

DATE: May 3, 2019
TO: Bolinas Lagoon Advisory Council
FROM: Veronica Pearson, Open Space Planner
SUBJECT: Agenda Item #7: Kent Island Vegetation Management Project

BACKGROUND

In 2011, Marin County Parks and the Open Space District (MCOSD) received funding through the National Estuary Restoration Act for the Kent Island Vegetation Management Project (“project”) that commenced in the summer of 2013. The National Estuary Restoration Act has provided funding for a consultant team of ecologists and botanists for project oversight, monitoring, and reporting. MCOSD has provided administrative and field staff who coordinate and conduct vegetation management activities, collect data, and have organized and led volunteer events. Additionally, the project has been supported by the Greater Farallones National Marine Sanctuary (GFNMS) and the Greater Farallones Association (GFA), with MCOSD and the GFA collaborating to manage and advertise community volunteer events.

PROJECT GOALS AND OBJECTIVES

The primary purpose of the project was to restore 29 acres of tidal marsh and coastal dune habitat on Kent Island through vegetation modification. Three goals were established to maximize the intended ecological benefits:

- Restore ecosystem resilience to significant natural disturbance impacts, and allow the island’s ecological and geomorphic processes to adapt to accelerated sea level rise and increased impacts of coastal storms;
- Increase biological diversity of native island vegetation by protecting and restoring important refuges for rare plants; and
- Reduce impediments to the island’s ability to reshape itself in response to sediment transport processes in Bolinas Lagoon due to coastal storms, currents, and waves.

The project’s objective was to remove non-native vegetation from the island and promote expansion of existing native plant populations, while protecting special status plants and wildlife in and adjacent to the project area. Annual monitoring was conducted to track the response of vegetation to treatment actions and to objectively determine if performance standards have been met. Additionally, a topographic survey was conducted prior to treatment actions (2012) and again at the end of the project (2018). Prescriptions for vegetation treatments were made using adaptive management principles and were informed by monitoring results and regular site assessments.

The target species for removal have been *Carpobrotus edulis* (ice plant), *Ammophila arenaria* (European beachgrass), *Lotus corniculatus* (Bird’s foot trefoil), and *Drosanthemum floribundum* (rose iceplant). In the Kent Island Project Design Plan, MCOSD proposed using a number of different eradication methods

to remove invasive species. Invasive plant treatment methods used in the project included manual removal, saltwater irrigation, girdling and mulching. One of the methods proposed was seawater irrigation and flooding (sand salinization) targeting ice plant (*Carpobrotus edulis*) and European beach grass (*Ammophila arenaria*). In early 2013, an irrigation system was constructed on Kent Island. Since then, staff have run into a number of obstacles with the irrigation method and terminated its use in 2016 as it was not cost or time effective.

MONITORING RESULTS

The 2013 *Project Monitoring Plan* outlined the monitoring methodologies and performance standards used to evaluate the success of the project. Using transect surveys, 2018 results were compared to 2013 baseline measurements to assess change after five years of treatments. Restoration progress was evaluated using the year-five performance standards established in the *Project Monitoring Plan* (Table 1). Determination of whether the target invasive species had met the performance standard was analyzed by vegetation community.

During the process of classifying Kent Island's vegetation communities in 2012 (Figure 1), the vegetation types were named after the dominant species and included the name(s) of target invasive species, which were co- or sub-dominant within stands. Vegetation communities within the project treatment area were re-surveyed this year to assess shifts in species composition. In several communities, cover of target invasive species was reduced to a level where the community classification changed (Table 2). In general, the overall composition in these communities was similar to that recorded in 2012 with the exception that cover of target weed species were eradicated or reduced to trace amounts (<1%).

As compared to baseline data, the 2018 results of vegetation monitoring revealed mixed results for the four primary target invasive species. Two of these species met the year-five performance targets within their monitored vegetation community, *Ammophila arenaria* and *Drosanthemum floribundum*. *Ammophila arenaria* showed a 100 percent reduction as compared to baseline data. While this is encouraging, it is important to note that a population of this species is still present on the island and will need continual monitoring and management. This future effort will be outlined in the upcoming Kent Island *Operations and Maintenance (O&M) Plan*, which will be a guide for long-term management of the project.

This was the fourth straight year that *Drosanthemum floribundum* was absent in the monitoring transects, meeting the performance target of 100 percent reduction in cover. Annual surveys for this species are still needed to detect and treat recurring patches.

