Extended Abstract

Oceanography 2018: Re-establishing sustainable coastal protection by mimicking natural processes - Anne Marie Clements - Anne Clements and Associates Pty Ltd.

Abstract

Coasts worldwide are ravaged by major storms. Planning on exposed coasts requires an understanding of the impacts of previous storm events. The approach taken for storm protection in this project was to re-establish native dune ecosystems with their inherent ability to withstand and recover from storms, rather than to construct a rigid engineered seawall. The May-June 1974 storms on the Australian east coast provided an impact benchmark for the likely "1 in 100-year events" for the Magenta Shores project. The calculated storm bite on previously mined Magenta beach dunes was up to 300m3 of sand per linear meter. Mineral sand mining resulted in highly erodible loose quartz sand, 'stabilized' by the South African Chrysanthemoides monilifera subsp. rotundata (Bitou bush). These highly degraded coastal ecosystems were on irregular landforms with a reduced occurrence of soil binding fungi and associated native host plants. Regular monitoring showed that colonization occurred in stages, with increases in diversity dependent on the ongoing removal of dense bitou seedlings.

The primary colonizing species Spinifex sericeus and development of a fungal network were essential for secondary colonizing species Acacia longifolia subsp. sophorae. Within three years, natural species subject the calmed dune ecosystems. The dune shape depended on establishing the prostrate primary colonizer Spinifex, and maintaining the shape and sand volume was dependent on the sand grain-trapping mechanisms of the fungal hyphae and their host plants. Overall, the project demonstrated the importance of mimicking natural processes??? By allowing windblown sand to form crests and swales parallel to the beach; creating protected fibrous coastal tea-tree windrow microenvironments; burying Spinifex seed heads in the moist sand layer for primary colonization of the renovated dune and establishing primary colonizing native vegetation cover and associated fungal hyphae.

Mimicking natural processes central to progressive creation and maintenance of the reconstructed beach dune ecosystem, as a part of the naturally maintainable advance of Magenta Shores, on the central coast of New South Wales, Australia. The reserved and improved initial dune formed the first line of storm defence. Placement of tough Leptospermum windrows allowed windblown sand to form peaks and swales parallel to the beach. Burial of Spinifex kernel head in the moist sand layer reached primary clearance of the reconstructed dune and advance of a mud fungous hyphae network prior to introduction of secondary inhabiting types. Monitoring threats were used as roosts by birds, promoting re-introduction of native plant species requiring propagation by digestive tract stimulation. Scrub revival compact struggle from weeds, agreeing natural foliage cover to succeed. On-going weeding and monitoring are essential at Magenta Shores until bitou bush is controlled for the entire dimension of beach. The reconstructed dunes provide greater shield from sand movement and storm bite, for built properties, residue

significant vegetation and delicate estuarine ecosystems.

The Magenta Shores golf and tourist development fronts 2.3 km stretch of wind-swept, storm exposed Tuggerah Beach on Australia's east coast. The projected storm bite on this beach during a 1 in 100year storm event is up to 300 m3 of sand per linear metre of beach, based in the 1974 storm event. The sand dunes were naturally dishonoured by former sand-mining, mono culture of Chrysanthemoides monilifera and use as a landfill place. The project expected to rise the natural defence against storm waves and wind erosion. This was completed by re-establishing the natural ecosystems associated to the parallel beach ridge landform, typical of a stable coastal Quaternary sand system. Dune slopes were stripped and re-contoured, natural sand trapping mechanisms placed on crests and onshore winds transported the sand to make foredune crests. The project expected to rise the normal defence against storm waves and wind erosion. This was reached by re-establishing the natural ecosystems related with the parallel beach ridge landform, typical of a stable coastal Quaternary sand system. Dune slopes were exposed and re-contoured, natural sand trapping mechanisms located on tops and aground winds transported the sand to form foredune crests. From the 12month trials on the re-constructed dunes, the most operative method of re-establishing foredune Spinifex sericeous subjected vegetation was the burial of ripe Spinifex seed head in the moist sand layer. This accomplished primary colonisation and expansion of a soil fungal hyphae system prior to introduction of secondary colonising species. Propagation of Spinifex depended on its maturity. Ripe seed coincides with bird assemblies on the beach harvesting ripe seed in late December. Monitoring stakes were used as perch by birds, endorsing re-introduction of natural plant species requiring propagation by digestive tract motivation. Bush regeneration reduced competition from weeds, permitting natural vegetation cover to succeed. The success was accomplished by mimicking the natural processes and was measured by cumulation of sand volume in the dunes and the ability to bear the summer storms. The recreated dunes now offer improved safety from sand movement and storm bite for constructed properties and natural ecosystems.

Sand dunes are common features of shoreline and desert environments. Dunes provide habitat for highly specialized plants and animals, including rare and species. They can protect beaches from erosion and recruit sand to eroded beaches. Dunes are threatened by human activity, both intentional and unintentional. Countries like the us, Australia, Canada, New Zealand, the uk , and Netherlands, operate significant dune protection programs. Stabilizing dunes involves multiple actions. Planting vegetation reduces the impact of wind and water. Wooden sand fences can help retain sand and other material needed for a healthy dune ecosystem. Footpaths protect dunes from damage from foot traffic. They can also protect beaches from erosion and recruit sand to eroded beaches and to several other places too.

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