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Cojo West Terrace Wetland Assessment

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Cojo West Terrace Wetland Assessment



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INTRODUCTION

This report provides an update to the delineation of potential wetlands that meet federal and state standards on the Cojo Terrace of the Jack and Laura Dangermond Preserve in Santa Barbara County, California. This section of the preserve, hereafter referred to as the Study Area, consists of approximately 1,046 acres of coastal scrub, grasslands, dunes, and wetlands. A comprehensive wetland delineation study was previously conducted in 2012 by Althouse and Meade, Inc. of the entire 24,000 acres of the preserve. In the subsequent decade, the local climate underwent periods of drought and changes in management and land use. The Study Area covers the historic Cojo Ranch, which was managed as cattle rangeland since the 1800s. In 2017, The Nature Conservancy (TNC) acquired the Study Area as well as the adjacent Jalama Ranch and founded the Dangermond Preserve with the mission to preserve and steward the undeveloped land and protect and restore its biodiversity and wildlife connectivity. In 2022, a pilot study on the removal of invasive highway iceplant (*Carpobrotus edulis*) began in the northern, coastal section of the Cojo Terrace (Zone C and D, Figure 2). To further inform restoration efforts in the dunes and scrub, TNC contracted the Cheadle Center at UC Santa Barbara to update the 2012 wetland delineation and provide recommendations for wetland restoration.

In the original report by Althouse and Meade, Inc., the authors identified potential jurisdictional wetlands and other waters using the United States Army Corps of Engineers (USACE) methodology outlined in the 1987 Manual and 2008 Arid West regional supplement. The USACE field methodology lists wetland hydrology indicators, hydric soil indicators, and hydrophytic vegetation indicators. An area must meet all three indicators and have connectivity to Traditional Navigable Waters to qualify for federal jurisdiction under the Clean Water Act. Meeting just one of the three indicators is sufficient to meet the California Coastal Act of 1976 standards for wetland protection. (CCR Tit. 14, § 13577). