San Diego Association of Governments
Rare Dune Species Restoration Project
Nature Collective
Annual Report
Project Period: March 08, 2023 - June 30, 2024
SANDAG Contract Number: S1125507

Executive Summary

The Rare Dune Species Restoration Project aims to enhance critical dune habitat for rare plant species through biomass and non-native species removal and expand existing occurrences of rare plants through seed collection, dispersal, and planting pollinator attractive species. By using SDMMP (San Diego Management and Monitoring Program) IMG (Inspect and Manage) monitoring protocol we have determined that we have increased plant density and extent size of Nuttall's acmispon (*Acmispon prostratus*) and expanded the extent of Orcutt's pincushion (*Chaenactis glabriuscula var. orcuttiana*). After multiple years of mapping coast woolly heads (*Nemacaulis denudata var. denudata*), we have determined that we have expanded the occurrence extent. Among the things we've learnt in the last year are the importance of installing container plants in the late fall or early winter and the necessity of doing monthly weed control passes over the entire project site. For the remainder of the Project, we will continue with seed collection and dispersal, container plant installation, weed control, and monitoring.

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Project Background

Project Setting and Location

The project boundary includes 8.34 acres of dune habitat within Cardiff State Beach and San Elijo Lagoon Ecological Reserve. The preserves are located in Cardiff-by-the-Sea, a community in the city of Encinitas. The project boundary is comprised of Seaside Terrace Dunes (STD) and Cardiff Living Shorelines (CLS) to the west of Highway 101 and West Basin Dunes (WBD) to the east of Highway 101. Nuttall's acmispon (*Acmispon prostratus*), coast woolly heads (*Nemacaulis denudata var. denudata*), and Orcutt's pincushion (*Chaenactis glabriuscula var. orcuttiana*) are the three focus species of this project. All three species were already existing on the site prior to the commencement of this project. These dunes are man-made and are a popular attraction to locals and tourists. The dunes see a considerable amount of traffic and trampling throughout the year which brings in an assemblage of invasive and non-native species.

Project Need

Coastal dunes are a critically endangered habitat due to rising sea levels and urbanization. Habitat fragmentation and development further threatens the habitat and sensitive flora and fauna that inhabit the dunes. Enhancement of existing dune habitat and expansion of suitable rare plant populations is critical to the sustainability of this ecosystem. The purpose and objectives of the Project satisfy the MSP Goal to: "Maintain or enhance existing Nuttall's acmispon occurrences to ensure multiple conserved occurrences with self-sustaining populations to increase resilience to environmental and demographic stochasticity, maintain genetic diversity, and ensure persistence over the long term (>100 years) in coastal bluff and coastal dune habitats."

Project Methods

To meet the project goals and objectives we will 1.) collect and spread seed of rare and perennial dune species in areas of need, 2.) install container plants in areas of high non-native species cover and/or high foot traffic, 3.) control non-native and invasive species throughout the project boundary, and 4.) conduct annual IMG monitoring.

Project Goals

Table 1. Quantifiable Goals

Project Quantifiable Result	Achieved?	Reasoning
Collect 5 lbs. of seeds per year from target Species	Yes	Collected 12.6 lbs. in Year 1.
Grow 1,000 containers per year	No	Vegetation has filled in naturally and it is unnecessary to plant in most of the project area.
Spread approximately 20 lbs. of seed	Partially	We spread 8 lbs. of seed is Year 1, we are on track to fulfill this objective by the end of the project.
Plant approximately 5,000 containers	No	Vegetation has filled in naturally and it is unnecessary to plant in most of the project area.
Maintain <5% invasive cover; 10% non-native cover; and 60% of plant cover.	Partially	The average non-native plant cover for all sites is <5%, average plant cover is 50%
1 weekend GOIN program the first 2 years to actively engage the community	Yes	1 weekend GOIN event was held during Year 1.

Work Performed by Task

Task 1- Seed Collection & Propagation

Budget: $6,245 (from grant agreement)
Spent: $4,927 (to date)
Match for Task: $12,017.04 (to date)

We began seed collection on May 18th, 2023, and we have continued throughout Year 1, as needed. Table 2 below details the amount in grams and lbs. of the seed collected per species throughout Year 1. Nature Collective Staff and volunteers collected seed. We began seed collection for 2024 during this past quarter. We will continue to collect next quarter for spreading in the fall. Most seeds will be used for spreading and not propagation. Table 1 below shows the quantities of seed collected per species in 2023 and to date for 2024.

