Factsheet # 23

Using LiDAR and Object Based Image Analysis (OBIA) to map wetlands in Mt. Rainier National Park

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UW
Understanding multiscale dynamics of landscape change through the application of remote sensing & GIS
Remote Sensing & Geospatial Analysis Laboratory

Figure 1. 3-D image of wetlands using LiDAR data

Summary: The combination of LiDAR and Object based image analysis (OBIA) provides a cost-effective approach to map wetlands across large spatial extents. LiDAR removes problems associated with tree canopy and topography while OBIA provides the ability to automate the wetland classification process.

LiDAR: LiDAR is an active remote sensor that penetrates the canopy and therefore removes any shadowing or blocking effects. We used four LiDAR derived data products; canopy surface model, ground model, LiDAR intensity image, and a slope index. Figure 1 is an example of a LiDAR point cloud colored using an aerial image.

Object based image analysis: OBIA mimics the way that humans recognize patterns. OBIA **detects** patterns within multiple data input layers, **segments** these patterns at a user defined scale and **classifies** these segments through the development of a ruleset. We used Trimble eCognition software for our analysis.

Study Area

Mt. Rainier National Park

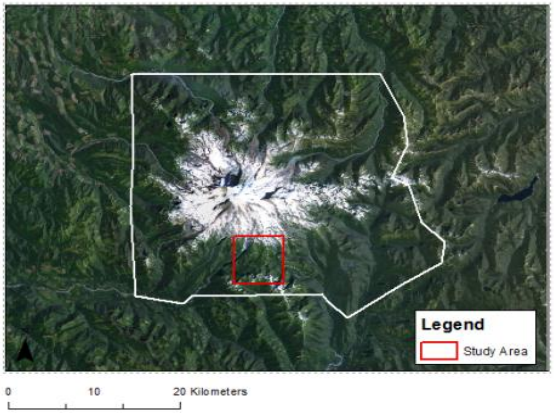


Figure 2. The study area is located in Paradise Meadows in Mt. Rainier National Park

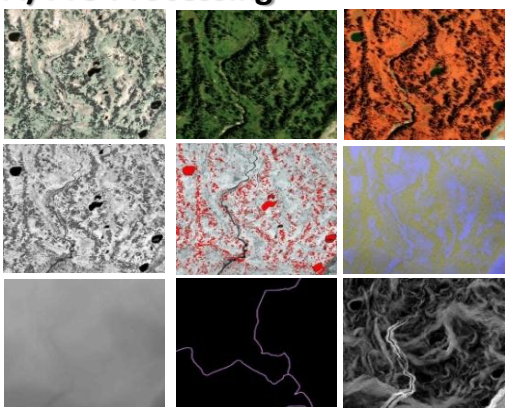
Methods

One of the strengths of OBIA is that it allows the analyst to use multiple data input layers. (Figure 3a), However, we ran the segmentation only on the LiDAR data layers (Figure 3b).We chose from hundreds of classification features (i.e. color, shape, size) to develop our classification ruleset (Figure 3c). We mapped significantly more wetlands than had been previously detected in other wetland inventories (Figure 3d).

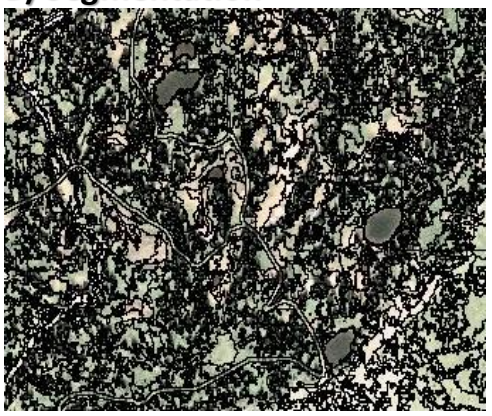
Input Data Layers:

- 2006 aerial imagery
- 2009 aerial imagery
- Lidar intensity
- Lidar intensity below 2 meters
- Surface model
- Ground model
- Roads layer
- Trails layer
- Slope index

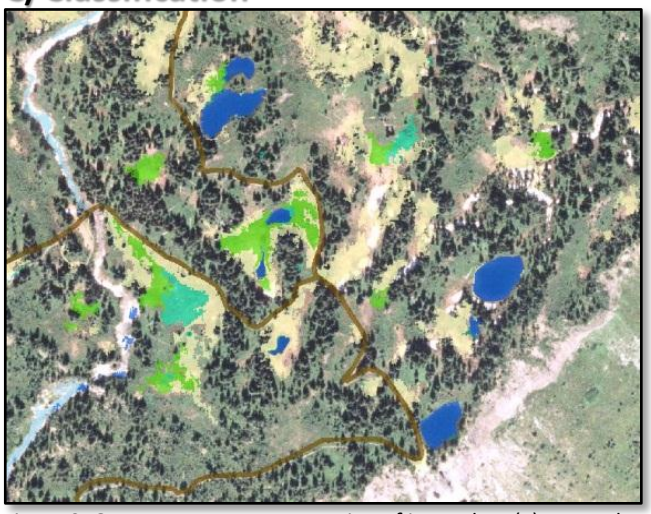
A) Pre-Processing



B) Segmentation



C) Classification



D) Results

Accuracy Assessment:

21/25 = 84% using amphibian dataset from Mt. Rainier National Park

61/64 = 95.31% using USFWS National Wetland Inventory

Figure 3. OBIA process. Pre-processing of input data (a), example of segmentation of data (b), example of classification of wetlands (c), & results using available datasets from Mt. Rainier and the National Wetland Inventory

THE ISSUE: A repeatable cost-effective approach to map wetlands over large spatial extents is needed. However, complex topography and tree canopy obscures wetlands and causes shadows, which makes wetland classification using traditional remote sensing methods infeasible.

THE KEY QUESTIONS:

Can the use of LiDAR remove problems associated with trees and topography in the classification of wetlands?

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