FINAL ENVIRONMENTAL ASSESSMENT

Humboldt Bay National Wildlife Refuge

Sea-Level Rise Adaptation Demonstration Project

June 2015

I. PURPOSE AND NEED FOR ACTION

Proposed Action: We propose the removal of European beachgrass (*Ammophila arenaria*) and iceplant (*Carpobrotus edulis* x *C. chilense*) from the foredunes of the Bair parcel on Humboldt Bay National Wildlife Refuge ("the Refuge") followed by revegetation with native species. The proposed removal of invasive non-native plant species and the subsequent reintroduction of native plant species is a demonstration sea level rise adaptation project that will test the premise, based on three years of monitoring at the Refuge, that the replacement of European beachgrass by particular configurations of native species (i.e. species composition and topographic position) will facilitate the natural migration of the foredune inland and upward in elevation as sea level rises. Figure 1 shows the location of the Bair parcel.

The Proposed Action tiers from the 2009 Humboldt Bay NWR Complex Comprehensive Conservation Plan/Final Environmental Assessment and the 2015 minor amendment to the CCP which are incorporated by reference. The Proposed Action is consistent with Goal 2 "Conserve and restore globally rare dune and dune forest habitats, and support recovery of threatened, endangered and endemic species," Objective 2.1 " Within 5 years, restore the Ma-le'l Dunes and Table Bluff units dune mat/foredune grassland habitat; Over 15 years, create ongoing experimental dune blow-outs in late successional, low diversity dune mat (to mimic natural disturbances), and assess impacts on existing habitat and special status plants on the Lanphere Dunes Unit." The Proposed Action is also consistent with Goal 3 "Conserve and restore all refuge habitats through prevention and control of invasive plants and animals," Objective 3.2 "Control and reduce the spread of established invasive species populations in refuge habitats," Strategy 3.2.8 "Assess dune swale invasive plants and implement large scale experiments as appropriate." The Proposed Action is in accordance with the Recovery Plan for the Menzies' wallflower and beach layia (USFWS 1998) which calls for additional restoration of *Ammophila*-dominated dunes to native dune mat. The Proposed Action is consistent with the Humboldt Bay Area Plan of the Humboldt County Local Coastal Program (Humboldt County 2014). The Humboldt County LCP was effectively certified by the Coastal Commission in 1986 and has policies to protect Environmentally Sensitive Habitat Areas including dune habitats. The LCP was amended in 1993 to incorporate the Beach and Dunes Management Plan (Humboldt County 1993). The California Environmental Quality Act (CEQA) checklist included as Attachment A has been completed for compliance with CEQA, should an agency of the State of California undertake the proposed action as its project.

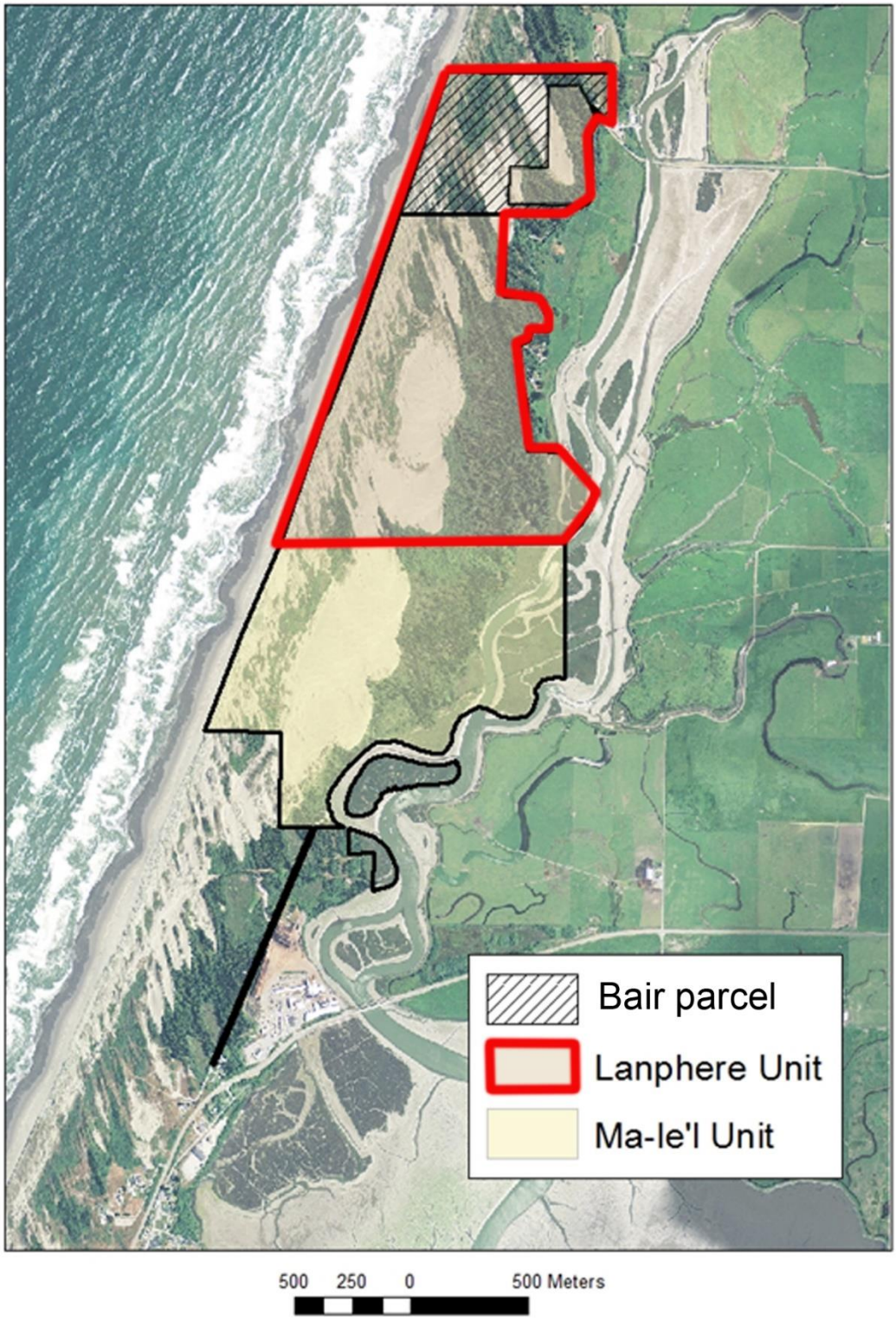


Figure 5. Location of the Bair parcel of the Lanphere Dunes Unit, Humboldt Bay National Wildlife Refuge.

The demonstration sea level rise adaptation site is based on three years of monitoring conducted at the Lanphere and Ma-le'l Dunes Units of the Refuge, which showed that European beachgrass trapped most of the sand blowing off of the beach on the lower, seaward slope of the foredune, rather than allowing sand to flow over the foredune and into the semi-stable dunes behind it. In contrast, native dune mat allowed sand to be transported up the face of the foredune and over the crest (Pickart 2014a). This monitoring and other studies (Christiansen and Davidson-Arnott 2004, Davidson-Arnott 2005) support that this inland flow of sand is a necessary condition for the foredune to migrate up in elevation as it moves inland in response to sea level rise, a process known as translation. Without it, as the erosion accompanying sea level rise occurs, the foredune may be at risk of eroding away instead of translating inland and upward, removing the buffering role it plays in the dune system.

Decision to be Made: The U.S. Fish and Wildlife Service (Service) will use the Environmental Assessment (EA) as a basis for determining whether the Proposed Action constitutes a major Federal action significantly affecting the quality of the human environment or would result in a finding of No Significant Impact.

Issue Identification:

The Service has internally and through continued coordination with the public since the completion of the 2009 Humboldt Bay NWR Complex CCP/EA, identified the following potential issues with respect to the Proposed Action:

1) Presence of the threatened Western Snowy Plover.
2) Presence of the endangered Menzies' wallflower and beach layia.
3) Presence of sensitive archeological resources.
4) Destabilization of the foredune and loss of foredune buffering capacity.
5) Loss of wetlands due to foredune destabilization.

II. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

No Action: Under the No Action alternative, the foredune would remain vegetated with invasive European beachgrass and iceplant.

Proposed Action: In summer 2015, up to 1.6 ha (4 acres) of European beachgrass would be removed by California Conservation Corps crews under the supervision of a Refuge biologist or contractor (see Fig. 2). The Proposed Action may be phased, with up to 0.8 ha (2 acres) removed in 2015 and the remaining area to be removed at a subsequent date. Prior to removal, a Refuge biologist would flag any individuals of endangered Menzies' wallflower within or surrounding the impact area (including access routes) and would erect sand barriers if needed so that no disturbance of these plants occurs. Endangered beach layia would have completed seed dispersal by this time. Removal would be accomplished by individuals using shovels to detach rhizomes while the top of the plant is pulled and piled. Plant material would either be burned in piles or transported by ATV on the beach to an off-site composting area. All necessary burn permits would be obtained and burning would not occur on a "no-

burn" day. The local Fire District would be informed, and notices would be published in the local newsletter or websites of adjacent communities.

Plants begin to resprout from remaining rhizomes quickly during the growing season, and crews would return to dig resprouts weekly to every other week. Past research has shown that plants can be completely killed in one growing season if retreatment is frequent enough, by depleting stored carbohydrates while restricting photosynthesis. However we would plan for continued treatment the second year as needed.

Any iceplant encountered within the project area would also be removed. The standard protocol for iceplant removal is to pull up plants, removing as much of the rhizomes as possible. Most plants would not be completely killed by this first treatment, and any new shoots with attached rhizomes would be pulled as needed. Retreatment would be continued beyond the scope of this project by Refuge staff until all iceplant is dead. Iceplant that is removed would be bagged and transported by ATV on the wave slope, and taken to a composting facility.

In summer 2015 seeds of the following dune mat species would be collected: dune goldenrod (*Solidago spathulata*) (1,060), beach pea (*Lathyrus littoralis*) (425), beach morning glory (*Calystegia soldanella*) (212), beach buckwheat (*Erigonum latifolium*) (8,500), beach evening primrose (*Camissonia cheiranthifolia*) (2100), yellow sand-verbena (*Abronia latifolia*) (1275), beach bur (*Ambrosia chamissonis*) (1,060). The choice of species, proportion and density of seeds collected and planted is based on past experimentation (Pickart and Sawyer 1998), including what is known about germination rates, suitability of species for an early successional environment, and cost. Seeds would be collected by trained refuge staff from areas dispersed throughout parts of the refuge where no Menzies' wallflowers occur. No more than 10% of the seed produced by an individual plant would be taken, and harvested plants would be a minimum of 3 m apart. Seeds would be stored in a dry cool area until the fall rainy season begins. At that time, beach morning glory and beach bur seeds would be scarified by hand using sand paper. Seeds would be sown on the surface with light raking of sand to cover them. Seeding would occur in designated dune mat areas, around transplanted divisions, as needed to balance species composition.

Once the rainy season begins, and before seeding, 775 rooted divisions or cuttings of the following species would be collected: dune goldenrod, beach buckwheat, seaside daisy (*Erigeron glaucus*), beach strawberry (*Fragaria chiloensis*), and beach bluegrass. Plants would be put in the ground the same day they are harvested by using two crews and an ATV to transport between them. In a separate stage, 7,600 culms (stems) of sea lyme grass (*Elymus mollis*) would be collected from existing, dense populations on the Lanphere Dunes Unit. Plants would be heeled in on site if not planted the same day. For all species, planting would be done by opening a small hole with a spade (narrow-bladed planting shovel), inserting the stem, roots, or rhizomed part of the plant, and closing and tamping the hole. For sea lyme grass only, two culms are planted in each hole, and leaves are trimmed to promote rhizome growth. All planting would be done after a pattern of seasonal rainfall is established.

