Tasking High-Resolution Satellite Imagery for Monitoring Ecosystem Projects

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The Corps of Engineers St. Paul District's GIS team is a part of an adaptive management team tasked with monitoring the Marsh Lake Habitat Enhancement Project. This ecosystem project is located on the Minnesota River in West-Central Minnesota and is a multi-agency 15-year effort to return Marsh Lake to a less degraded and higher functioning condition. One of the key project objectives is to restore aquatic and emergent vegetation to the lake which had almost disappeared by the 1990s. The GIS team's role is to collect new imagery that would assist in determining how the vegetation in Marsh Lake responded after the construction of project features in 2020. High-resolution air photo and satellite imagery (<1m) can help visualize, monitor, and analyze an active or completed ecosystem project. However, finding imagery with site level detail during a specific time of year is challenging and costly. Publicly available air photo imagery from the Farm Service Agency provides high-resolution imagery but is generally flown every two years and only during the summer months. Publicly available satellite imagery from the Sentinel-2 satellite can provide imagery for most clear days but is lower resolution (10-20 meters) making it difficult to see site details. Contracting a plane or drone crew will provide high-resolution detail and timely collects but can come with significant costs. Today it is possible to task a high-resolution satellite to capture imagery over large expanses of land during a specific time frame with less costs than ever before.

The GIS team was given an area of interest which covered approximately 5,665 hectares. The anticipated image collection needed to have significant detail (less than 1m cells) and be collected once per month during the growing season. Given these requirements, the GIS Team worked with the Army Geospatial Center's Aerial Imagery Office to task a satellite for this data collection effort starting in 2022.

Between May 2022 and November 2022, six high-resolution (50 cm) true color and color infrared satellite (Pleiades) images were collected. The images were shared with the adaptive management team and published to a public ArcGIS StoryMap. The images have shown an increase of emergent and submersed aquatic vegetation which can damper wave action and filter nutrients, thus improving water clarity. The collection effort has continued into 2023 with six more expected images for viewing and analysis. To better determine specifics, an ongoing GIS imagery comparison analysis is being run by the GIS team to determine the approximate acreage change of open water and emergent vegetation from 2015 to 2023 using pre-project and post-project aerial imagery during the month of August. The imagery analysis results will be shared at the end of 2023 with project sponsors and the public.

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