

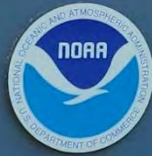


Restoring coastal grassland on deeply scraped soils in Monterey County, CA

Andrea Woolfolk, Mary Paul, and Bill Fortner
Elkhorn Slough National Estuarine Research Reserve

ELKHORN SLOUGH

NATIONAL ESTUARINE RESEARCH RESERVE



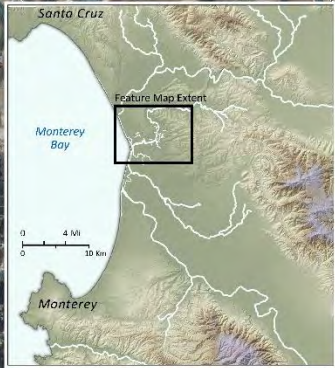


38°45'00"N

38°45'00"N

121°55'00"W

121°55'00"W



Monterey Bay
Submarine Canyon

ELKHORN SLOUGH

Elkhorn Slough National
Estuarine Research Reserve

Hester Marsh
Restoration Site

Parsons
Slough

Mass
Landing

Hester Marsh
Landing

Santa Cruz

Monterey Bay

Monterey

Feature Map Extent

0 4 Mi
0 10 Km

Elkhorn Ranch

Spinnaker Road

Elkhorn Road

Elkhorn Road

Elkhorn Road

Elkhorn Road

Elkhorn Road

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Elkhorn Road

Elkhorn Road

Elkhorn Road

Hester Valley Road

Hester Valley Road

Hester Valley Road

Hester Valley Road

Hester Valley Road

Hester Valley Road

Elkhorn Road

Elkhorn Road

Elkhorn Road

Elkhorn Road

Elkhorn Road

Elkhorn Road

Elkhorn Road

Elkhorn Road

Elkhorn Road

Elkhorn Road

121°55'00"W

121°55'00"W





Elkhorn Slough

Former salt marsh

Salt marsh that is beginning to drown



Photo by Heather Hayashi



38°45'00"N

38°45'00"N



0 1 2 Km
0 1 2 Mi

0 4 Mi
0 10 Km

38°45'00"E

38°45'00"E



Photo by Kiliiii Yuyan

A wide-angle photograph of a former salt marsh at Hester, now converted into a mudflat. The foreground is dominated by a muddy, cracked surface with scattered clumps of green grass and patches of yellowish-green algae. Several weathered wooden posts are stuck in the mud. In the middle ground, a line of taller, reddish-brown grasses separates the mudflat from a grassy hill. The background features a dense line of evergreen trees under a grey, overcast sky. The overall scene depicts a landscape that has been significantly altered by human intervention.

Former salt marsh at Hester:
converted to mudflat after diking and draining



Pajaro River



Hester Project Area



Pajaro River



Hester site





Similar upland scraping was done on the property in the 1970s to create levees and reclaim marsh.





Reference sites





Photo by Kiliiii Yuyan



Photo by Luciane Coletti



Monterey Bay

Phase 1 Grassland

Elkhorn Slough



Phase 1 Area, 2018: Five acres







Monterey Bay

Phase 2

Phase 1 Grassland

Elkhorn Slough



Phase 2 Area, 2021: three acres





A wide-angle photograph of a field of seeded meadow barley in Phase 1. The plants are tall and green, with many dark, elongated seed heads visible. In the background, there are rolling green hills and several electricity pylons under a cloudy sky. A semi-transparent grey rectangular box is overlaid on the upper middle part of the image, containing the text "Can this approach work?".

Can this approach work?

Seeded meadow barley in Phase 1

Did we build a weed-free prairie paradise?