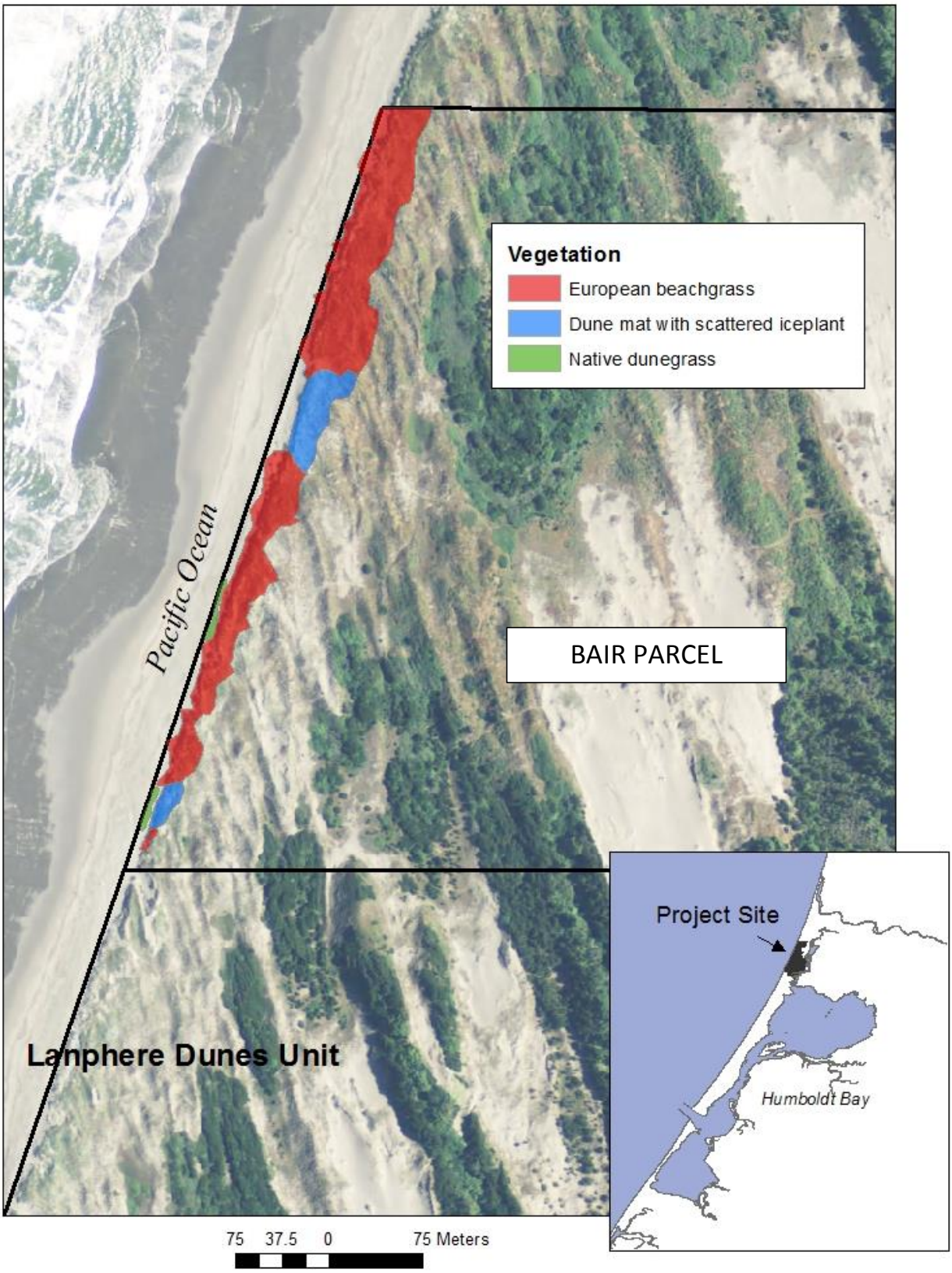


Figure 2. Map showing European beachgrass at the site of the Proposed Action.

The project area would be divided into approximately 50-m long segments (Fig. 3), and European beachgrass would be removed from six of the eight segments (with the remaining two segments held as a control). The remaining three segments in each of the two areas would be planted with: 1) Sea lyme grass on crest, 2) A mixture of sea lyme grass and dune mat on crest, and 3) dune mat on crest (Fig. 3). This planting pattern is designed to compare response of the foredune with respect to two variables: sand transport and accumulation. The morphology of the invaded foredune is controlled by European beachgrass cover, which causes over-steepening (McDonald 2014). We would monitor the ability of the different planting combinations to return the foredune to a more typical profile, and to measure the volume of sand that accumulates at different topographic positions, including moving beyond the crest. Topographic monitoring would be carried out seasonally using terrestrial LiDAR. Vegetation monitoring would utilize hybrid point intercept/quadrat sampling and would be carried out annually (at a minimum) to measure vegetation composition and cover.

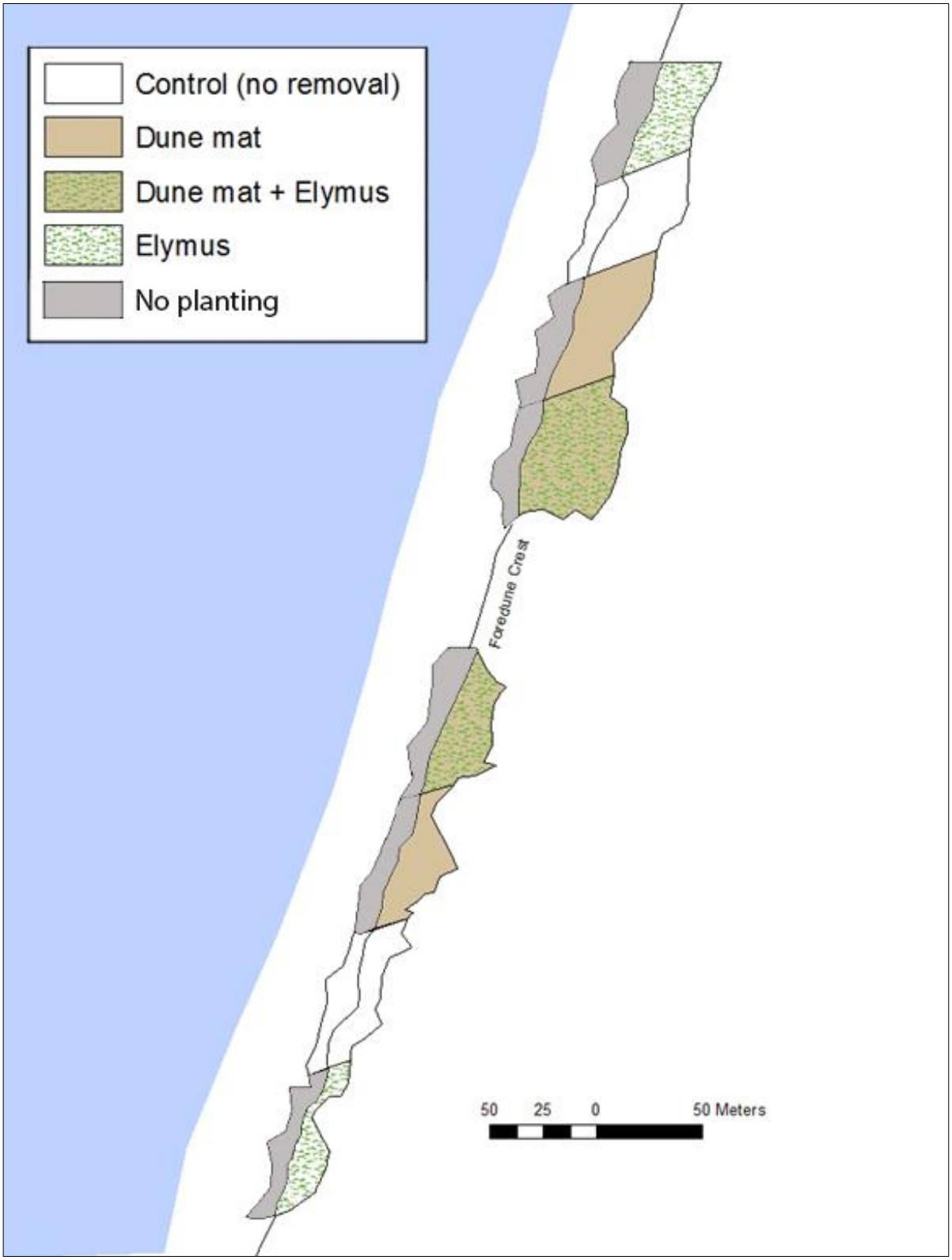


Figure 3. Aerial view showing different planting treatments after European beachgrass removal (and the no-removal control areas) under the Proposed Action.

III. AFFECTED ENVIRONMENT

A full description of the affected environment can be found in the 2009 Humboldt Bay NWR Complex CCP/EA. A site-specific description of the affected environment on the Bair Addition is provided below.

Biological Environment –

The existing condition of the site is a foredune backed by an abandoned foredune, both dominated by European beachgrass (Fig. 4). The outer, seaward-facing foredune was built by European beachgrass, and its morphology and vegetation differ from the abandoned foredune behind it where European beachgrass invaded a past foredune built by native species. In the latter case, relict native plants are mixed with the European beachgrass and would provide a jump start for revegetation. There is only one small area of sea lyme grass. The second foredune built by European beachgrass is a result of progradation that occurred along the upper North Spit since the 1960s, and the native foredune to the south prograded an equal amount. The upper beach is vegetated sparsely with sea rocket (*Cakile maritima* and *C. edentula*), both non-native, non-invasive species common along the Pacific coast.

Studies have shown that both vascular and nonvascular plant diversity is reduced in invaded areas (Breckon and Barbour 1974, Glavich 2000, Pickart and Barbour 2007). European beachgrass invasion has also been shown to reduce arthropod abundance and diversity compared with native foredunes at the Lanphere Dunes and other sites (Doudna and Connor 2012). Some small mammals (primarily rodents) were found to occur at greater densities and higher diversity in European beachgrass-dominated dunes compared with native vegetation due to the higher protective cover (Thompson et al. 2000), however all of these rodent species are common.

Native foredunes in the vicinity are vegetated by two intermixing vegetation alliances, "Sea lyme grass patches" (*Elymus mollis* herbaceous alliance) and "Dune mat" (*Abronia latifolia-Ambrosia chamissonis* herbaceous alliance) (Sawyer et al. 2009). The dune mat community is very diverse, and supports both special status and endangered plants. Cover is variable but typically low, allowing for sand movement during high winds, which causes localized plant mortality and reduces direct interspecific competition, promoting diversity (Pickart and Sawyer 1998). Most herbaceous dune plants have arbuscular mycorrhizae (Rose 1988), the symbiotic association of fungal mycelium with the roots of plants, which allows the plants to exploit nutrients (especially phosphorus, which aids in drought resistance). Since mycorrhizal spores are present in the soil after European beachgrass removal, there is no need to introduce them for revegetation. There are many other microorganisms that play a role in the dune ecosystem, such as endophytic fungi on both European beachgrass and sea lyme grass (Park et al. 2005). Although these complex relationships are not fully understood, past projects have demonstrated that native plant communities are easily restored on foredunes where European beachgrass has been removed (Pickart 2013, Wheeler 2014).

Figure 4. European beachgrass on the foredune at the site of the Proposed Action (a) view from crest of abandoned foredune, showing double foredune, and (b) view from upper beach.

The area behind the European beachgrass-dominated active and abandoned foredunes at the site of the Proposed Action is vegetated by native Dune mat mixed with invasive iceplant at the south end, and by invasive "Yellow bush lupine scrub" (*Lupinus arboreus* seminatural scrub alliance) to the north (Fig. 5). Lupine is removed annually from the southern dune mat area.

Wetlands-

Seasonal freshwater wetlands (swales) occur to the east of the Proposed Action, but not on the site itself (Fig. 6). Swales form when deflation occurring behind active moving dunes intersects the freshwater table. This occurs in a zone of the dunes called the "deflation plain." Deflation plains develop in dune systems that include "transgressive" moving dunes. The dunes in the vicinity of the Proposed Action include large transgressive, parabolic dunes that are still actively migrating. These mobile dunes are not currently fed by any sand blowing in from the beach or foredune. They originated more than 100 years ago (most likely as a result of the 1700 megaquake along the Cascadia subduction zone) and are now migrating independently of the dune processes seaward of them. In the deflation plain, the open sand surface is lowered during peak summer winds when the water table is low. Once the summer water table is reached, the moist sand cannot move and the swale stabilizes. In winter, the water table rises and can cause ponding or saturation. Wetland species colonize, beginning with herbaceous species such as slough sedge (*Carex obupta*) and eventually woody species including Hooker's willow (*Salix hookeriana*) and/or beach pine (*Pinus contorta*). The swales to the east of the Proposed Action are dominated by woody vegetation.

