

Golden Meadow Marsh Creation, Land:Water Change Analysis
09/14/2022

Mississippi State University and Ducks Unlimited collaborated to conduct a land:water change analysis on the Golden Meadow Marsh Creation site pre and post construction.

IMAGERY COLLECTION

Pre-construction imagery was collected on 07/25/2019 using a DJI Phantom 4 Pro carrying a MicaSense RedEdge 5-band multispectral camera. Images were collected with the goal of monitoring the efficacy of marsh terraces in helping to protect and restore coastal wetlands.

Imagery was collected using a MicaSense RedEdge sensor, a five-band sensor that produces an image for each band. The bands are blue, green, red, red edge, and near infrared. Center wavelengths are 475 nm, 560 nm, 668 nm, 717 nm, and 840 nm. The bandwidth for each is 20, 20, 10, 10, and 40 nm, respectively.

The data has been processed into an orthomosaic using Agisoft Metashape. The data has been converted into reflectance units using a reflectance panel, yielding results that should reside between 0.0 and 1.0. The mosaic is still subject to irradiance changes in flight, and also exhibits some specular reflections, which can affect the values and put them outside the normal 0-1 range.

Band 6 is an alpha data band. 0.0 represents NoData, and this has been specified in ArcMap and should display correctly in it and other GIS software. The orthomosaic is in 32-bit floating point BGREN (blue, green, red, red edge, NIR) GeoTIFF format.

NOTE: This data contains significant sun glint. Masking out those areas in the raw imagery produced a worse product, so it has been left as-is. The underlying land data is fine, and looks solid in ArcMap using a "Percent Clip" stretch with a min of 0.5 and max of 49.

Geographic Information:
Projection: WGS84
Horizontal: degrees
Location: 29.405959 (top)
 -90.308230 (left)
 -90.296001 (right)
 29.394265 (bottom)

Post-construction imagery was collected a DJI Phantom 4 Pro carrying a DJI FC6360 5-band multispectral camera on 10/07/2020. Imagery was collected using a DJI FC6360 camera, a five-band sensor that produces an image for each band, as well as a traditional RGB image. The bands are blue, green, red, red edge, and near infrared. Center wavelengths are 450 nm, 560 nm, 650 nm, 730 nm, and 840 nm. The bandwidth for each is 32, 32, 32, 32, and 52 nm, respectively.

The data has been processed into an orthomosaic using Pix4D's Pix4Dmapper. The process converts the imagery into reflectance units. For this particular image set, a reflectance panel and irradiance sensor was used. The reflectance values should range from 0.0 to 1.0. Due to limitations in collection and the downwelling light sensor for the Phantom 4, these values will be incorrect if lighting has changed significantly. In general, this will be because of cloud cover. There is a