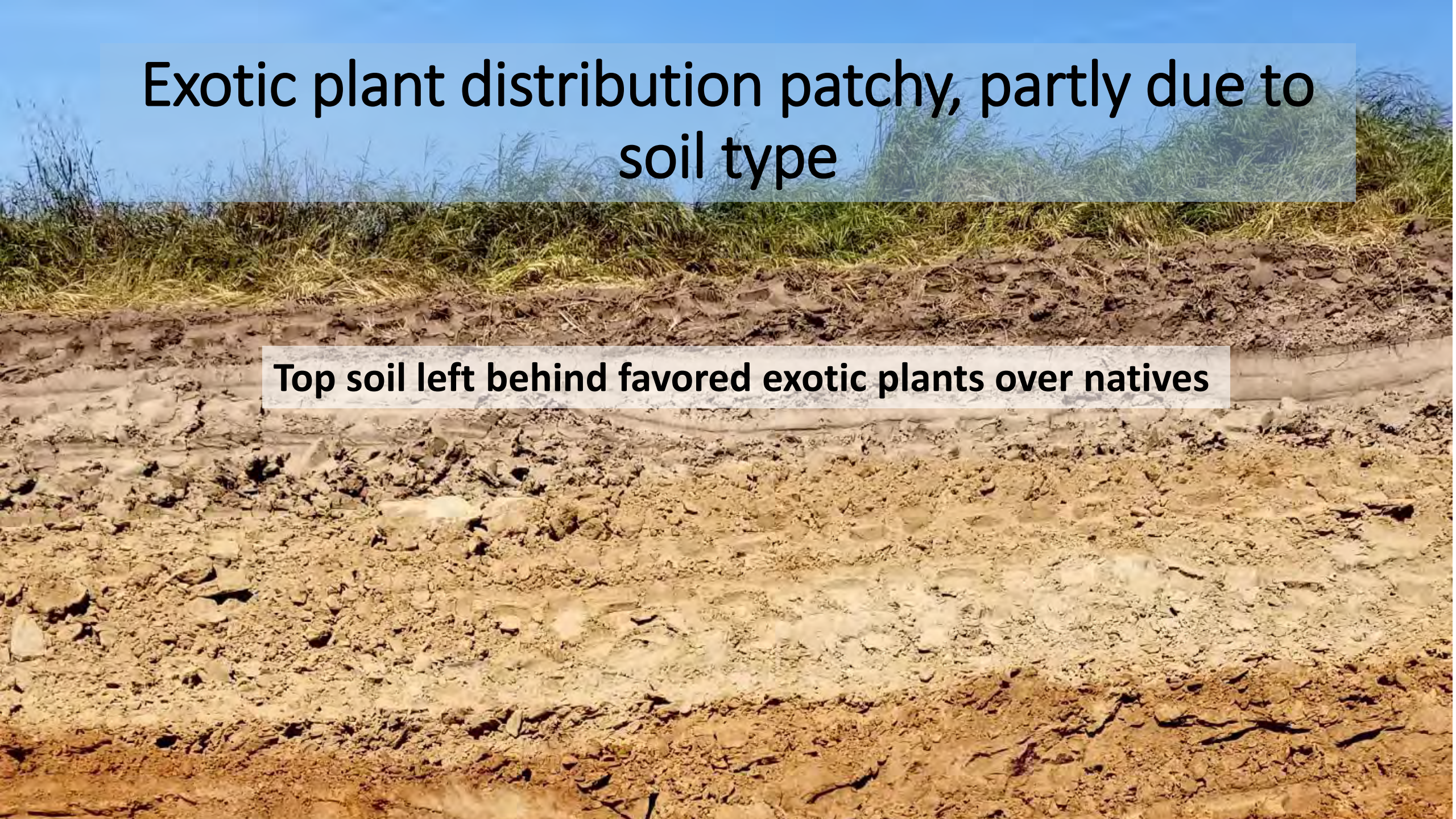
No.

Our big seven weeds in both Phase 1 and Phase 2 have been:

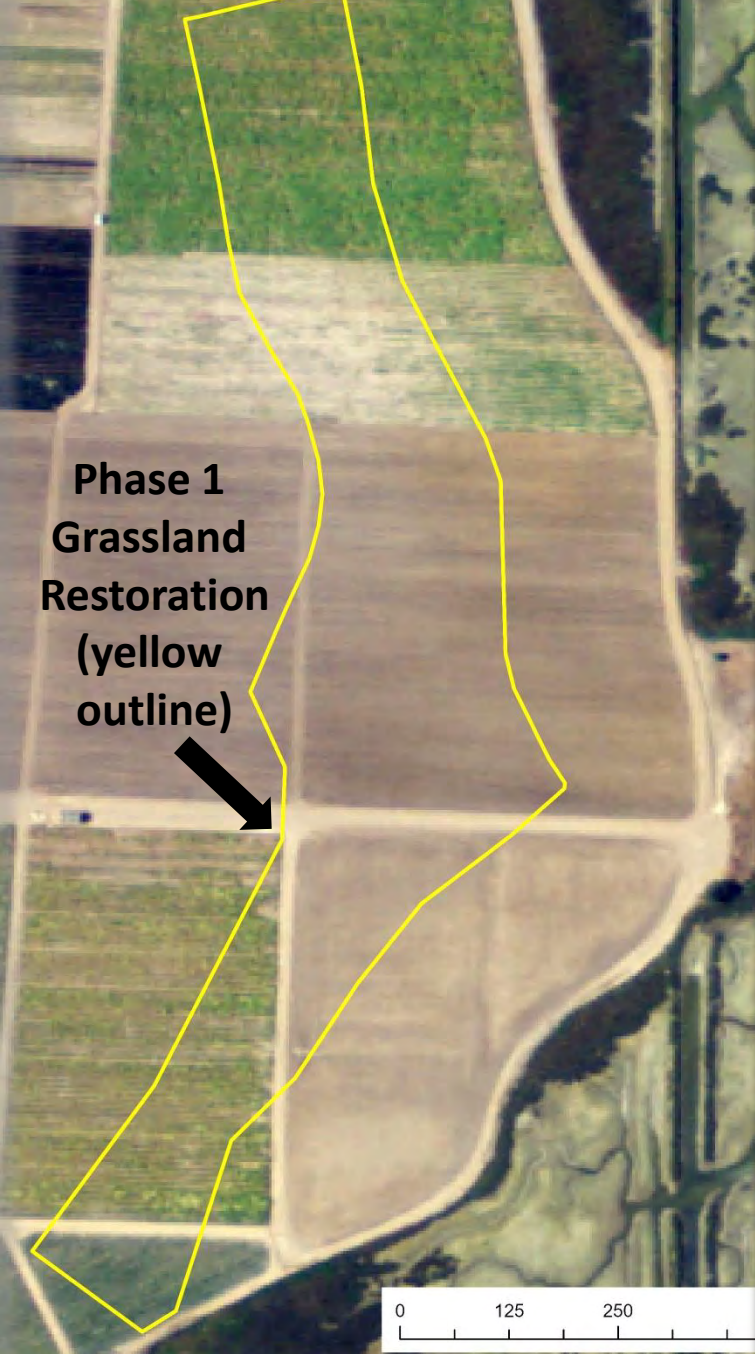
1. Non-native fescues (*Festuca* spp.)
2. Rabbitsfoot grass (*Polypogon monspeliensis*)
3. Non-native bromes (*Bromus* spp.)
4. Bristly oxtongue (*Helminthotheca echioides*)
5. Horseweeds (native and non-native: *Erigeron* spp.)
6. Sweet/yellow clovers (*Melilotus* spp.)
7. Burclover (*Medicago polymorpha*)