Federal and California Endangered, Threatened and Special Status Species-

Two surveys of the project area and a 2-meter buffer to the east was undertaken, one February 2015 and a second in March 2015, to locate any occurrences of federal and state threatened, endangered, and special status plant species. Individuals of federal and state-listed Menzies' wallflower and beach layia were found only in the transition area at the *Ammophila*/dune mat edge of the southern stand of European beachgrass. Both endangered plants are found behind the foredune area that is to be restored. Although known to occur in undisturbed dune mat on the adjacent Lanphere Dunes Unit, no occurrences of the California Special Status Species dark-eyed gilia (*Gilia millefoliata*) and American glehnia (*Glehnia littoralis* ssp. *leiocarpa*) were found. The survey occurred during the blooming period of all but American glehnia, which is a perennial and would be in a vegetative state.

The Western Snowy Plover has not been known to nest on the Lanphere and Ma-le'l Dunes based on surveys that are carried out under the direction of the U.S. Fish and Wildlife Service (unpublished data). The lack of nesting may be due to the narrowness of the beach and the relatively steep foredune; plovers generally nest in areas with wide beaches that have sparse vegetation (U.S. Fish and Wildlife Service 2007). No critical habitat has been designated in or near the site of the Proposed Action (DOI 2012).

Figure 5. The southern area of European beachgrass (A, top) which is backed by Dune mat mixed with iceplant, and the northern area (B above) showing that dune mat has been invaded by yellow bush lupine. Although there is no lupine present in the photo, the vegetation is dense, and includes coyote brush (*Baccharis pilularis*), a shrub that does not normally occur in Dune mat.

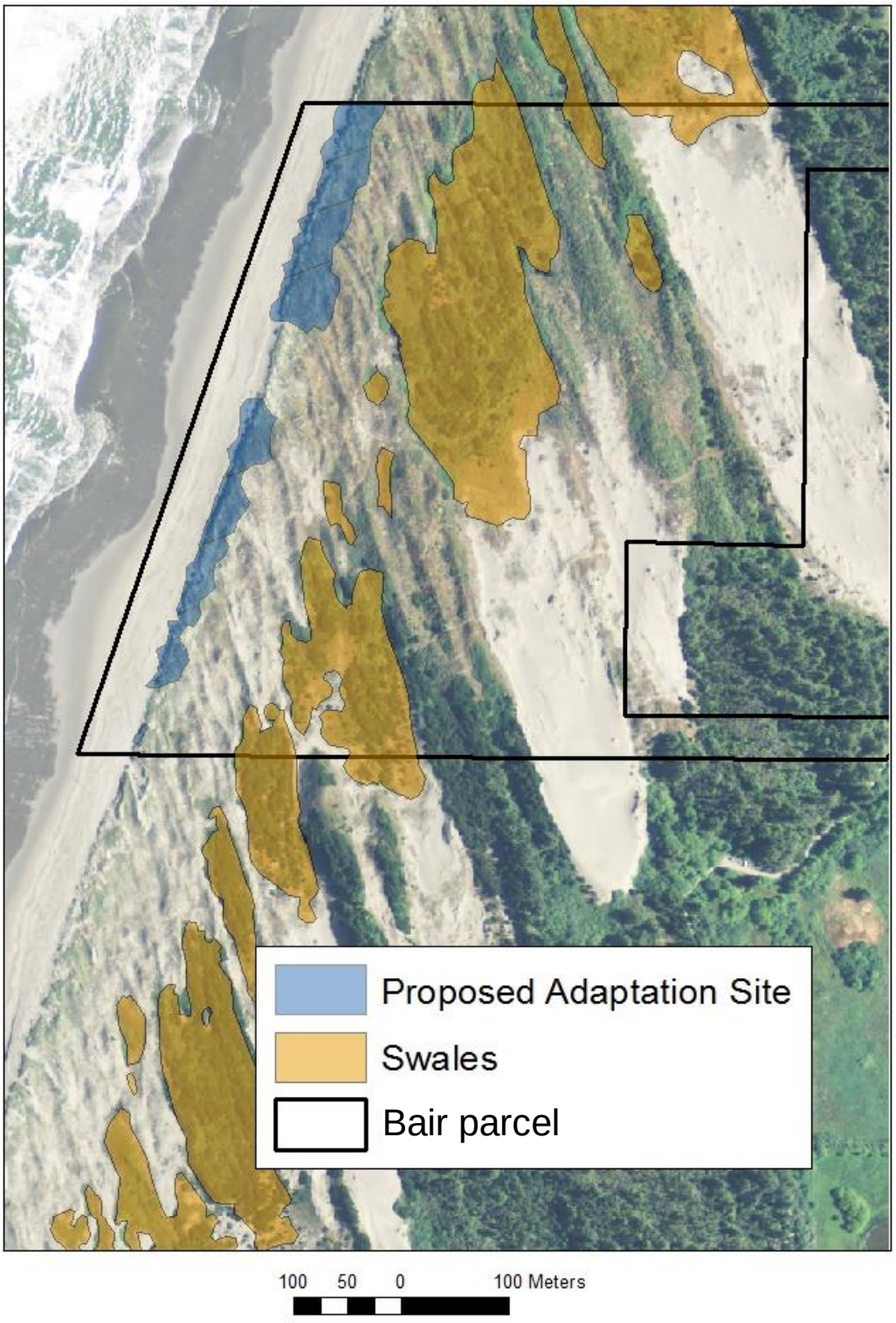


Figure 6. Map showing location of swales (seasonal wetlands) with respect to the Proposed Action.

Cultural Resources –

Humboldt Bay is the ancestral heartland of the Wiyot Indians. There are hundreds of known and undiscovered historic and prehistoric archeological sites around Humboldt Bay. The Wiyot people carried out implement making and food preparation in the dunes and numerous middens have been documented in the deflation plains of the Lanphere Dunes. Wiyot people continue to gather plants in the region. The dunes are considered of high cultural significance to the Tribes. All but 0.36 ac on the eastern edge of the patch of European beachgrass to be removed is located on a foredune that has prograded (extended westward) since the 1960s (Fig. 7). Thus, the potential for culturally significant artifacts to be present is low.

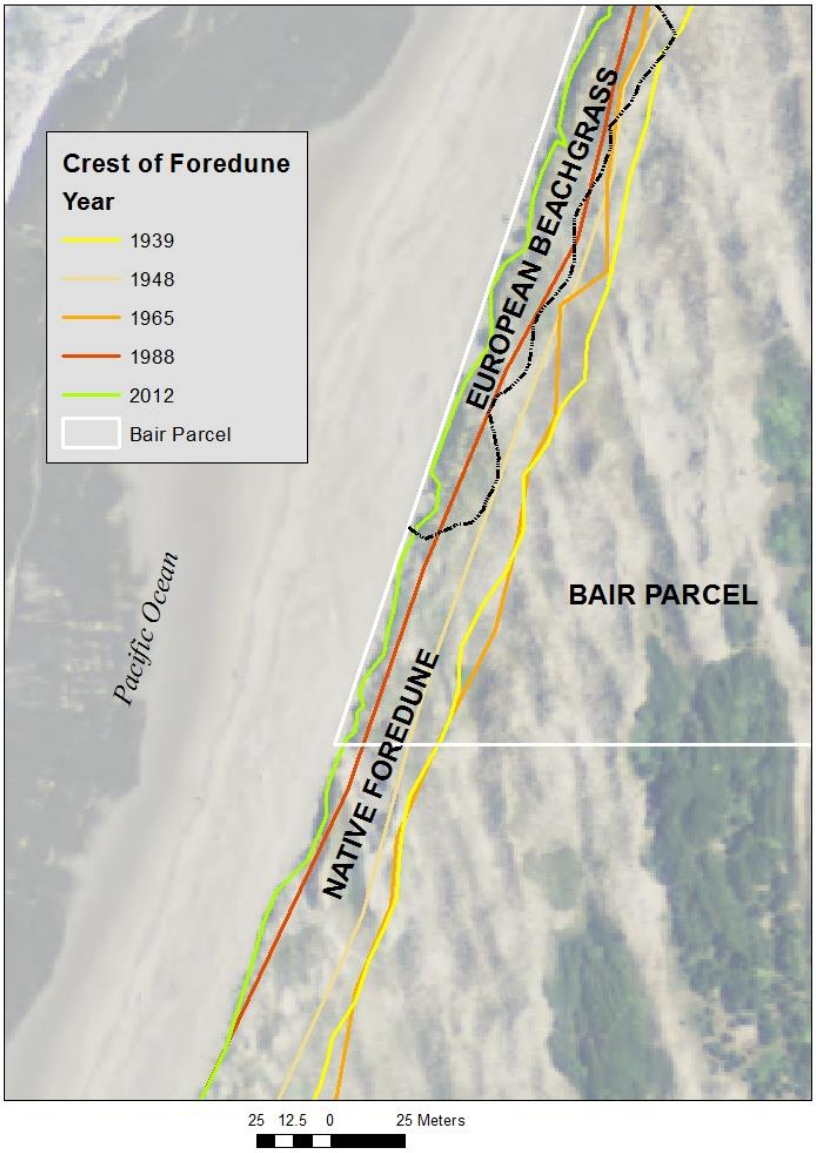


Figure 7. Location of foredune crest as it prograded between 1939 and 1988 with relation to present day European beachgrass (to the north) and native dune mat (to the south).

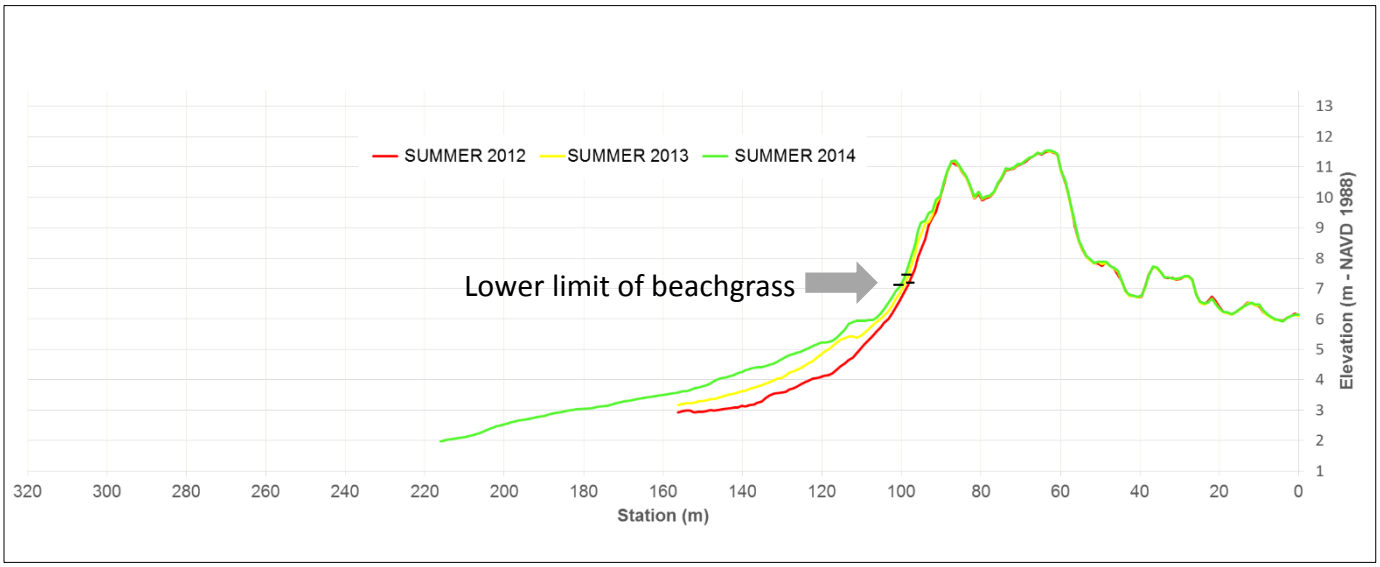
Physical Environment—

Figure 8 shows two topographic profiles taken from and fairly typical of the project area that illustrates the relatively steep profile and double foredune which indicates overstabilization. Seasonal and annual changes from Jan. 2012 through Jan. 2015 are depicted in different colors. During the period of observation, the foredune has been building seaward, at its base and on its seaward face, at the same time that elevation of the beach has increased. This trend reflects the lack of major storm activity during the period of monitoring. Major erosional events, causing vertical cliffing of the foredune, typically occur in significant El Niño or, to a lesser extent, La Niña years (Pickart 2014b). When cliffing occurs, the beach is scoured down in elevation. Sand cannot be transported to the crest of the foredune until a "ramp" forms over a period of months or sometimes years, by the combination of windblown sand moving up the seaward face as well as sloughing off the vertical, cliffed face itself (Christiansen and Davidson-Arnott 2004). Figure 9 shows topographic profiles taken near the project area in native foredunes at the Lanphere Dunes Unit. A distinct difference in morphology is evident when compared the European beachgrass – dominated foredunes. The native foredunes are composed of a single, broader, higher, more gradually sloping ridge. Sand accumulation over the same time period has resulted in deposition either at the base of the foredune in the form of an "incipient" foredune, and or on the seaward face, crest, or behind the crest. The incipient foredune formed during the 3.5-year monitoring period, and is most prominent where sea lyme grass is dominant. This grass is able to grow lower on the beach than European beachgrass due to a higher salinity tolerance (Baye 1990), causing deposition and the formation of an incipient foredune.