Table 2. Seed Collection – Year 1

Species	**Common name**	**2023 (g)**	**2024 (g)**	**Total (g)**	**Total (lbs.)**
Abronia maritima	sticky sand verbena	1165	303	1468.0	3.236
Abronia umbellata	pink sand verbena	515	8.4	523.4	1.153
Acmispon prostratus	Nuttall's acmispon	1146.9	770.2	1917.1	4.226
Ambrosia chamissonis	beach bur	755	-	755.0	1.665
Atriplex coulteri	Coulter's saltbush	0.2	-	0.2	0.0004
Atriplex leucophylla	beach saltbush	2.7	-	2.7	0.006
Camissoniopsis cheiranthifolia	beach primrose	67	-	67.0	0.147
Camissoniopsis lewisii	Lewis' evening primrose	-	8.5	8.5	0.019
Chaenactis glabriuscula var. orcuttiana	Orcutt's yellow pincushion	27.02	10.7	37.7	0.083
Croton californicus	California croton	67.69	-	67.7	0.149
Eriogonum parvifolium	seacliff buckwheat	260	-	260.0	0.573
Lupinus concinnus	bajada lupine	3	1	4.0	0.009
Nemacaulis denudata var. denudata	coast woolly heads	590.07	-	590.1	1.301
Nicotiana clevelandii	Cleveland's tobacco	4	-	4.0	0.009
	Total	**4603.5**	**1101.8**	**5705.3**	**12.578**

During Year 1 we propagated species in our nursery to outplant at the project site. We also partnered with San Diego Botanic Garden (SDBG) for propagation of some species. They have successfully grown the species we gave them seed for and we will outplant the containers this fall. We are approximately 60% complete with this task.

Task 2- Work & Monitoring Plan

Budget: $2,381.72 (from grant agreement)
Spent: $2,175.40 (to date)
Match for Task: $0 (to date)

We began planning and researching seed collection, propagation, seeding, planting, maintenance, and monitoring on March 10, 2023. Planning involved creating timelines and expectations for each task throughout the course of the project. We are 100% complete with the work and monitoring plan.

Task 3- Seeding & Planting

Budget: $27,132.72 (from grant)
Spent: $4,193.51 (to date)
Match for Task: $0 (to date)

During Year 1 Nature Collective staff and volunteers spread seed throughout the project boundary. We began seeding efforts on November 10, 2023. In the spring, our seeding efforts proved to be effective after species were observed in locations they had not previously been recorded. Table 3 shows the quantities of each species spread per location. A total of 3637.94 grams (8.02 lbs.) were broadcasted in predetermined locations. To broadcast spread seed, we mixed the seed with sand and vermiculite to weigh the seeds down and retain moisture, respectively. One of the focus areas of this effort was at West Basin Dunes where we removed large patches of biomass with volunteers over summer 2023. Before spreading and raking in seed we raked up additional litter into piles so the seed would have direct contact with the sand. This proved to be an effective method as this area was heavily vegetated with new germination this spring.

Table 3. Seed Broadcasting – Year 1

Species	**Common name**	**STD (g)**	**CLS (g)**	**WBD (g)**	**Total (g)**
Abronia maritima	sticky sand verbena	-	459	-	459
Abronia umbellata	pink sand verbena	-	5.63	7.04	12.67
Acmispon prostratus	Nuttall's acmispon	158	252.27	512.54	922.81
Ambrosia chamissonis	beach bur	-	524	-	524
Atriplex coulteri	Coulter's saltbush	-	-	1.1	1.1
Camissoniopsis cheiranthifolia ssp. suffruticosa	beach primrose	-	9.27	-	9.27
Chaenactis glabriuscula var. orcuttiana	Orcutt's yellow pincushion	141.02	-	285.91	426.93
Croton californicus	California croton	-	-	10.32	10.32
Eriogonum parvifolium	seacliff buckwheat	-	414.8	-	414.8
Lupinus concinnus	bajada lupine	-	-	3	3
Nemacaulis denudata var. denudata	coast woolly heads	170	119.27	561.07	850.34
Nicotiana clevelandii	Cleveland's tobacco	-	-	3.7	3.7
Total (g)		**469.02**	**1784.24**	**1384.68**	**3637.94**

