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The Use of Heavy Machinery (Excavators) to Remove *Ammophila arenaria* (European beachgrass) from Native Sand Dunes at Point Reyes National Seashore

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Heavy machinery was used to remove 4 acres (1.6 hectares) of *Ammophila arenaria* (European beachgrass) at Abbott's Lagoon, Point Reyes National Seashore in February 2004. The process took 4 weeks and now, six months since removal, the results are very encouraging. This write-up will outline the history of *Ammophila arenaria* at Abbott's Lagoon, project preparation, removal method, removal results, and thoughts for the future.

Background

Functioning native coastal sand dune ecosystems are very rare in California. Point Reyes National Seashore is home to one of the last large, relatively intact dune ecosystems on the West Coast. Many listed species depend on functioning dune ecosystem for their survival including: the threatened Western snowy plover, the endangered Myrtle Silverspot butterfly, and the endangered plants *Layia carnosa and Lupinus tidestromii*. The purpose of this project is to restore coastal dune habitat for these species and restore natural dune processes.

The nonnative plant *Ammophila arenaria* has invaded significant portions of high quality coastal dune habitat all along the Pacific Coast, including over 800 acres at Point Reyes National Seashore. The perennial plant's dense stands can be over 1 meter tall and rhizomes can extend over 2.5 meters down; *Ammophila* sp. spreads primarily by rhizome. *Ammophila* sp., in addition to out-competing native species, builds an unnaturally high, stable foredune at the front of the beach. This "sea wall" of *Ammophila* sp. prevents animals such as the Western Snowy Plover from nesting in all but a narrow, exposed strip of sand along the beachfront and prevents natural sand movement.

The 4-acre project site rests on a strip of dunes that separates the ocean from Abbott's Lagoon. The location of the removal was chosen because it would allow plovers to access the back dunes and beachgrass cover was nearly 100%.

Mechanical methods were used because of the dense nature of *Ammophila* sp., the lack of native plants, and the fact that hand removal methods have resulted in aggressive re-sprouting of beachgrass rhizomes. Using the hand removal method, roots and rhizomes of *Ammophila* sp. are dug to a depth of 1/2 to 1m deep. All plant material is carefully raked up and piled for composting. Re-sprouts, resulting from rhizomes that remain in the sand, must be removed 15 to over 20 times before complete removal is accomplished.

Project Preparation

Several compliance documents were prepared prior to the project beginning. These documents covered issues such as: California Coastal Commission notification, US Fish and Wildlife Service concurrence, and the park's internal Project Review (which included and exercise concerning mechanical tools in a wilderness area and archeological inspection of the site).

Prior to beginning the project background data that was gathered. This included a survey of all rare and native pants in the project area and surrounding areas. Two elevation transects were set up to determine the actual topographic change following removal. These transects ran across the project from the ocean to the lagoon with the elevation recorded every 3 meters. The intention is to monitor elevation changes due to actual removal and blowing sand movement following removal. Permanent photo-monitoring sites were established throughout the project site.

Removal Methods

Two excavators of 13 and 21 metric tons each were used. Each excavator was equipped with a four-foot bucket and thumb. The machine operators were two employees of PORE's roads and trails department; we paid their salaries for four weeks. The remoteness of the work site posed re-fueling logistic challenges. The machines could run for about 15 hours on a tank of gas (or about 2 days). An emergency spill kit was kept on site in case of a blown hydraulic line.

The actual burial of the beachgrass was a four-step process.

1. First an area of approximately 4 meters x 5 meters x 1-2 meter deep was cleared of *Ammophila* sp. Care was taken to dig deep and remove all the rhizomes and roots. This *Ammophila* sp. and "dirty sand" was piled on top of adjacent mature *Ammophila* sp.
2. Second the clean sand beneath was dug out and stockpiled in an adjacent clean sand area. In doing this, the pit was dug as deep as possible, 3+ meters deep. Final excavated pit size is usually about 4m x 5m x 3m deep (swimming pool size).
3. Third the large pit was filled with the recently removed *Ammophila* sp., the *Ammophila* sp. beneath, and all the dirty sand. The hole was filled to within about 1-1.5 meters of the surrounding elevation.

	2 months later	4 months later	6 months later
deep mech. removal	0.3 (95%C.I.=0.25)	0.7 (95%C.I.=0.58)	0.7 (95%C.I.=0.5)
shallow mech. removal	15 (95%C.I.=6.25)	6.8 (95%C.I.=2.76)	10.5 (95%C.I.=3.7)
hand removal	31.6 (95%C.I.=14.7)	35.6 (95%C.I.=14.8)	31.5 (95%C.I.=11.7)