The difference between the behavior of the foredunes in Fig. 8 and those in Fig. 9 illustrates the differences in their morphology, depositional trends, and potentially the ability to adapt to sea level rise. The European beachgrass foredune is lower, narrower, and steeper than the native foredune. Both types of foredune have built seaward as the beach elevation increased (there were no large erosional events during the monitoring period), but only the dune mat foredune allowed sand to reach and overtop the crest. The ability of European beachgrass to halt movement of sand over the foredune has also been documented in other regions (Petersen et. Al 2011). Both types of foredune are equally vulnerable to localized cliffing and erosion (Pickart 2014b), events that are predicted to increase in frequency and magnitude with climate change. Over time, and with sea level rise, the foredune must migrate inland in order to remain intact. Without an intact foredune, the buffering ability of the dune system is reduced. The changes in the European beachgrass foredune suggest an inability to undergo translation (movement inland and up in elevation), while those in the dune mat foredunes suggest facilitation of translation.

Social Environment –

The site of the Proposed Action is located within Humboldt Bay National Wildlife Refuge. The nearest private residence is 0.8 km (0.5 miles) to the east, and is not located downwind of prevailing winds. Lanphere Road, a private road that leads to the refuge office, and private residences are all separated from the project site by stabilized dune forests.



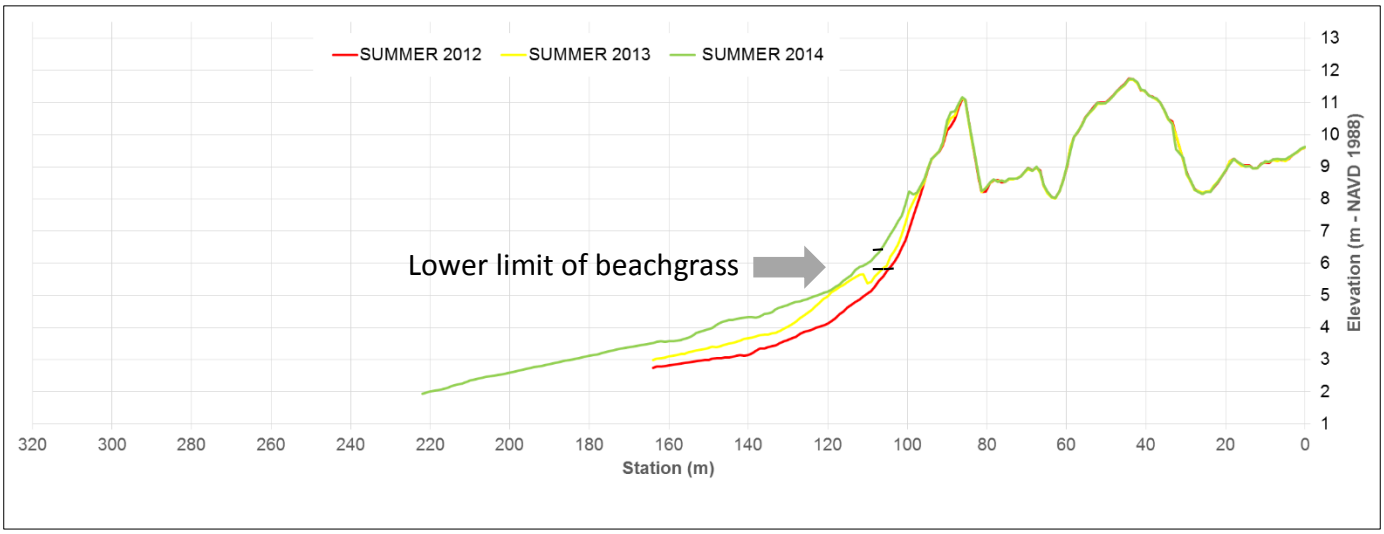
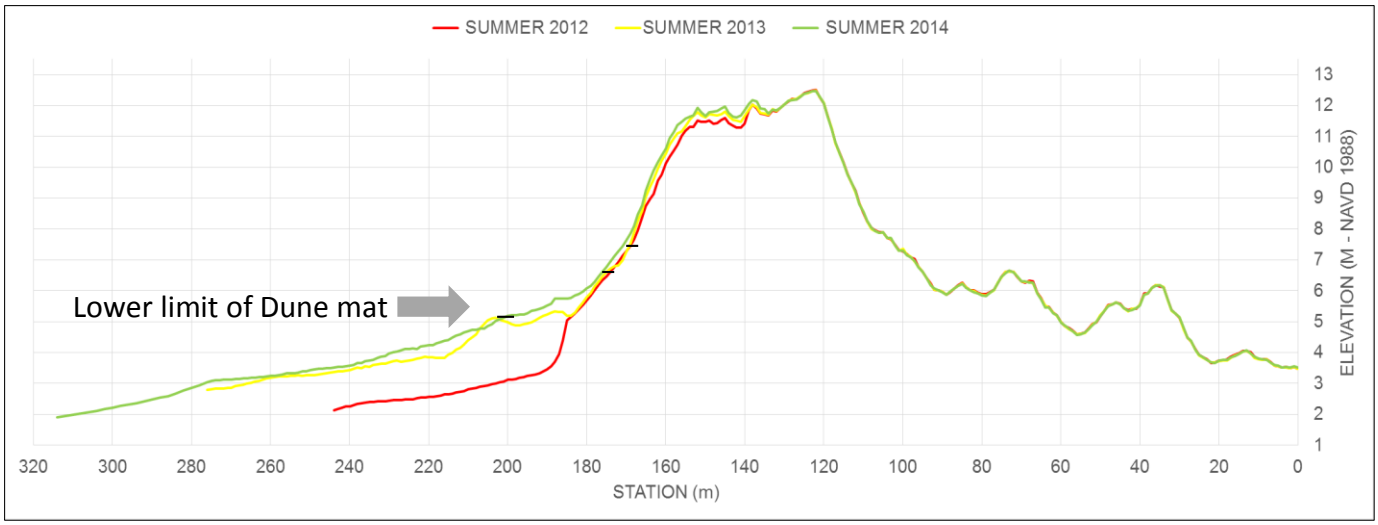


Figure 8. Topographic profiles of the non-native, invasive European beachgrass dominated foredune at the site of the Proposed Action, showing changes in summer profile from 2012-2014. The ocean is on the left. Horizontal axis is relative to eastern start of transect and is not comparable with other figures. Vertical axis is height in m (NGVD 1988). Colors represent the year the profile was taken (three consecutive years in summer). In both transects the beach (below the seaward limit of vegetation) increased in elevation. In the vegetated portion of the foredune, sand accumulation occurred primarily at the base and lower seaward face of the foredune. No sand reached or overtopped the crest.



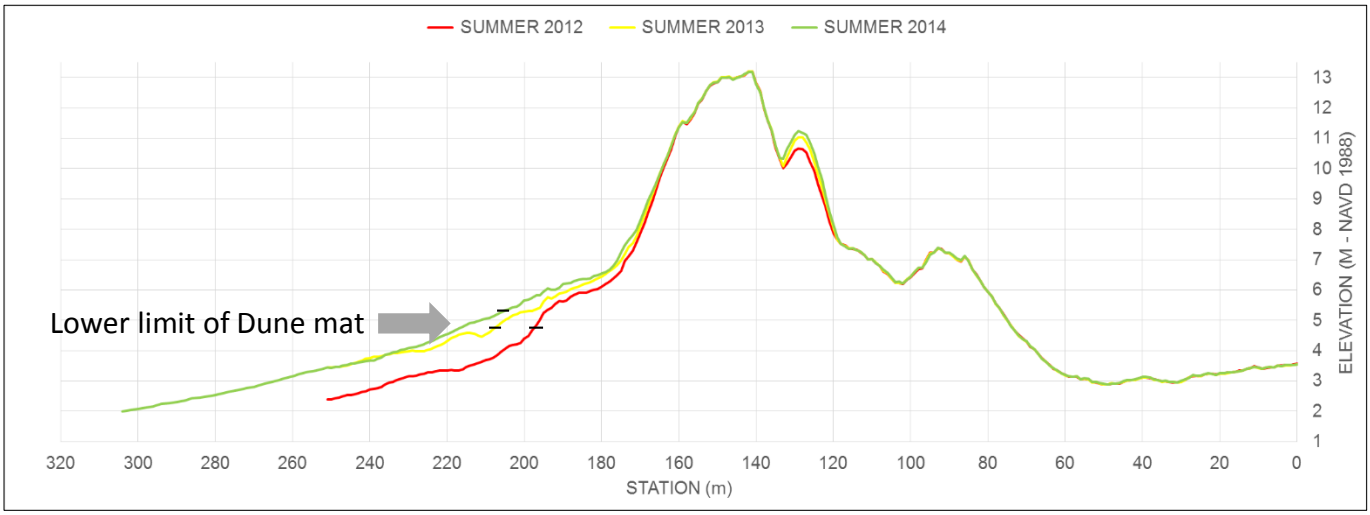


Figure 9. Topographic profiles of the native dune mat dominated foredune south of the Proposed Action showing changes in summer profile from 2012-2014. The ocean is on the left. Horizontal axis is relative to eastern start of transect and is not comparable with other figures. Vertical axis is height in m (NGVD 1988). Colors represent the year the profile was taken (three consecutive years in summer). As with the European beachgrass profiles in Figure 8, the beach (below the seaward limit of vegetation) increased in elevation. However, in contrast to the beachgrass foredunes, these sites accumulated sand at (above) or beyond (below) the crest.

IV. ENVIRONMENTAL CONSEQUENCES

No Action Alternative:

Biological Environment –

Under the No Action Alternative, European beachgrass would continue to dominate the foredune at the project site. In the short term, this would continue to cause very low biological diversity. The European beachgrass/dune mat boundary would likely move farther east, causing additional loss of native plants including endangered Humboldt Bay wallflower and beach layia. Indirect impacts would include the continued stabilization of the dune mat community to the east, causing further shifts to late successional species, non-native species, and higher cover. This would move conditions away from those suitable for endangered plants.

In the short term, the sea level rise adaptation methods to be tested under the Proposed Action would not be evaluated for effectiveness. This could slow the development of sea level rise adaptation planning both on the refuge and on adjacent public and private dunes, with potentially far-reaching implications to the biological communities found on the dunes.

In the long term, the foredune at this site would potentially be eroded (rather than migrate) due to climate-change induced storms and sea level rise. Having failed to transfer sand over the crest allowing migration of the foredune, the semi-stable dunes behind the foredune, which, in the southern portion of the site, support rare plant communities and endangered plants, would be exposed to the erosive actions of tidal surges and waves. The low-lying swales (seasonal, freshwater wetlands) would be subject to overwash and salt water contamination. The freshwater table would be vulnerable to salt water intrusion, and freshwater wetlands would become brackish, resulting in a change in vegetation type. Increased vulnerability and erosion of the foredune and semi-stable dunes would result in a reduction in the ability of native plants to shift ranges or evolve and expand tolerances.