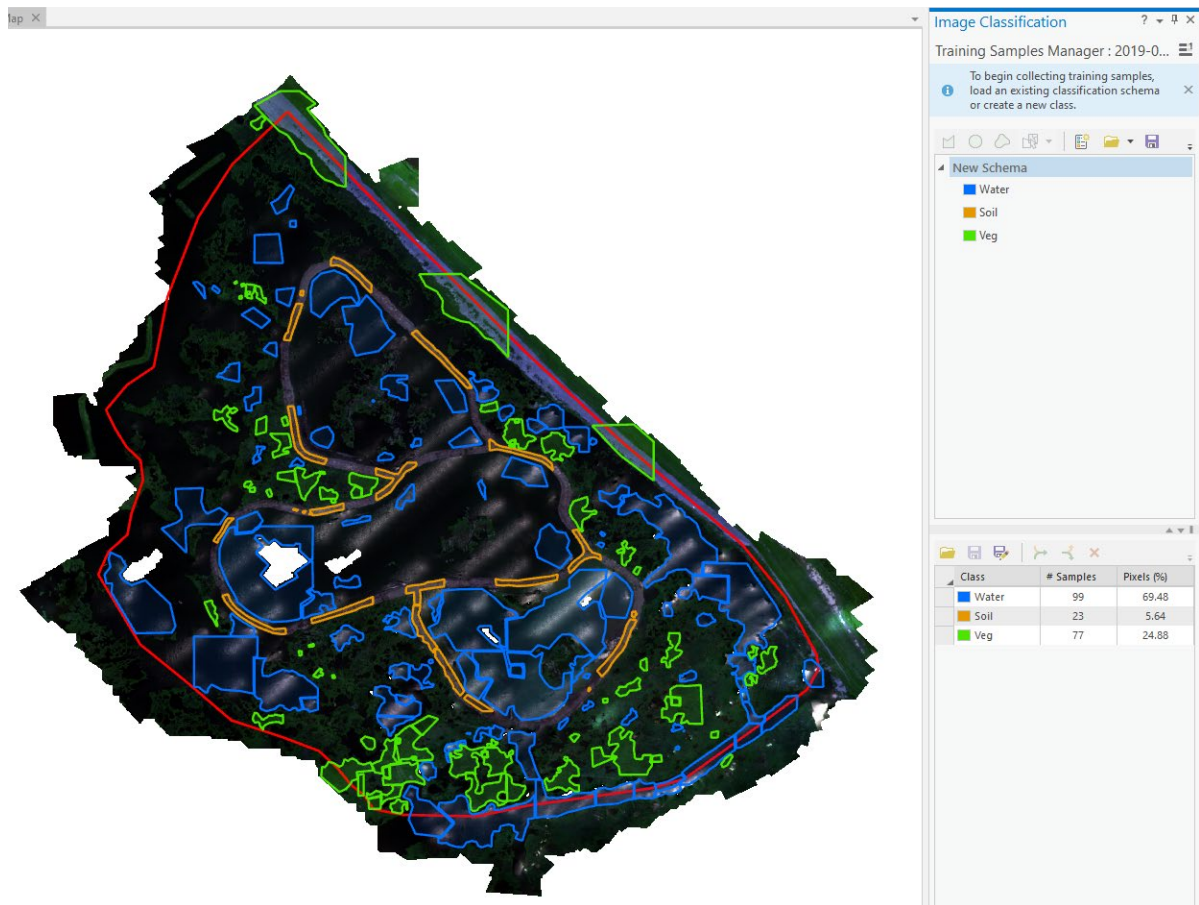
small amount of solar irradiance change as well over the flight, although that change should not heavily impact the data for its intended use. The orthomosaic is in 32-bit floating point BGREN (blue, green, red, red edge, NIR) GeoTIFF format.

Geographic Information:
Projection: WGS84 UTM Zone 15
Horizontal: meters
Location: 3256009.10441 (top)
761219.92031 (left)
762395.47979 (right)
3254681.98955 (bottom)

Imagery is available at this location under the heading “Ducks Unlimited Imagery”:
<https://uas.hpc.msstate.edu/nasem.php> Note that pre-construction imagery was initially collected on 05/29/19, but it was found to be corrupted. A replacement flight was conducted on 07/25/19.

IMAGE CLASSIFICATION METHODOLGY

The change analysis domain was established based on the project boundary established in the grant proposal (red line in images below). Initially, 3 classes were created for the training dataset: water, vegetation, and soil (see below for before/after aerial imagery with training polygons).



