



U.S. Fish and Wildlife Service

Humboldt Bay National Wildlife Refuge
Humboldt County, California

Ma-le'i Dunes Restoration Photodocumentation



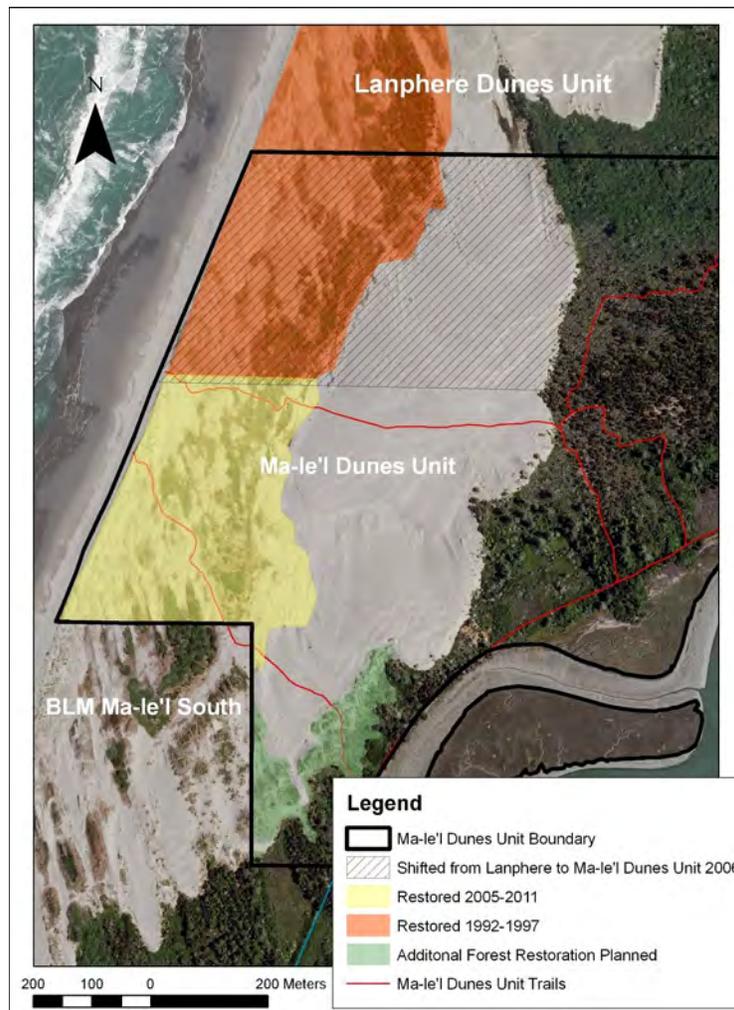
June 2017

Humboldt Bay National Wildlife Refuge
6800 Lanphere Rd.
Arcata, CA 95521

Introduction

The Ma-le'i Dunes Unit of Humboldt Bay National Wildlife Refuge consists of two parcels with different restoration histories. The northern 100 acres of land were purchased when the Lanphere Dunes were still owned and managed by The Nature Conservancy. This northern parcel was restored concurrent with the rest of the Lanphere Dunes Unit between 1992 and 1997 (for information and photographic time series on that project see separate report). The southern 160 acres was acquired by the U.S. Fish and Wildlife Service in 2005. Between 2005 and 2011 European beachgrass, yellow bush lupine, pampas grass, iceplant, and other invasive plants were removed from the foredune zone and deflation plain of the site. English ivy, cotoneaster, English holly and other forest invasives were cleared from the forest. Native dunegrass was planted along the foredune in 2009 through 2011.

Major restoration activities were completed in 2011. Follow-up is ongoing to remove any remaining resprouting or newly dispersed beachgrass and iceplant as well as recruits of annual grasses and yellow bush lupine from the seedbank. The photographic time series presented here illustrates the results of restoration to date.



Photopoint 2 (179)



View of the foredune taken from just behind the crest looking south (BLM lands in distance). Cover is primarily European beachgrass, with some coyote brush.



Six years after removal began, the foredune crest has flattened out. Some native species have volunteered, but the area is still fairly open with abundant sand movement.

Photopoint 2 (179)



The area has vegetated considerably in three years, with a blowout forming through the middle ground. American dunegrass was planted in 2009-11 and is visible in on the right in background.



The blowout is still active, while other areas have increased in vegetation cover. Foredune height has increased in places with greater topographic variation overall.

Photopoint 3 (175)



Crest of the foredune, which is densely vegetated by European beachgrass.



Sand transport has increased since beachgrass was removed. American dunegrass planted in 2009 has become established among volunteering dune mat species, especially yellow sand-verbena.