Wetlands-

The No Action Alternative would have no impacts on wetlands. Because the dunes are overstabilized seaward of the wetlands, the wetlands would continue to lack the dynamic properties of swales that are found in native areas. These properties include disturbance from deflation and deposition, which cause wetland/upland boundaries to fluctuate, increased edge and greater species diversity.

Federal and California Endangered, Threatened and Special Status Species-

Under the No Action Alternative, European beachgrass and iceplant would continue to spread, and would eventually outcompete the endangered Humboldt Bay wallflower and beach layia occurring in the transitional area on the southern portion of the site. The invasive species would continue to move into the remaining dune mat areas to the east, threatening additional populations located there. The No Action Alternative would have no effect on the Western Snowy Plover, which does not nest at the site.

Cultural Resources

Under the No Action alternative, erosion of the foredune could still occur under particular conditions such as a significant El Niño winter. Over the long-term, due to changes anticipated in the Physical Environment as the result of the No Action Alternative under conditions of sea-level rise (see below), the vulnerability of Cultural Resources that occur inland of the project site to exposure and their loss to erosion could potentially be accelerated compared with the Proposed Action.

Physical Environment–

Under the No Action Alternative, European beachgrass would continue to overstabilize the foredune at the project site, restricting sand movement to the semi-stable dunes behind. Significant erosional events (storm surges and waves, particularly during El Nino or La Nina conditions, could cause the foredune to be scarped and devegetated, and possibly for blowouts to form. However, provided European beachgrass remained behind or adjacent to these disturbances, it would again stabilize the sand, preventing sediment from overtopping the crest. However, with the increased frequency of significant erosional events predicted under climate change models, the European beachgrass dominated foredune might not be able to rebuild before additional erosion occurs, causing a retreat of the foredune face. This would not be balanced by the transport of sand over the crest of the foredune, and the foredune as a feature would be vulnerable to loss, allowing storm related overwash and erosion of backing dune features.

In the short term, the sea level rise adaptation methods to be tested under the Proposed Action would not be evaluated for effectiveness. This would slow the development of sea level rise adaptation planning both on the refuge and on adjacent public and private dunes, which would increase the vulnerability of the dunes regionally to detrimental sea-level rise impacts.

Over the long term, the amount of sediment moving inland would be reduced. If the foredune becomes eroded, and no sediments have been permitted to reach the backing dunes, these areas will be lower in elevation relative to rising seas than if sediment were reaching them. If the dunes eroded as far east as the deflation plain, there would be significant overwash and flooding in the lower lying deflation plain. This would result in a cumulative loss to the buffering ability of the dune system.

Air Quality-

Under the No Action Alternative no prescribed burning would occur since European beachgrass would not be removed.

Social Environment –

In the short term, the No Action Alternative would delay testing of sea level rise adaptation methods and constrain sea level rise planning now being undertaken by Humboldt Bay stakeholders. In the long term, if the Proposed Action is not taken, it would prevent a greater understanding of our foredune dynamics, increasing the probability that successful adaptation measures would not be undertaken along the North and South Spits, potentially making Humboldt Bay more vulnerable to sea level rise impacts.

Proposed Action:

Biological Environment –

In the short term, the Proposed Action would result in a reduction or loss of vegetative cover after European beachgrass is removed and before revegetation is mature. Some areas of native vegetation may become buried by mobilizing sand. Based on past projects, over time, open sand on the foredune will decrease. Previous projects did not employ immediate revegetation, and this step is expected to reduce the amount of time when open areas on the foredune are vulnerable to wind erosion. Monitoring of past projects has demonstrated that species composition will shift from more colonizing species like beach bur, beach morning glory, seaside daisy and yellow sand-verbena, to later successional species such as beach bluegrass, dune goldenrod, beach buckwheat and dune knotweed (*Polygonum paronychia*). However, natural blowouts will maintain areas of open sand where early successional species can reestablish, maintaining high levels of diversity. Blowouts are a common characteristic of high energy shorelines such as that of the North Spit (Hesp 2002). They cause the formation of new long-walled parabolic dunes that migrate inland, increasing the volume and heterogeneity of forms in the deflation plain. Seasonal wetlands are both created by the migration of parabolic dunes, and buried by their advance. Over time, as can be seen in a study documenting change to dune topography since the 1930s (U.S. Fish and Wildlife Service unpublished data), wetlands shifted spatially but increased in area overall dramatically.

Landscape connectivity would be enhanced through the Proposed Action, as the restored foredune on the project site becomes connected to the adjacent native foredune to the south. Gene flow would be increased, which could potentially improve the opportunity for organisms to evolve in response to changing climatic conditions.

As in all refuge actions, adaptive management would be practiced throughout the course of the project. This would allow for any needed, corrective actions to occur. An example of such actions could be additional plantings if cover doesn't progress as expected.

Wetlands-

The dunes at the site of the Proposed Action have been overstabilized by invasive vegetation and no longer support the natural processes present on the Lanphere and Ma-le'l Dunes to the south. In a natural system, swales are dynamic features that expand and recede depending on the processes acting around them. At their seaward end, swales may become buried by the tongues of sand (new parabolic dunes) originating from foredune blowouts. These parabolic dunes eventually stabilize, creating a transitional edge between the upland parabolic dunes and the wetland swales. The wetland upland ecotone, a zone generally known for high species diversity (Kark et al. 2002), is increased. At their eastern margins, the swales in a naturally functioning dune system expand as the deflation plain migrates eastward behind the larger moving dunes. For example, the acreage of wetlands on the Lanphere Dunes Unit increased from 18 to 87 acres between 1948 and 2012 as the

moving dunes migrated eastward. However, these processes are not currently functioning at the site of the Proposed Action. Although the deflation plain continues to expand, the seaward end of the swales has become stabilized by invasive vegetation. The Proposed Action does not constitute complete restoration of these processes because it is located only along the foredune. European beachgrass, iceplant and yellow bush lupine will continue to occur between the foredune and the swales. The immediate planting to be carried out under the Proposed Action will minimize sand movement. The wetlands present on the Bair parcel are located eastward of the maximum extent of sand movement that has occurred since the restoration on the adjacent Lanphere parcel, and no burial of wetlands is expected to occur. The CCP calls for re-establishment of natural dune processes at the site, and the expectation is that eventually these swales will become more dynamic like those to the south.

Federal and California Endangered, Threatened and Special Status Species-

Under the proposed action, all individuals of Menzies' wallflower occurring in the transitional dune mat/European beachgrass boundary, as well as all those within 2 m outside the boundary would be flagged by a qualified botanist prior to the start of work. Because these plants occur only in areas that have sparse European beachgrass, disturbance to the species would be avoided. If sand movement near any endangered plants causes a threat, a plywood barrier would be erected windward of the plant to prevent deposition on the plant itself. Beach layia exists only as seeds during the time of impact and would not be affected. In the short term the proposed Action would have no effect on endangered species. In the long term, the Proposed Action would greatly benefit the Menzies' wallflower and beach layia, because it would increase their immediate available habitat through the removal of invasive species and planting of native species. The Proposed Action would prevent further spread of the invasive species and subsequent loss of endangered plants east of the site. The Proposed Action would have no effect on the Western Snowy Plover, which does not nest in the vicinity.

Cultural Resources-

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, requires Federal agencies to take into account the effects of their undertakings on significant cultural resources that are, or may be, eligible for inclusion in the National Register of Historic Places. NHPA defines an undertaking as a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency, those carried out with Federal financial assistance, those requiring a Federal permit, license or approval, and those subject to state or local regulation administered pursuant to a delegation or approval by a Federal agency. Under this definition, the proposed project is an undertaking subject to NHPA consideration.

The Proposed Action to remove European beachgrass and iceplant and plant native vegetation using manual methods are activities that are covered under Appendix B of the Region 8 Programmatic Agreement among the Service and the Advisory Council on Historic Preservation, and the California State Historic

Preservation Officer requiring a field survey. A cultural resource field survey of the project area was conducted in April 2015. No historic or prehistoric sites were identified. Given the relatively recent accretion/creation of the foredune (i.e., last 60 years), the likelihood for archaeological resources is considered to be low.

The Service consulted with three Native American Indian tribes during project planning. Letters and email correspondence were sent to the Wiyot, Blue Lake Rancheria, and the Bear River Band of Rohnerville Rancheria on April 16, 2015, advising them of the availability of the draft EA and requesting their input. During a meeting on May 15, 2015, the tribes requested consideration that the survey coverage be expanded to the east of the project area. Rationale for an expanded survey was to evaluate any areas in which sand may move following removal of invasive plant species. The Service Cultural Resource Specialist considered the request and determined that an expansion of the immediate project area was not appropriate. The dunes are a constantly changing, dynamic environment. The foredune undergoes cyclic changes annually due to seasonal weather and oceanic current patterns, and interannually due to the El Niño Southern Oscillation and Pacific Decadal Oscillation climate cycles. During significant El Niño years sea level is raised and storm frequency and intensity are greater, leading to erosion that far exceeds the average annual changes in beach and foredune morphology. Even in a non-El Niño year, the coincidence of spring tides and storm surges can result in significant erosional events. These processes are the primary driver of dune erosion, and occur in both invasive and native foredunes as documented by the air photo record. It is not possible to predict the occurrence or location of El Niño driven foredune scarping or the subsequent movement of sand. The manual removal of European beachgrass results in an immediate and short term change in the foredune shape within the project area. Changes outside of this area may occur unpredictably over subsequent decades and would not t be tied directly to beachgrass removal.

A field survey was completed and no cultural resources were identified in the Area of Potential Effect. It is expected that the proposed project will have no potential to affect historic properties.

If any cultural resources are discovered while removing European beachgrass, a qualified archaeologist will evaluate the finds and appropriate protection measures consistent with the requirements of 14 California Code of Regulations section 1504.5(f) will be taken, if necessary. In the event that any human remains are encountered or in the event that unassociated funerary objects or grave goods are discovered, work in the immediate vicinity of the discovery, other than non-disturbing documentation, shall cease and the Service shall comply with applicable State laws (14 California Code of Regulations § 15064.5€, Health & Safety Code § 75050.5, and Public Resources Code § 5097.98), Native American Graves Protection and Repatriation Act as outlined at 43 CFR 10 and, Archaeological Resources Protection Act at 43 CFR 7.

Physical Environment –

The proposed project is expected to cause an initial lowering of the foredune after European beachgrass is removed. If storm surges with high wave energy occur during

the restoration process, some or all of the outer double foredune built by the beachgrass could potentially be scarped (cliffed). This type of erosion, caused by undercutting of the foredune at its base, occurs without respect to vegetation type (Pickart 2014b). Based on past, similar projects adjacent to the project site, the foredune is expected to return to or exceed its pre-project elevation within approximately 5 years after project completion. A recent study demonstrated that native foredunes on the upper North Spit of Humboldt Bay are not significantly different in height than invaded, European beachgrass foredunes (McDonald 2014). This study documented a north-south gradient of foredune height, with the highest foredunes at the north end of the Spit in the vicinity of the Proposed Action. This gradient was independent of vegetation or management, and probably reflects underlying environmental gradients such as sediment supply or subsidence. A second study found that shoreline loss resulting from storm scarping on the upper North Spit is localized and independent of vegetation and management type (Pickart 2014b). There is an overall erosional trend occurring on the North Spit, documented both by this second study and by the U.S. Army Corps of Engineers (2012). The cause is unknown, but could stem from or be exacerbated by the decade-long practice of dredged material from Humboldt Bay being disposed of beyond the littoral zone (Moffat and Nichol 2013). This practice is being changed due to concerns about potential erosion. The study of shoreline loss indicated that erosion, like foredune height, also occurs along a gradient of greatest erosion at the south to lowest at the north in the vicinity of the Proposed Action. The same underlying processes responsible for variation in foredune height may be driving this. Initial changes to the morphology of the foredune after European beachgrass removal would be followed by a period of equilibration. The foredune would regain a more gradual seaward slope. The steep peaks of the European beachgrass foredunes would erode, filling the low depression between the first and second foredune and resulting in a more natural profile and single foredune.