Exotic plant distribution patchy, partly due to soil type

Top soil left behind favored exotic plants over natives



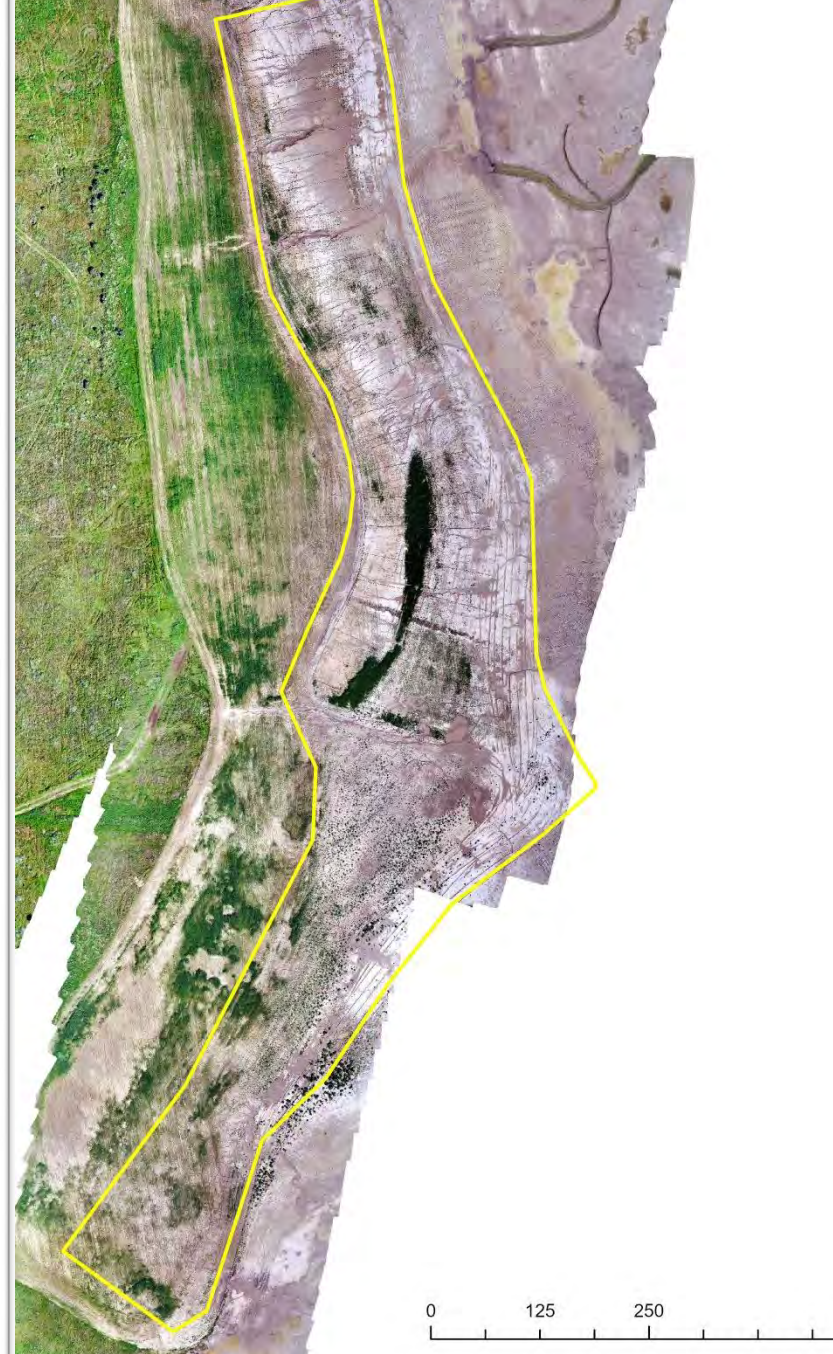
2009 before project