Photo 1. West Basin Dunes after biomass removal

Photo 2. Volunteers spreading and raking seed

We installed a total of 160 1-gallon container plants between Seaside Terrace Dunes and Cardiff Living Shorelines during Year 1 (Table 4). Plants were installed in areas of dense non-native sweet clover and areas that see high foot-traffic, in order to prevent social trails. Because of the GOIN event we waited until late winter to install container plants. Although the visiting schools enjoyed planting the container plants, we will plant earlier in Year 2 to take advantage of winter precipitation events. The installed plants had decent survivorship; however, when compared to another nearby project that we installed dunes species at in October, the growth and survivorship were quite lower.

Table 4. Container Plant Installation – Year 1

		Quantity (1-gal)			
Species	**Common name**	**1/8/2024**	**02/24/24**	**02/26/24**	**Total**
Eriogonum parvifolium	Sea cliff buckwheat	40	30	20	90
Camissoniopsis cheiranthifolia ssp. suffruticosa	Beach primrose	15	30	20	65
Ambrosia chamissonis	Beach bur	0	5	0	5
	Total	**55**	**65**	**40**	**160**

Photo 3. NC staff installing container plants

Photo 4. Rare species growing in seeded area

We are approximately 40% complete with the seeding and planting task

Task 4- Maintenance

Budget: $42,570.30 (from grant)
Spent: $15,959.44 (to date)
Match for Task: $29,959.68 (to date)

We began maintenance work on March 16, 2024. Throughout Year 1 maintenance tasks have included biomass removal, weed control (hand, mechanical, and chemical), and watering of installed container plants. Despite the heavy winter rainfall weeds were less abundant in the spring 2024 compared to spring 2023. We can likely attribute this to our diligent and repetitive weed control efforts reducing the non-native seed bank. During Year 1 we hosted 17 volunteer events, many of which included hand-pulling non-native species that surrounded rare species.


Photo 5 & 6. Before and after removal of non-native sea lavender (*Limonium sinuatum*)

We are approximately 50% complete with the maintenance task.

Task 5- Monitoring

Budget: $13,523.69 (from grant)
Spent: $10,487.35 (to date)
Match for Task: $0 (to date)

We began monitoring work on March 16, 2023. The monitoring task involved vegetation transect monitoring, annual IMG surveys for Nuttall's acmispon and Orcutt's pincushion, and photo monitoring. We began the project by conducting vegetation transect monitoring each quarter; however, we decided to cut-back to conducting them once, annually due to the lack of change in data and unnecessary trampling of sensitive habitat. Spring 2023 and 2024 project photo monitoring and transect photo monitoring can be found in Appendix B and C, respectively.

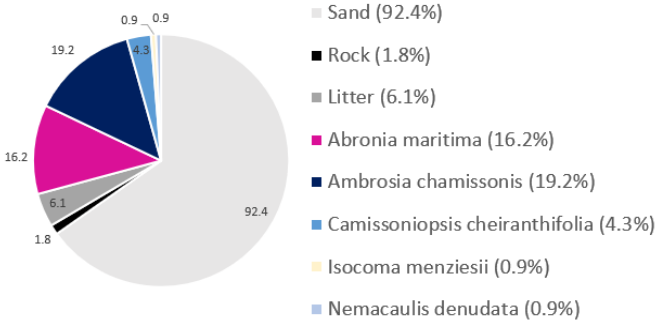
Vegetation Transect Monitoring

The graphs below show the average percent cover data of all the transects per site from April 2023 and April 2024. At all three sites the percent cover of Nuttall's acmispon increased from baseline data collection in April 2023. At Cardiff Living Shorelines Nutall's acmispon increased 1.5%, at Seaside Terrace Dunes it increased by 14.6%, and by 9.8% at West Basin Dunes. Additionally, non-native species cover has decreased at Seaside Terrace Dunes from 15.9% in 2023 to 4.9% in 2024. At West Basin Dunes we saw an increase in non-native cover of 1.8%. The non-native cover primarily consists of four-leaved allseed (*Polycarpon tetraphyllum*)- a non-native that is not defined as invasive by Cal-IPC. This species is a common annual weed, its small size makes it difficult to control when existing between rare annual species.

