San Francisco Bay Ecotone
Vegetation Restoration & Management

2008-09 Grant Report

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Abstract

Vegetation management is often straightforward: control weeds, amend soils, seed/plant natives, maintain things during establishment, and then some long-term maintenance to ensure the community stabilizes as intended. However in habitats adjacent to San Francisco Bay these tactics have not meet with success, forcing managers to reconsider dominant paradigms and test novel tactics. One of those paradigms is the "bunchgrass hypothesis", which proposes a grass-dominated herbaceous community for much of Coastal California's valleys. Minnich (2008) found this was due to an inappropriate baseline set after the influences of European activities, but our aesthetics may also play some part in what appears to be a bias against forblands. For three years we have attempted to restore grasslands to preclude invasive forbs during habitat creation, as recommended in a management plan, but found grasses difficult to establish onsite and ineffectual against invasive forbs. Further background research and the casual introduction of a native forb have led us to reconsider that plan.

Introduction

Before the Clean Water Act (CWA) was passed in 1972, humans regularly dumped refuse into coastal wetlands, which is apparent from the number of landfills within the tidal marshes of San Francisco Bay (Estuary). One of the smaller municipal landfills created uplands in what is called New Chicago Marsh, a former tidal salt marsh in Alviso, CA now impounded by the salt ponds fringing the Southern portion of the Estuary. In the 1970s this landfill was capped after the CWA and acquired by the US Fish and Wildlife Service (FWS) National Wildlife Refuge (NWR) System in the 1970s when it acquired the marsh. The Don Edwards San Francisco Bay NWR (hereafter the Refuge) established their Environmental Education Center (EEC) on these new uplands.

The landfill was capped with random fill soils that apparently did not have a native seedbank, and may have introduced non-native species. But whether the weeds were brought with the soils or found their way onsite by other vectors the plant community was soon dominated by non-native species. In the 1980s the site had become a solid mass of invasive weeds – poison hemlock, mustards, thistles, fennel, etc. – that grew "overhead". The grounds of the EEC became unusable, so the Refuge decided to begin managing the weeds. Over the next decade they succeeded in clearing the weeds with a great deal of volunteer effort and no small portion of maintenance staff time. But the natives did not return, and each year after the weeds were managed the site would remain barren until the fall when rains would recruit more weeds.

The Refuge decided active revegetation methods were needed and hired Peter Baye to draft a Vegetation Management Plan (VMP, 2006) for the EEC. That plan provided an overall vision for the plant communities he concluded were historically found in similar geomorphic positions adjacent to the intertidal zone in this portion of the Estuary. Baye provided key species that he believed would be useful in initial stages but did not provide exhaustive species lists to guide long-term vegetation management efforts. Nor did he provide detailed plans and specifications for managing vegetation; just a few general recommendations that we have tried to work with over the past three years of implementation. These will be addressed in detail below, but the first step in Baye's plan was to establish grassland to preclude weeds.

After receiving the VMP in 2006, the Environmental Education staff at the EEC attempted to implement it by purchasing grass seed and manually scattering it, but it seemed that without any seedbed preparation or irrigation to supplement poor rainfall they were unsuccessful. In September of 2007 the EEC acquired a volunteer Restoration Ecologist (Thomson, this author) who provided recommendations for standard grass seeding techniques, but hydroseeding was ultimately unsuccessful as well. The grasses germinated, and attempted to establish, but heavy animal browse kept them from performing well. Further background research suggested grasses would not thrive on poor soils. So we decided to test feasible soil treatments to help the grasses germinate, establish better under heavy browse, and compete with weedy forbs.

Synergistic rationales led us to test tilling, topdressing with compost, rolling for compaction, and straw mulching. Drill seeding was tested in 2008 as the remaining mechanical method; seed imprinting does not work well on clay soils so it will not be assessed. A variety of native grasses known to have occurred adjacent to San Francisco Bay's intertidal zone were purchased from a seed supplier that collected them from sites around the estuary. Several weed management techniques were also assessed during this work, including "the stale seedbed" method used in agriculture and "salinization", which uses salt water as an herbicide. Supplemental irrigation was used to mitigate any influence of the continuing drought, and several animal browse control techniques were also tested.