Cover of *Carpobrotus edulis* was reduced as compared to baseline measurements in four of the five vegetation communities monitored: *Carpobrotus* dominant (-89%), *Festuca-Carpobrotus* (-27%), *Festuca-Carpobrotus/Sand* (-47%), and *Grindelia* (-100 %). In the fifth vegetation community, *Festuca-Carpobrotus/Ammophila*, a 25 percent increase in *Carpobrotus edulis* was observed. Overall, this species fell short of the year-five performance target in four of the five vegetation communities. After vegetation monitoring occurred in early June 2018, manual removal of *Carpobrotus edulis* continued through the end of October and will continue beyond the scope of the grant-funded period. Thus, it is likely that significant reductions of *Carpobrotus edulis* will be observed in the next year.

Cover of *Lotus corniculatus* can vary greatly from year to year, depending on environmental conditions. During the drought years of 2014-2015, germination was low, and all plants were treated before setting seed. The temporary break in the drought last year caused an explosion in germination and many plants successfully set seed. Despite increased efforts to control this species by manual removal, an increase of 31 percent relative cover within the monitored stand (from 36 percent in 2013 to 47 percent in 2018)

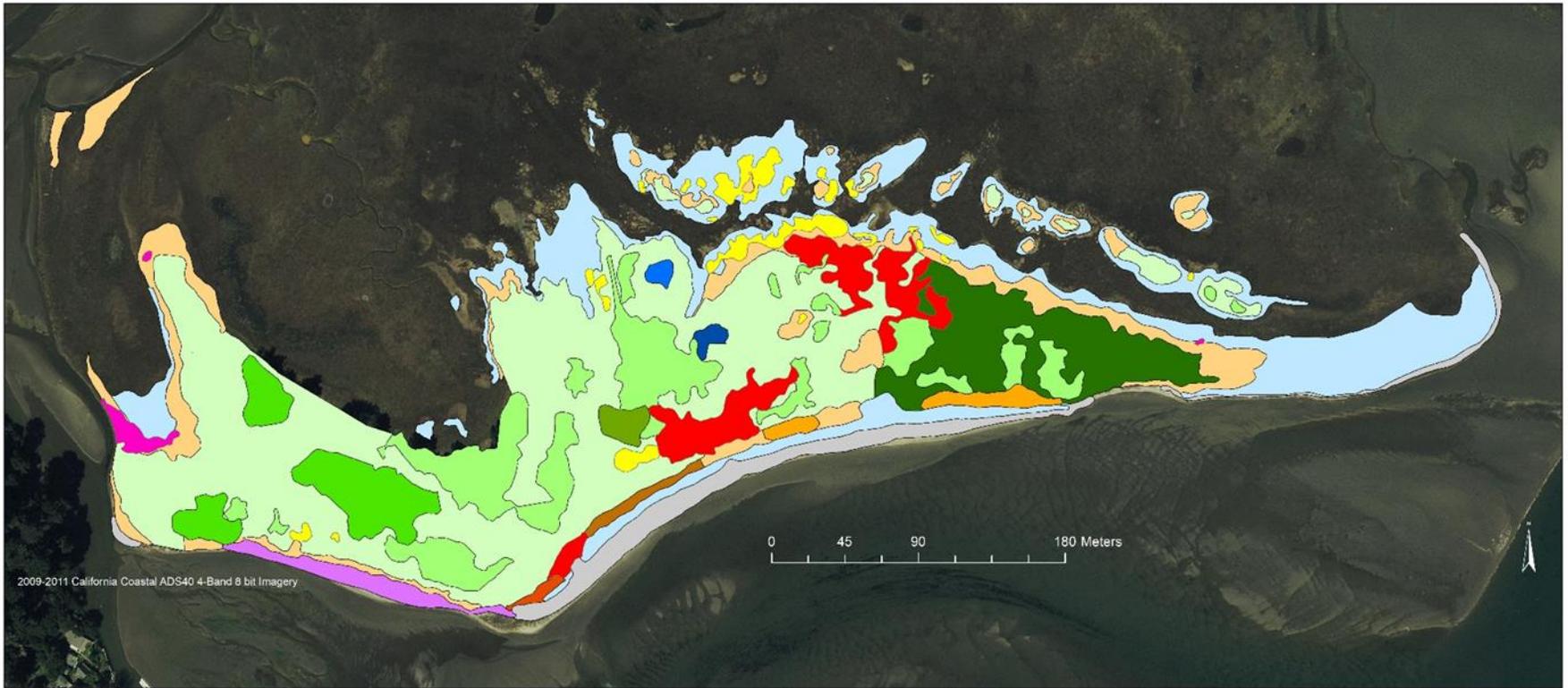
was observed. The year-five performance target was 95 percent reduction in cover, and therefore not met. While results are specific to the one transect where *Lotus corniculatus* is measured, the species has demonstrated similar patterns in germination and increased cover across the project area.