Graph 1-6. Average Percent Cover by Site from April 2023 & April 2024

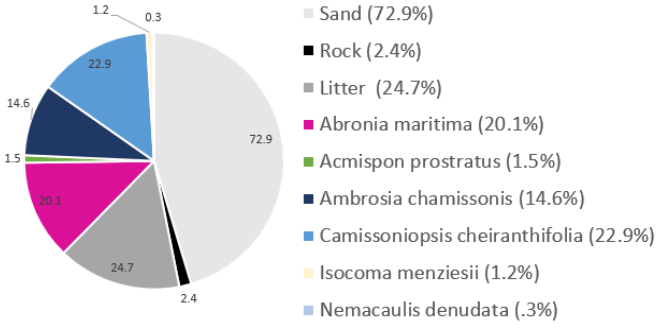
April 2023

Cardiff Living Shorelines

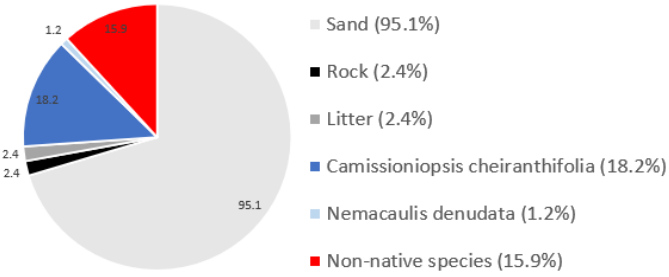


April 2024

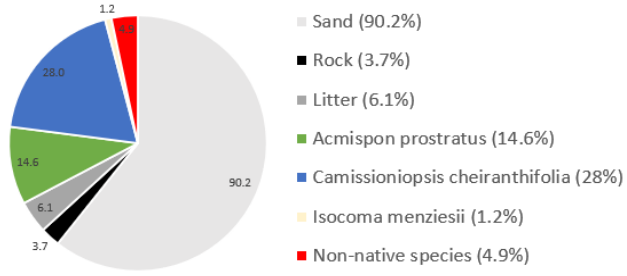
Cardiff Living Shorelines



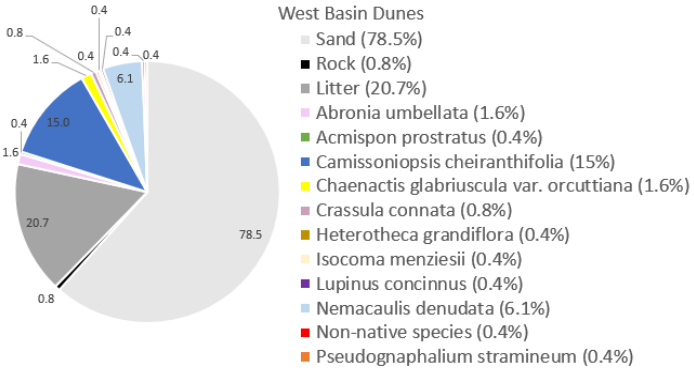
Seaside Terrace Dunes



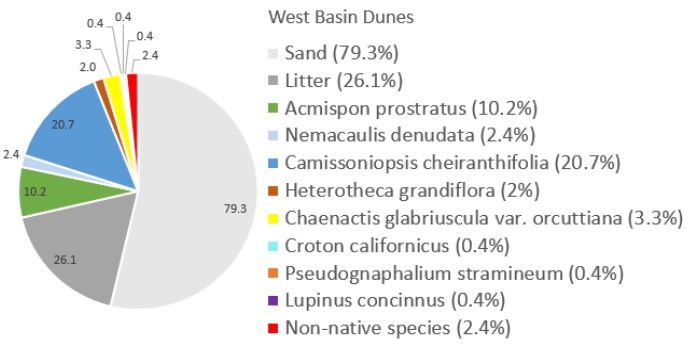
Seaside Terrace Dunes



West Basin Dunes



West Basin Dunes



The native vs. non-native cover data for all transects can be found in Appendix D.