Methods & Materials

A four-acre parcel recommended in the VMP for "alkali grassland" was divided into 16 quarter-acre plots (Figure 1), so the four soil treatments could be factorally applied to assess all possible interactions. The rationale for these treatments was as follows:

a) tilling is part of pre-seeding weed abatement methods (i.e. the stale seedbed) - it improves the seedbed for grasses but not for forbs as we undersand the guilds' germination requirements, and it loosens soils, which aid establishment by easing rooting.

b) amending with compost by topdressing is feasible over large acreages, it also makes a good seedbed, and if several inches are applied it can inhibit the germination of forb seeds via burial.

c) compaction by rolling loosened soils can help regain moisture retention lost to tilling, and it can reduce the erosion potential on slopes, but it should improve forb seed germination by reducing shading from a roughened surface, thus favoring undesirable species.

d) mulching with straw should also improve moisture retention, act like a grass thatch layer to reduce forb recruitment from the seedbank by shading, and could eventually contribute to improved soil structure.

Figure 1. Original 2008 Treatment Design

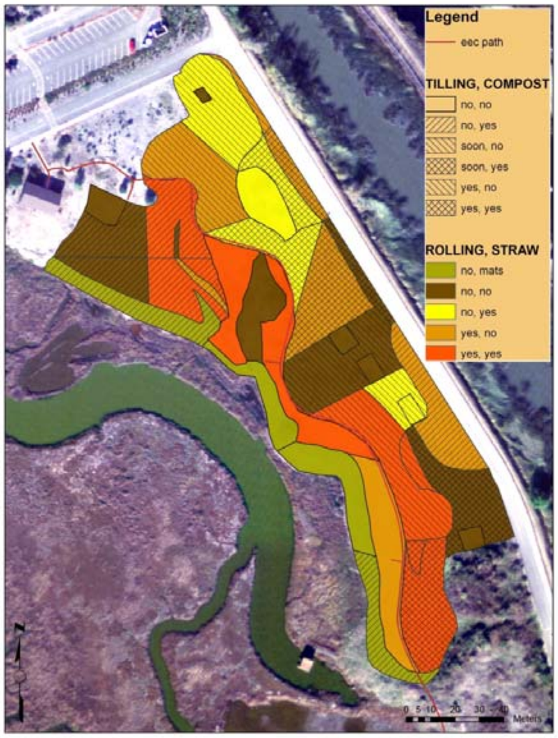


Figure 2. Revised 2008 Treatment Design

Note: in the Figure 2 legend "T" = tilling, "C" = compost, and "S" = straw mulching.

Tilling, composting and compaction treatments were applied before, and straw mulching after drill seeding on November 10, 2008. Unfortunately compaction was dropped from the study this year (due to equipment issues), leaving 8 half-acre treatment areas with the following combinations: compost (C1), compost and straw mulching (CS1), no treatment (N1), straw mulching (S1), tilling (T1), tilling and composting (TC1), tilling, composting, and straw mulching (TCS1), and finally tilling and straw mulching (TS1) (apply to Figure 3). Figure 2 shows the revised treatment layout. Seed was purchased from Pacific Coast Seed (PCS in Livermore, CA). We selected nine of the available grass species based on their historic occurrence around the Estuary and PCS' collection site (Table 1). PCS recommended a seeding rate of 37 pounds per acre for seed drilling and designed the seed mix based on their understanding of the specific species' interactions. Note the species rates listed below do not add up to 100% due to inert materials in the mix (i.e. chaff).

