San Diego Association of Governments
Rare Dune Species Restoration Project
Nature Collective
Final Report
Project Period: March 08, 2023 – March 02, 2026
Submission Date: June 2026
SANDAG Contract Number: S1125507

Executive Summary

The Rare Dune Species Restoration Project addressed the region's Management Strategic Plan (MSP) goal for restoring rare dune habitat and implementing conservation efforts for Nuttall's acmispon (*Acmispon prostratus*), an MSP SO species, in the MSP North Coast Management Unit (MU 7). Nature Collective (NC) was granted the Environmental Mitigation Program project for two sites: dunes in the West Basin of San Elijo Lagoon and dunes along Cardiff Living Shorelines. NC approached the project with the strategy of hand-control of biomass and nonnative invasive plants and planting native dune plants from containers and seeds through staff and volunteer efforts to establish dune populations and ensure continued success of Nuttall's acmispon populations at the site.

NC used SDMMP (San Diego Management and Monitoring Program) IMG (Inspect and Manage) monitoring protocol to determine that we increased plant density and extent of Nuttall's acmispon over the course of the project. Native plants at the project site are now established, and pollinators are using the sites, ensuring the continuing success of the population. We also decreased nonnative invasive plant cover at the sites, which removes competitive pressure on native plants and opens sandy areas for other dune-dwelling species to thrive. Future efforts should continue monitoring for and removing nonnative invasive plants to ensure sustained rare dune plant populations and long-term project success.

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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 sites are located in Cardiff-by-the-Sea, a community in the city of Encinitas in the Management Strategic Plan (MSP) Management Unit (MU) 7 (North Coast MU). 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 (Appendix A). Nuttall's acmispon (*Acmispon prostratus*), coast woolly heads (*Nemacaulis denudata var. denudata*), and Orcutt's yellow 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, particularly in the WBD site (ACPR_7CSPA018) with few pollinators and few occurrences at the CLS site. 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 nonnative 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 satisfied the MSP Goal for Dunes and Coastal Bluffs vegetation communities 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 1.) collected and spread seed of rare and perennial dune species in areas of need, 2.) installed container plants in areas of high non-native species cover and/or high foot traffic, 3.) controlled non-native and invasive species throughout the project boundary, and 4.) conducted annual IMG monitoring. By focusing this project on not just one species but an entire community of rare and common pollinator attractive plants, Nuttall's Acmispon establishment was more likely to be sustainable, successfully pollinated, and produce viable seeds.

Project Goals

Table 1. Quantifiable Goals

Project Quantifiable Result	Achieved?	Reasoning
Collect 5 lbs. of seeds per year from target Species.	Yes	Collected 33.42 lbs of seed throughout the project.
Grow 1,000 containers per year.	No	Vegetation filled in naturally and by seeding and it was unnecessary to plant in that quantity of container plants in most of the project area.
Spread approximately 20 lbs. of seed.	Yes	We spread ~20 lbs. of seed throughout the project (~8 lbs. per year in Year 1 and Year 2 and supplemented with 2-3 lbs. in Year 3).
Plant approximately 5,000 containers.	No	Vegetation filled in by seeding and naturally and it was unnecessary to plant containers in most of the project area.
Maintain <5% invasive cover; 10% nonnative cover; and 60% of plant cover.	Yes	The average nonnative plant cover for all sites by the end of the project was <5% (0.13%), average plant cover was 37.8% which was within 60% relative cover for average dune sites.
1 weekend GOIN program the first 2 years to actively engage the community.	Yes	3 weekend GOIN events were held during the project; one event per year engaging a total of 41 families.

Work Performed by Task

Task 1–Seed Collection & Propagation

Budget: $6,245.86 (from grant agreement)
Spent: $6,245.86
Match for Task: $12,017.04

We began seed collection on May 18th, 2023, and we continued throughout the project as needed. Table 2 below details the amount in grams and lbs. of the seed collected per species. Nature Collective Staff and volunteers collected seed between July - October. Most seeds were used for spreading and not propagation.

During the project, 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 outplanted the containers in the fall.

Table 2. Cumulative Seed Collection

Species	Common name	Total (g)	Total (lbs)
Abronia maritima	sticky sand verbena	5,123.88	11.30
Abronia umbellata	pink sand verbena	547.8	1.21
Acmispon prostratus	Nuttall's acmispon	4,116.91	9.08
Ambrosia chamissonis	beach bur	3,251.32	7.17
Atriplex leucophylla	beach saltbush	47.9	0.11
Camissoniopsis cheiranthifolia	beach primrose	67	0.15
Camissoniopsis lewisii	Lewis' evening-primrose	17	0.04
Chaenactis glabriuscula var. orcuttiana	Orcutt's yellow pincushion	48.42	0.11
Croton californicus	California croton	67.69	0.15
Eriogonum parvifolium	seacliff buckwheat	666	1.47
Lupinus concinnus	bajada lupine	5	0.01
Nemacaulis denudata var. denudata	coast woolly heads	1,194.89	2.63
Nicotiana clevelandii	cleveland's tobacco	4	0.01
	Total	1,5157.81	33.42

Photo 1. Processing and cataloging seeds after collection. September 14, 2023.

Task 2–Work & Monitoring Plan

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

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.

Task 3–Seeding & Planting

Budget: $27,132.79 (from grant agreement)
Spent: $27,132.79
Match for Task: $0

Nature Collective staff and volunteers spread seed throughout the project boundary. Each 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. A total of 8,602.92 grams (18.97 lbs.) of seeds were spread during the project. The bulk of seed broadcasting occurred in Year 1, with 3637.94 grams (8.02 lbs.) broadcasted, and Year 2, with 3954.98 grams (8.78 lbs.) broadcasted. In fall of 2025, we adjusted the amount of seeds spread to only cover areas that needed additional plants which used ~2-3 lbs of seed. To broadcast spread seed, we mixed the seed with sand and vermiculite to weigh the seeds down and retain moisture, respectively. Each project site was subjected to seeding in areas cleared of debris and vegetation.

Table 3. Cumulative Seed Broadcasting

Species	Common name	Total (g)	Total (lbs)
Abronia maritima	sticky sand verbena	2,998.24	6.61
Abronia umbellata	pink sand verbena	30.67	0.07
Acmispon prostratus	Nuttall's acmispon	1,581.46	3.49
Ambrosia chamissonis	beach bur	2,087.16	4.60
Artiplex leucophylla	beach saltbush	12	0.03
Atriplex coulteri	Coulter's saltbush	1.1	0.00
Camissoniopsis cheiranthifolia ssp. suffruticosa	beach primrose	9.27	0.02
Chaenactis glabriuscula var. orcuttiana	Orcutt's yellow pincushion	492.43	1.09
Croton californicus	California croton	15.72	0.03
Eriogonum parvifolium	seacliff buckwheat	644.8	1.42
Lupinus concinnus	bajada lupine	3	0.01
Nemacaulis denudata var. denudata	coast woolly heads	1,192.67	2.63
Nicotiana clevelandii	Cleveland's tobacco	3.7	0.01
	Total	**9,071**	**20**

Photo 2. Nuttall's Acmispon in bloom in a seeded area. May 19, 2025.

We installed a total of 288 1-gallon container plants between STD and CLS during the project (Table 4). We focused efforts on filling in spaces between plants and deterring weed growth (Appendix A: Map E). Plants were installed in areas cleared of non-native sweet clover and areas that see high foot-traffic to prevent social trails. We included some California boxthorn (*Lycium californicum* CRPR 4.2) along the perimeter of the project boundary in two frequented social trails since it mounds and has thorns that should help to dissuade off trail foot traffic. We aligned our planting efforts with fall and winter to have more favorable weather and increase the chance of plant survival. Our GOIN events were successful with the visiting families showing excitement while planting the container plants and learning about the sensitive species along the dunes. Regular irrigation visits were made to ensure plant health, although supplemental irrigation visits were alleviated during some rain events.

We completed seeding and planting in the fall of 2025.

Table 4. Cumulative Container Plant Installation

Species	Common name	Total (1gal)
Abronia maritima	sticky sand verbena	7
Abronia umbellata	pink sand verbena	3
Acmispon glabor	deerweed	5
Ambrosia chamissonis	beach bur	38
Camissoniopsis cheiranthifolia ssp. suffruticosa	beach primrose	72
Eriogonum parvifolium	sea cliff buckwheat	156
Lycium californicum	California boxthorn	2
Peritoma arborea	bladderpod	5
Total	**8 species**	**288**

Task 4–Maintenance

Budget: $42,570.30 (from grant agreement)
Spent: $42,570.30
Match for Task: $29,959.68

We began maintenance work on March 16, 2023, and continued throughout the project. Maintenance tasks included biomass removal, weed control (hand, mechanical, and chemical), and watering of installed container plants. Weed growth trended down throughout the life of the project. We attributed this to our diligent and timely weed control efforts reducing the non-native seed bank. Many of the volunteer projects that we hosted throughout the project included hand-pulling non-native species that surrounded rare species, planting, and watering container plants.

Task 5–Monitoring

Budget: $13,523.69 (from grant agreement)
Spent: $13,523.69
Match for Task: $0

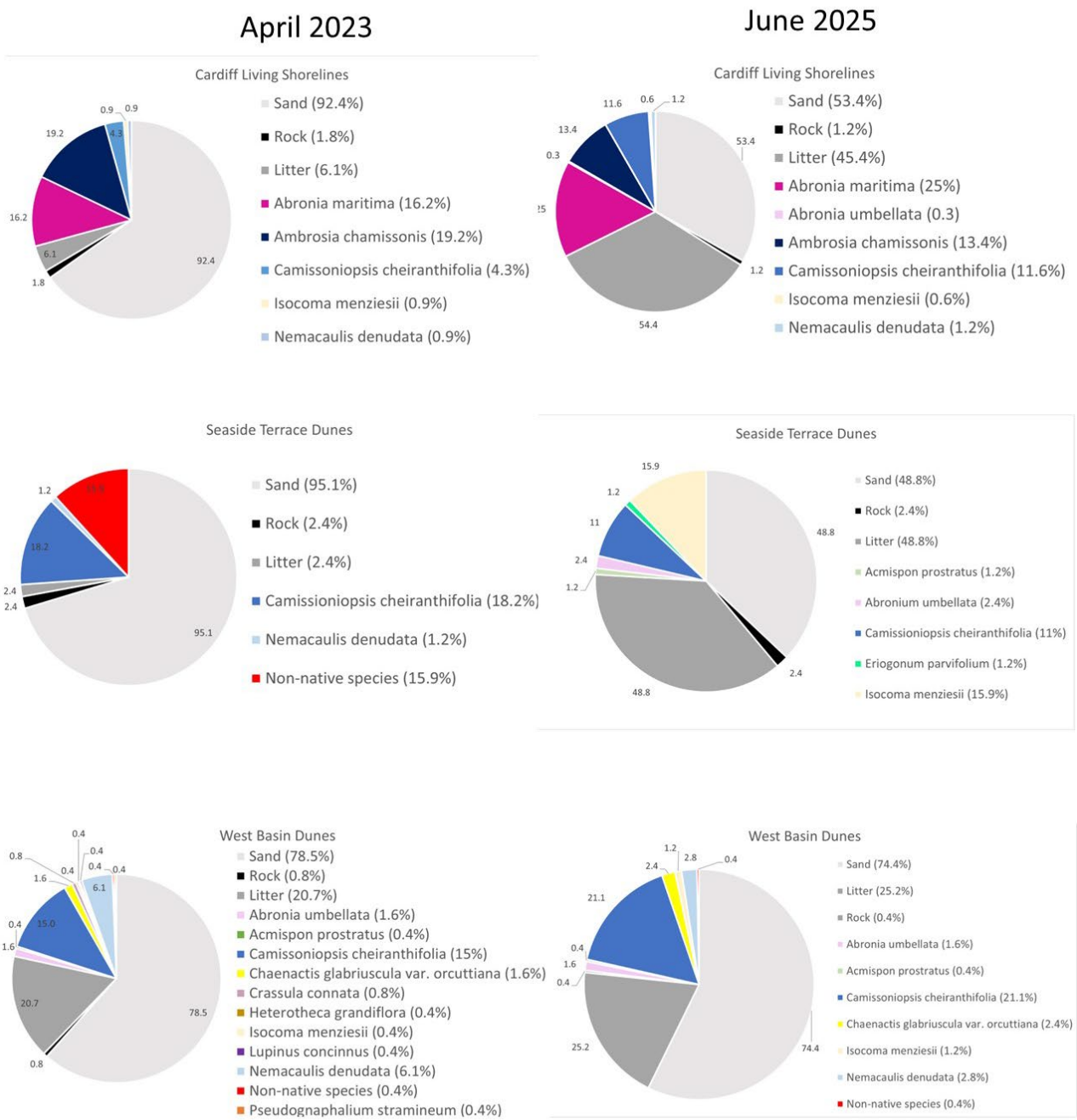
We began monitoring work on March 16, 2023 and continued through Year 2. Quantitative monitoring tasks involved vegetation transect monitoring, annual IMG surveys for Nuttall's acmispon and Orcutt's yellow pincushion, and photo monitoring. We began the project by conducting vegetation transect monitoring each quarter; however, we cut back to conducting them one time per year due to the lack of change in data and to avoid unnecessary trampling of sensitive habitat. Our monitoring was completed in 2025 as the 2026 dune monitoring will occur after project completion. Spring 2023 and 2025 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 June 2025 and the native vs. non-native cover data for all transects can be found in Appendix D. At CLS the species richness increased from 5

to 6 with substantial percent cover increase of red sand verbena (*Abronia maritima*) from 16.2% to 25% and beach evening primrose (*Camissoniopsis cheiranthifolia ssp. suffruticosa*) increasing from 4.3% to 11.6%. At STD, species richness increased from 3 to 5 species, adding Nuttal's acmispon and pink sand verbena (*Abronia umbellate*) to the transect. Additionally, non-native species cover decreased at STD from 15.9% in 2023 to 4.9% in 2024 and 0% in 2025. At WBD, we saw an increase in beach evening

Graph 1-6. Average Percent Cover by Site April 2023 vs June 2025



primrose from 15% to 21.1%. This is the only site that recorded a non-native cover (0.4% average), primarily consisting 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.

Rare Plant Monitoring

From 2022 - 2025 we conducted SDMMP IMG monitoring surveys for Nuttall's acmispon and Orcutt's pincushion. Maps showing the spatial data collected during these surveys from 2022-2025 can be found in Appendix A: Maps F and G.

Nuttall's acmispon (*Acmispon prostratus*)

We saw a variation in trends of Nuttall's acmispon from 2022 to 2025 across the three project sites. There was a significant increase in the individual count and mapped extent of Nuttall's acmispon between 2022 and 2025, although some variation in population, extent, and location through the years. For the annual IMG surveys, we recorded an exact count of the individual plants (Table 5). We counted 9,887 in 2022 and 14,291 in 2025. This was a 145% increase in population count. However, there was an overall decrease in Nuttall's acmispon across all sites compared to 2024, which is likely attributed to a lesser and later rain year. Additionally, Nuttall's acmispon across all sites appeared stunted in 2025 with a much lower rate of flowering plants than in previous years.

Conversely, although there was an overall increase in population, which is largely attributed to substantial increases at West Basin Dunes, there was an overall slight decrease in population at Seaside Terrace Dunes (STD) and Cardiff Living Shorelines (CLS). Table 5 shows the changes by site for each year.

Table 5. Population Count and Mapped Extent of Nuttall's acmispon (acmispon prostratus) 2022–2025

	Population Count				Area Mapped (Acres)			
Site	2022	2023	2024	2025	2022	2023	2024	2025
West Basin Dunes	7,273	8,746	20,860	12,471	1.1	1.5	1.9	1.5
Seaside Terrace Dunes	2,126	1,920	3,504	1,667	0.5	0.29	0.64	0.64
Cardiff Living Shoreline	488	173	302	153	0.22	0.11	0.19	0.05
Total	9,887	10,836	24,666	14,291	1.9	1.9	2.8	2.2

Much of the occurrence growth can be seen within the area of WBD where we removed biomass and spread seed. Two main factors may have impacted the Nuttall's acmispon population along CLS. The foreshore dunes are subject to high tide and storm events that regularly shrink dune sizes. Additionally, the growth of red sand verbena was plentiful and crucial in combating erosional forces, however

the growth minimized open sandy area that Nuttall's acmispon requires for germination, as seen in Appendix B. This species is included in our biomass reduction efforts to create suitable conditions for rare coastal dune species to survive. The survey plot photos from the IMG monitoring can be found in the Year 2 Annual Report Appendix E.

Orcutt's yellow pincushion (*Chaenactis glabriuscula var. orcuttiana*)
We saw a significant increase in Orcutt's yellow pincushion in 2025 compared to 2024, although the 2025 population was slightly less than in 2023. As shown in Table 6, the population count during surveys doubled from 2024 to 2025.

Table 6. Population Count and Mapped Extent of Orcutt's yellow pincushion (Chaenactis glabriuscula var. orcuttiana) 2023–2025

	Population Count			Area Mapped (Acres)		
Site	**2023**	**2024**	**2025**	**2023**	**2024**	**2025**
West Basin Dunes	24752	10189	20946	0.1891	0.2848	0.22
Seaside Terrace Dunes	534	0	0	0.0078	0	0
Harbaugh Seaside Trails	1942	402	920	0.3046	0.1674	0.34
Total	**27228**	**10591**	**21866**	**0.50**	**0.45**	**0.56**

Despite the overall slight decrease in population size in the West Basin Dunes, we saw a dramatic increase in population size, likely from successful germination of the seeds we spread. Appendix A: Map G shows the mapped extent of Orcutt's yellow pincushion in 2025. The final SDMMP IMG plot photos can be found in the Year 2 Annual Report Appendix E.

Task 6–Reporting & Media

Budget: $5,378.41 (from grant agreement)
Spent: $5,378.41
Match for Task: $0

We began reporting and media work on June 19, 2023. Quarterly reports were submitted regularly. We completed this task in March 2026.

Task 7–GOIN Program

Budget: $19,731.49 (from grant agreement)
Spent: $19,731.49
Match for Task: $10,020.17

Over the course of the grant period, Nature Collective planned, implemented and evaluated three habitat restoration-focused Get Out In Nature (GOIN) events with youth and families from four elementary schools from the Escondido Union School District – Orange Glen, Glen View, Rose, and Pioneer. Students in grades 3-5 and their families were invited to participate.

Funding supported transportation, program experiences, and family "adventure kits" (backpack with a hand lens, field guide, nature journals/pencils, and/or other exploration tools). A total of 41 families participated in these events, including 72 youth, 58 parents/adults, and 18 school chaperones/teachers. Events were hosted in the month of February in 2024, 2025, and 2026.

Participants engaged in hands-on activities to explore and learn about the Cardiff Living Shoreline rare dune habitat, as well as contribute to its care and restoration. Activities included (1) using simple transects to "look closely" and identify a variety of native and invasive species that may be found in the dune system, (2) use hand tools to carefully remove invasive species and/or plant essential native species, (3) discover the various wildlife that use the dunes for shelter, nesting, and food sources, (4) conducting a dune/beach clean-up to remove debris from the sensitive habitat. Participants also learned about the important role dunes play in protecting natural and human infrastructure, including those found along and in the San Elijo Lagoon adjacent to Cardiff Living Shoreline.

Photo 3. GOIN participants planting potted dune plants. February 7, 2026.

Task 8–Administrative

Budget: $14,035.74 (from grant agreement)
Spent: $14,035.74
Match for Task: $0

We began administrative tasks on March 10, 2023, including project management, planning, and invoicing. Administrative tasks were completed in March 2026.

Conclusions

The Rare Dunes Species Project was successful in completing all attainable goals and deliverables. As stated in past quarterly reports–after project planning began, we determined that we would not meet two of our performance measures including "*Atriplex coulteri* – 200 individuals restored" and "*Phacelia stellaris* – 200 individuals restored." However, we spread a small amount of seed that we could obtain for *Atriplex coulteri* and we restored 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 did not meet the original performance measures for *Atriplex coulteri* or *Phacelia stellaris* due to the lack of seed available to ethically collect as well as the difficult germination requirements. Additionally, we grew and installed 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 (*Charadrius nivosus*) use this area for foraging in the winter and require bare ground. In Year 1 we waited until February to install container plants for our GOIN event, and as a result the survivability of container plants was over 60%. We learned from this and in Year 2 we installed container plants in November to take advantage of all winter precipitation events and minimize supplemental irrigation needs. In addition, plants were installed denser to improve suppression of nonnative species.

Completed work 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 yellow pincushion (*Chaenactis glabriuscula var. orcuttiana*). Germination of the seed we collected and spread was successful in expanding occurrence extents and producing seed for population self-sustainability. Due to variation in rain each year, some of the population numbers and extent lowered from year to year but still increased from baseline conditions to the end of the project.

Nature Collective's efforts to adapt to plant container plants in areas of previously-high nonnative species cover and disperse seeds in areas with sparse rare plants ensured the success of the project. Successful germination of collected seeds indicates that pollinators are visiting the sites and populations of Nuttall's acmispon are self-sustaining. To continue maintaining rare plant populations at the Project sites, future efforts will need to include monitoring and removal of nonnative invasive species as well as monitoring of fencing to minimize trampling by the public.

Geographical Information Systems Data

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

Shapefiles from the Year 2 Annual Report are uploaded to the SDMMP Project Page, including for:

- Nuttall's acmispon distribution
- Orcutt's yellow pincushion distribution
- Planting and seeding area

SDMMP Project Page

To complete the grant requirements, your Final Report (along with all annual or interim reports) must be added to your project's Project Page on the SDMMP website. Add any necessary photographs to the photo carousal and fill out the photograph information. *Please contact Sarah McCutcheon (smccutcheon@usgs.gov) or Emily Perkins (eperkins@usgs.gov) if you are having trouble accessing or editing your project page.*

Performance Measures

EMP11_Final Report Performance Measures.xlsx

State of Preserve Monitoring

SDMMP and SANDAG will be collecting specific data from each grant project in order to update the *Status of the Regional Preserve System in Western San Diego County*. Information collected will become available on SDMMP's Dashboard.

To access the **State of Preserve Monitoring Excel Spreadsheet:**

- Please fill out the spreadsheet by simply double-clicking the *State of Preserve Monitoring* chart.
    - The excel sheet will open up and allow you to input data. Once you are finished inputting the data into the excel sheet, scroll the excel sheet to the top with the headers displayed. Then simply click once on the grey space to the right of the excel sheet to return to the Word document to resume editing.

Habitat Type	Habitat Enhancement through Invasive Species Control	Habitat Created/Restored	Acres Requiring Management	Acres Requiring 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:** MSP SL, SO and SS Species (https://sdmmp.com/msp_doc.php; Section 2.8 and 2.9; Table V1.1-1) that the management actions of the project are specifically designed to benefit to help 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 other sensitive species that will or already have directly benefitted from the project

Appendices

- Appendix A: Maps
- Appendix B: Photo Monitoring
- Appendix C: Transect Photo Monitoring
- Appendix D: Vegetation Transect Data
- Appendix E: Project Photos

Appendix A: Maps

Map A: Rare Coastal Dune Species Habitat Restoration Project Overview

Rare Dune Community - Project Overview

Map B: Photo Monitoring Points

Photo Monitoring Points

Map C: Transect Monitoring Locations

Transect Monitoring Locations

Map D: SDMMP IMG Monitoring Plots

MSP IMG Protocol Monitoring Plots

Map E: Planting and Seeds Areas

Planting and Seed Broadcasting Areas—Dune Restoration 2023-2025

Map F: Nuttall’s acmispon Distribution 2022-2025

Nuttall's acmispon (Acmispon prostratus) Distributions 2022 - 2025

Map G: Orcutt’s pincushion Distribution 2022-2025

Orcutt's pincushion (Chaenactis glabriuscula var. orcuttiana) Distribution 2022 - 2025