Rare Plant Monitoring

In 2023 and 2024, we conducted IMG monitoring surveys for Nuttall's acmispon and Orcutt's pincushion in April and May, respectively. Maps showing the spatial data collected for the two species as well as coast wooly heads can be found in Appendix A: Map F-H.

Nuttall's acmispon (*Acmispon prostratus*)

We have seen a significant increase in the individual count and mapped extent of Nuttall's acmispon between 2022 and 2024. Table 5 shows the changes by site for each year. For the IMG surveys we recorded an exact count of the individual plants, we counted 9,887 in 2022 and 24,666 in 2024. This is a 249% increase in population count. All three sites expanded their population size over the past three years.

Table 5. Population Count and Mapped Extent of Nuttall's acmispon 2022-2024.

	Population Count			Area Mapped (Acres)		
Site	2022	2023	2024	2022	2023	2024
West Basin Dunes	7,273	8,743	20,860	1.1	1.5	1.9
Seaside Terrace Dunes	2,126	1,920	3,504	0.50	0.29	0.64
Cardiff Living Shorelines	488	173	302	0.22	0.11	0.19
Total	9,887	10,836	24,666	1.9	1.9	2.8

Much of the occurrence growth can be seen within the area of WBD where we removed biomass and spread seed. The photos below show the vegetation transect in this area in April 2023 and April 2024. Nuttall's acmispon seed had highly successful germination in the cleared areas which can be seen in Photo 8. The percent cover data and plot photos from the IMG monitoring can be found in Appendix F.

Photo 7. WBD before biomass removal

Photo 8. WBD after biomass and seeding efforts

Orcutt's pincushion (*Chaenactis glabriuscula var. orcuttiana*)
We saw a significant decrease in Orcutt's pincushion in 2024. As shown in Table 6 the population count was cut by over half. This is likely due to the later and less frequent winter precipitation events.

Table 6. Population Count and Mapped Extent of Orcutt's pincushion 2022-2024.

	Population Count		Area Mapped (Acres)	
Site	**2023**	**2024**	**2023**	**2024**
Seaside Terrace Dunes	534	0	0.0078	0
West Basin Dunes	24,752	10,189	0.1891	0.2848
Harbaugh Seaside Trails	1,942	402	0.3046	0.1674
Total	27,228	10,591	0.50	0.45

Despite the overall decrease in population size, we did have successful germination of the seeds we spread in West Basin Dunes. Appendix A: Map G shows the new polygons on the northern portion of WBD. We counted 77 individuals in these polygons. Additionally, saw an increase in the mapped extent size in WBD, which is primarily where we spread seed. The percent cover data and plot photos from the IMG monitoring can be found in Appendix G.

Task 6- Reporting & Media
Budget: $5,378.41 (from grant)
Spent: $2,489.40 (to date)
Match for Task: $0 (to date)

We began reporting and media work on June 19, 2023. Quarterly reports were submitted regularly. We are approximately 35% complete with this task.

Task 7- GOIN Program
Budget: $19,731.49 (from grant)
Spent: $10,214.72 (to date)
Match for Task: $10,020.17 (to date)

We began planning our GOIN program on September 10, 2023. We hosted our first GOIN event on February 24th. Schools from Escondido participated in the event with our Ecologist and Educators. The schools were split into three rotations where they learned monitoring techniques, planting, weeding, and participated in a beach trash clean-up. We are 50% complete with the GOIN task.

Photo 9. GOIN attendees installing container plants

Photo 10. GOIN attendees observing plant species

Task 8- Administrative

Budget: $14,035.74 (from grant)
Spent: $4,165.28 (to date)
Match for Task: $0 (to date)

We began administrative tasks on March 10, 2023, including project management, planning, and invoicing. We are approximately 35% complete with this task.