Table 1. 2008 Native Grass Seed Mix (PCS)

Species	Rate
Bromus carinatus	7.5 lbs/ac
Hordeum brachyantherum	7 lbs/ac
Festuca rubra molate	5 lbs/ac
Vulpia microstachys	4 lbs/ac
F. idahoensis roemerii	3.5 lbs/ac
Deschampsia caespitosa	3 lbs/ac
Agrostis pallens	2 lbs/ac
Danthonia californica	2 lbs/ac
Koeleria macrantha	1 lbs/ac

Sampling was stratified random, based on the treatment areas. A $1m^2$ quadrat was placed at random ten times in each treatment area, and a modified Synthetic Presence Index (SPI - Hartnall, 1984) was measured for each species that was not rendered unidentifiable due to browse. The SPI combines visual estimations of percent cover with average height to create a volume. Data were managed in MS Excel and analyzed in SYSTAT 11 using ANOVA (General Linear Models). Please note the caveats below.

Sampling was performed after most grasses had senesced for the year. This was due in part to the fact that animal browse played a significant role again this year, and we hoped more time would allow the grasses to overcome browse pressure. Browse kept most of the grasses well cropped and unidentifiable except where stinging nettle (*Urtica dioica*) held back the rabbits, allowing three-week fescue (*Vulpia microstachys*) to seed. Although we were able to identify most forbs, weed management continued to remove them preferentially, so we decided not to make grass vs. forb comparisons this year and instead looked at overall vegetation performance to assess soil treatment efficacy.

Two stale seedbed methods were tested to reduce the weed seedbank prior to sowing seed. The standard method used by farmers involves irrigating the site outside of the growing season to recruit weeds. A variation of the method used by the Midpenninsula Open Space District (L. Bankosh, pers. com.) relies upon using the first germinating rains of the season to stimulate weed germination. Recruited weeds are then controlled as needed, depending on conditions and the timing of planting.

Several animal browse control techniques were tested to reduce their impact on grass establishment. Our two main browsers are rabbits (both Western brush rabbits, *Sylvilagus bachmani* and black-tailed jackrabbits, *Lepus californicus*) and Canada Geese (*Branta canadensis*), although American Coots (*Fulica americana*) have been spotted eating the grasses in the past. Exclusion fencing made from chicken wire and T-posts were place in various locations around the site as overall control areas for animal browse. We also tested the use of tree shelters and other individual planting browse protection to create areas where rabbits might not want to enter. And the Refuge's feral predator management program officer (Brian Popper, USDA APHIS) recommended a goose exclusion technique ("goose grid") they use at Oakland International Airport, a 30x30 grid of stakes and fishing line with reflective tape, which we setup in several areas. Since we were monitoring the grasses for browse we did not perform any behavior studies with these techniques.

One technique unrelated to the grass seeding work is Salinization, or the use of salt water to control intolerant weeds. It was performed as recommended by the VMP in high marsh ecotonal habitats where native halophytes (salt tolerant vegetation) already occur, such as alkali heath (*Frankenia salina*), and/or areas planned for halophytic species. Our method is to pump water, which varied from 40-60ppt during the treatments, from the sloughs of New Chicago Marsh through a portable irrigation system onto areas where we will be propagating high salt marsh ecotonal species (i.e. salt tolerant natives). Based on earlier tests we applied approximately 10 hours of salinization (5 days @ 2 hours/day) in each salinization area. Note: the California Department of Pesticide Regulation and the US EPA both declined to regulate this activity under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA, 1972), and believed the mixing of NaCl with H_2O would create a "25B" compound exempt from regulation.

Results

Some caveats are necessary to ensure the data are interpreted correctly. First, as noted in the Introduction, about a decade of weed management work has occurred at the EEC, which appears to have dramatically reduced the weed seedbank in the area. And due to an overriding need to ensure the success of all vegetation management work at the EEC, weed management has continued through this cycle of methods testing. We are attempting to get funding to perform work at the San Pablo Bay NWR where testing could include putting natives head-to-head against weeds without assistance. So it would not be correct to attribute the distribution of weeds onsite to the tested methods alone.