December 2018 – excavation complete



March 2019

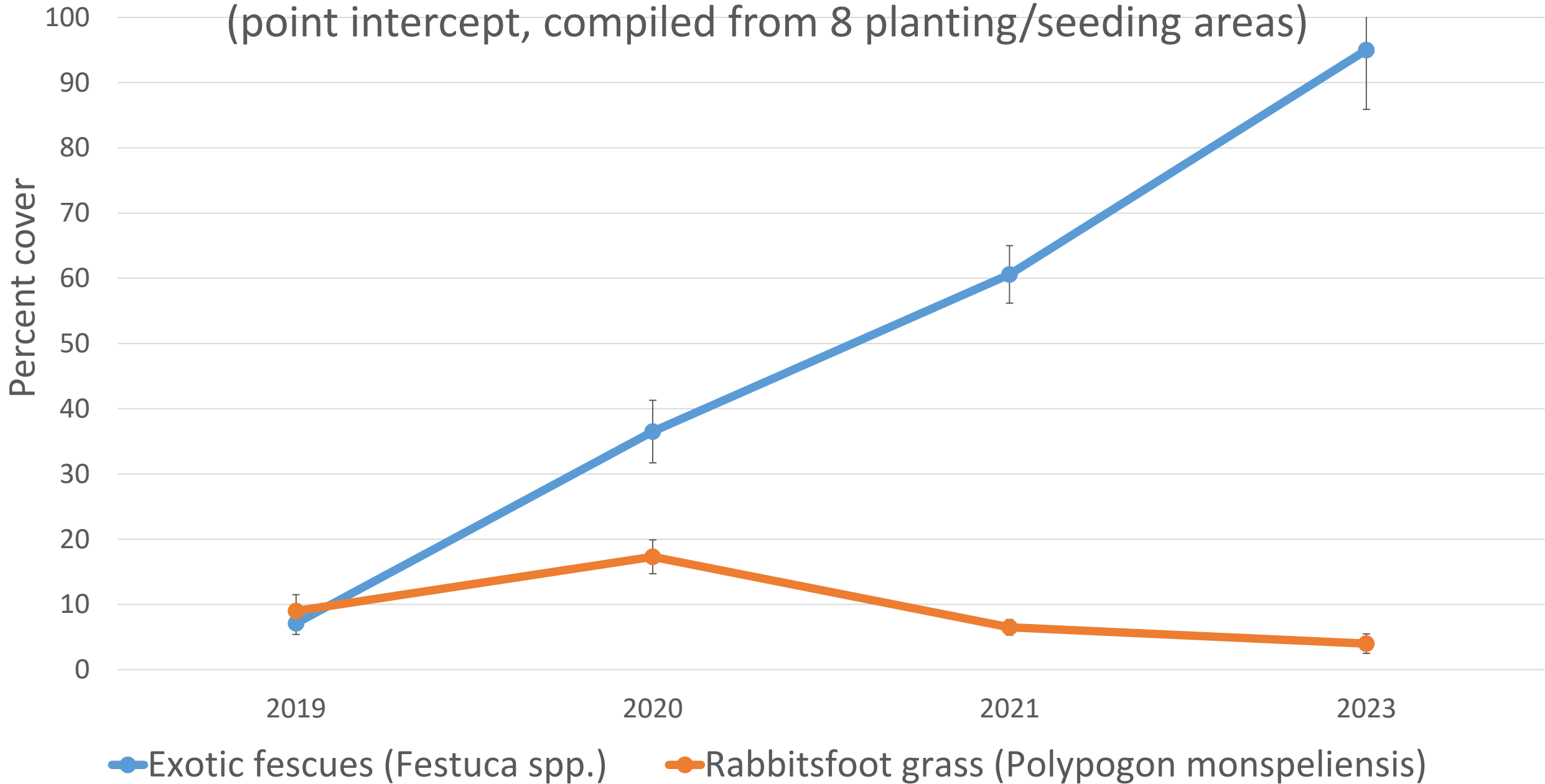


Weed control, done as needed. Most successful in deeply scraped areas.