Appendix B: Photo Monitoring

March 2023 to June 2025

Photo Point 01

March 2023

June 2025

Photo Point 02

March 2023

June 2025

Photo Point 3

March 2023

June 2025

Photo Point 4

March 2023

June 2025

Photo Point 5

March 2023

June 2025

Photo Point 6

March 2023

June 2025

Photo Point 7

March 2023

June 2025

Photo Point 8

March 2023

June 2025

Photo Point 9

March 2023

June 2025

Photo Point 10

March 2023

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Photo Point 11

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Photo Point 12

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Photo Point 27

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Photo Point 28

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Photo Point 29

March 2023

June 2025

Photo Point 30

March 2023

June 2025

Photo Point 31

March 2023

June 2025

Photo Point 32

March 2023

June 2025

Appendix C: Transect Photo Monitoring

April 2023 to June 2025

ESC_L1_03_T1

South Facing North

April 2023

June 2025

North Facing South

April 2023

June 2025

ESC_L1_03_T2

South Facing North

April 2023

June 2025

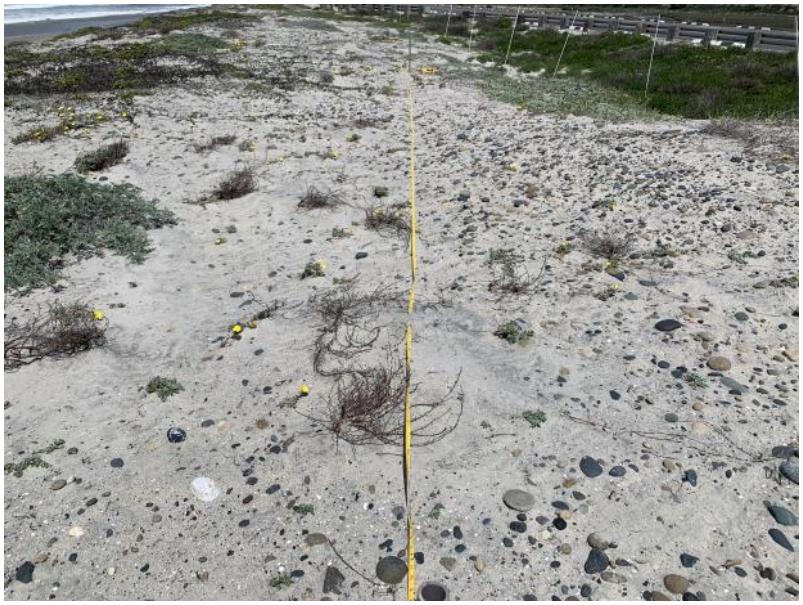
North Facing South

April 2023

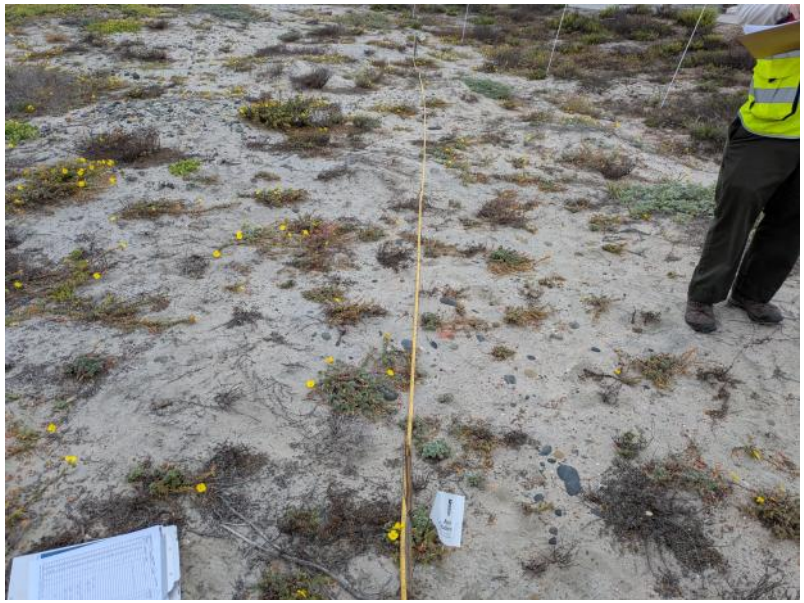
June 2025

ESC_L1_03_T3

South Facing North



April 2023



June 2025

North Facing South

April 2023

June 2025

ESC_L1_03_T4

South Facing North

April 2023

June 2025

North Facing South

April 2023

June 2025

ESC_L1_03_T5

South Facing North

April 2023

June 2025

North Facing South

April 2023

June 2025

ESC_L1_03_T6

South Facing North

April 2023