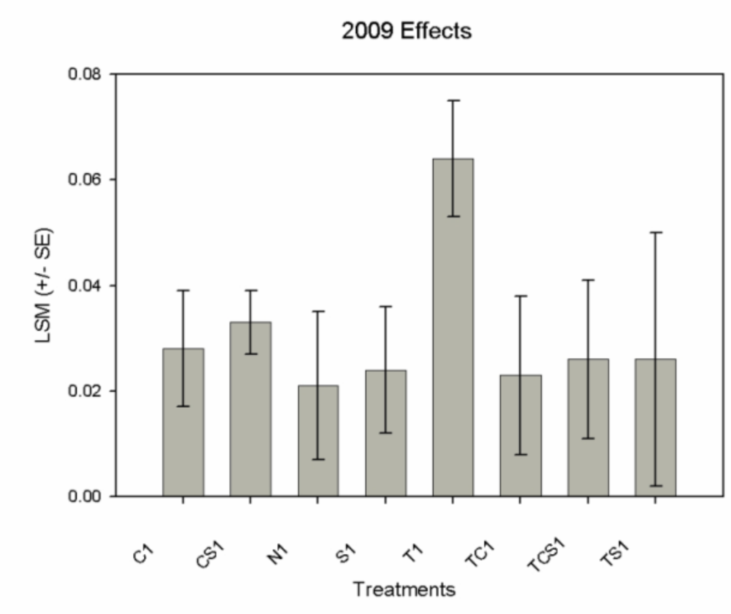
Second, we should also note that we were unsatisfied with the seed drilling contractor's work, which appeared to be haphazard and incomplete. They failed to cover the seed so it is possible that variable amounts were lost to animal browse. And there is also a real possibility the seed was not applied at an even rate throughout the site. Our observations of seed germination could indicate this, or they could indicate the influence of the soil treatments, but there were areas where we could not find seed in the uncovered rangeland seed drill furrows.

And third, supplemental irrigation was used to improve the performance of the grass seed mixture, which cannot be feasibly performed throughout the Estuary's ecotone. Although seeding performance might be comparable to years when no supplemental irrigation was necessary, this is not a reliable approach due to uncertainties inherent in the spatial and temporal variability of annual rainfall. Irrigation was used at the EEC due to the aforementioned need for positive results onsite. Our conclusions below will incorporate these caveats, among others.

Although we have some significant quantitative results to share, the majority of this year's results are qualitative. But we believe these results are informative, if not definitive, given our understanding of the ecology of herbaceous communities in this region, which will be discussed in the conclusions below. Figure 3 shows the overall performance of all vegetation (grasses and forbs) in the 8 treatment areas defined on Page 3; LSM on the x-axis is "least square mean", plus or minus the Standard Error, of mean plant volume: percent cover x average height). Although there was only one apparent significant difference among treatments we noted several useful observations during fieldwork:

1) tilling may have improved the seedbed for grasses, but it was unclear if this was just an unintended (lucky) interaction with the drill seeding contractor's failure to cover the seed (loose soils tended to cover the seed without any effort on the part of the contractor);
2) composting appears to have at least improved the germination rate, which might have been another lucky (unintended) interaction with the seeding contractor's poor work, however without straw mulching the composted areas were the first to die-back (brown-out) during the drought in January, although compost appears to have help reduce weed recruitment from the seedbank likely due to burial;
3) and straw mulching was an obvious benefit to the grasses, as those areas withstood the drought conditions better than other treatment areas, but it was difficult to assess if the straw had an influence on weed recruitment from the seedbank.

Figure 3. 2008-9 Soil Treatment Results



Although most treatments appear to have differences in Figure 3, most significant differences were likely lost to the influence of animal browse. And the one significant difference in treatment effects was not due to the soil treatment; it was due to the introduction of a native annual forb in that treatment area: fiddleneck (*Amsinckia menziesii*). Fiddleneck was spread by a volunteer in one area and did exceedingly well, creating the significant difference in treatment area "T1" (only tilling). During its growing period, all weeds had a very difficult time competing against it.