Annual Conclusions

Year 1 of the Rare Dunes Species Project has been successful. We have accomplished all performance measures and are on track to complete all attainable goals and deliverables. As stated in past quarterly reports- after project planning began, we determined that we will more than likely not be able to meet two of our performance measures including "Atriplex coulteri – 200 individuals restored" and "Phacelia stellaris" – 200 individuals restored". However, we anticipate restoring 400+ individuals of Chaenactis orcuttiana ssp. glabriuscula (Orcutt's yellow pincushion) to replace those performance measures. Orcutt's yellow pincushion is listed at California Rare Plant Rank 1B.1 – "Plants rare, threatened, or endangered in California and elsewhere; seriously threatened in California" and has only 20 presumed extant occurrences in California. (CNPS, RPP 2023) We do not expect to meet the original performance measures due to the lack of seed available to ethically collect as well as the difficult germination requirements. Additionally, we plan to grow and install considerably less container plants than originally stated in the Scope of Work. After project planning began, we determined that container plants were only needed in two areas on the southwest side of Highway 101, to suppress weeds and limit trampling. We also did not want to over vegetate the area because snowy plovers use this area for foraging in the winter.

For Year 1 we waited until February to install container plants for our GOIN event, the survivability of container plants was over 60%. For Year 2 we plan to install containers in October to take advantage of all winter precipitation events. Plants will be installed earlier and denser to improve suppression of non-native species.

Completed work has enhanced habitat and expanded occurrence extents of three rare plant species: Nuttall's acmispon (*Acmispon prostratus*), coast woolly heads (*Nemacaulis denudata var. denudata*), and Orcutt's pincushion (*Chaenactis glabriuscula var. orcuttiana*). Germination of the seed we collected, and spread was successful in expanding occurrence extents and producing seed.

For the remainder of the project, we will continue with seed collection and dispersal in areas where rare species are sparse. Additionally, this fall we will install 200+ container plants in areas of high non-native species cover.

Geographical Information Systems Data

Maps for the Project are included in Appendix A: Maps.

Shapefiles are uploaded to the SDMMP Project Page.

- Nuttall's acmispon distribution
- Orcutt's pincushion distribution
- Coast wooly head distribution
- Non-native species treatments
- Planting and seeding area

Performance Measures

2024 Q2 - Year 1
Performance Measu

State of Preserve Monitoring

Habitat Type	Habitat Enhancement through Invasive Species Control	Habitat Created/Restored	Acres Requiring Management	Acres Requrining Monitoring
Dunes & Coastal Bluffs	8.34	0.88	8.34	8.34

Definitions

- **Management Strategic Plan (MSP):** The Management and Monitoring Strategic Plan for Conserved Lands in Western San Diego County: A Strategic Habitat Conservation Roadmap (or simply "MSP Roadmap" or "MSP") is a comprehensive, landscape-scale adaptive management and monitoring framework for prioritized species and vegetation communities in western San Diego County.

- **Habitat Type:** Please select from one of the MSP listed habitats. If the habitat type is not listed, please do not select from the dropdown and manually type in the habitat type name. Provide acreage by specific habitat types, do not combine multiple habitat types with one acreage calculation.

- **Habitat Enhancement through Invasive Species Control (acres):** removing invasive plant or animal species to improve ecological function.

- **Habitat Created/Restored (acres):** Establishing habitat where it did not exist before; returning a damaged site to a natural or native state.

- **Fencing (feet):** fencing installed for grant purposes to lessen a threat or stressor to habitat

- **Acres Requiring Management:** activities such as vegetation thinning, invasive plant treatment, etc. that are necessary for maintaining previous enhancement, restoration, or creation efforts.

- **Acres Requiring Monitoring:** any regular monitoring conducted to establish baseline and/or determine success of grant project.

- **Sensitive Species[1]:** Species outlined in the MSP that are unlikely that managing the vegetation community or habitat alone would ensure the species persists over the long-term on Conserved Lands in the Management Strategic Plan Area.
- **Sensitive Species Planted:** List any sensitive plant species that were seeded/planted for this project

- **Sensitive Species Benefitted:** List any sensitive species that will or already have directly benefitted from the project.

[1] Refer to SDMMP website for complete list of identified MSP Sensitive Plant or Animal species. The link will direct to the webpage.

Appendices

- Appendix A: Maps
- Appendix B: Photo Monitoring
- Appendix C: Transect Photo Monitoring
- Appendix D: Vegetation Transect Data – Native vs. Non-native Cover
- Appendix E: Project Photos
- Appendix F: Nuttall's acmispon IMG Data
- Appendix G: Orcutt's pincushion IMG Data