The monitoring associated with this project will be the first opportunity to quantitatively measure the recovery of elevation loss and changes to foredune morphology following removal of European beachgrass in this region. Terrestrial LiDAR monitoring (precise, 3-dimensional scans of the surface) will allow these changes to be quantified.

Over time, the proposed alternative would restore the flow of sediment from the beach into the dunes located to the rear of the foredune. Through this process, in combination with intermittent blowouts that evolve into slowly stabilizing parabolic dunes, and by the transport of sand long distances during high wind events, the volume of the dune system would be maintained as its profile translates upward and inland. This would maintain the storm-buffering effect of the foredune locally, and protect interior freshwater wetlands. Although the effects would be localized, they would be enlarged by the presence of the adjacent restored dune systems to the south.

Through short- and longterm monitoring of the response of the foredune to restoration, our understanding of foredune processes will be increased. The demonstration site will provide information on how different assemblages of plants located at different topographic positions influence the ability of the foredune to

translate up and inland while maintaining its integrity. The results of this project have the potential to guide future adaptation efforts regionally.

Air Quality –

A short-term impact would be posed by smoke generated by burning piles. Past projects have shown that smoke from pile-burning is quickly dispersed. Prescribed fire(s) would follow smoke management plan recommendations to only burn during SE, E, or NE wind conditions that would blow smoke toward the ocean and away from the public. As described in the CCP/EA, when periodic controlled burning is needed, the refuge coordinates with the North Coast Unified Air Quality Management District (District), which monitors PM10 and other pollutant levels, and regulates prescriptive burning. The District allows prescriptive burns on the refuge when conditions and PM 10 levels permit. Any potentially adverse effects to air quality from controlled burning of vegetation are mitigated through the timing and other requirements of the approved burn plans coordinated with the District. Greenhouse gases emitted as a result of the Proposed Action will be minimized by using manual rather than mechanized techniques.

Social Environment –

Under the Proposed Action residents of Manila to the south or Mad River to the north could potentially see smoke from burning piles of European beachgrass. This would happen infrequently, would be of short duration, and would follow the approved burn plan coordinated with the Air Quality District. The increased flow of sand or potential for blowouts resulting from the Proposed Action would be highly localized. There are no residences or communities that would be affected by increased sand movement. The stabilized, forested dunes ultimately separate all of the processes to the west from any residences to the east. In the long term these communities would potentially benefit from what is learned and applied about sea level rise adaptation around Humboldt Bay. As described under the Physical Environment, restoring the flow of sediment from the beach into the dunes is expected to ultimately maintain the storm-buffering effect of the foredune, resulting in a more resilient barrier system that would continue to protect the Bay.

Cumulative Effects –

The cumulative effects of dune habitat restoration were addressed in the 2009 CCP/EA. The Service concluded that the cumulative impacts of restoration and enhancement actions on dune mat/foredune grassland and dune swale (freshwater, seasonal wetland) plant communities was expected to be cumulatively beneficial. The Proposed Action is consistent with effects described in the 2009 CCP/EA. The Proposed Action would contribute to the cumulatively beneficial effects to plant and animal communities and to the dune ecosystem overall.

V. AGENCIES AND PERSONS CONSULTED

U.S. Fish and Wildlife Arcata Office Coastal Program

Paula Golightly, Supervisory Fish and Wildlife Biologist, Coastal Program.

Conor Shea, Fluvial Geomorphologist/Engineer, Coastal Program

Jim Watkins, Fish and Wildlife Biologist, Endangered Species Program
U.S. Bureau of Land Management
Jennifer Wheeler, Botanist
Sam Flanagan, Jr., Geologist
Humboldt Bay Harbor, Recreation and Conservation District
Adam Wagschal, Conservation Director
Humboldt Dunes Cooperative
Friends of the Dunes
Carol Vander Meer, Executive Director
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University of Victoria, British Columbia
Ian Walker, PhD. Department of Geography
Flinders University, Australia
Patrick Hesp, PhD, School of the Environment
California Native Plant Society
Carol Ralph, President
Humboldt BayKeeper
Jen Kalt
Humboldt County Board of Supervisors
Mark Lovelace, Humboldt County Supervisor
California Coastal Commission
Mark Delaplaine
Manila Community Services District
Christopher Drop, General Manager
Humboldt Bay Municipal Water District
Carol Rische, General Manager
California Coastal Conservancy, Su Corbaley

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APPENDIX A

CEQA ENVIRONMENTAL CHECKLIST

CEQA Environmental Checklist

PROJECT DESCRIPTION AND BACKGROUND

Project Title:	Humboldt Bay National Wildlife Refuge Sea-Level Rise Adaptation Demonstration Project
Lead agency name and address:	
Contact person and phone number:	
Project Location:	Humboldt Bay NWR, Bair parcel
Project sponsor's name and address:	US Fish and Wildlife Service, 6800 Lanphere Rd., Arcata CA 95521
General plan description:	NR
Zoning:	NR/A,B,W
Description of project: (Describe the whole action involved, including but not limited to later phases of the project, and any secondary, support, or off-site features necessary for its implementation.)	We propose the manual removal of up to 4 acres of European beachgrass and iceplant from the foredune of the Bair parcel on Humboldt Bay NWR. Plants are pulled while using a shovel to dislodge rhizomes. After the initial treatment, re-treatment of rhizomes would occur up to weekly for the first summer, and as needed thereafter.In the first fall following removal, we would revegetate with native plant species, using both seeds and divisions collected from the adjacent Lanphere Dunes.
Surrounding land uses and setting; briefly describe the project's surroundings:	The project site is located within the Lanphere Dunes Unit, Humboldt Bay National Wildlife Refuge. To the north are unoccupied coastal dune parcels and Mad River Beach County Park. The project is restricted to the foredune. East of the foredune are dune ridges, seasonal wetlands, a large moving dune field and a stabilized dune forest. East of the dune forest lie the dirt road that accesses the refuge, the refuge office and caretaker building, and two private residences. The residences are built on old dune forest and have adjacent agricultural land used for grazing and haying.
Other public agencies whose approval is required (e.g. permits, financial approval, or participation agreements):	The California Coastal Commission requires a consistency determination.

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project. Please see the checklist beginning on page 3 for additional information.

	Aesthetics		Agriculture and Forestry	X	Air Quality
X	Biological Resources	X	Cultural Resources	X	Geology/Soils
X	Greenhouse Gas Emissions		Hazards and Hazardous Materials		Hydrology/Water Quality
	Land Use/Planning		Mineral Resources		Noise
	Population/Housing		Public Services		Recreation
	Transportation/Traffic		Utilities/Service Systems		Mandatory Findings of Significance

DETERMINATION:

On the basis of this initial evaluation:

X	I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.
☐	I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.
☐	I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.
☐	I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.
☐	I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required

Signature:	**Date:**
Printed Name:	**For:**

CEQA Environmental Checklist

Dist.-Co.-Rte.	P.M/P.M.	E.A.

This checklist identifies physical, biological, social and economic factors that might be affected by the proposed project. In many cases, background studies performed in connection with the projects indicate no impacts. A NO IMPACT answer in the last column reflects this determination. Where there is a need for clarifying discussion, the discussion is included either following the applicable section of the checklist or is within the body of the environmental document itself. The words "significant" and "significance" used throughout the following checklist are related to CEQA, not NEPA, impacts. The questions in this form are intended to encourage the thoughtful assessment of impacts and do not represent thresholds of significance.

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
I. AESTHETICS: Would the project:				
a) Have a substantial adverse effect on a scenic vista	☐	☐	☐	X
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway	☐	☐	☐	X
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	X
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	X
II. AGRICULTURE AND FOREST RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment Project; and the forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	X
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	X

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	X
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	X
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	X

III. AIR QUALITY: Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:

a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	X
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	X	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non- attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	X	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	X	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	X	

The Proposed Action would include the potential for burning the invasive vegetation that is removed from the project area. Burning vegetation would release PM10 for which Humboldt and Del Norte counties are classified as nonattainment. Burning invasive vegetation piles would be done only with a burn plan that is approved by the North Valley Unified Air Pollution Management District.

IV. BIOLOGICAL RESOURCES: Would the project:

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service? All individuals of the endangered Humboldt Bay wallflower found adjacent to the impact area or in the transition area would be flagged and avoided, and barriers erected if sand movement could potentially affect any plants. Any beach layia present would be in a seed state and not be impacted. Special status species are not present. The project will result in increased habitat for all of these species.	☐	☐	☐	X
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	☐	☐	☐	X

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	X	
All work is restricted to the immediate foredune, the closest seasonal wetland is 150 ft away. The vegetation between the foredune and this wetland is stabilized by invasive species. The foredune will be replanted which will limit sand movement towards the wetland.				
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	X
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	X
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	X

V. CULTURAL RESOURCES: Would the project:

a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	X
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☐	☐	X
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	X
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	X

In April 2015, FWS conducted a cultural resources survey of the project area. No historic or prehistoric sites were identified. However, if any cultural materials, sites, or properties should be discovered, a qualified archaeologist will evaluate the finds and appropriate protection measures consistent with the requirements of 14 California Code of Regulations § 1504.5(f) will be taken, if necessary. In the event that any human remains are encountered or in the event that unassociated funerary objects, or grave goods are discovered, work in the immediate vicinity of the discovery, other than non-disturbing documentation, shall cease and BLM shall comply with applicable State laws (14 California Code of Regulations § 15064.5(e), Health & Safety Code § 75050.5, and Public Resources Code § 5097.98), Native American Graves Protection and Repatriation Act (NAGPRA) as outlined at 43 CFR 10 and, Archaeological Resources Protection Act (ARPA) at 43 CFR 7.

VI. GEOLOGY AND SOILS: Would the project:

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☐	X
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42?	☐	☐	☐	X
ii) Strong seismic ground shaking?	☐	☐	☐	X
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	X
iv) Landslides?	☐	☐	☐	X
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	X	

There is no topsoil on the dunes. The foredune is expected to be lowered after Ammophila is removed, and the sharp peaks caused by Ammophila will become more rounded and merge into a single rounded crest like a native foredune. The elevation is expected to recover based on past projects, when vegetation is established. Vegetation will be planted immediately after removal, minimizing elevation loss. The project is located on a wildlife refuge managed for ecological processes and biodiversity, and no infrastructure would be affected.

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☐	X
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	X
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	X

VII. GREENHOUSE GAS EMISSIONS: Would the project:

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☐	X
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	X

The proposed removal of invasive plant species would be done by hand.

VIII. HAZARDS AND HAZARDOUS MATERIALS: Would the project:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	X
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	X
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	X

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	X
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	X
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	X
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	X
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	X

IX. HYDROLOGY AND WATER QUALITY: Would the project:

a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	X
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	X
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☐	☐	X
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☐	X
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	X
f) Otherwise substantially degrade water quality?	☐	☐	☐	X

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	X
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	X
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	X
j) Inundation by seiche, tsunami, or mudflow	☐	☐	☐	X
X. LAND USE AND PLANNING: Would the project:				
a) Physically divide an established community?	☐	☐	☐	X
b)Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	X
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	X
XI. MINERAL RESOURCES: Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	X
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	X
XII. NOISE: Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☐	X
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	X
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	X

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	X
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	X
) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	X
XIII. POPULATION AND HOUSING: Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	X
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	X
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	X
XIV. PUBLIC SERVICES:				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:	☐	☐	☐	X
Fire protection?	☐	☐	☐	X
Police protection?	☐	☐	☐	X
Schools?	☐	☐	☐	X
Parks?	☐	☐	☐	X
Other public facilities?	☐	☐	☐	X

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
XV. RECREATION:				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	X
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	X
XVI. TRANSPORTATION/TRAFFIC: Would the project:				
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☐	X
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☐	☐	☐	X
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	X
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	X
e) Result in inadequate emergency access?	☐	☐	☐	X
f) Conflict with adopted policies, plans or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☐	☐	☐	X
XVII. UTILITIES AND SERVICE SYSTEMS: Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	X
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	X

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	X
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	X
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	X
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	X
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	X

XVIII. MANDATORY FINDINGS OF SIGNIFICANCE

a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	X
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☐	☐	X
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	X

APPENDIX B

COMMENTS AND RESPONSES

The U.S. Fish and Wildlife Service received a total of five comment letters on the Draft Environmental Assessment. These letters are included in Appendix B. Four of the comment letters were brief letters of support. One letter included substantive comments, which have been numbered on the attached comment letter. Responses are correspondingly numbered on the list of responses that follows.