Results were mixed on the browse protection methods. The "goose grid" appeared to be successful in causing geese to avoid those areas, but rabbits were undeterred so the grasses were heavily browsed in them. The tree shelters were successful in keeping browse off of the plant inside, and when the shelters were placed in dense arrays, such that only a foot or two remained between them, the rabbits were deterred from browsing the grasses between them. We did not get to see their effect on geese because the statewide Canada Goose Population Stabilization Program was successful in New Chicago Marsh so their browse pressure seemed almost nonexistent.

The pre-seeding weed abatement methods had some effect, as some weeds were treated prior to seeding, but they were ineffectual overall due to the seasonality of weed emergence. Unless the stale seedbed method were performed for an entire year many of the site's weeds would not be controlled. However salinization proved to be a very successful method in appropriate habitats. Native halophytes responded to salinization like irrigation, but salt intolerant weeds of both the grass and forb guilds were controlled. Earlier testing showed that sufficient quantities (M&M rate stated above) salinated the soils enough to keep salt intolerant weeds out of the treatment areas for almost 2 years, so we will be watching these treatment areas for residual effects.

Conclusions

Testing for the 2008-09 growing season primarily focused on facilitating grass seed germination and establishment. Based on the results of previous years testing and some key changes in the project focus, significant changes were made in our approach. The approach outlined by the VMP included establishing a cover crop of grasses to preempt species that are more difficult to control onsite (VMP author's assertion). The VMP's author believed that a monoculture of undesirable grasses, *Lolium multiflorum* and *L. perenne* (which hybridize - Jepson Manual, 1993), could then gradually be eliminated by inter-plantings of rhizomatous grasses (*Leymus triticoides* and *Distichlis spicata*), and finally diversified with competitive native forbs (such as *Amsinckia menziesii* and *Centromadia pungens*).

In previous years the project tested the use of the Loliums for a weed-exclusion cover crop as recommended in the VMP. Unfortunately, after hydroseeding the Loliums and providing supplemental irrigation to mitigate periods of poor rainfall during the wet season they were not vigorous enough to provide their intended function during the first year as required by our new project focus. Nor did it appear that several years would enable them to perform well with animal browse because they are kept too short to provide any cover.

An explanation of our project focus here will be helpful. In 2008 this project acquired several grants (see Acknowledgements below) to research and develop methods for managing vegetation in habitats ecotonal (i.e. adjacent, surrounding) to the intertidal marshes of San Francisco Bay. These habitats are a critical component of the tidal marsh ecosystem, so managing their vegetation is a key component of facilitating the recovery of endangered obligate species. This means that our project focus expanded beyond the boundaries of the EEC to encompass the Estuary's entire ecotone.

The scope of this task, specifically managing vegetation over hundreds if not thousands of acres around the Estuary, renders many standard techniques infeasible. The parcel size at which management entities could even afford to spray herbicides (probably much less than 100 acres) means that successful vegetation management in the Estuary's ecotonal habitats would take decades, if not centuries. And if it were to take a century then no margin of error would be left before tens of thousands of acres of restored intertidal marshes began reaching equilibrium elevations (Atwater et al., 1979), where ecotonal vegetation started recruiting throughout the marsh plains. If the Estuary's ecotone remains dominated by non-native species, then it is reasonable to assume the restored marshes will become filled with undesirable weeds that may not provide the habitat functions and values needed by the ecosystem.

We have used this reasoning as a practical basis for the development of methods. And in the case of the project's VMP we have found the use of grasses alone as cover crops inadequate for many reasons. Temperate grasslands exist on well-developed topsoil (Webber, 2002), and soils in the Estuary's ecotone are severely disturbed, so grasses are not vigorous in these soils. The arid conditions found in most of the Estuary's margin select for drought tolerant species and more forbs meet this criterion than grasses. One regular volunteer pointed out the obvious: if grasses would be competitive onsite then why are they not here already? Avena fatua and barbata exist nearby but have not been able to significantly colonize the EEC; even Lolium multiflorum dominates a low lying area nearby, yet this invasive species cannot seem to invade the site. Based on our experience, grasses are the preferred forage for many herbivores in the region, so they are preferentially browsed and have a more difficult time establishing. And on habitat creation sites where no native seedbank exists, not propagating forbs would fail to address the need for other guilds in grass-dominated herbaceous communities.