June 2025

North Facing South

April 2023

June 2025

ESC_L1_03_T7

South Facing North

April 2023

June 2025

North Facing South

April 2023

June 2025

ESC_L1_03_T8

South Facing North

April 2023

June 2025

North Facing South

April 2023

June 2025

ESC_L1_03_T9

South Facing North

April 2023

June 2025

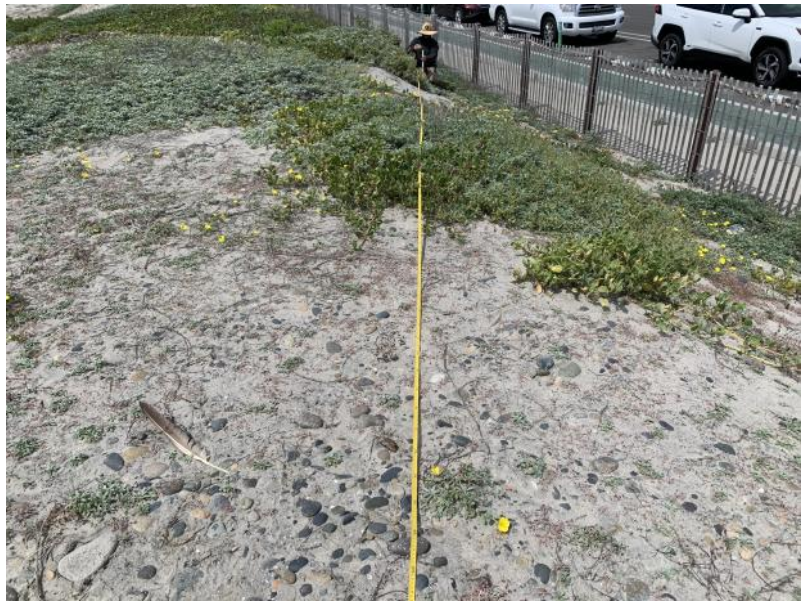
North Facing South

April 2023

June 2025

ESC_L1_03_T10

South Facing North



April 2023

June 2025

North Facing South

April 2023

June 2025

ESC_L1_03_T11

South Facing North

April 2023

June 2025

North Facing South

April 2023

June 2025

ESC_L1_03_T12

South Facing North

April 2023

June 2025

North Facing South

April 2023

June 2025

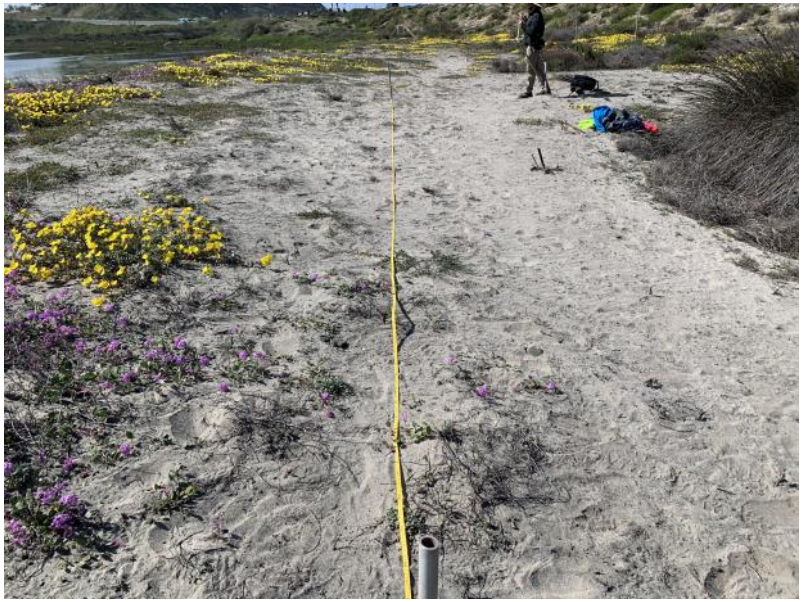
ESC_L1_03_T13

South Facing North

April 2023

June 2025