Photopoint 3 (175)

2014



Additional planting of American dunegrass was carried out in 2011, and this species is now dominant on the foredune. An incipient foredune has formed seaward of the established foredune and is vegetated by American dunegrass and yellow sand-verbena.

2017



Cover has increased in places, and species composition of non-grasses has shifted from yellow sand-verbena to the later successional beach buckwheat. The incipient foredune was partially eroded in the preceding two winters, but has increased in height.

Photopoint 3 (12)

2005



View north of the established foredune, densely vegetated with European beachgrass.

2011



Following European beachgrass removal, sand mobility has increased and vegetation is dominated by early successional yellow sand-verbena except in areas where American dunegrass was planted in 2009.

Photopoint 3 (12)



Additional planting of American dunegrass was carried out in 2011 and it is now the dominant species on the foredune. An incipient foredune has formed seaward of the established foredune.



Conditions are similar to 2014, however, the incipient foredune was partially eroded in the preceding two winters, and the foredune crest has increased in elevation.

Photopoint 4 (194)

2005



View of the backdunes looking southeast. Dune mat is dominated by dune goldenrod, and European beachgrass has encroached in the right rear-ground.

2011



European beachgrass in rear-ground has been replaced by dune mat. Overall, cover of early successional beach pea increased.

Photopoint 4 (194)

2014



2017



Little change occurred in this backdune area in the six year since the 2011 photograph.

Photopoint 7 (86)

2005



European beachgrass colonizing the transgressive dunefield has created peaked hummocks east of the deflation plain.

2011



The hummocks are lower and now colonized by beach strawberry. Willows have grown in cover and stature in the wetland. The forest in the background is being covered by the transgressive dunes, causing trees to die.

Photopoint 7 (86)

2014



2017



There is little change between 2011 and 2017, other than the appearance of pines in the wetland.

Photopoint 13 (352)

2005



In this pre-restoration photograph of the backdunes and deflation plain, European beachgrass has invaded in the right foreground and yellow bush lupine is present in the swale.

2011



By 2011, dune mat (dominated by dune goldenrod and beach strawberry) had replaced European beachgrass. The swale is less weedy after duff and lupine removal.

Photopoint 13 (352)

2014



2016



Between 2011 and 2017 a public use trail was established. The swale has succeeded to a greater percentage of woody vegetation and dune mat cover is increasing.

Photopoint 17 (311)



European beachgrass was invading this area of the backdune, and can be seen on the foredune in the background



Dune mat now covers the dune ridges. New sand movement is occurring in the lee of the fore-dune with some slipface development. The swale in the foreground has expanded as stabilizing beachgrass was removed.

Photopoint 17 (311)



Dune mat cover has continued to gradually increase. The rear swale has succeeded to a greater degree of woody vegetation. The lee of the foredune has gradually increased in stability and slipfaces are no longer present.

Photopoint 17 (347)



Beachgrass, lupine, and coyote brush invading dune ridges in the middleground, with some European beachgrass visible in the background on the foredune.



Dune mat species have colonized the ridges in the middle ground, while the lee of the foredune is mostly still moving sand.

Photopoint 17 (347)

2014



2016



Change since 2011 is subtle, with gradually increasing dune mat cover in middle ground, and the open sand areas in the lee of the foredune shrinking.

Photopoint 19 (6)



An area where European beachgrass built an outer foredune, and the inner foredune retains some native dune mat.



In the year following beachgrass removal, native beach sagewort is increasing on the inner foredune, while the outer foredune, with little cover is less peaked and is becoming less pronounced as a distinct feature.

Photopoint 19 (6)



The outer foredune has lost elevation and the foredunes are no longer distinct. American dunegrass planted on the foredune in 2009 is spreading, and sand is now being transported to the lee of the inner foredune.



Native cover has continued to increase.

Photopoint 20 (8)



The foredune in the background is completely covered with European beachgrass, which is now invading the interior dune ridges.



Sand mobilized in the foredune at left is migrating inland. Native dune mat now covers the interior ridges.

Photopoint 20 (8)

2014



2016



The slipfaces in the background have now stabilized.

Photopoint 26

2004



View from a high ridge showing European beachgrass, yellow bush lupine, and coyote brush covering dune ridges and hummocks in the deflation plain.

2011



The deflation plain wetlands have expanded with the removal of beachgrass, and willows are colonizing. The dune ridges now support dune mat. There are now active slipfaces in the center of the foredune area (right background).

Photopoint 26



There is little change since 2011. The slipface on the left has continued to migrate. Willows and now pines are increasing in cover in the wetlands.