Finally, it is possible, if not likely, that sites with conditions like the EEC would never have been dominated by grasses. Minnich's research (2008) found strong evidence that once away from maritime influences along the coast the arid conditions in California selected for native forblands. Except on river floodplains where grasses could get adequate water supplies, it is likely the Spanish explorers did not find grasslands in interior California. But even if grasses were able to successfully compete against undesirable forbs, they would take years to develop past the establishment period when active weed management is required. We concluded the use of any intensive technique required for the establishment of grassland infeasible at our scales, whether area spraying broadleaf-specific herbicides, any form of pre-seeding weed control, or installing and removing browse protection devices, so we are discounting grasses alone as cover crops and shifting out attention to native forbs.

We will be utilizing hydroseeding for propagation in the future for a number of reasons. Although seed drilling is a fairly efficient method of spreading seed uniformly there are several problems with the method. Drills put the seed down in rows spaced 3-6 inches apart, which leaves open ground for weed recruitment during the first few years as the grasses infill. One volunteer thought this was "penny-wise, pound-foolish", meaning that although you may initially save money by using less seed you are likely to spend more managing weeds during the grass establishment period than if you were to use twice as much seed for hydroseeding. And weeding by any method is not feasible at our scales (hundreds to thousands of acres). The drill operator can reseed areas, putting seed rows between the initial rows, or crossing the first rows to make a grid arrangement, but area may still be left open and this also requires double or even triple the implementation time. Hydroseeding is also able to cover uneven ground and steep slopes where a drill is not functional. And finally, certain hydroseeders are able to "hydrosprig", which is a method for vegetatively propagating stolons (i.e. root divisions). Hydrosprigging is covered more thoroughly below in the new plan.

2009-10 Implementation Testing Plan

Our results over the past three growing seasons lead us to question the VMP's focus on grasses alone for weed exclusion cover crops and focus on native forbs with grasses. Part of our reasoning not stated above is based in Community Ecology theory. Simply put: how are grasses supposed to compete against forbs who often occupy different ecological niches? There is not enough water for warm season grasses in sites above active floodplains, and cool seasons grasses seem to have difficulties thriving in the region's wet season. But even if the grasses could form a perfect thatch layer any disturbance like a person or animal crossing the site would open up canopy gaps and could stimulate germination of forb seeds. And without any native forb seeds to offer competition to invaders grasslands are essentially unprotected.

But grasses don't perform well on our site; neither the non-native Lolium species recommended as a temporary cover crop by Baye (2006) nor the mix of grasses native to the Estuary could provide cover that meets our management goals. This was due in part to animal browse, which was responsible for keeping our entire 4-acre treatment area shorter than any lawn. But even without animal browse, and with significant weed management during establishment, it would be highly unlikely for the grass guild to preclude weedy forb recruitment. One need only look to the hills in spring at the wildflower displays to understand grasslands are never just occupied by members of the grass guild. It is a herbaceous community dominated by grasses, but forbs are almost always present, playing a role in the community.

So we began preparing to focus on the use of native forbs this year. We have contracted with Pacific Coast Seed to collect native forbs seed for our fall testing, reserving a portion to begin propagating and amplifying it on their farms. They have collected or should collect the following species:

Table 2. Native Forbs Collected by PCS

Scientific Name	**Common Name**
Amsinckia Menzeisii	fiddleneck
Centromadia pungens	spikeweed
Hemizonia congesta	tarweed
Heliotropium curassavicum	heliotrope
Malvela leprosa	alkali mallow
Atriplex triangularis	big saltbush
Madia exigua	gumweed

