US Army Corps of Engineers
Engineer Research and Development Center

Parametric Study of Biomass on Short-term Dune Evolution

Need

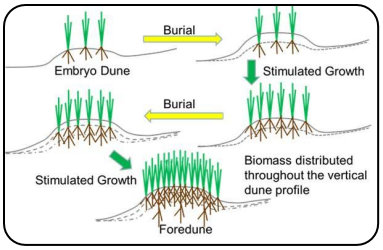


Illustration of dune growth and biomass distributions.

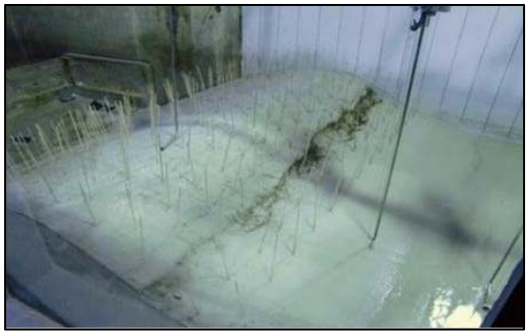
Dunes have, and continue to be, natural or engineered features which prevent or decrease flooding by waves and storm surge. Currently, morphological models do not consider the effect of vegetation when estimating short-term dune response to erosional events, and present dune construction practices may result in a loss of resiliency since biomass and sediment aggregation is not considered. While this potential loss of sediment leads to a decrease in coastal storm protection, it also leads to a loss of investment. Over the past 10 years the US Army Corps of Engineers has spent $1.4 billion in dredging projects that included beach renourishments and dune construction. This figure does not include all the state or local investments in dunes to reduce the risk of coastal flooding. A quantative measurement of dune erosion with varying degrees of biomass can inform the USACE and others on the value of vegetation and susquently lead to improved guidance and practices.

Approach

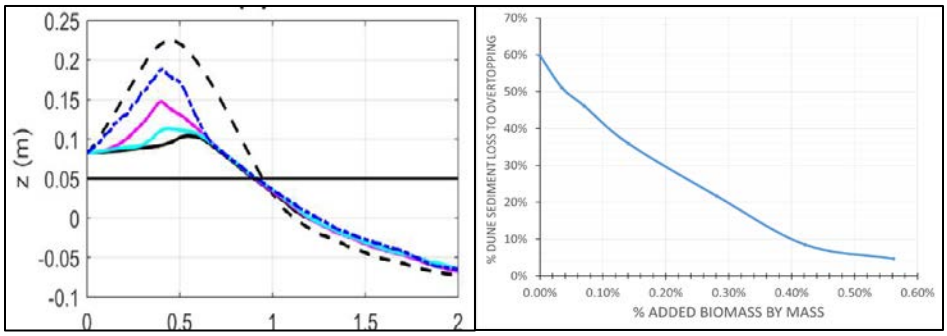
Isolating the effect of vegetation on dune morphology is problematic in the field as hydrodynamic conditions, vegetation species and growth habits, and dune morphology cannot be controlled and replicated. A laboratory setting offers a controlled environment to isolate the response of dune morphology to vegetation by allowing for comparisons to a control case under known, repeatable conditions. The dune morphological change will be quantified by a 1:15 scale model with aboveground and varying amounts of belowground biomass encompassing the range of dune ecology from non-planted to sparse/newly planted to mature vegetation.

Outcomes

Detailed measurements of water surface elevation, overwash (both water and sediment), and dune morphology will be collected with high-precision instrumentation. Products include laboratory measurements of dune profiles with varying degrees of biomass to serve as comprehensive model validation datasets for dune morphological models. This research tasks will provide USACE engineers with quantitative benefits of dune vegetation during erosive events for improved coastal planning.



Picture of the laboratory experiments showing the addition of below and aboveground biomass.



The left figure shows the pre- (dashed black) and post-measured dune profiles with no biomass (black), aboveground (cyan), belowground (pink), and above and belowground biomass (dark blue). The right figure shows the reduction of erosion with the addition of increasing belowground biomass.

More Information

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For more information on FRM R&D, see the ERDC FRM wiki:
https://wiki.erdc.dren.mil/Flood_and_Coastal_Storm_Damage_Reduction_Research_Program