North Facing South



April 2023

June 2025

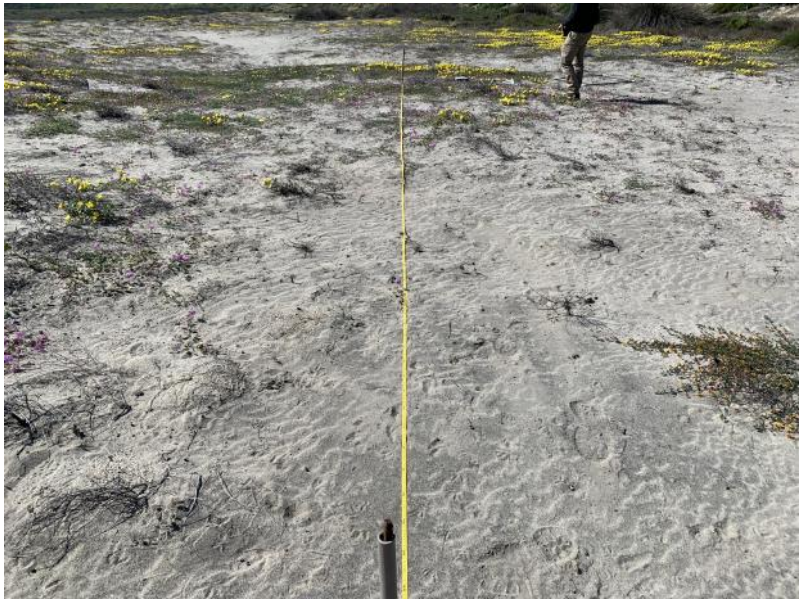
ESC_L1_03_T14

South Facing North

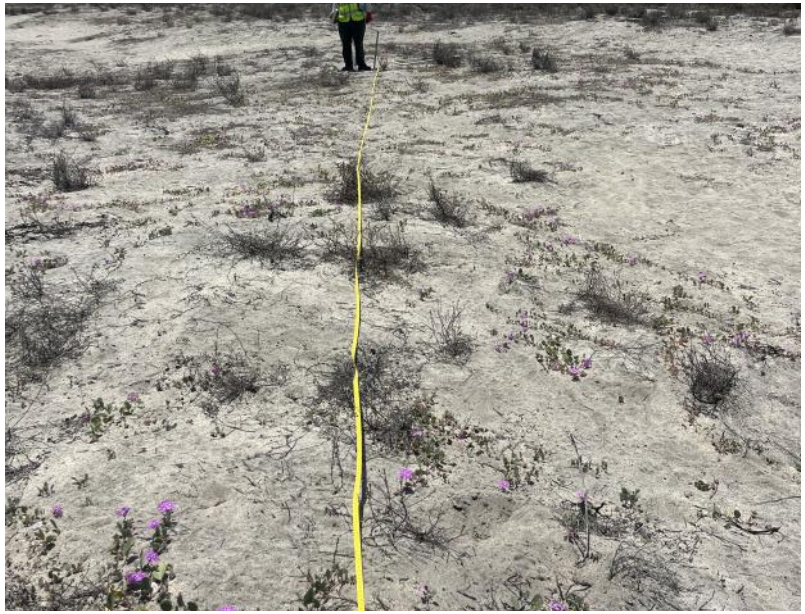
April 2023

June 2025

North Facing South



April 2023



June 2025

ESC_L1_03_T15

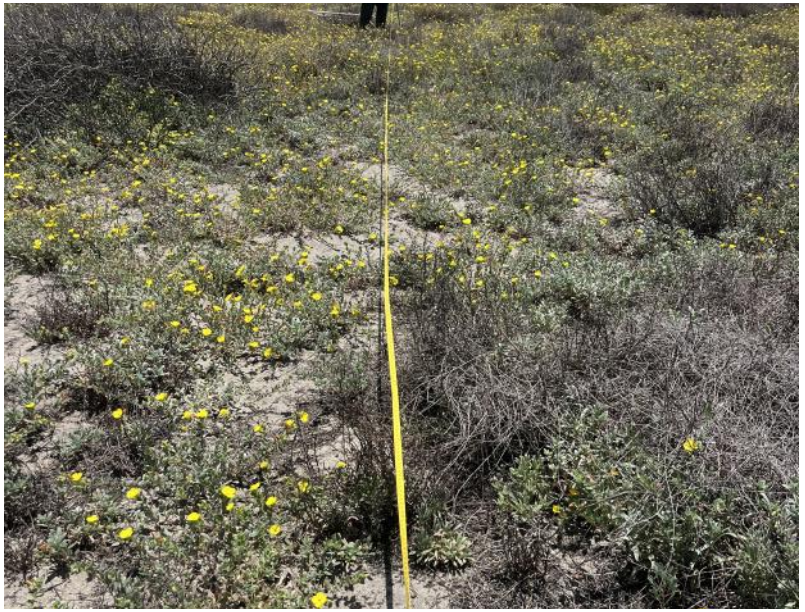
South Facing North

April 2023

June 2025

North Facing South

April 2023



June 2025

ESC_L1_03_T16

South Facing North

April 2023

June 2025

North Facing South

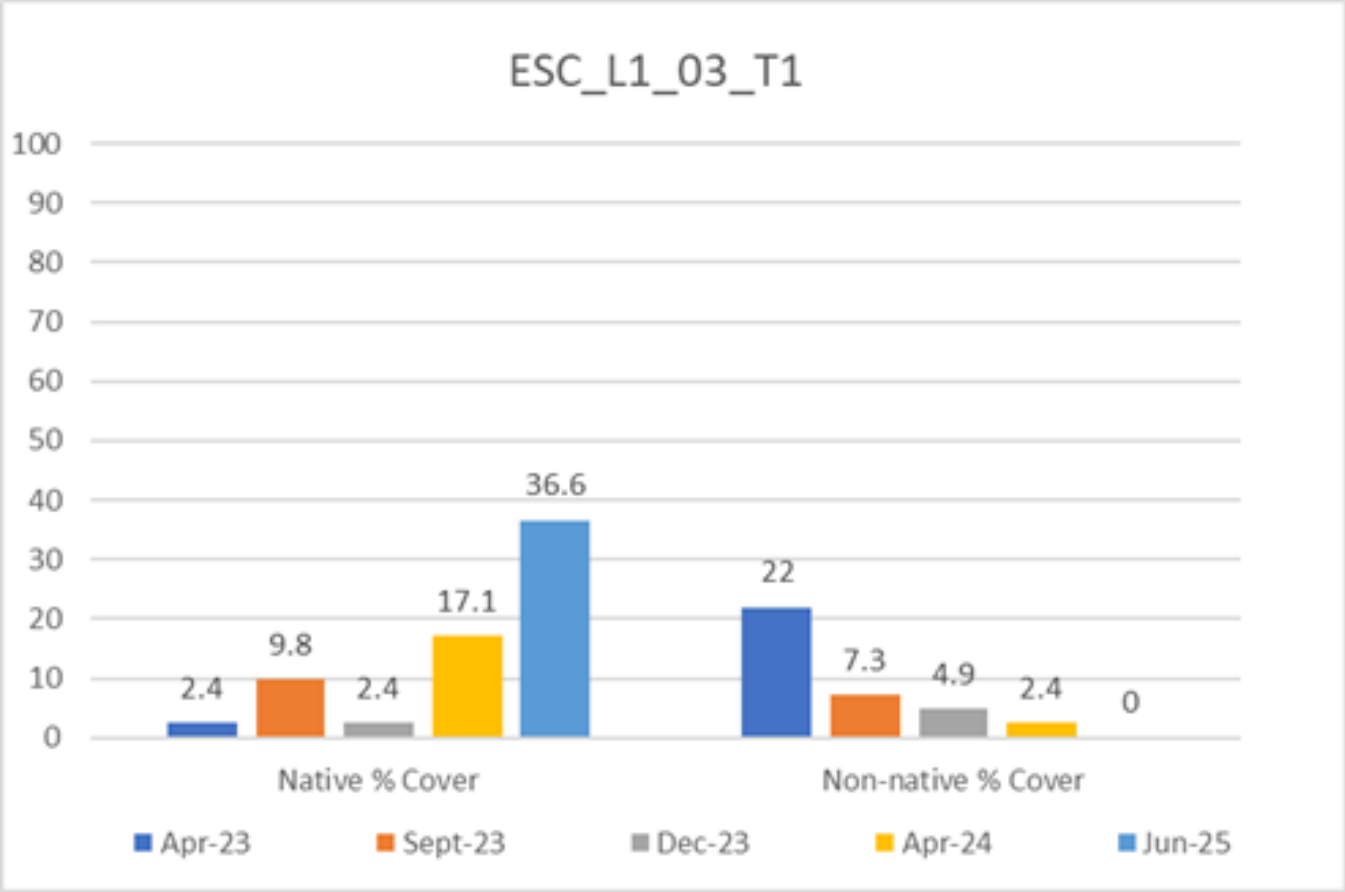
April 2023

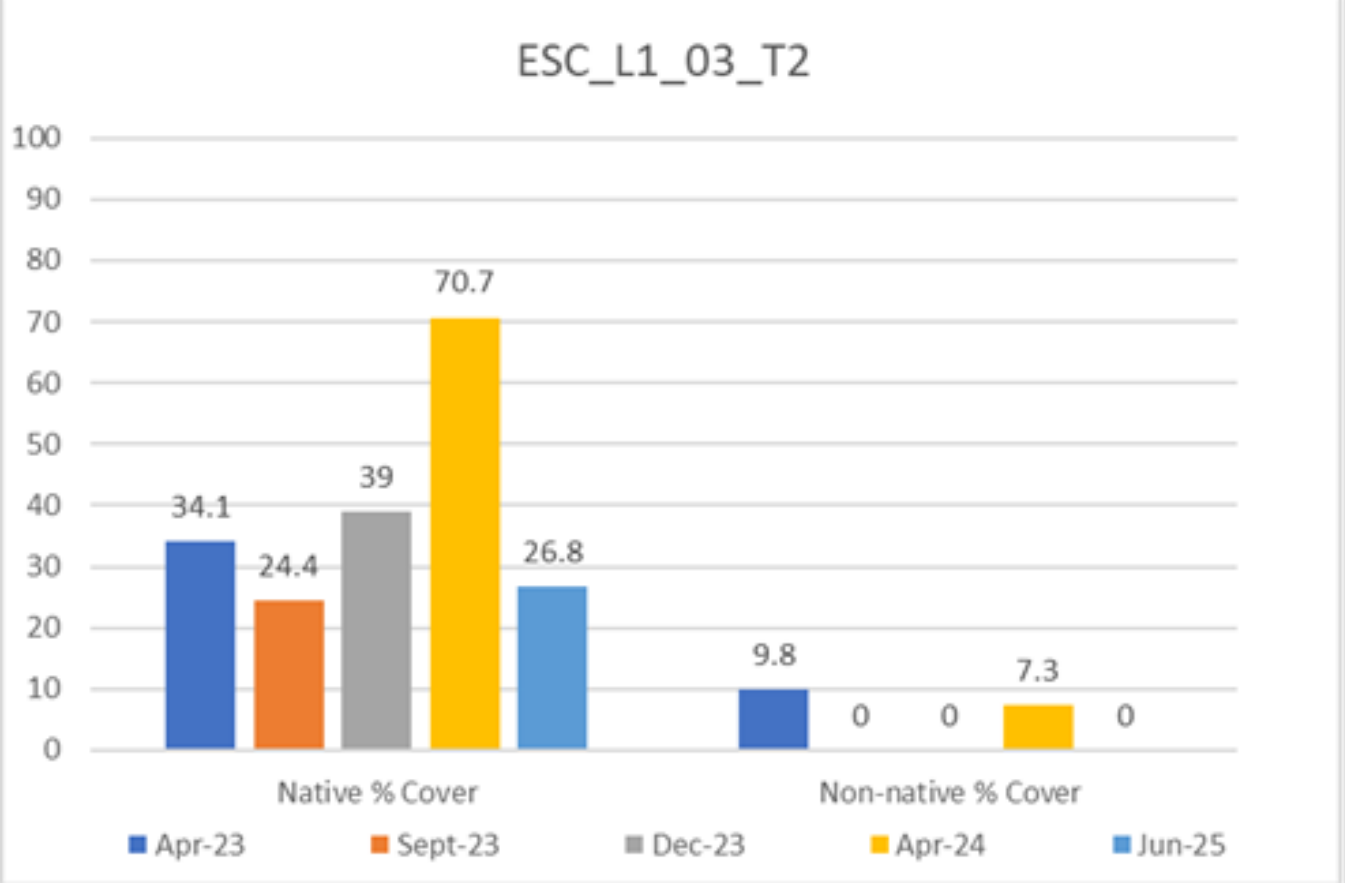
June 2025

Appendix D: Vegetation Transects

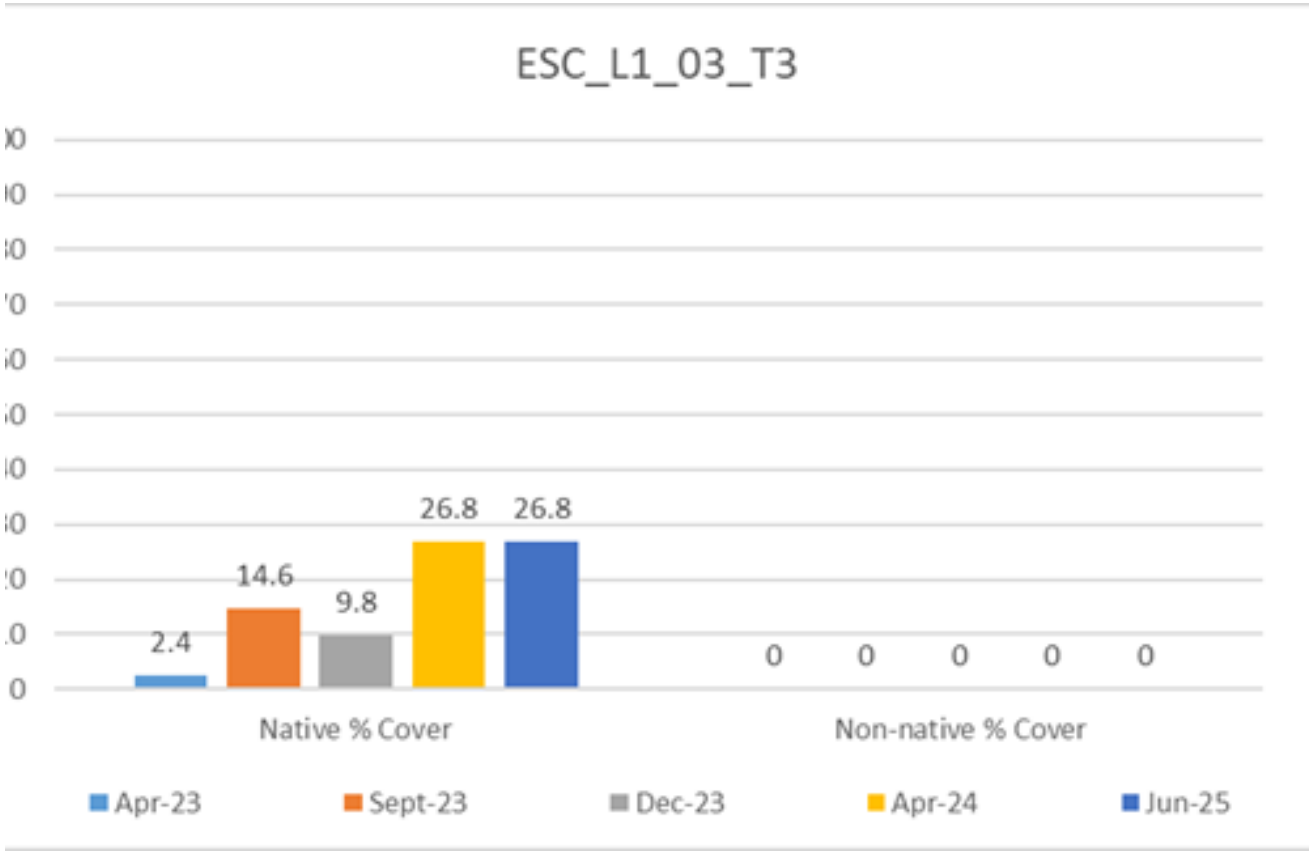
Native vs. Non-native Cover

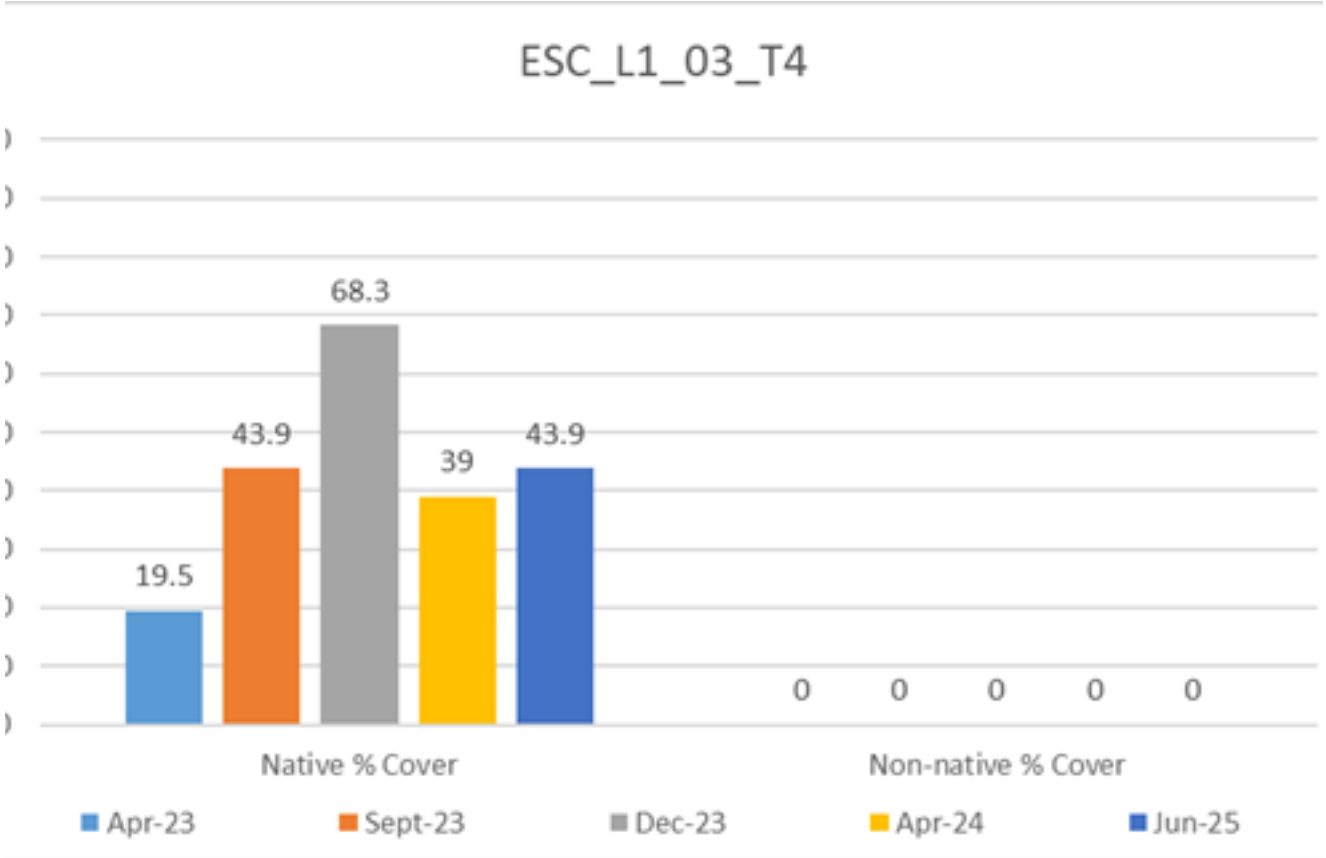
Seaside Terrace Dunes



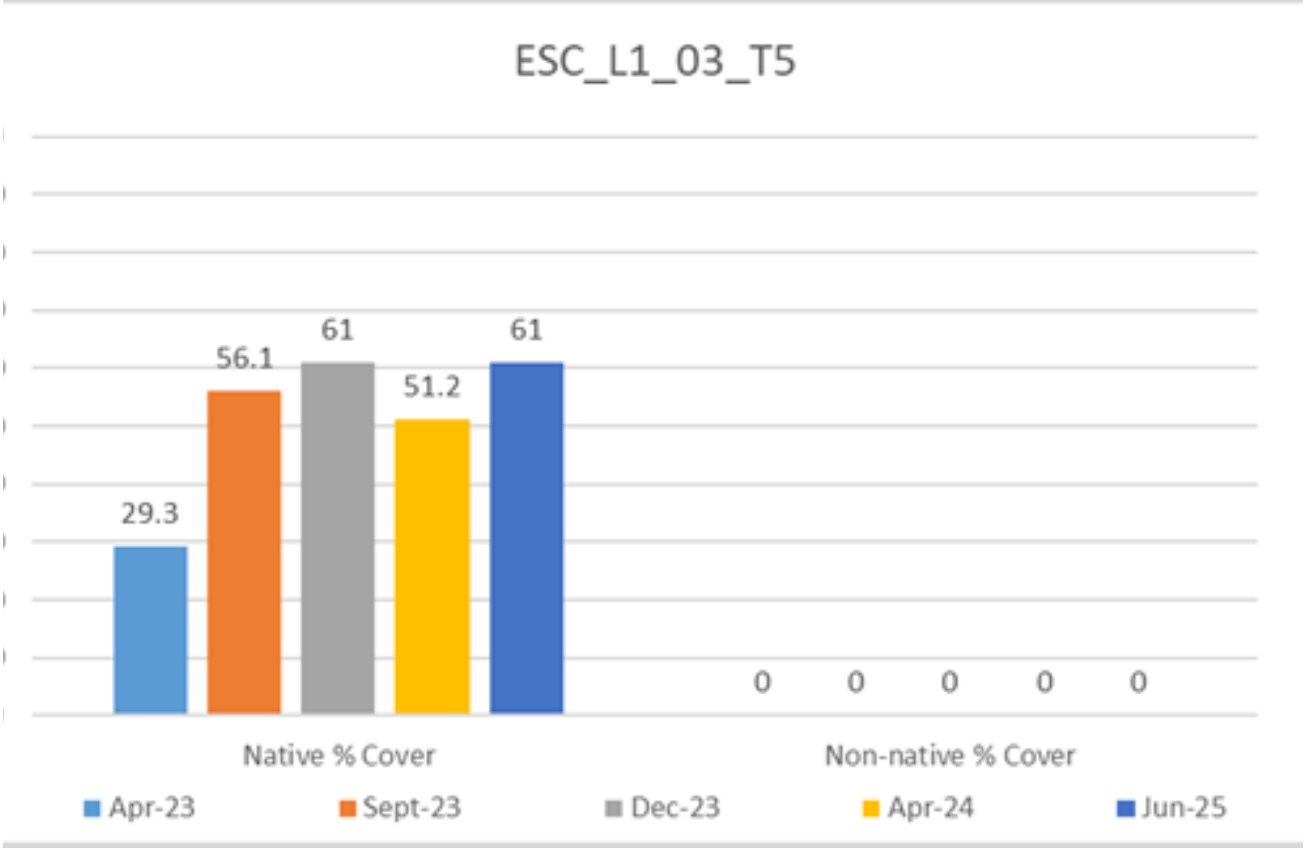


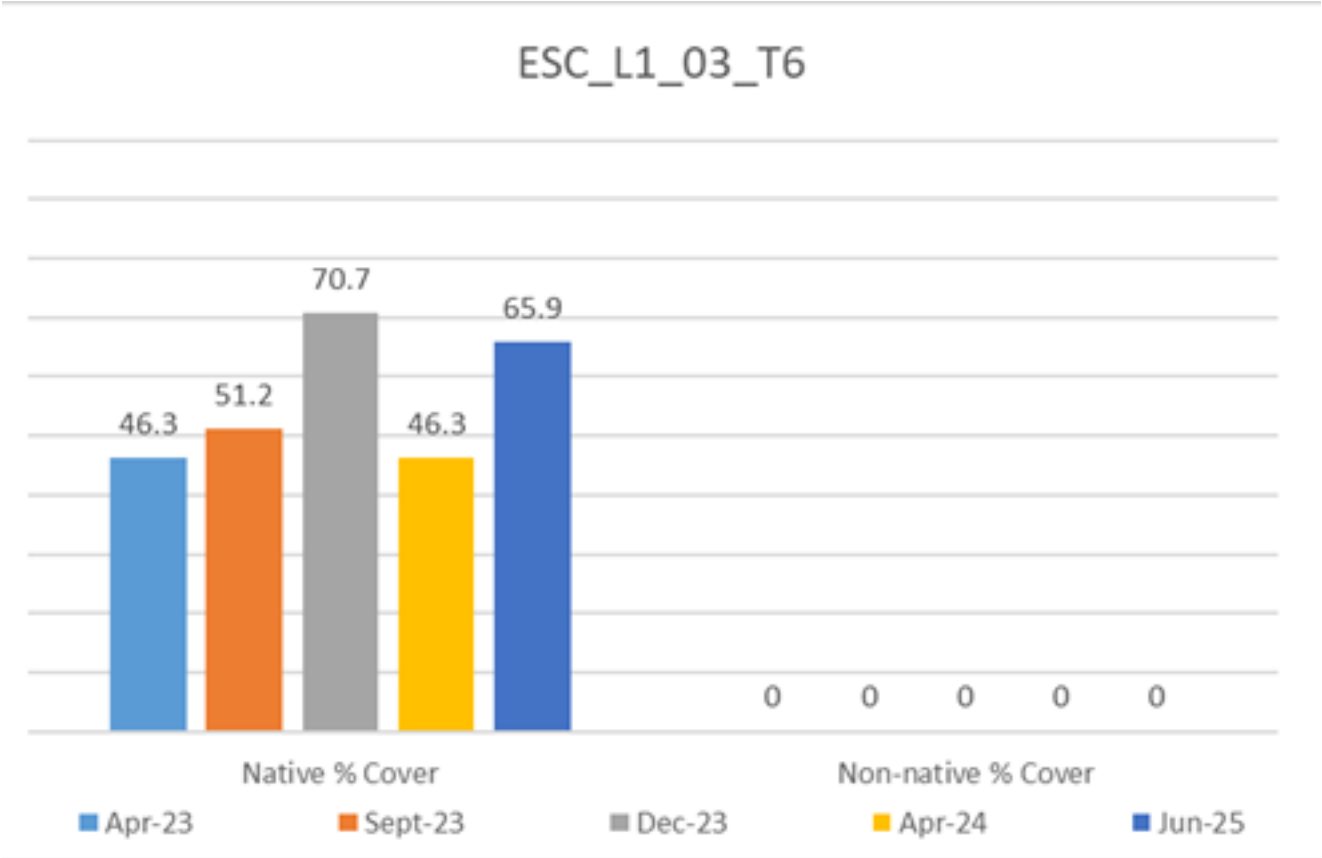
