**Limonium ramosissimum** Treatment Pilot & Development of a Marsh Vulnerability Index for San Francisco Bay

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San Francisco Estuary tidal marshes serve many important functions, including providing habitat for endangered plants and animals. However, more than 85% of the Estuary's marshes have been lost to various forms of development, and the remaining marshes are often fragmented from one another and lack a significant high marsh component and estuarine-terrestrial transition zone. These anthropogenic impacts increase the vulnerability of the Estuary's tidal marshes to further degradation by invasive species, and loss of marsh acreage from sea level rise.

Aside from the Invasive Spartina Project's cordgrass eradication effort, there has been a coordinated regional program to address invasive plants in the Estuary's tidal marshes. Our two-year pilot project funded by a grant from the National Fish & Wildlife Foundation (NFWF) has two primary activities: (1) removing high-priority populations of invasive sea lavender and (2) assessing the vulnerability of the Estuary's tidal marshes to invasive plant damage.

In the summer of 2016, Limonium was treated at 12 sites in Alameda, Marin, and San Mateo Counties using chemical and manual methods, with follow-up treatment planned for 2017.

In a complementary effort, a team of local marsh ecologists utilized the USFWS Invasive Plant Inventory and Early Detection Tool (IPEDT) developed by Giselle Block and her colleagues to assess the vulnerability of 40 large marshes based on current invasive plant presence, ecological integrity, and vectors of invasive plant dispersal. Rankings were used to prioritize weed mapping at ten sites (two of which were completed in September 2016). Initial results from mapping will be used to test regional coordination of invasive plant treatment to maximize benefits to high-value tidal marshes.

In tidal marshes, “Terrestrial Pathways” included levees, trails, roads, railroads, and perimeter-to-area ratios at landlocked sites, while PG&E boardwalks were considered negligible. “Aquatic Pathways” included channels, flood control waterways, outer shorelines, and perimeter-to-area ratios for island sites. Flooding was only considered if marsh elevations were known, and was used to infer flooding frequency. For “Transport Vectors” ecologists considered public visitation, hunting, and fishing, either by boats, bikes, or on foot, as well as dredging and construction activities nearby. Lastly, “Anthropogenic Disturbances” in marshes included revegetation efforts, invasive cordgrass treatment, and lack a significant high marsh component and estuarine-terrestrial transition zone.

**How applicable to this ecosystem?**

No, the given criteria from the three IPEDT categories were applicable to the Estuary’s tidal marshes. For “Importance to Other Priority Natural Resources of Conservation Concern”, there were many low-designated invasive species the ecologists and provide useful information concerning invasive species, so the criteria was often ruled out. The other two criteria contributed to score separation for the 40 sites that were assessed.

**Unique considerations within the criteria:**

**Area**

- “Killing energy” – the ecologists focused on marsh hydrology and characterization, and considered sediment dynamics, composition of ground, and fragmentation by levees and other natural pathways, in addition to impact from anthropogenic, and its influence on surrounding estuaries. The “Killing energy” criterion was not considered at the given sites, but was removed from the dataset to better understand the distribution and cover of invasive species.

**Invasion Risk:**

- Invasive species were scored on the likelihood of establishment and spread, as well as how invasive species may affect other species, ecological processes, and human activities. The “Invasion Risk” criterion was not considered at these sites.

**Plant Status:**

- The “Invasive Plant Status” criterion was not considered at these sites.

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