Sediment Accretion in Thin Layer Placement (TLP) Marshes

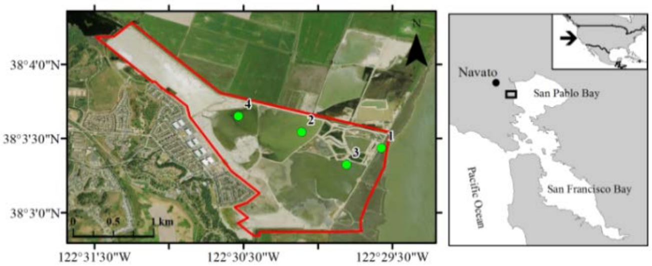
Dredging Operations Environmental Research (DOER) Program

Problem

Restored and constructed marshes represent an integral component of the estuarine sediment budget. These restored marshes are increasingly being built using dredged sediment. However, the efficacy and sustainability of thin layer placement (TLP) of dredged material are not well understood. Specifically, the effect of TLP on the biophysical process of accretion and the ability of these marshes to retain placed dredged material, as well as serve as a suspended sediment sink thereby reducing deposition and maintenance in navigation areas, are poorly understood. These unknowns reduce the USACE ability to effectively design TLP projects. Established methods of determining accretionary dynamics in marshes can be applied to existing TLP projects to address this knowledge gap. The criteria for TLP of dredged material are based on 1) the cost of placement 2) the suitability of the marsh placement area and 3) the sustainability of benefits derived from the TLP. While the first criterion will remain a major and likely unchanged factor in TLP projects, the suitability and sustainability of marsh placement areas are not standardized criteria especially with respect to long-term elevation capital and re-establishment of the biophysical accretion process after placement.

Study Description

Sediment accretion rates will be determined in restored and natural tidal marshes in the San Francisco Bay Estuary using radionuclide chronologies. These data will be used to develop protocols for applying Gamma spectroscopy for measuring sediment accretion at TLP sites. Sediment cores taken from each study site will be analyzed for ^{210}Pb and ^{137}Cs activity via gamma ray spectroscopy to determine the 50-100 year sediment record. The accretion dynamics of these wetland systems will be related to the hydrodynamic regime as well as the method of sediment placement. Comparisons of the mineral and organic composition of the soil between restored and natural sites will be used to determine if the accretionary process has been become re-established in TLP placement sites.

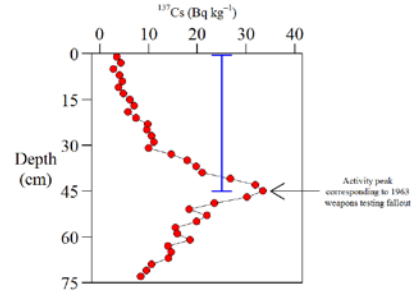


Products

The objectives of this RT are to generated ^{137}Cs and ^{210}Pb chronology for marsh cores from both TLP/BU and unrestored, reference marshes and use these data to determine best practices for TLP placement. These chronologies will be used to determine rates of mineral sediment and organic matter accumulation as well as accretion of the marsh surface through time. This research will produce two TNs, one TR, and a journal article. These products will describe the best practices for radionuclide analysis, the use of radiochronology in TLP marshes, a comparison of accretion dynamics in restored TLP and natural reference marshes, and best practices for evaluating radiochronology data to improve TLP project design. The products of this research will result in an increased USACE understanding of the effect of TLP on wetland sediment accretion and understanding of how to design TLP projects to improve marsh function. The products of this research can then be applied in development of models used to optimize design and function of TLP wetlands.

Summary

This project will enhance the understanding of the sustainability of TLP projects as well as identify performance criteria that will be helpful in determining the best practice for beneficial use of dredged material used for TLP. Comparison of the sediment record in TLP and adjacent reference marshes will help determine the trajectory and time line of recovery of natural accretion dynamics to TLP marshes and any alterations in the accretionary process that should be expected temporarily or long-term. Understanding these processes will squarely address gaps in the USACE's fundamental knowledge of 1) optimizing design of TLP projects 2) how and for how long these beneficial use practices will persist and 3) how TLP site sediment accretion dynamics differs from natural marsh systems.



Balancing operational and environmental initiatives and meeting complex challenges of dredging and dredged material placement in support of the navigation mission.

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