Cardiff Living Shorelines



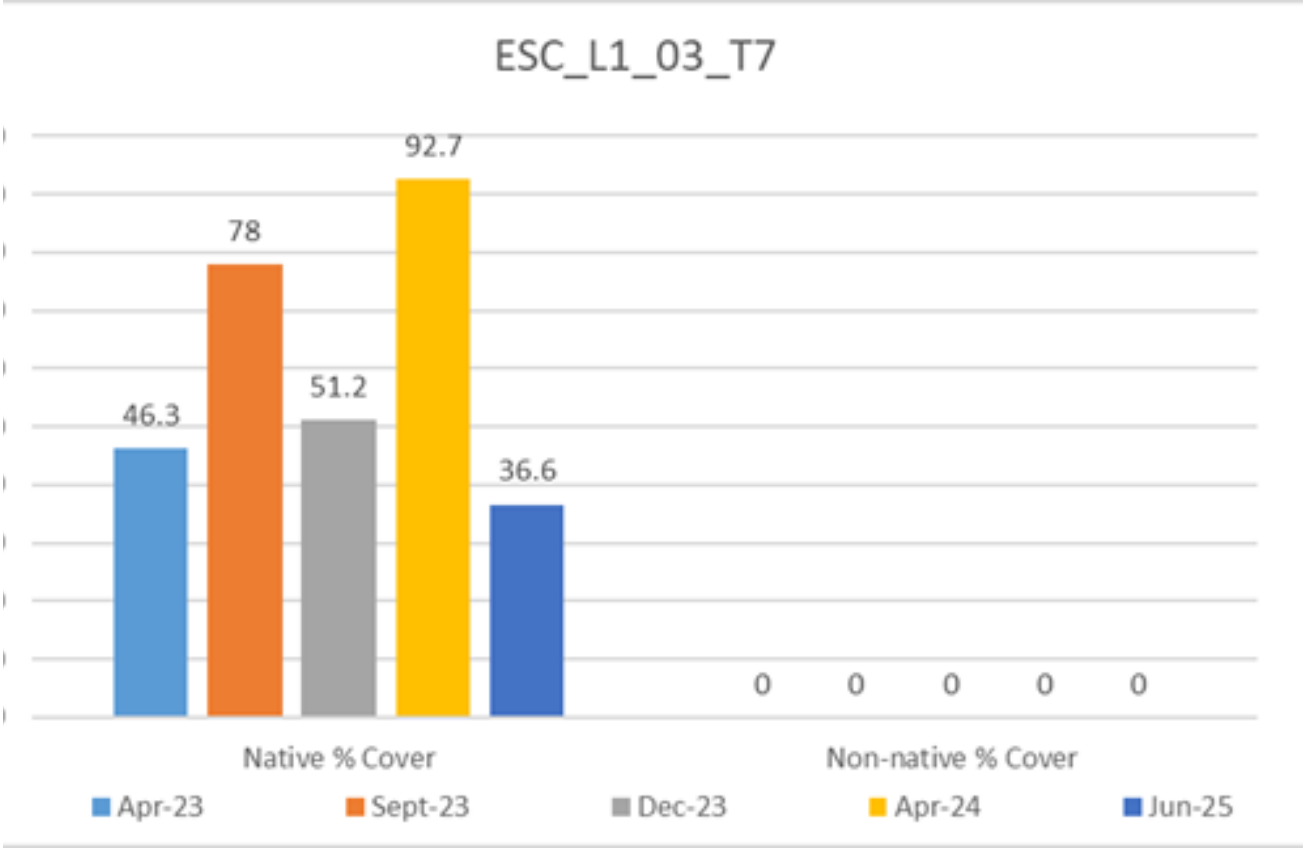


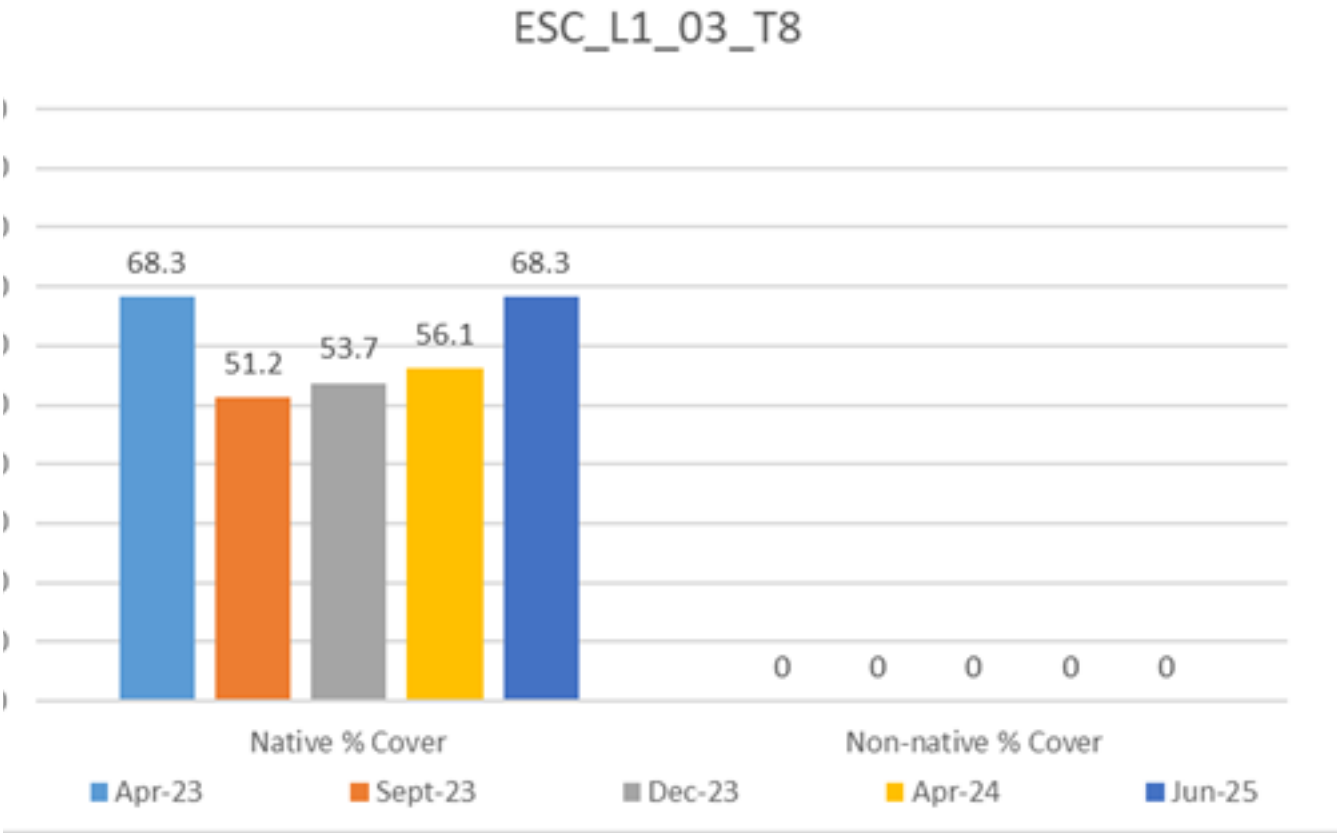
Cardiff Living Shorelines



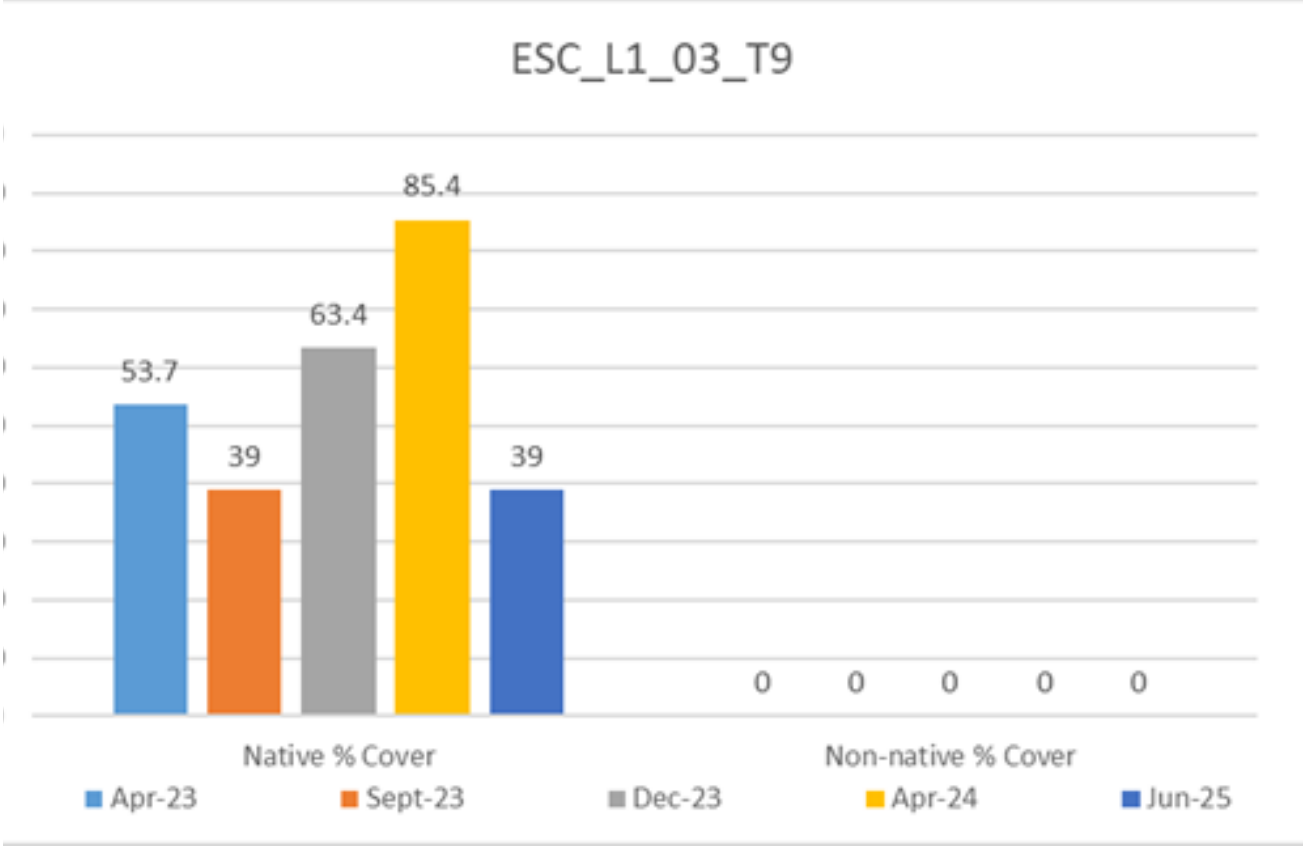


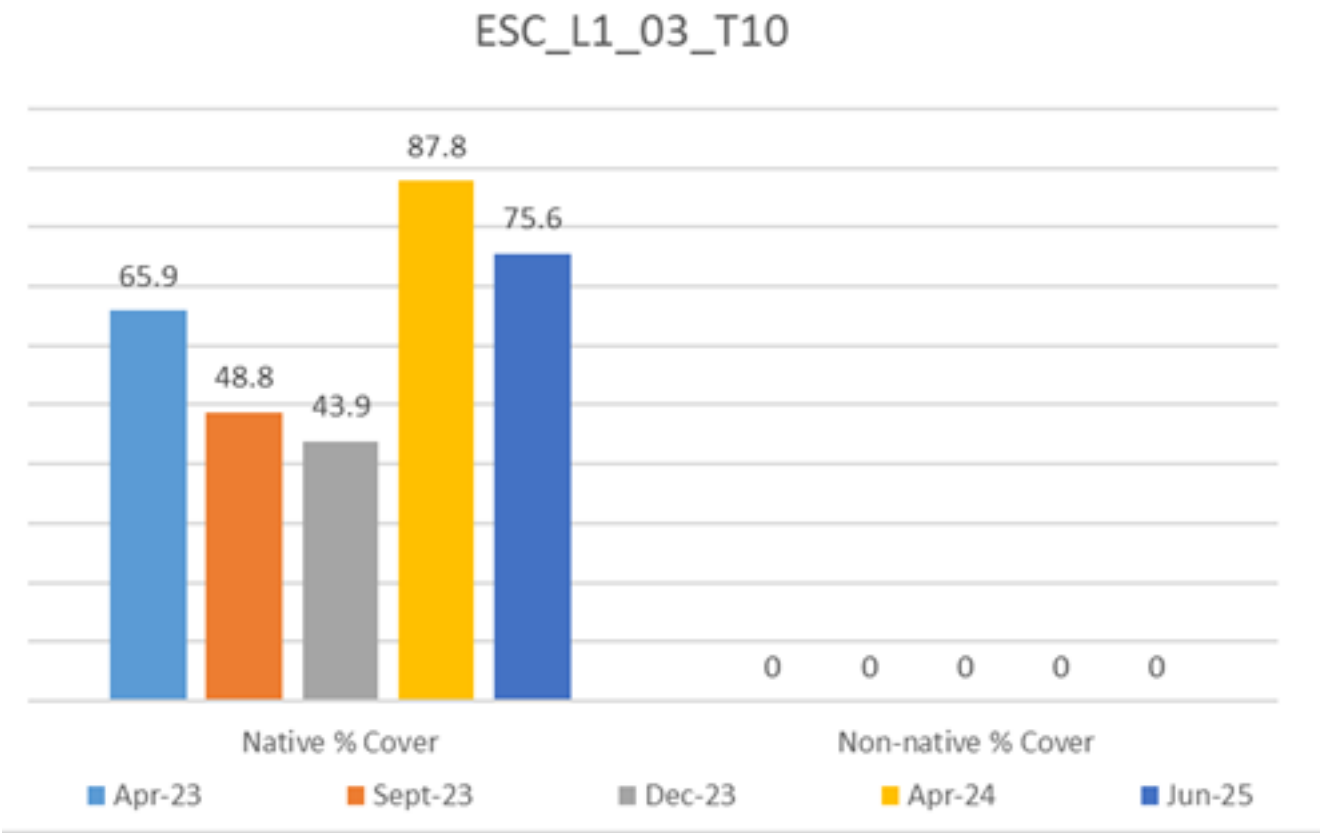
Cardiff Living Shorelines



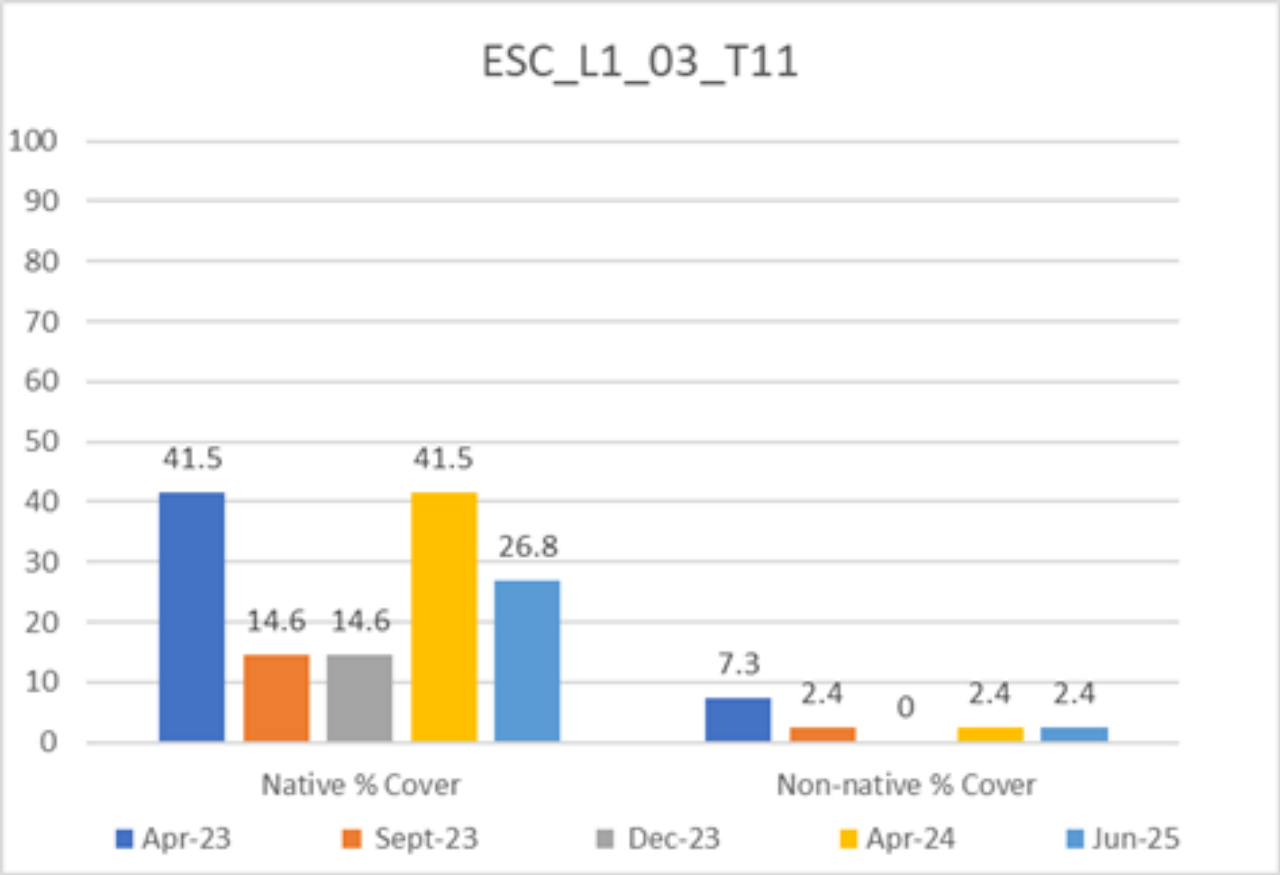


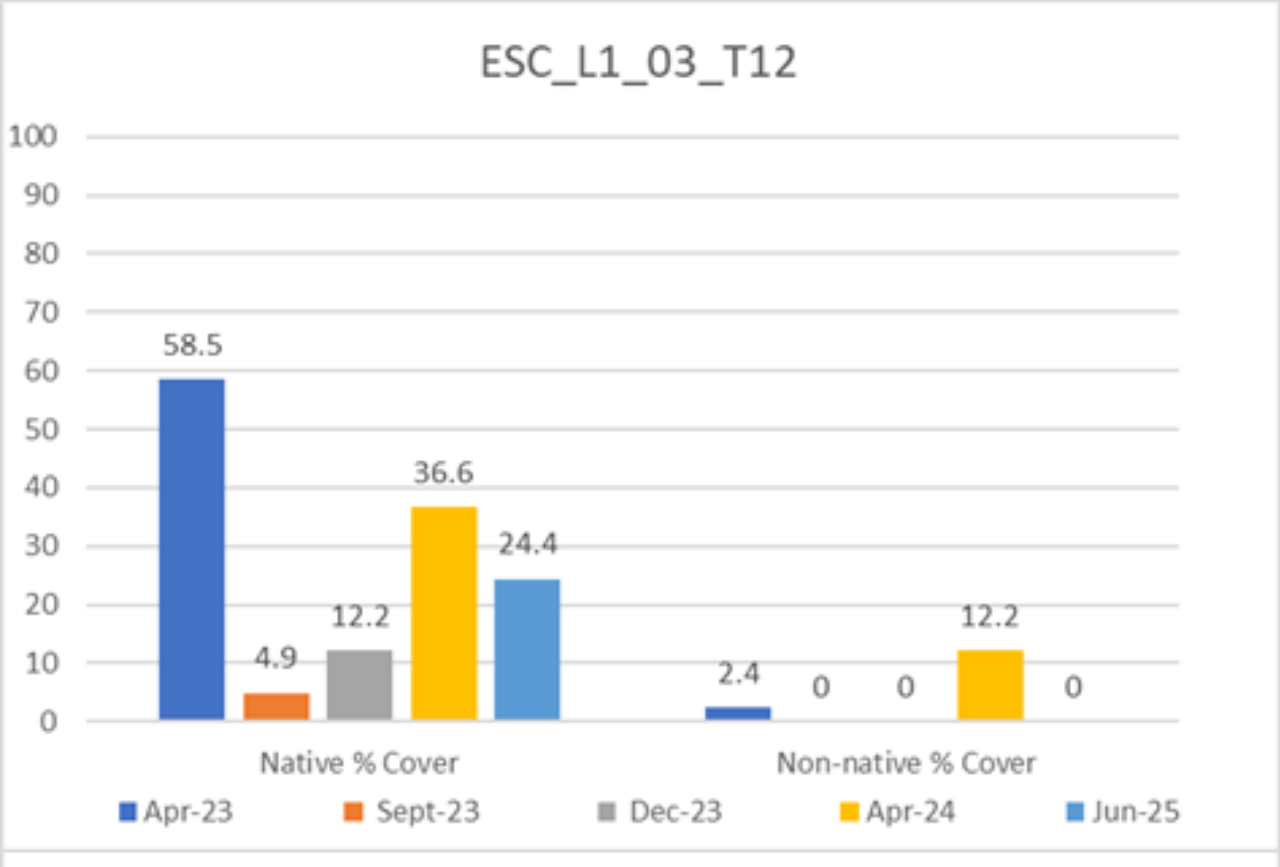
Cardiff Living Shorelines



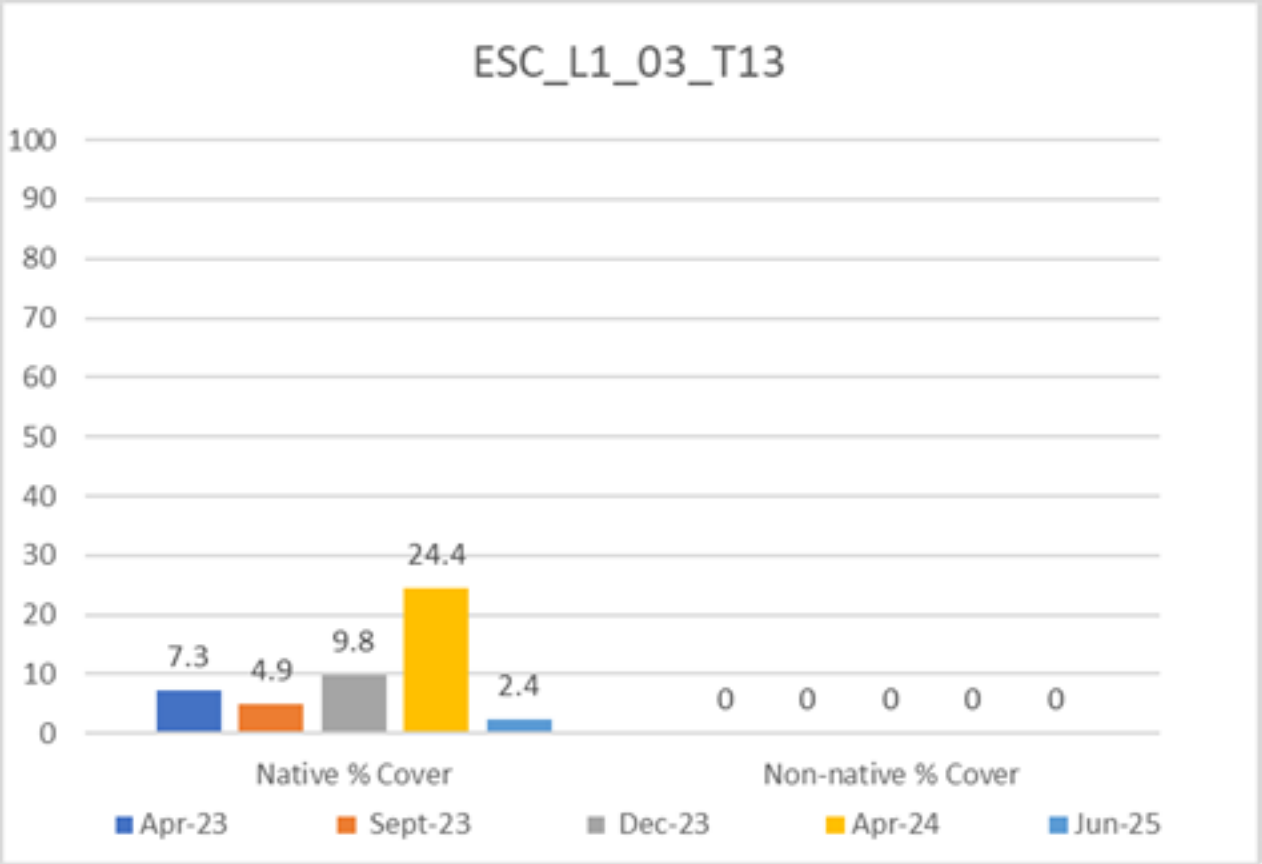


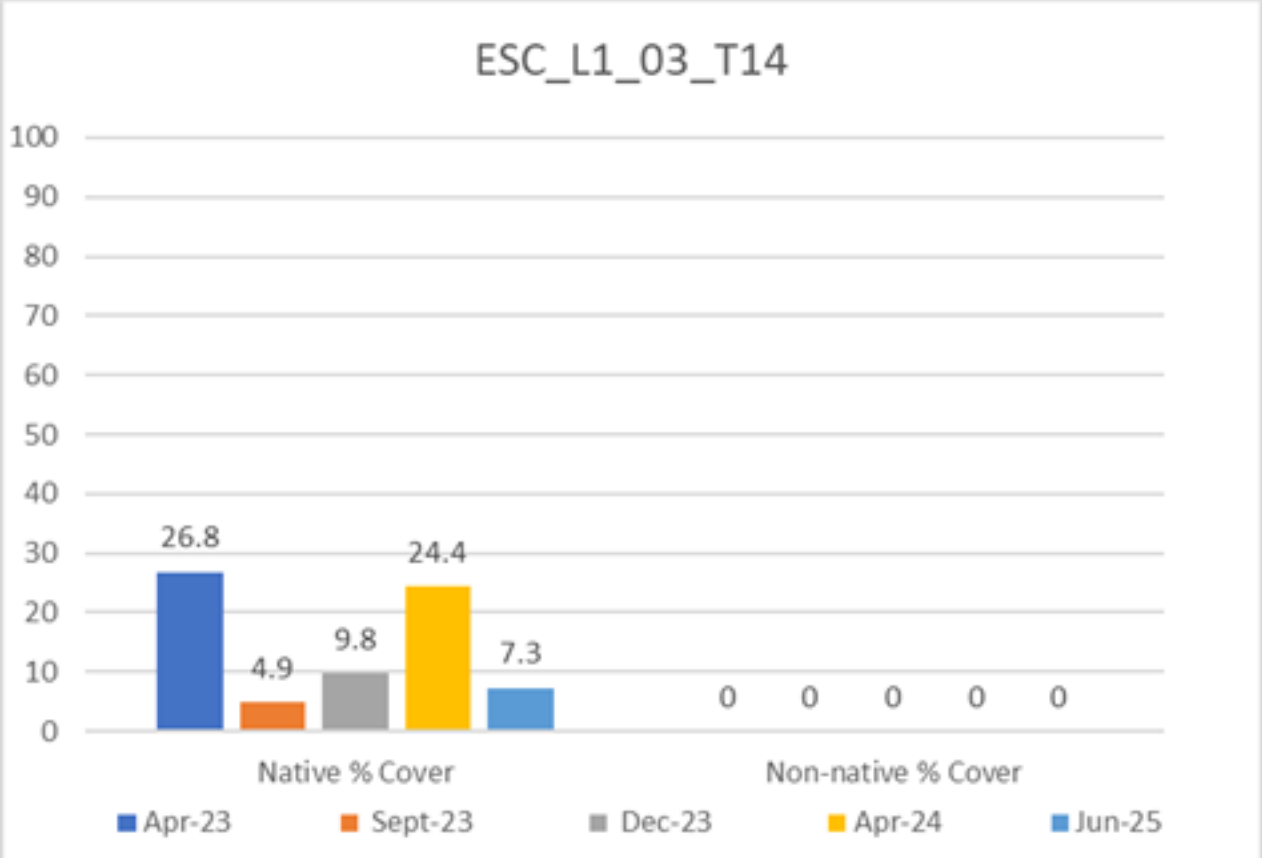
West Basin Dunes



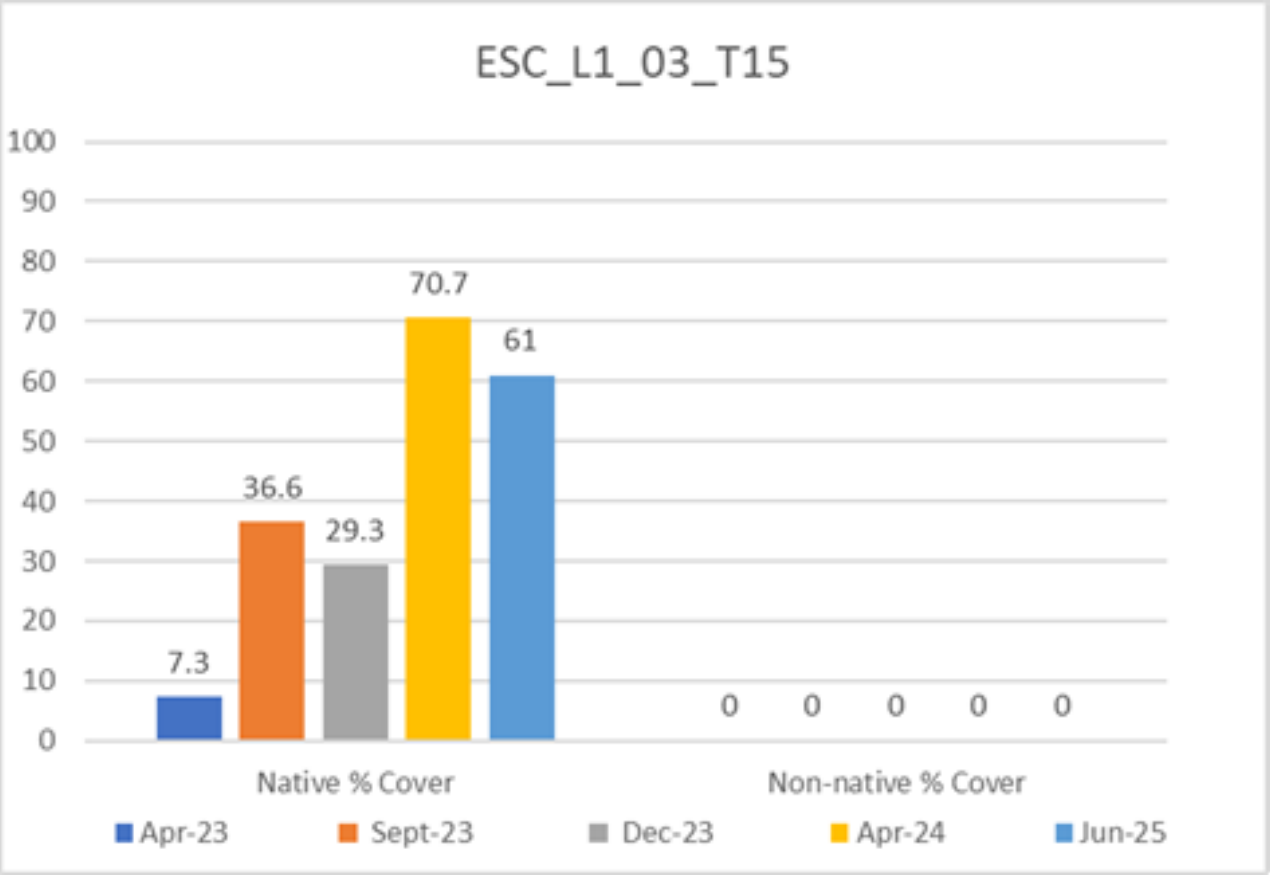


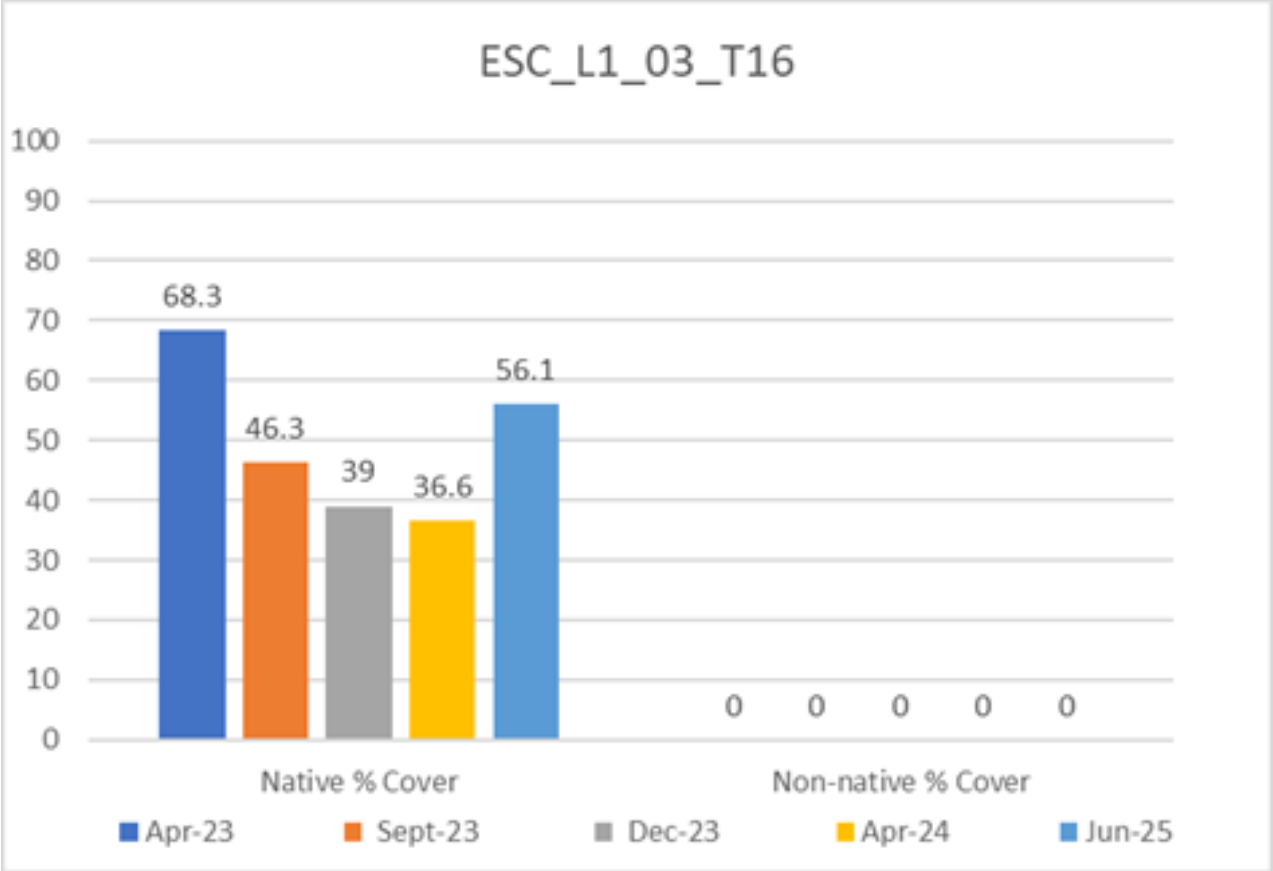
West Basin Dunes





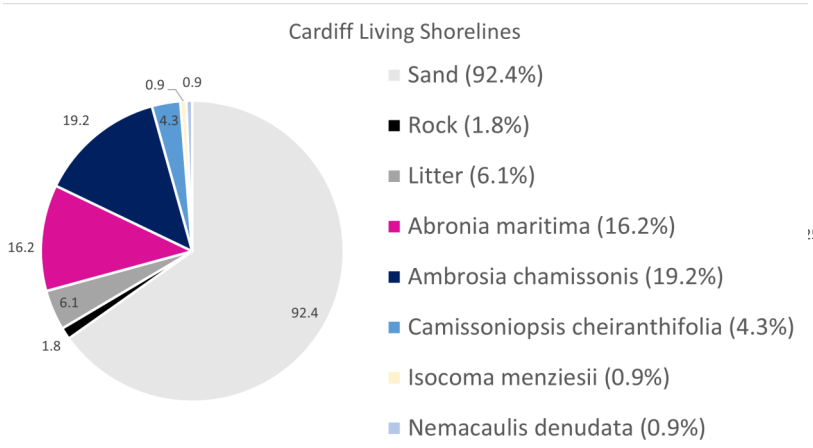
West Basin Dunes



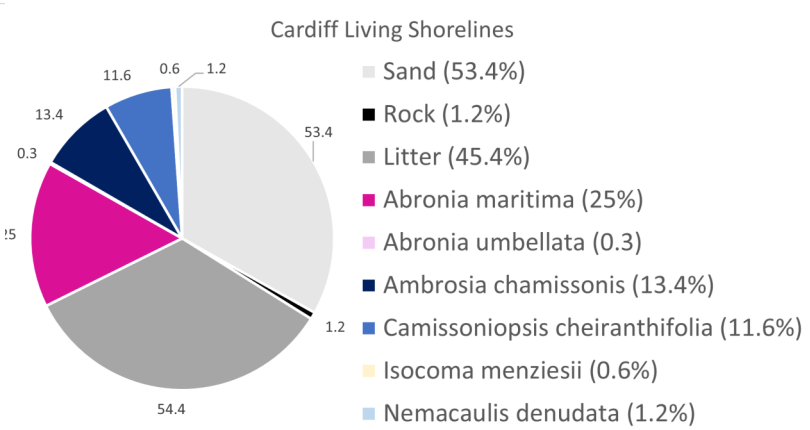


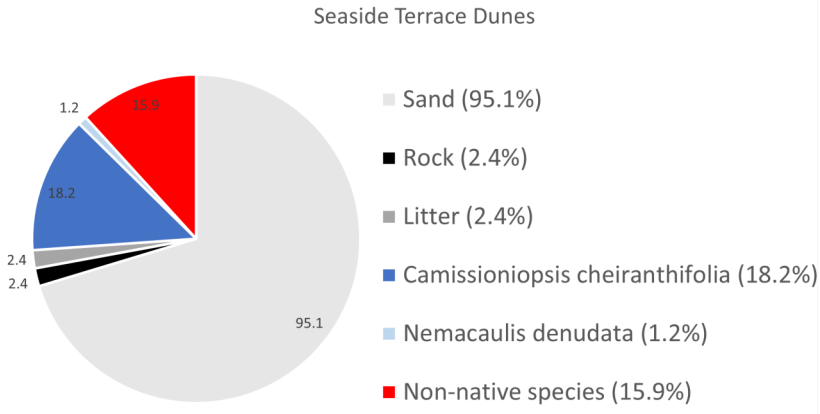
Average Species Composition by Site April 2023 vs June 2025

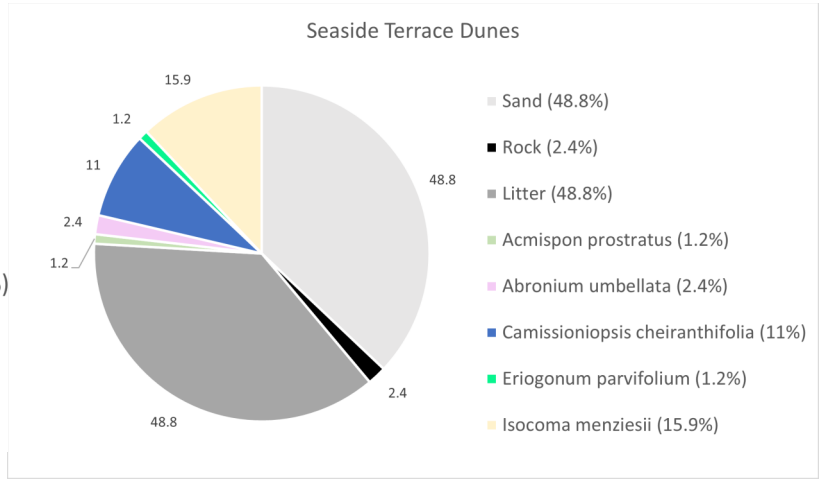
