

Tidal Marsh Revegetation by Design: Rapid Enhancement of Habitat to Benefit California Clapper Rail

Two Examples from Eden Landing Ecological Reserve

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Revegetation Design Strategy

Whale's Tail South and Cargill Mitigation Marsh are two marshes that differ greatly in restoration age (time since restored to tidal action) as well as marsh physical and biotic complexity. Both marshes were heavily invaded by hybrid *Spartina*. Successful treatment at these marshes has allowed for revegetation with *Spartina foliosa* to move forward.

Rapid Habitat Enhancement

As shown in the example photos above, native marshes that support sustainable California clapper rail populations are typically large with extensive channelization and high vertical vegetative complexity. Clapper rail densities have been found to peak at marshes that have a mix of elevation-based marsh zones, with 5-10% defined as low marsh (Liu et al. 2012)¹.

Two native marsh species primarily provide the vertical cover needed by foraging, nesting and roosting clapper rails: *Grindelia stricta* in the mid- to high- marsh plain and *Spartina foliosa* in the low marsh and along marsh plain channels.

Planting design for rapid habitat enhancement:

- Focus on *Grindelia* and *S. foliosa*
- Plant high density planting "patches" and "plots"
- Distribute *Grindelia* patches throughout marsh to benefit as many potential clapper rail territories as possible
- Reintroduce *Spartina foliosa* where locally extirpated
- Enhance high tide refugia (marsh "islands/berms" and upland transition zone)

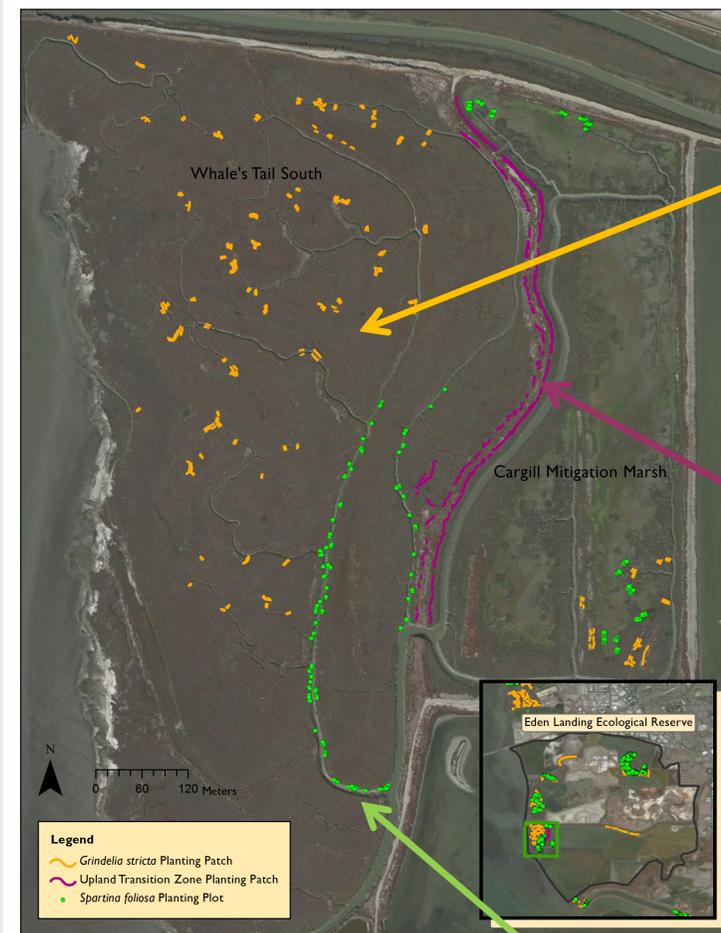
Eden Landing Examples

Whale's Tail South: restored to tidal action in 1930. Mature marsh plain with extensive *Grindelia* along some channels. Critical missing component of clapper rail habitat is *Spartina foliosa* which was extirpated by invasive *Spartina* and has not re-colonized.

Revegetation plan: plant *Grindelia* along appropriate marsh plain channels where not present and reintroduce *S. foliosa* along marsh plain channels. Enhance upland transition zone.

Cargill Mitigation Marsh: young restoration marsh restored to tidal action in 1998 and subsequently infested with invasive *Spartina*. Portions of marsh plain are at appropriate elevation for *Grindelia*; low marsh present throughout.

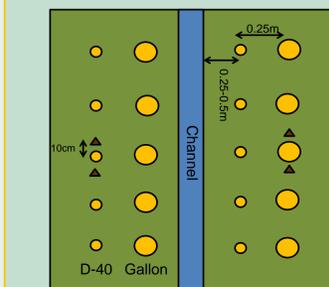
Revegetation plan: plant *Grindelia* along appropriate channels and higher elevation berms within the interior and reintroduce *S. foliosa* on mudflat areas. Enhance upland transition zone.



Planting Designs

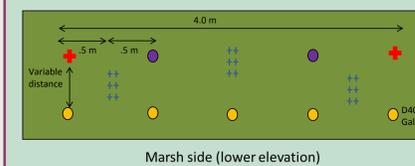
Marsh Plain Channel *Grindelia stricta*

- Each patch has:
- 4m in length, both sides of channel
 - 10 *Grindelia stricta* (D-40 and Gallons)
 - 1 one-gallon *Distichlis spicata* (bed-propagated; each divided into two)
 - Salt-hardened



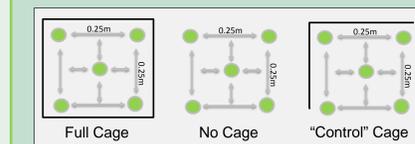
Upland Transition Zone

- Each patch has:
- 4 m in length, variable width
 - 5 *Grindelia* (salt-hardened, some caged, mostly D-40s)
 - 2 *Baccharis douglasii*
 - 2 *Artemisia californica*
 - 18 *Elymus (Leymus) triticoides* (6 ramets per cluster)



Marsh Plain Channel *Spartina foliosa* – 2012-2013

- Each block includes:
- Multiple "plots" clustered in a grid pattern that varies based on site conditions
 - Each plot consists of five plugs of *Spartina foliosa* as shown above
 - Caged
 - Eight source populations propagated in beds at The Watershed Nursery



2011-2013 Planting Numbers and Initial Survivorship

2011-2012: Whale's Tail South

- 5,531 plants installed

Initial Survivorship:

- Marsh plain channel *Grindelia* was 41%
- Upland transition zone species – 25%

2012-2013: Whale's Tail South and Cargill Mitigation Marsh

- 6,533 plants installed

¹Liu, L., Wood, J., Nur, N., Salas, L., and D. Jongsomjit. 2012. California Clapper Rail (*Rallus longirostris obsoletus*) Population Monitoring: 2005-2011. PRBO Technical Report to the California Department of Fish and Game, Petaluma, CA: PRBO Conservation Science.