Effects of manual and mechanical removal of Ammophila arenaria on coastal plant communities and dune morphology

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## **Coastal Sand Dunes**



Audubon







## **Removal Treatments**

#### Manual



#### Mechanical

California State Parks

# Dune Morphology

#### • UAV

- DJI Phantom 4
- Structure for Motion (SfM)/Agisoft
- Analysis included
  - Built a digital elevation model (DEM)
  - Compared treatment areas' foredune height with Kruskal-Wallis test (α=0.05)





### Ammophila arenaria cover Gold Bluffs Beach



## Shannon's diversity index Gold Bluffs Beach



## Gold Bluffs Beach NMDS



Stress: 0.138 PERMANOVA: F=31.88, df= 2, R<sup>2</sup>= 0.133, p-value=0.005

## Little River NMDS



Stress: 0.115 PERMANOVA : F= 104.56, df=1, R<sup>2</sup> = 0.440, p-value= 0.005

## **Tolowa Dunes NMDS**



NMDS1 Stress: 0.139 PERMANOVA : F= 84.126, df=1, R<sup>2</sup> = 0.321, p-value= 0.005















Treatment

Treatment

### Results

- Both removal treatments lowed target species cover
- Native diversity was greater after removal in manual plots than mechanical
- At both Gold Bluffs Beach and Little River mechanical removal lowered the foredune
- At Little River the removal area had low dune hummocks rather than a tall linear foredune

#### **Management Implications**

Restoration goals will determine which removal

#### treatment to use

- Mechanical removal
  - Decreased the cover of A. arenaria
  - Price is lower
- Manual removal
  - Native diversity is higher

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## **Vegetation Monitoring**

- Monitoring in manual, mechanical and control plots
- 1 m<sup>2</sup> plots cover recorded to closest percentage point
  - converted to Braun-Blanquet cover scale to match previous data
- Analysis included
  - Kruskal-Wallis test (α=0.05)
  - Non-metric multidimensional scaling (NMDS) ordination with a PERMANOVA









#### East

#### Vegetation Plot Layout



### Ammophila arenaria cover Little River



### *Ammophila arenaria* cover Tolowa Dunes



## Shannon's diversity index Little River



## Shannon's diversity index Tolowa Dunes

