

# Engineering With Nature Project Fact Sheet



## Coastal Carbon Capture via Beach Nourishment: Pilot Deployment of Olivine Sands as a Tool for Mitigating Climate Change

### Background

Climate change and sea level rise is a major threat to the nation's coastlines, requiring novel solutions by the USACE to address increased risks to coastal communities. Mixing olivine, a natural mineral, into dredged sediments as part of beach nourishment can remove carbon dioxide that, at scale, may reduce future impacts of sea level rise and climate change. While there is great potential for utilizing olivine sands as innovative tool in coastal protection in the context of a changing climate, much of this work on this topic has been theoretical in nature and completed at small scale. This project will leverage an already planned pilot field placement of olivine along the Outer Banks, NC in Spring 2023 being led by partner Project Vesta and allow for detailed measurement and analysis of the fate of olivine in the nearshore.

### Objectives

Olivine has different physical characteristics than typical beach sands, which has direct implications for the morphologic development of nearshore and beach systems with olivine placements. For this reason, quantifying the cross-shore, longshore, and vertical redistribution of the placed olivine sediments is necessary to assess differences relative to the natural transport dynamics and in order to effectively calculate the total carbon capture potential of olivine sand placement. Tracking of the sediment fate as part of this work will serve as a critical step towards calculating added protective and climate benefits of this emerging technology. This project aligns well with the goals of the Engineering With Nature® program through advancing innovative solutions that leverage natural processes to increase project benefits, as well as close collaboration across the USACE and with non-federal partners.

### Approach

This work will include the development and testing of spectral-based identification of olivine sands, using both handheld cameras and satellite imagery, in order to track the movement of the placement. Sediment samples will be collected from the ocean floor and on the beach in order to assess the spatio-temporal transport patterns of the sediments. Additionally, data derived from sediment coring completed in the nearshore, using amphibious vessels at the USACE Field Research Facility, will be used to quantify vertical mixing of olivine with the native beach sands.

### Outcomes

This geoen지니어ing solution has direct application to USACE given that the technology can be incorporated into nourishment project designs with limited modification. This effort will quantify sediment retention in the active portion of the littoral system and will be used, in conjunction with project partners, to quantify the carbon capture potential for olivine released in the nearshore. Demonstration of this technology could have broad implications for future costs savings for the USACE and other coastal stakeholders.

**Hazards of Concern to USACE**  
Storm-Driven Beach/Dune Erosion & Flooding Impacts  
Sea Level Rise Impacts

**Potential Solution to Lessen Impacts and Reduce Future USACE Costs**  
Enhanced Coastal Weathering Using Olivine  
 $4 \text{CO}_2 + 4 \text{H}_2\text{O} + \text{Mg}_2\text{SiO}_4$   
Natural Chemical Reactions in Water  
 $4 \text{HCO}_3^- + 2 \text{Mg}^{2+} + \text{H}_4\text{SiO}_4$   
Olivine Incorporated Into Existing Placement Projects to Enable Rapid Scaling  
Nearshore and Beach Placement

**Proposed R&D Efforts to Assess Enhanced Coastal Weathering Along U.S. Coastlines**  
Comprehensive tracking of fate of olivine in first U.S. based pilot deployment in Spring 2023.  
Leveraging an upcoming large scale existing (non-Federal) placement  
Unique Visible and Spectral Properties of Olivine Enable Tracking its Movement  
Utilizing Cross-Lab ERDC Expertise  
Nearshore Field Data Acquisition  
Terrestrial and Satellite-Based Remote Sensing  
Vibrocoring and Sediment Analysis

ERDC US Army Corps of Engineers  
UNCGREENSBORO  
PROJECT VESTA  
Custom IR/Spectral Camera Development

### Points of Contact:

Justin Shawler (ERDC CHL), [Justin.L.Shawler@usace.army.mil](mailto:Justin.L.Shawler@usace.army.mil),

804-310-2412