APPENDIX B

COMMENTS AND RESPONSES

The U.S. Fish and Wildlife Service received a total of five comment letters on the Draft Environmental Assessment. These letters are included in Appendix B. Four of the comment letters were brief letters of support. One letter included substantive comments, which have been numbered on the attached comment letter. Responses are correspondingly numbered on the list of responses that follows.

Nelson, Eric <eric_t_nelson@fws.gov>

Fwd: Support for Environmental Assessment focused on Dune Restoration at HBNWR

1 message

---------- Forwarded message ----------
From: **lucinda adamson** <la@birdallyx.net>
Date: Sat, May 23, 2015 at 5:34 PM
Subject: Support for Environmental Assessment focused on Dune Restoration at HBNWR
To: eric_t_nelson@fws.gov

Mr. Nelson,

As a resident of Manila, CA I am writing to express my support for the Humboldt Bay National Wildlife Refuge's Sea Level Rise Adaptation Demonstration Project. The similar work done by Friends of the Dunes has reduced the non-native species, increased native species, restored the natural ecosystem processes and resulted in healthier and more resilient dune ecosystems. And as a result these restored areas are much more pleasant and beautiful to be around. I can't wait for the day that our entire coastal dune habitat has been restored.

Thank you and best wishes for this project.

Lucinda Adamson
Wildlife Rehabilitator
Bird Ally X, Humboldt Wildlife Care Center
BS in Wildlife Biology HSU '12

Re: Comments about Sea Level Rise Adaptation Demonstration Project

Nelson, Eric <eric_t_nelson@fws.gov> Fri, May 22, 2015 at 8:07 AM

On Thu, May 21, 2015 at 5:38 PM, Laura Corsiglia <lacorsiglia@gmail.com> wrote:

Dear Eric Nelson,

As a person concerned with the current and future wellbeing of wild animals, plant life and whole ecosystems, I'm writing to express support for the Humboldt Bay National Wildlife Refuge Sea-Level Rise Adaptation Demonstration Project. I've read the draft Environmental Assessment available on the Refuge's website and find it to be sound, reasonable and forward-thinking.

As a resident of Manila, my daily walks demonstrate the amazing variety of native dune plants that thrive in restored areas– and I look forward to seeing more of them in more places. That this work would tend to enhance the resiliency of the whole of Manila in the face of sea level rise is also impressive.

Thank you,

Laura Corsiglia

72 Mill Rd. Manila, CA 95521

Laura Corsiglia
Co-director, Bird Ally X
www.birdallyx.net

Re: Comment for HBNWR Sea Level Rise Adaptation Demonstration Project

Nelson, Eric <eric_t_nelson@fws.gov> Thu, May 21, 2015 at 11:02 AM

On Thu, May 21, 2015 at 10:40 AM, Elissa Blair <eb@birdallyx.net> wrote:

> Good morning Mr. Nelson,
>
> I am writing to express my support for the Humboldt Bay National Wildlife Refuge's Sea Level Rise Adaptation Demonstration Project. As a recent Humboldt State University graduate from the Wildlife program and staff for the non-profit Bird Ally X, I fully support this project and believe it will reduce non-native species and increase native species, resulting in healthier, more resilient dunes. Additionally, as an admirer of native plants, I would personally love to see more natives growing at our local dunes and believe that they vastly improve ecosystems.
>
> Thank you for your time,
>
> Elissa Blair
> Wildlife Rehabilitation Assistant, Bird Ally X
> Advocacy Committee, California Council for Wildlife Rehabilitators
> (c) 559-974-5823
> birdallyx.net
> ccwr.org

Fwd: I Support Climate Ready Sea-Level Rise Adaptation Demonstration Project

1 message

---------- Forwarded message ----------
From: **Erin C. Alvey** <eca134@humboldt.edu>
Date: Wed, May 6, 2015 at 6:07 PM
Subject: I Support Climate Ready Sea-Level Rise Adaptation Demonstration Project
To: eric_t_nelson@fws.gov

Climate change is not an ideology, it is a reality. Please act in favor of the Lanphere restoration.
I am a graduate student at HSU studying ecology. The Climate Ready proposal is soundly based in real science, which will help improve the adaptability & survivorship of Humboldt County and subsequently improve the quality of life for all voters, now and in the future.

I am a graduate student at HSU studying ecology. The Climate Ready proposal is soundly based in real science, which will help improve the adaptability & survivorship of Humboldt County and subsequently improve the quality of life for all voters, now and in the future.

Uri Driscoll

1578 Fickle Hill Rd

Arcata, Ca 95521

5/22/2015

Eric Nelson

HBNWR Refuge Manager
P.O. Box 576
Loleta, CA
Draft Environmental Assessment for the Humboldt Bay National Wildlife Refuge Sea-Level Rise Adaptation Demonstration Project

Mr. Nelson,

One of the main problems with the draft environmental assessment (EA) associated with the sea level rise adaptation proposal is that many of the assumptions relied on in the assessment are based on only three years of monitoring. Similar projects in the area have been going on for close to 30 years. Why the monitoring reports from other years are not referenced in the EA is not explained.

Comnt. No. 1

The Bair parcel represents a healthy, vibrant habitat with complex wetlands that provide shelter for migrating birds and wildlife as well as a diverse native and naturalized plant ecosystem. Previous studies have indicated that wildlife populations such as rodents and raptors have diminished following European beachgrass (EBG) removal in adjacent dunes in the Lanphere unit.

Comnt. No. 2

Photographs of local dune areas that have been converted from an ammophila based foredune to an e. mollis based foredune reveal that significant sand destabilization has caused filling of dune swale wetlands and has diminished the water carrying capacity of the foredune. As Ms. Pickart pointed out in a lecture earlier this year native pines are dying in the Lanphere unit where EBG has been removed. Areas in close proximity that maintain established naturalized EBG support healthy native pines and associated forest habitat.

Comnt. No. 3

Comnt. No. 4

The intentional movement of large volumes of sand has not been indicated in consistency determinations nor have grading permits been taken out with the county for those purposes. In this proposal there contains both the intention to promote large volumes of sand to destabilize as well as stated intentions to maintain stability. That inconsistency is unexplained.

Comnt. No. 5

EBG has been known to create extensive wetlands habitats. The removal of EBG has, according to aerial photos, been shown to reduce wetlands. Comparative areas reveal considerable improvements to wetland health where EBG based foredunes remain. Wetlands are highly regarded throughout the world as a critical natural feature for buffering coastlines from storm effects.

Comnt. No. 6

EBG is known to have a higher drought tolerance than E.mollis due to the ability to curl its leaves. Drought conditions compiled with the lesser capable E.mollis will cause the erosion of more sand into the woody dune swale vegetation and bury wetland vegetation such as hookers willow and beach pine. This has already happened in adjacent areas to the south of the proposed project area after beach grass removal. Intence spring winds has cause localized plant loss through wind blown sand scour and makes establishing any plant life extremely difficult.

Comnt. No.7

Established wetland buffers and emergent wetlands are not included in this proposal. As indicated in figure 6 the proposed action is within the 250 foot buffers of the dune swale wetlands. There is no mention of a wetland restoration permit include in this proposal.

Comnt. No.8

Menzies wall flower is found in the transition areas of the European beachgrass indicates a compatible role between the two plants. Considering that the EBG is a pioneering species and the wallflower is not it can't be expected that there would be established populations of wallflower within the pioneering EBG areas. As in other local dune habitats wall flower thrives behind EBG dominant foredunes.

Comnt. No. 9

Page 11 of the EA describes a prograding EBG dune west of an emergent wetland between the first two dune ridges followed by dune mat habitat and shrubs that include native coyote bush. This indicates a progression westward instead of an eastward migration as the proposed action promotes. There is no supporting documentation that would indicate a preference to an inland migration as the proposed action indicates, over a westward progradation when climate changes are considered.

Comnt. No. 10

EBG helps to create a westward prograding foredune which is noted in this proposal's EA. This indicates that the terrestrialization of the foredune has occurred via EBG offering a wider buffer from expected sea level rise and increased storm effects. This proposal intends to reverse this trend by destabilizing the foredune and promote a migration of sand inland.

Figure 7 shows the progradation of the foredune during the era of EBG. The comment on page 14 that says that EBG foredunes are lower, narrower and steeper seems in direct contradiction. There is no reference to support the comment "over time and with sea level rise the foredune must migrate inland to remain intact"

Comnt. No. 11

The western snowy plover has not benefited by the EBG eradication efforts in recovery unit 2 and may actually have caused nesting success to drop. Despite almost two miles of EBG eradication on the north spit no Snowy plover nests have been successful except for an area that is fronted by an EBG dune. (FOD 2014)

Comnt. No. 12

Page 17 under the no action comments there appears to be an overemphasis on endangered plants while this proposal is meant to address sea level rise and maintaining habitat to buffer the effects of expected increases in storm intensities. The supposition that there would be erosion by the no action option seems to not consider the prograding that EBG has historically contributed. The migration of a dune eastward promoted under the proposed action would also be considered erosion but would have the significant effect of infilling wetland areas. EBG has been known to create extensive wetlands and decrease erosion.

Comnt. No. 13

Under the no action element of this proposal the no effect to the wetlands would be preferred. Since EBG has helped create and protect these extensive wetland areas, without mitigations to address the expected infill this proposed project should not be promoted.

Comnt. No. 14

The proposal's suggestion through the no action element that with the possibility of increased erosional events that the EBG dunes may not be able to rebuild, does not take into consideration that historically EBG dunes are resilient and easily rebuilt. The Mad River spit is a good example of that. The concern under the no action element, that the vulnerability to increased foredune loss, is not consistent with the refuges' proposal to purposely cause blowouts in the foredune using heavy equipment.

Comnt. No. 15

On page 18 the comment regarding a concern that the foredune would migrate into the deflation plane under the no action element is also a direct contradiction to the proposed action that actually promotes the eastward migration of sand into the deflation plain.

Comnt. No. 16

Page 19 under the biological environment element the loss of native plants is of concern. While previous projects were supposed to replant and only remove in a patchwork fashion to prevent destabilization that protocol had not been followed resulting in excessive erosion that has still not been corrected.

Comnt. No. 17

The FWS study mentioned in the EA documenting the wetland areas since 1930 which coincides with the beginning of the EBG era, support Ms. Pickarts comments and local observance regarding the extensive wetlands that EBG created. Ariel photos and site visits indicate that the proposed project area has a significantly richer wetland features when compared to the EBG eradicated sites in the adjacent Lanphere unit.

Comnt. No. 18

While it is encouraging to see a concern with not causing sand erosion into wetlands the proposal contradicts itself by promoting an expectation of a more “dynamic” process that includes such erosion.

Comnt. No. 19

Menzies wall flower occurs in the transitional boundary of the EBG. Since the foredune has migrated west with the introduction of EBG it can be argued that the EBG has actually help establish new wall flower habitat. But again this is not meant to be a save the wall flower project but a Climate ready one which will have different considerations.

Comnt. No. 9

The acknowledgment that a lowering of the dunes will occur after EBG removal is important. However the suggestion that topography will be restored within 5 years is unsupported. At the south spit (BLM) topography has not been restored even after almost 10 years and has left the roadway to the south jetty more vulnerable. Original topography has also not been established on the Rudd parcel in MDRA after EBG removal over a decade ago. The McDonald study mentioned is not pier reviewed and only relied on one lidar reading to reach an ambiguous conclusion. Additionally the intentional filling of an emergent wetland between the first two peaks of the ammophila dune is not addressed or mitigated in this proposal or addressed in the associated EA.

Comnt. No. 20

On page 22 is another inconsistent statement that through the proposed action wetlands would be protected. Increasing sand migration into wetlands simply does not protect a wetland function. There currently exists many examples of sand burying wetland habitats where the EBG has been eradicated.

Comnt. No. 21

The proposal clearly promotes the inland migration of sand. The stabilized forests on the interior dunes are being smothered by the windblown sand particularly where EBG eradication efforts have been undertaken. One such migrating dune in north Ma-lel has engulfed the rare coastal forest and is estimated to be just a few years from entering the Mad River slough. The presumption that an eroding dune is more protective or resilient than a densely vegetated dune is unsupported.