- 
- Limited mowing with tractor and weed whackers
 - Limited hand pulling, mostly where we have planted broadleaf plants
 - Limited salting, only along the bottom edge at salt marsh transition
 - Spot spraying, mostly broadleaf weeds, using clopyralid and triclopyr herbicides

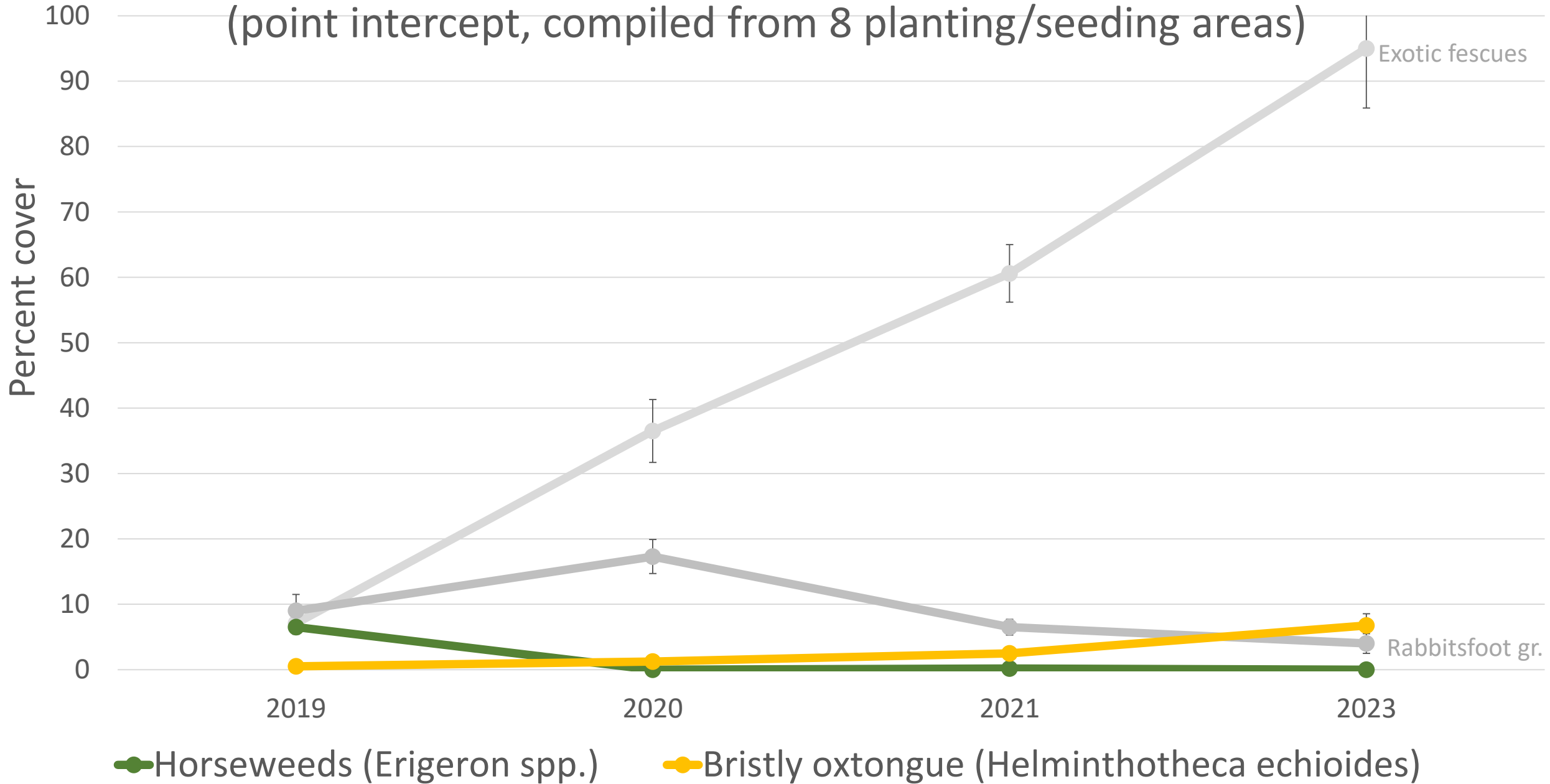
Weedy Plants in Phase 1

(point intercept, compiled from 8 planting/seeding areas)



Weedy Plants in Phase 1

(point intercept, compiled from 8 planting/seeding areas)



Overall, we've gotten a lot of native plant growth!



2019



Creeping wildrye, 2023

2021



Blue eyed grass, 2023



2021



Coastal gumweed, 2023



2021



Mixed flowers and native grasses, 2023



Some lessons learned along the way . . .

