Publication of Research Article: "National Exposed Sediment Search and Inventory (NESSI): Utilizing Satellite Imagery and Machine Learning (ML) to Identify Dredged Sediment Placement Site Recovery"

Impact Statement: ERDC Environmental Laboratory (EL) researchers developed a spatially explicit rapid assessment tool to track upland dredged material placement site evolution, from disturbance to recovery, which is a first step towards calculating co-benefits of Beneficial Use of Dredged Material (BUDM). This model known as NESS generates a record of placement activity and provides the basis for assessing co-benefits at a national scale.

The research article titled *"National Exposed Sediment Search and Inventory (NESSI): Utilizing Satellite Imagery and Machine Learning to Identify Dredged Sediment Placement Site Recovery"* by researchers Drs. Thomas P. Huff, Emily R. Russ, and Todd M. Swannack of the Integrated Ecological Modeling team of the ERDC Environmental Laboratory (EL) in the *Journal of Remote Sensing*. https://doi.org/10.3390/rs17020186

The National Exposed Sediment Search and Inventory (NESSI) showcases a new ERDC capability for using Machine Learning (ML) techniques to identify dredged sediments. A combination of satellite imagery data obtained and processed using Google Earth Engine and ML algorithms were applied at known dredged material placement sites to develop a time series of dredged material placement events and subsequent site recovery (Figure 1). These disturbance-to-recovery time series are then used in a landscape analysis application to better understand site evolution within the context of the surrounding areas.

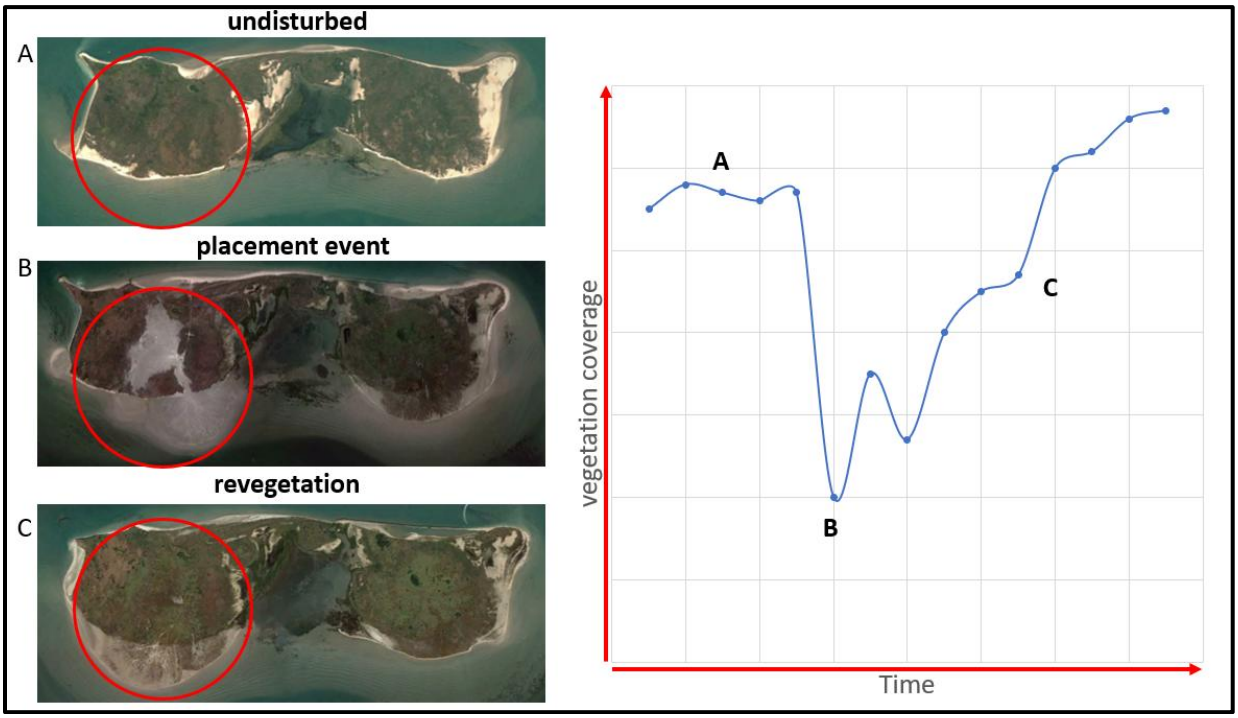

Figure 1. The left pane of Figures (A-C) shows an example progression of dredge placement. The right pane shows a simulated dataset of the drop in vegetation coverage that is associated with changes in imagery reflectance that NESSI is using to detect the sediment placement.

The impetus for developing such a model was the fact that sediment imbalances generate from dredging and human activity in a watershed. These imbalances can be variable within a littoral system, with adjacent areas experiencing sediment starvation and/or excess sediment. Historically, sediments were viewed as an inconvenient biproduct destined for disposal; however, Beneficial Use of Dredge Material (BUDM) is a practice that has grown as a preferred methodology for utilizing sediment as a resource to help alleviate sediment deficits within a system. BUDM enables organizations to adopt a more innovative sediment management approach that also provides ecological, economic, and social co-benefits. Although location data are available on BUDM sites, especially in the US, there is limited understanding on how these sites evolve within the larger landscape, which is necessary for quantifying the co-benefits. To move towards BUDM more broadly, new tools need to be developed to allow researchers and managers to understand the effects and benefits of this practice. NESSI helps fill that knowledge gap.

Future research will leverage the NESSI database to assess what ecosystem service benefits can be measurably gleaned from beneficial use of dredged sediments and how these benefits can be maximized at the national scale.

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