife**

Proposed Project Timeline

- **Project Methodology/Workflow Development** - Present to January 2020
- **Rules Based Expert System Development** - January to Mid-February 2020
- **Software Tool Development** - Mid-February to April 2020
- **SCGIS Call for Abstracts** - Anticipated by March 27th 2020 (TBA)
- **Final Report and Presentation Development** - April to May 2020
- **Project Deliverables Provided to USDA and PANYNJ Stakeholders** - May 2020
- **SCGIS Conference** - Anticipated July 2020 (TBA)

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