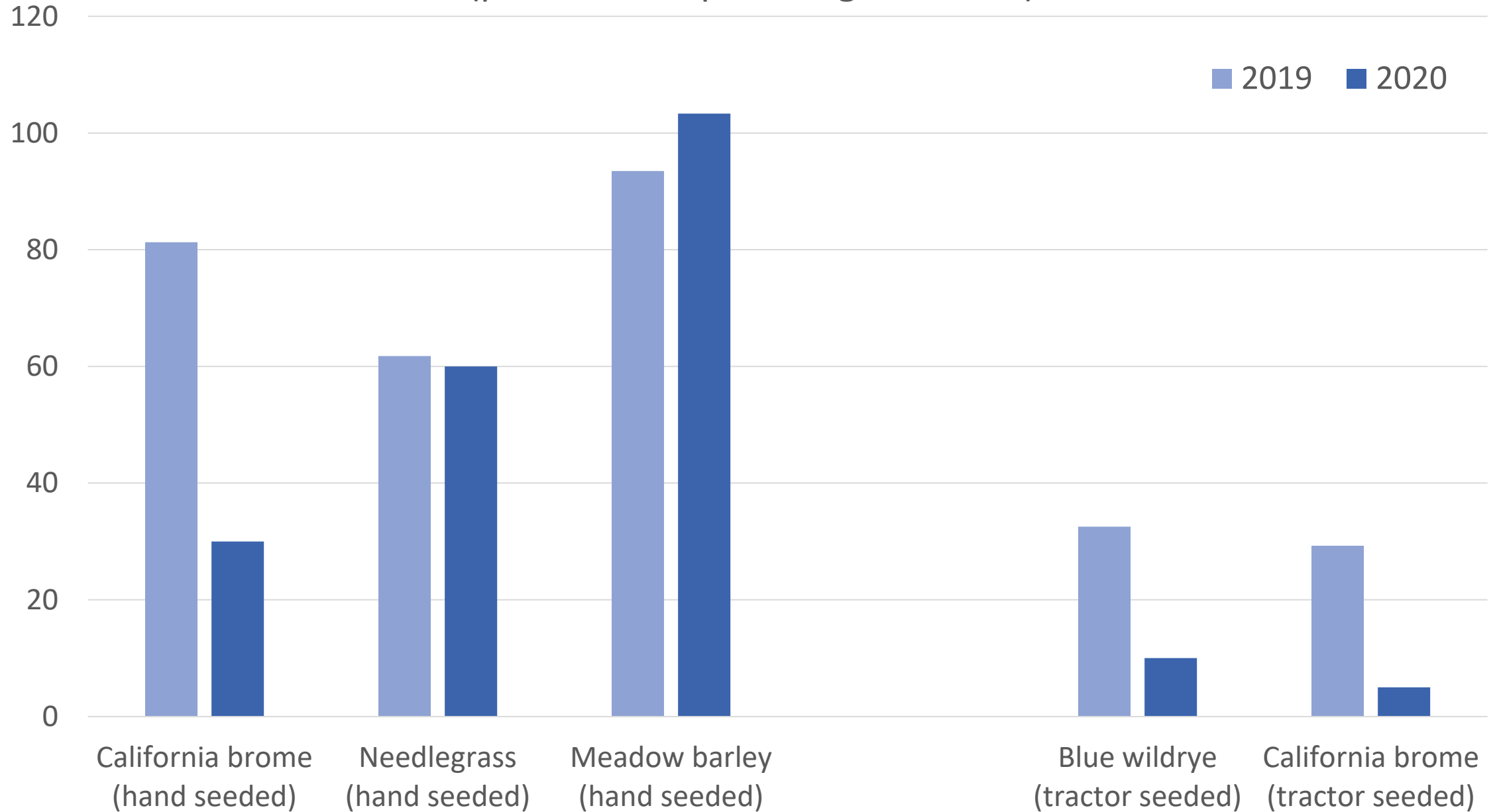




We were surprised that our hand seeding did much better than the tractor seeding



Phase 1 Area: Percent Cover of Seeded Grasses (point intercepts along transects)



