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Coastal Adaptation Policy Brief

REVISED JANUARY 2018

Dune Restoration

Introduction

California's sand dunes are relatively limited due to its young, tectonically active coastline.[1] However, restoring or rebuilding the persistant and previously existing dune habitats can be a "green" coastal adaptation opportunity, offering protective benefits and ecosystem services that enhance the natural landscape.[2]

Dunes provide a number of ecological and human benefits, including wildlife habitat, recreation, water purification, and beach access.[3] Dunes also act as a coastal barrier to storm surge and flooding and can buffer against rising seas.[4] The sand stored in dunes functions as a reservoir during storm events for beaches that dissipate storm wave energy and protect areas landward of the dune complex.[5]

Dune restoration projects seek to recapture the naturally protective benefits of these systems and reestablish the storm surge buffer that existed prior to the loss or impairment of the dune system. Depending on the location and breadth of existing dune systems, dune restoration may take two forms: rehabilitating eroded or biologically impaired dune systems ("dune rehabilitation"),[6] or artificially constructing a dune system which has been lost entirely either by construction or erosion ("dune rebuilding").[7] Each form has certain methodologies, costs, and benefits.

Tradeoffs

Dune rehabilitation is an engineered process whereby native plant revegetation, non-native plant removal,[8] organic dune thatching, and dune fencing are used to stabilize dunes and propagate enduring dune recovery.[9] California's Department of Parks and Recreation has completed several successful dune rehabilitation projects with the goal of protecting coastal park lands, but they have not yet been applied to protect other properties.[10] Dune rehabilitation is generally less expensive than dune rebuilding. However, it relies on natural processes and a steady supply of accumulated sand; thus, this process may take many years to produce a functioning and protective restored dune system.

Dune rebuilding requires the artificial deposition and formation of sand, either piped in from dredge sites offshore or transported from nearby sand mines.[11] This method can be achieved more quickly than an augmented dune rehabilitation project, but the necessary planning, costs, and resulting environmental impacts from heavy machinery and non-native sediments may prove prohibitive.

Dune restoration efforts face similar hurdles as other engineered strategies in coastal areas. For instance, "coastal squeeze" might make rebuilding dunes impractical, especially in front of coastal private property where limited space exists to adequately restore or rebuild dune systems.

1 Gary Griggs, Introduction to California's Beaches and Coast 249 (2010).

2 California Coastal Commission, Sea Level Rise Policy Guidance 185 (2015), *available at* http://documents.coastal.ca.gov/assets/slr/guidance/August2015/0_Full_Adopted_Sea_Level_Rise_Policy_Guidance.pdf.

3 Peter Alpert, *Coastal Dunes, in* Ecosystems of California, 409, 418 (Harold Mooney & Erika Zavaleta eds., Univ. of Cal. Press 2016) (explaining that "nearly one-third of the city of San Francisco sits atop a Holocene dune system that was once one of the largest in the state.").

4 *Id.*

5 Woods Hole Sea Grant & Cape Cod Cooperative Extension, Coastal Dune Protection & Restoration 1 (2008), *available at* https://www.whoi.edu/fileserver.do?id=87224&pt=2&p=88900.

6 *Dune Construction and Strengthening (2015)*, European Climate Adaptation Platform, http://climate-adapt.eea.europa.eu/metadata/adaptation-options/dune-construction-and-strengthening (last visited Oct. 2, 2017).

7 Woods Hole Sea Grant & Cape Cod Cooperative Extension, *supra* note 5, at 2.

8 *Coastal Dune Habitat Restoration Projects: Why is Dune Restoration Important?*, National Park Service, https://www.nps.gov/pore/learn/management/planning_dunerestoration_importance.htm (last visited Oct. 2, 2017) ("Coastal dunes offer a buffer against storm extreme tides and storm surges. This buffering capacity, however, is minimized and potentially eliminated when dunes are over-stabilized by invasive plant species or other alterations. Over-stabilization makes dunes more susceptible to loss from erosion by not enabling them to move or migrate naturally in response to sea level rise and changes in erosional patterns.").