Within the project area there are three naturally occurring rare plant species on Kent Island: *Castilleja ambigua* ssp. *ambigua* (salt marsh owl's clover), *Chloropyron maritimum* ssp. *palustre* (Point Reyes bird's-beak) and *Abronia umbellata* var. *breviflora* (pink sand verbena). There was little change in the aerial extent and abundance of *Castilleja ambigua* ssp. *ambigua* and *Chloropyron maritimum* ssp. *palustre* since 2012. Yet, the population of *Abronia umbellata* var. *breviflora* was discovered in 2012 and consisted of two young plants—suggesting that the species had recently colonized the island. Since then, the species is monitored annually to track the condition of this population. On June 12, the annual census found 170 plants.

A topographic and bathymetric survey of Kent Island and Bolinas Lagoon was conducted by the U.S. Geological Survey (USGS) in 2012-2013 to create a digital elevation model (DEM) of the system for use in Bolinas Lagoon management and restoration planning. The 2018 topographic survey of Kent Island was designed to replicate, and in some areas exceed, the coverage of the 2012 RTK GPS survey. Generally, the analyses performed indicate that elevation change is greater in the vegetation treatment areas vs. untreated areas, thus supporting the assumption made in the Project Monitoring Plan that assumes that elevation change will be greater in treated vs. untreated areas. However, it is inconclusive whether the change detection is directly related to vegetation management efforts aimed at meeting the project goal of allowing the channel to self-adjust with natural disturbance.

CONCLUSION

Overall, MCOSD is satisfied with the progress made since 2012. The performance targets set in 2012 were highly ambitious, and the realities of meeting complete eradication of these highly invasive species is unlikely due to the perseverance and reproductive tenacity of these species. Significant progress has been made in reducing the target species, as seen by the colonization of *Abronia umbellata* var. *breviflora* and the change in composition of the vegetation communities. MCOSD will continue vegetation management efforts on the island utilizing volunteers and seasonal staff. Staff is also working on a Operation and Maintenance Plan that will outline how the agency will ensure that overall goals of the project continue to guide the management of the island. This will entail continuing the partnership with the Greater Farallones Association (GFA) on educational outreach and management activities, as well as continuing monitoring efforts.



Kent Island

Plant Communities

June 2012

Plant Community

- Cakile maritima*
- Distichlis spicata*
- Festuca rubra-Carpobrotus edulis*
- Festuca rubra-Carpobrotus edulis/Ammophila arenaria*
- Festuca rubra-Carpobrotus edulis/Artemisia pycnocephala*
- Festuca rubra-Carpobrotus edulis/Elymus x vancouveriensis*
- Festuca rubra-Carpobrotus edulis/Soil*

- Grindelia stricta*
- Grindelia stricta-Carpobrotus edulis*
- Grindelia stricta-Carpobrotus edulis/Elymus mollis*
- Grindelia stricta-Carpobrotus edulis/Elymus x vancouveriensis*
- Juncus balticus*
- Juncus balticus-Carpobrotus edulis*
- Plantago maritima*

Stand of Target Weeds

- Carpobrotus edulis* (dominant)
- Drosanthemum floribundum*
- Lotus corniculatus*

Created by: Shelly Benson. Contact information: shelly.benson@yahoo.com, 707-479-6777

Figure 1. Map of Kent Island vegetation communities, 2012

Table 2. Vegetation community classification at the beginning and end of the project. Bold types indicate communities that were reclassified.

| 2012 Vegetation Types | 2018 Vegetation Types |
|--|--|
| <i>Festuca rubra</i> - <i>Carpobrotus edulis</i> | <i>Festuca rubra</i> - <i>Carpobrotus edulis</i> |
| <i>Festuca rubra</i> - <i>Carpobrotus edulis</i> / <i>Ammophila arenaria</i> | <i>Festuca rubra</i> |
| <i>Festuca rubra</i> - <i>Carpobrotus edulis</i> /Sand | <i>Festuca rubra</i> |
| <i>Grindelia stricta</i> - <i>Carpobrotus edulis</i> | <i>Grindelia stricta</i> - <i>Carpobrotus edulis</i> |
| <i>Grindelia</i> - <i>Carpobrotus</i> / <i>Elymus mollis</i> | <i>Grindelia stricta</i>/<i>Elymus mollis</i> |

Table 1. Summary of project performance standards for species tracked by vegetation monitoring.

| Species | Y5 performance target |
|---|--|
| Native species | Native species are dominant, relative cover >99% (absolute cover of non-native target species <1%) |
| Rare species | |
| <i>Castilleja ambigua</i> ssp. <i>ambigua</i> | Density not significantly different between treated and non-treated areas |
| Invasive species | |
| <i>Ammophila arenaria</i> | >99% reduction on cover |
| <i>Carpobrotus edulis</i> | >95% reduction on cover |
| <i>Drosanthemum floribundum</i> | 100% reduction on cover |
| <i>Lotus corniculatus</i> | >95% reduction on cover |