April 2023

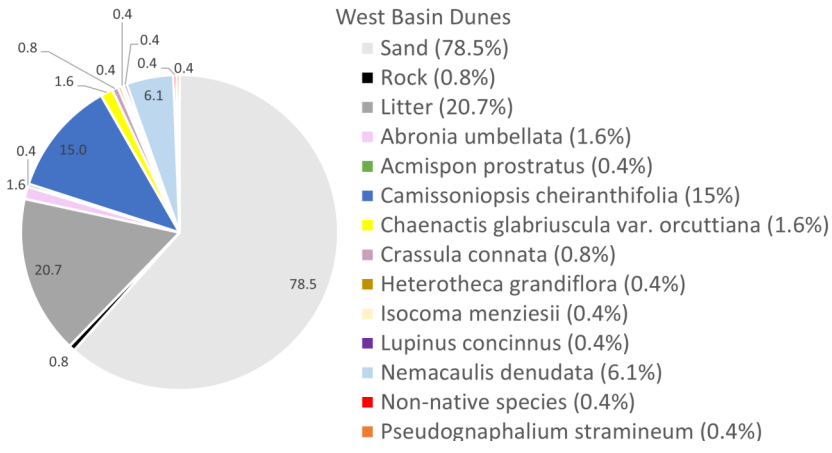


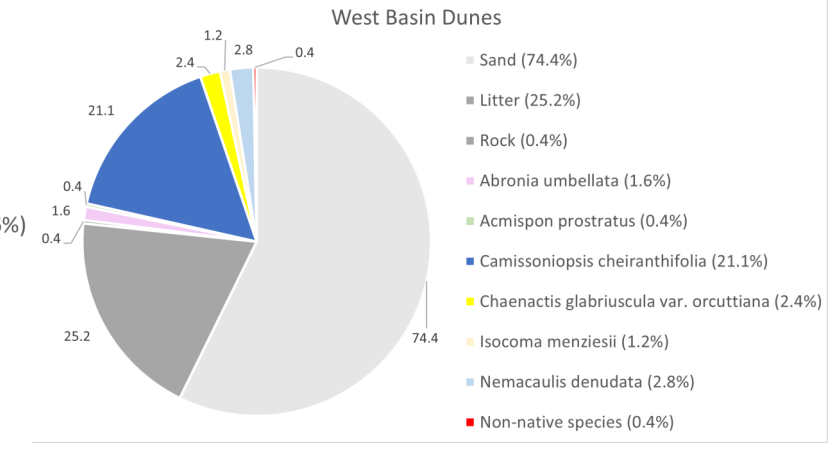
June 2025











Appendix E: Project Photos

Photo 1. Mounding Nuttall's lotus growing from broadcasted seed

Photo 2. Seacliff buckwheat (*Eriogonum parvifolium)* installed in the active restoration area

Photo 3. Orcutt's yellow pincushion in SDMMP IMG survey plot at WBD

Photo 4. Volunteer event at STD, installing native container plants between established native species

Photo 5. Rare dune plant species at CLS at the end of the Project with maintained fencing.

Photo 6. Close-up photo of Nuttall's lotus in full flower

Photo 7. Yellow-faced bumblebee on Nuttall's acmispon flower

Photo 8. Ceraunus blue on Nuttall's acmispon flower

Photo 9. Gray Hairstreak on a beach suncup