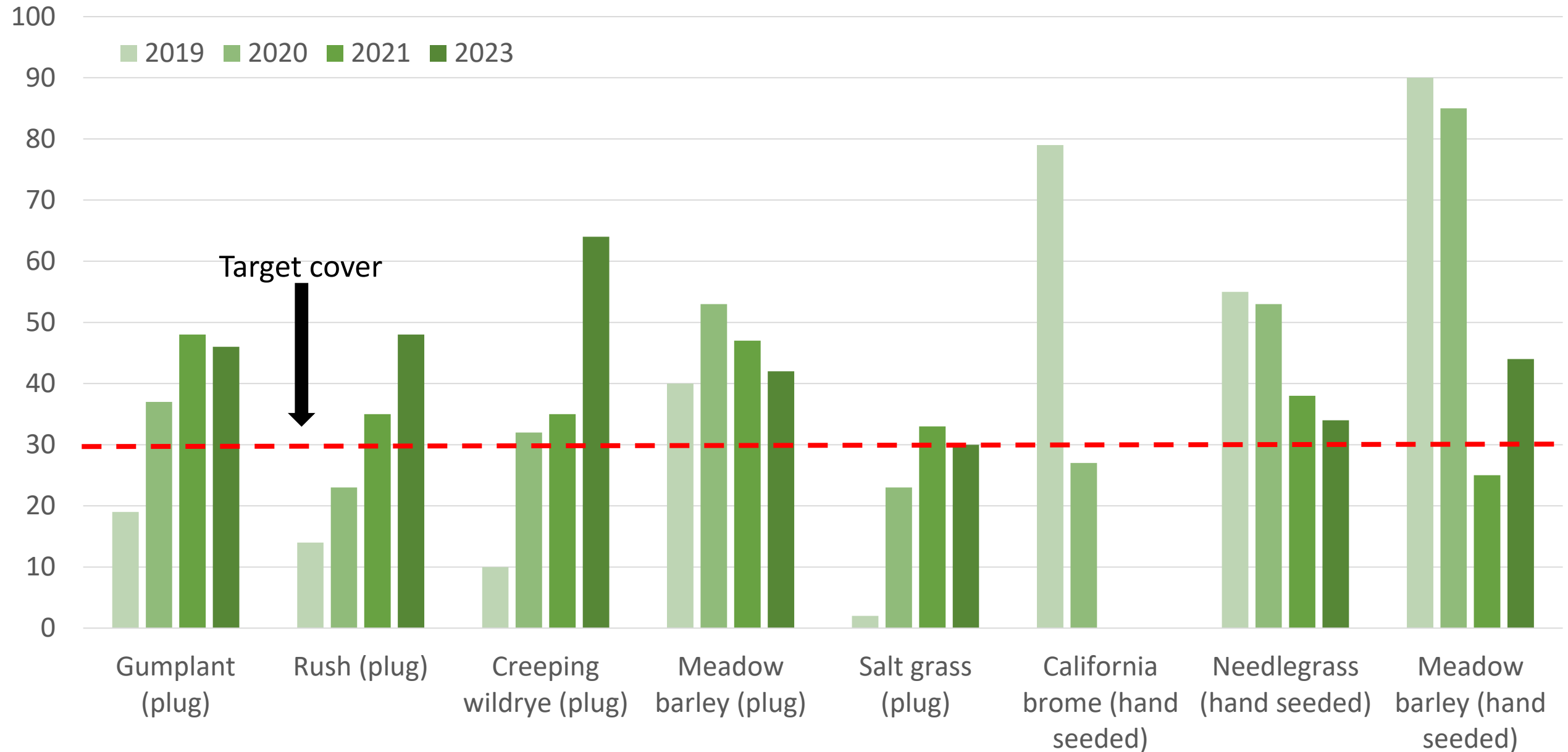


Reference sites matter, and rhizomes
are helpful long term

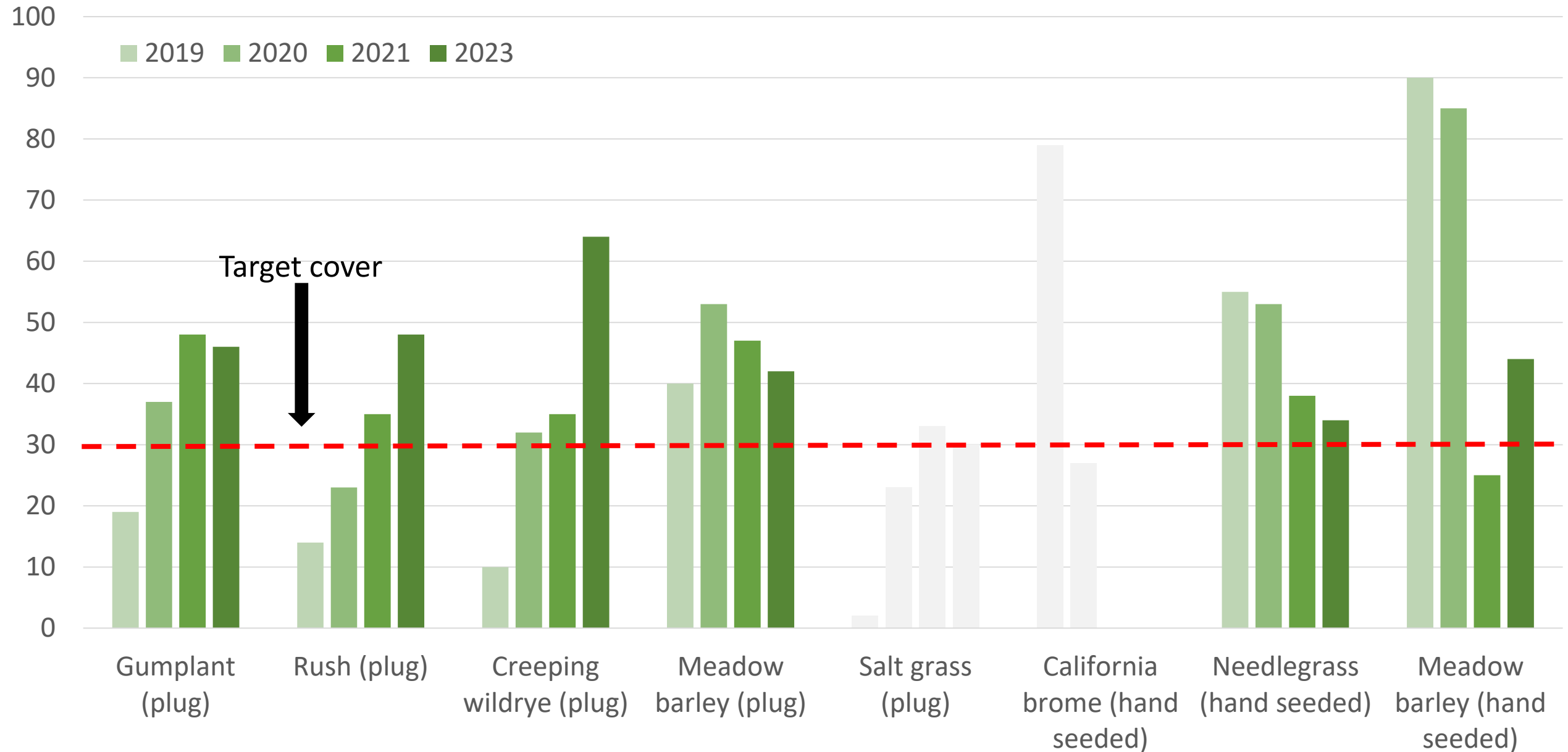


Mexican rush, 2019 vs 2023

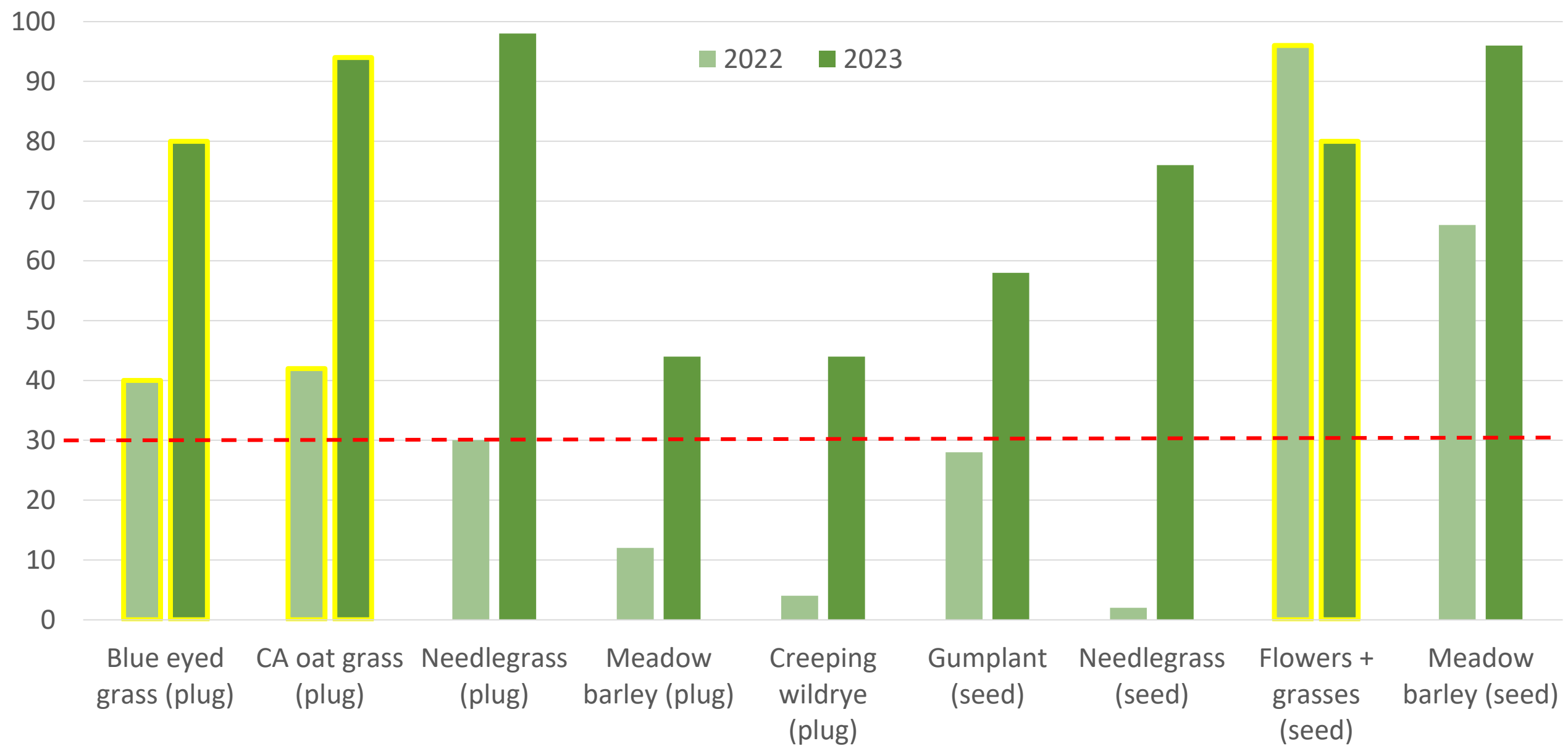
Phase 1 Area: Percent Cover of Target Native Plants (no data for 2022)



Phase 1 Area: Percent Cover of Target Native Plants (no data for 2022)



Phase 2 Area: Percent Cover of Target Native plants



Monterey Bay



Phase 3 Grassland

Phase 1 Grassland

Phase 2

Elkhorn Slough



Bill Fortner checks out Phase 3 grassland site



Lily the lab, Monique Fountain, and Mary Paul survey the Phase 2 needlegrass plot