In addition to those native forbs we will be using other native forbs and native grasses collected by PCS in the region, including:

Table 3. Appropriate Native Species in PCS Stock

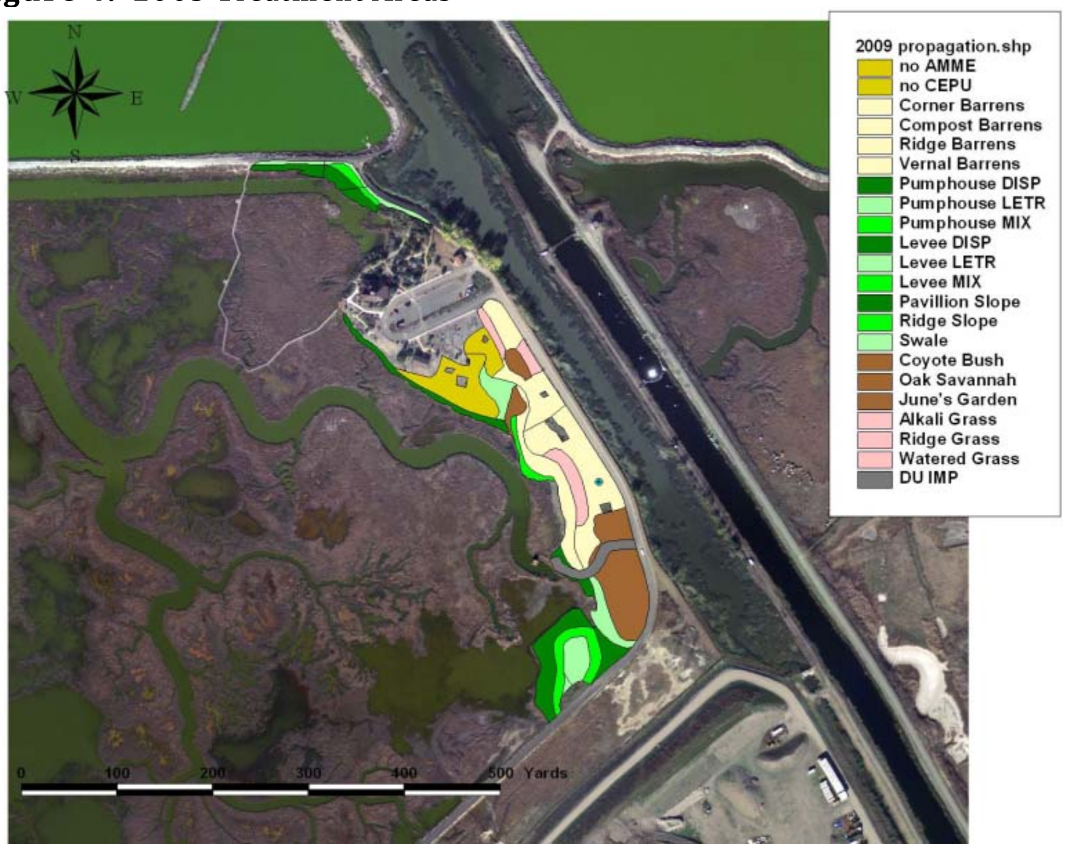
Scientific Name	**Common Name**
Ambrosia psilostachys	western ragweed
Artemesia douglasiana	mugwort
Lotus scoparius	deerweed
Euthamia occidentalis	western goldenrod
Baccharis douglasii	salt marsh baccharis
Aster chilensis	Chilean aster
Trifolium willdenovii	tomcat clover
Frankenia salina	alkali heath
Grindelia stricta	marsh gumplant
Vulpia microstachys	three-week fescue
Bromus carinatus	California brome
Hordeum brachyantherum	meadow barley
Nasella pulchra	purple needlegrass

These species will be utilized to create quick cover that can compete against non-native forbs and grasses by filling as many ecological niches as possible, given the availability of suitable native species. It remains to be seen if the available species provide cover throughout the year, but if temporal gaps are found they can be addressed with targeted collections for future work. We anticipate the forbs will dominate the site for some indeterminate time, if not in perpetuity. The forbs will likely improve the soils through the years, so at some point grasses may become more competitive, and if they do the native forbs will have created a seedbank onsite to provide competition against any future invasions.