9 *Dune Construction and Strengthening (2015), supra* note 6.

10 Molly Loughney Melius and Margaret R. Caldwell, California Coastal Armoring Report: Managing Coastal Armoring and Climate Change Adaptation in the 21st Century 12 (2015).

11 Woods Hole Sea Grant & Cape Cod Cooperative Extension, *supra* note 5, at 3.

Legal Considerations

Dune restoration projects require a coastal development permit (CDP) under the California Coastal Act.[12] Depending on the location of the project, the proximity of state-owned public trust lands, and the existence of a certified Local Coastal Program (LCP), either the California Coastal Commission or a delegated local government authority will be the responsible permitting authority for the CDP process.[13] To be issued a CDP, a dune restoration project must be consistent with the policies of the jurisdiction's LCP, the Coastal Act, and any conditions imposed by the permitting authority.[14] Additionally, given the rarity of intact California coastal dune systems and the reduced occurrence of the flora and fauna they support, dune restoration projects are likely to trigger the environmentally sensitive habitat area requirements under the Coastal Act[15] or the consistency requirements of the California Environmental Quality Act.[16]

A dune restoration project would also likely require federal U.S. Army Corps of Engineers permits. For instance, a permit would be required for dune restoration projects that involve filling navigable waters or other waters of the United States.[17] Further permits might also be required, depending on where the dune material is sourced.[18] Dune restoration projects on California state lands would be subject to any additional requirements from California's State Lands Commission (SLC) under their authority as land owner. Additionally, the SLC would require a lease agreement for dune restoration projects on state lands.[19]

Examples

Many of the major cities in California have lost their protective dunes, and therefore, the protective benefits of coastal dunes on their seaward boundary. To date, there have been several notable dune restoration projects in Northern California.[20] The success of future restoration projects will likely be affected by a changing climate and rising sea levels.

The Lanphere Dunes in Humboldt County is the first dune restoration project on the Pacific coast—dating back to the early 1980s. This project has become a template for restoration best practices with a focus on not just biotic and abiotic components, but also in supporting the underlying processes sustaining the dunes.[21] Monitoring efforts have shown that the first restoration projects have replenished the dunes to a health that matches that of neighboring systems.[22] Additionally, Return of the Natives, the U.S. Fish and Wildlife Service, and California State Parks have partnered together to complete a new dune restoration project at Monterey State Beach.[23]

Researchers

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12 *See* Cal. Pub. Res. Code §§ 30600-01.

13 Cal. Pub. Res. Code §§ 30600-01. For more information, *see* https://www.coastal.ca.gov/cdp/cdp-forms.html.

14 *See* Cal. Pub. Res. Code §§ 30200-65.5.

15 Cal. Pub. Res. Code § 30240(a).

16 Cal. Pub. Res. Code § 21080.5(d)(2)(A).

17 33 U.S.C. § 1344.

18 Sand can be sourced from mined sites or offshore sits. *See, e.g.*, WRA Environmental Consultants Conceptual Foredune Creation and Enhancement Plan 11-12 (2013), *available at* http://www.slc.ca.gov/Info/Reports/Broad_Beach/Appendix/C-1.pdf.

19 *See, e.g.*, State Lands Commission, General Lease – Beach Replenishment and Protective Structure Use, *available at* http://archives.slc.ca.gov/Meeting_Summaries/2016_Documents/08-09-16/Items_and_Exhibits/56.pdf.

20 Alpert, *supra* note 3, at 423.

21 *Dune Restoration*, U.S. Fish & Wildlife Service, https://www.fws.gov/refuge/Humboldt_Bay/wildlife_and_habitat/DunesRestoration.html (last visited Oct. 2, 2017).

22 *Id.*

23 *Coastal Dune Restoration*, California State University Monterey Bay, https://csumb.edu/ron/coastal-dune-restoration (last visited Oct. 2, 2017).

This research was completed in collaboration with Stanford Law School and the Natural Capital Project with support by the Stanford Woods Institute for the Environment through the Realizing Environmental Innovation Program.