Also unaddressed int his EA is the changes in wind velocity and its effects to back dune and wetland areas that occurs when topography is changed from a steeper dune to a lower more rounded one. This appears very significant where the big Ma-lel blowout has occurred on the foredune and the massive back dune downwind that has engulfed a rare coastal forest and is very close to reaching the Mad River Slough.

Comnt. No. 22

The supposed benefit to existing plant and animal life in the project area is not supported. As mentioned above rodent and rodent reliant species are reduced as a result of EBG removal.

Currently there exists a 250 foot buffer zone for local coastal wetlands. This proposal notes that the proposed project area has dune swale wetlands within 150 feet but does not identify mitigations for expected loss of localized wetlands due to eroding sand once EBG is removed.

Comnt. No. 23

This proposal also does not plan to monitor nor does the EA address the functions of protected wetlands and how they relate to EBG dunes and dunes once EBG has been removed. That is a significant omission. As already noted EBG has created extensive wetlands and the hydrology relating to the water holding capacity of EBG dunes vs a dune without EBG is not clearly understood. The vital chemistry and other related hydrological functions require that understanding prior to continued EBG removal. Numerous examples already exist on our local dunes to compare both types of dune structures. The benefits to studying existing examples cannot be overstated.

Comnt. No. 24

Under geology and soils the initial suggestion is that there would be no lateral spreading or that it is not located on a geological unit that is unstable is clearly not accurate. The stated intention of this proposal and its EA is to destabilize sand although that intention is inconsistent throughout the proposal. While it could be argued that there actually is soil and a microbial crust, albeit thin, at the proposed site the CEQA checklist suggests there is not.

Comnt. No. 25

It is important to understand what others throughout the world are doing to secure coastlines from anticipated effects of climate change. Nowhere that I am aware of is the preferred approach a destabilization of existing dune structures. The wetlands that are formed behind naturalized ammophila dunes are vital habitat for wildlife, infrastructure protections and plant diversity.

Comnt. No. 26

The many inconsistencies within the climate ready proposal and it associated EA are glaring examples of the challenges we face to secure dune structures and protect valuable habitat. Existing examples of both ammophila supported dunes and dunes where eradication projects have occurred should be carefully and transparently studied prior to assuming that coastal protections can be enhanced with native only vegetation. The purpose of introducing ammophila was for the protection of our coastline and it serves that purpose well with additional habitat benefits that need further considerations.

Comnt. No. 27

Response to Comment No. 1

The monitoring of past projects was carried out for vegetation parameters only. There are no available topographic studies of past restoration projects in our area. The proposed project will allow us, for the first time, to quantify morphological changes of dunes following removal of European beachgrass.

Response to Comment No. 2

Although we agree that the Bair parcel has high value wooded wetlands, we do not agree that they will be affected by the proposed action, for reasons described on pages 19-20 in the EA. The vegetation on the adjacent, upland, stable dunes that were historically invaded by yellow bush lupine does not represent a healthy native community. Past research has demonstrated the detrimental effects of yellow bush lupine invasion on dune ecosystems (Pickart et al. 1998). As stated in the EA, rodent and possibly raptor use of the European beachgrass-dominated foredunes may decrease. However, the project area is a small fraction of the total dune area on the parcel (and surrounding dune areas) used by these wildlife species. The adjacent native dunes support a healthy population level of these species, and we expect this level of use to be consistent on the restored Bair foredune. The increased use of dense European beachgrass by a small number of species does not represent added diversity. Other species, including many plants and invertebrates that are an important part of the food web on the dunes, have been shown to decline in diversity in European beachgrass-dominated dunes (Slobodchikoff and Doyden 1977, Aptekar 2000, Doudna and Connor 2012.

Response to Comment No. 3

We agree that there is increased sand movement after European beachgrass is removed from the foredune. The purpose of the demonstration project is to see if sediment transport increases while maintaining the natural morphology of a semi-continuous foredune. As stated in the EA (p. 17, 19), a native dune system is dynamic, and wetland boundaries will shift. The total deflation plain wetland area on the adjacent, restored Lanphere Dunes parcel has shown a net increase following restoration (removal of European beachgrass). Native herbaceous foredune plants are adapted to the available soil moisture. Increased nitrogen and water holding capacity in invaded dunes have been shown to favor non-native species that do not have these adaptations (Pickart et al. 1998).

Response to Comment No. 4

European beachgrass dominated dunes are more stable than native foredunes, and allow for colonization by pines and potentially some other native forest species. However, the native forest communities do not fully develop in European beachgrass dunes, and many non-dune species can become established, as can be seen in areas where European beachgrass has been present for over 70 years. The European beachgrass on the Bair parcel is very close to the shoreline and the salt spray level is too high to allow for establishment of pines.

Response to Comment No. 5

No grading permits are required for this project. A Negative Determination was filed with the California Coastal Commission and a concurrence letter was issued by the Commission on May 28, 2015.

Response to Comment No. 6

The buffering effect of wetlands on wave energy is not a characteristic of dune wetlands, which only occur behind a dune barrier. The dunes themselves buffer the coastline from wave and wind energy. On the Bair parcel, which has artificially high stability due to invasions by European beachgrass, yellow bush lupine and iceplant, the deflation plain swales have increased slightly in size since 1988. On the adjoining Lanphere and Ma-le'l parcels, which are restored, dune swales have shown a substantial net increase in size following restoration. In these more dynamic systems, the transgressive dune field continues to migrate southeastward, lowering the water table in its wake and forming new wetlands.

Response to Comment No. 7

Wind-blown sand and scour are normal components of a dune system. Plant loss through burial or scour is common and is balanced by the colonization of blowouts and open sand areas with new plant cover. Burial has been shown to increase species diversity in coastal dune plants (Stallins 2003).

Response to Comment No. 8

All required authorizations for this project have been obtained.

Response to Comment No. 9

Air photos show that European beachgrass has been expanding into the endangered Menzies' wallflower habitat behind the foredune at the south end of the project site. Past research has shown that Menzies' wallflower requires open space to establish (Pickart and Sawyer 1988). The presence of European beachgrass in the transition zone is not indicative of compatibility, it is the initial stage in an invasion that ultimately displaces endangered plants.

Response to Comment No. 10

There is no wetland present between the two foredune ridges pictured in Fig. 5 on p. 11 of the EA, just a topographic "swale" that does not intersect with the water table. Dune systems migrate inland as sea level rises (Davidson-Arnot 2005). Progradation is possible only on an uplifting coast with high sediment inputs (Psuty and Silveira 2010). The coastline at Humboldt Bay is subsiding, resulting in rates of sea level rise that are double those of other west coast shorelines (Cascadia GeoSciences 2013). It follows that long term progradation is not predicted under rising seas in our area, despite any localized, short-term progradation that may occur.

Response to Comment No. 11

Please see Figs 8-9 for a characterization of invaded and native foredunes on and adjacent to the study area, showing narrower, shorter, steeper foredunes in the invaded areas. Although this may seem inconsistent with the ability of European beachgrass to build the dune westward, this is also the part of the foredune most susceptible to storm scarping.

Response to Comment No. 12

As documented in the EA, there is no record of nesting Western Snowy Plover in the project area.

Response to Comment No. 13

The USFWS is obligated under the Endangered Species Act to address endangered species concerns. Erosion on European beachgrass dominated foredunes on the North Spit have been well documented, particularly following the El Niño and La Niña winters of 1998-2000, as cited in the EA.

Response to Comment No. 14.

The seasonal wetlands shown in Figure 6 were formed prior to the introduction of European beachgrass, as can be seen on historic air photos. For the reasons described in the EA, the Proposed Action is expected to have no effect on the dune swale wetlands.

Response to Comment No. 15

The EA does not state that foredunes dominated by European beachgrass cannot rebuild following erosion. The air photo record for the area clearly shows that both native and invaded foredunes are able to rebuild following erosion. The presence of a high foredune prior to the introduction of European beachgrass both on the project site and to the south demonstrates the ability of native species to build foredunes in our area.

Response to Comment No. 16

The statement on page 18 referred to the fact that the volume of sand currently stored in the foredune could be eroded as sea level rises, and that if no sand is allowed to transport eastward in the intervening period, there would no longer be a topographic buffer between the ocean and deflation plain. Both the foredune and the deflation plain will continue to migrate eastward, in tandem, until such time as the large transgressive dune field is stabilized by forest. There has been no connection between foredune processes and transgressive dune processes since the two decoupled in the 1960s due to the continuing expansion of vegetation in the system, both in native and invaded areas. The foredune cycles sand between the beach and the backing small, parabolic dunes. The much larger parabolic/transgressive foredunes to the east are not receiving new sediment, rather the feature is migrating eastward as a whole.

Response to Comment No. 17.

The size of the European beachgrass removal area on the project site is too small to merit a patchwork removal method. The demonstration project will quantify the amount of erosion

that occurs when native plants are actively planted. This technique has not been previously used in our area.

Response to Comment No. 18

European beachgrass was not present in the project area until circa 1970, as documented in the air photo record. The deflation plain had already formed due to the presence of native foredune building species. We do not know what is meant by your use of the term "richer," but the wetlands in the north of the Lanphere parcel are the same age and very similar in composition to those of the Bair parcel. Wetlands farther south on the Lanphere parcel were formed later and therefore are less structurally complex.

Response to Comment No.19

We have revised the section in question to clarify why there is not a concern with wetland burial. The wetlands present on the Bair parcel are located eastward of the maximum extent of sand movement that has occurred since the restoration on the Lanphere parcel. We are not ruling out the possibility that wetland burial could occur in this area as a result of future storm activity/erosion unrelated to management.

Response to Comment No. 20

We disagree with your assessment of the McDonald study. Only one LiDAR flight is needed to establish relative foredune height along the North Spit. The South Spit is a different area with different processes and ecology than the North Spit and comparison is not appropriate. The expectation of rebuilding is predicated in part on the high foredune heights at both native and invaded dunes at the Bair and northern Lanphere parcels. The demonstration project will allow us to quantify changes in foredune morphology post-restoration for the first time.

Response to Comment No. 21

The protection of the wetlands is provided by the maintenance of a foredune feature while dunes are migrating. We do not predict that the wetland will not be affected as the shoreline migrates inland over the long term with sea level rise. Rather, what remains of the wetland as sea level rises and dunes migrate inland will be protected from overwash more effectively if a foredune feature is maintained. Our project is designed to promote the retention of the foredune feature during sea level rise.

Response to Comment No. 22

The burial of the forest by inland transgressive dunes is unrelated to foredune processes. The foredune blowouts do not reach the transgressive dunefield. The transgressive dunefield is migrating as a separate body of sand. This burial is a natural part of dune cycles in our region. Buried soils in the dunes of Oregon and Washington indicate that dunes have previously been stabilized by forests and remobilized numerous times going back thousands of years (Wiedemann and Pickart 1996). Aeolian processes are a requirement for the formation and maintenance of dune systems. Blowouts are a natural part of our sand dune system and are

responsible for the large volume of sand currently stored behind the foredune on the project site. As blowouts migrate inland, they leave behind lateral “trailing” ridges that become stabilized by vegetation, forming dune ridges (Hesp 2002, and historic air photo record).

Response to Comment No. 23

The buffer zone that is applied to development is not applicable.

Response to Comment No. 24

As stated in Comment No. 18 above, the wetlands in the project site were not created as the result of European beachgrass invasion, as evidenced by historic air photos, and are not expected to be affected by the proposed action.

Response to Comment No. 25

The type of impacts and unstable soils referred to in the CEQA checklist is not relevant to the refuge site.

Response to Comment No. 26

There is considerable literature and scientific consensus that hard shoreline armoring is a temporary at best and will not prevent sea level rise. The proposed action is intended to increase sediment exchange between the beach and backing dunes in such a way as to facilitate the landward migration of a functioning foredune that retains a buffering function. Destabilization is not the intended or expected result of the action. The shoreline cannot be fixed in place by the presence of European beachgrass as sea level rises. Adaptation does not mean resistance, but rather adapting to coming change.

Response to Comment No. 27

The Proposed Action is a sea level rise adaptation demonstration project. The purpose is to transparently and rigorously document the response of the foredune to removal of European beachgrass followed by planting of native species.

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