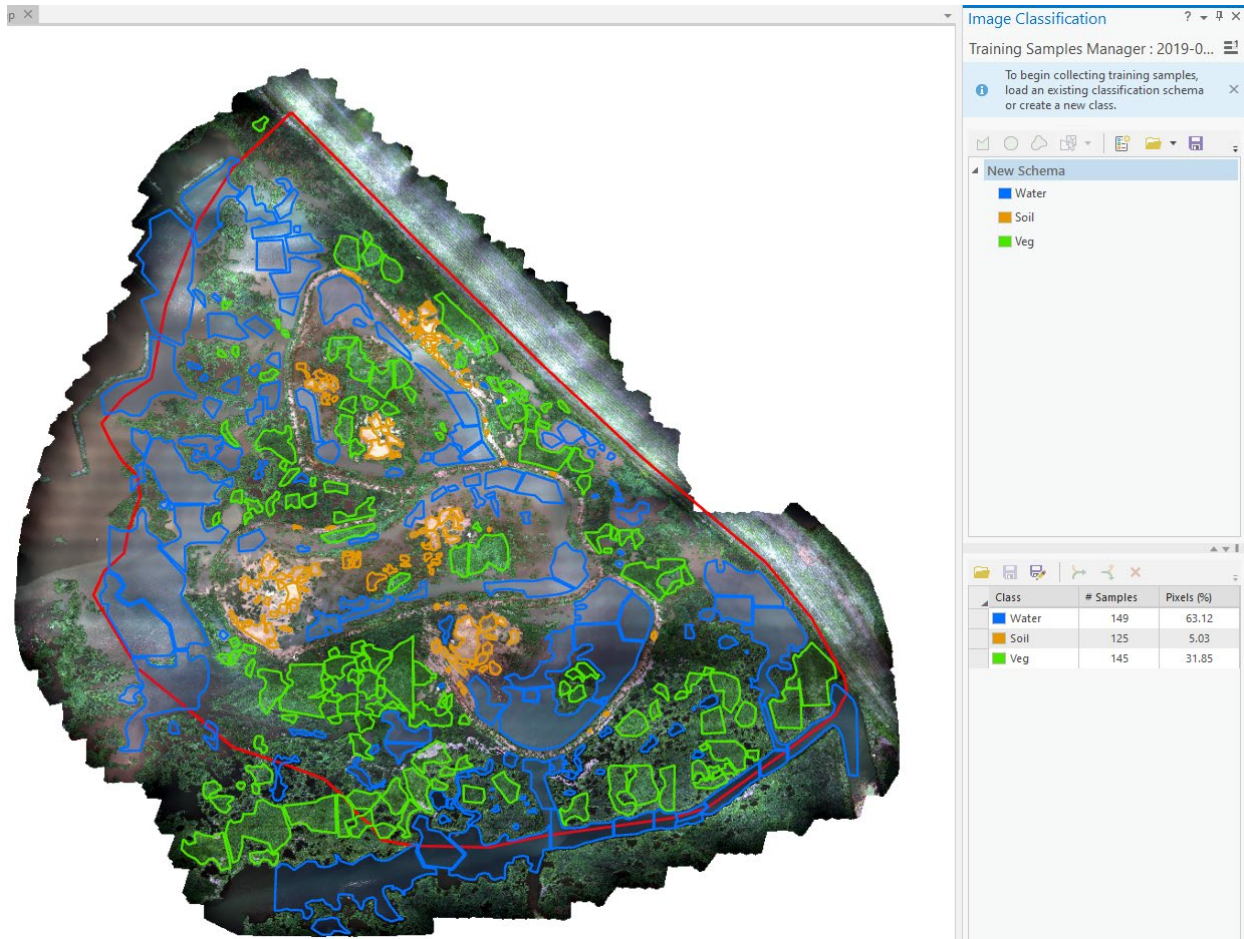


Image Classification was conducted using a Random Trees classifier (max. 500 samples). Post-processing relied on the Majority Filter tool to replace individual cells based on the majority of its 8 adjacent neighbors (replacement threshold = Majority). We used the Boundary Clean tool to smooth the boundaries between classified zones, specifically the descending sorting technique that sorts zones in descending order by size, with zones having larger total areas receiving higher priority to expand into smaller zones. We ran expansion and shrinking twice, the second time with priority reversed. Lastly, we used region group, set null, and nibble tools to reclassify small pockets (<100 pixels) of a given group.

Change analysis

Raster classifications were projected to USA Contiguous Albers Equal Area Conic (ESRI: 102003). An acreage field was added to the rasters attribute tables and acres calculated:

$$\text{Count} * \text{cell size}^2 * 0.0002471052.$$

One classification was converted to polygon using the raster to polygon tool (smoothing enabled) and geometry calculated to verify correct raster calculations. Change between the two time periods was calculated using nested conditional statements.

T1 = July 2019

T2 = October 2020

Remained Water = Both time periods were water
 Remained Land = Both time periods were land
 Changed from Water to Land = Water in T1 and Land in T2
 Changed from Land to Water = Land in T1 and Water in T2

Results

July 2019 (pre-construction)

Cover	Acreage
Water	94.4
Land	62.4
Total	156.8

October 2020 (post-construction)

Cover	Acreage
Water	59.7
Land	97.1
Total	156.8

Change Analysis

Class	Acreage
Water	56.3
Land	59.0
Water to Land	38.1
Land to Water	3.4
Total	156.8

Within the project domain, which included areas beyond the marsh creation containment levee footprint, the restoration activities resulted in an approximately 25% near immediate increase in land. Visual examination of publicly available imagery since 2020 indicates that created land within the containment levees have become fully vegetated and have expanded into some of the areas previously classified as open water. Thus, the 25% increase in land and vegetated marsh is to this point an underestimate.

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