Treatment Areas - We anticipate using approximately 6.5 acres of the EEC this fall for testing (Figure 4). Approximately 2.5 acres will be discussed below in the Hydrosprigging section, and the other 4 acres will be utilized as follows. It was decided by the project group to conserve the best of the 2008-09 treatment areas, and perhaps compare their progress to the 2009-10 treatments. We selected the best grass performance areas to retain (pink fill on Figure 4), which included a small area where the grasses filled well even though they were kept cropped by animal browse, a small section where we have continually watered because we needed to relieve pressure on the irrigation line while watering enclosures (not discussed here), and the slope of the "ridge" where stinging nettle protected the grasses from rabbit browse.

The rest of the available area will be utilized for testing native forb and grass seed mixtures, although we will not be seeding more fiddleneck or spikeweed in the areas where they already seeded themselves in order to understand their inter-annual dynamics better. The 1.5 acre Oak Savannah portion of the site will be utilized to test the performance of purple needlegrass (*Nasella pulchra*) by including it in the forb/grass seed mix. The oak area is also close to the water table, so it will also receive meadow barley (*Hordeum brachyantherum*) along with a few other areas that appear close to groundwater. We anticipate being able to test a few seeding rates of the mixture within the remaining 4 acres outside of the Oak Savannah. This will be an important test because many of the forbs we will be using are weedy in their own right (i.e. superior competitors) so seeding rates are likely important.

Figure 4. 2009 Treatment Areas



Hydrosprigging – Regional vegetation managers have always bemoaned their inability to propagate the two most aggressive native rhizomatous grasses, creeping wildrye (*Leymus triticoides*) and saltgrass (*Distichlis spicata*), by seed. Local populations of these species do not seed well, which is reportedly due to polyploidy (multiple sets of chromosomes) interfering with pollen maturation (Gould, 1945). Commercial seed companies have tried to meet demand for these species, but have not found commercially viable strains from local historic populations. So their use in restoration projects has been limited to manual container or root division plantings, which is not feasible for large-scale projects. Some have utilized seed from outside the region, such as the Yolo Bypass near Sacramento, but such decisions should not be made lightly due to the issue of genetic degradation (CNPS, 2001 and citations therein).

But there is a method for propagating rhizomatous grasses vegetatively over large areas. The method was developed by golf course hydroseeders and is called “hydrosprigging” because they spray stolons (i.e. root divisions) instead of seed. The method is not popular in Northern California because it does not work well with the grasses used in golf courses in this region. Sprigging has been used with saltgrass in Southern California, but we are unaware of anyone trying native wildryes yet. We have found a hydroseeding contractor who has some experience sprigging iceplant for Caltrans near Monterey Bay so it is possible to test the method this year.

So we would like to test hydrosprigging saltgrass and wildryes this fall, but we have not found any crops of these species available that were collected in this region. Most of these species that are cropped are for native seed, so they are collected in the Central Valley where they seed better, which brings us back to the issue of propagule sourcing and genetic degradation. We are discussing the issue internally (SFB NWR Complex biology staff) but it is an issue best addressed by a larger group with an expert in attendance to help guide the discussion. We are hoping to discuss this year in a roundtable meeting being organized by Giselle Block and David Thomson for vegetation managers in the region. That meeting will bring together approximately 20 vegetation managers from federal, state, and local governments, as well as NGOs active in the tidal marsh ecotones of San Francisco, Monterey, and Tomales Bays. This meeting will likely occur near the end of September or the beginning of October of this year.

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St. Andrews School – volunteer groups
and many Community Service Days

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Google – community service initiative through "Hands On Bay Area"
Cisco Systems – community service initiative through "One Brick"
HOPE Services – almost weekly workgroups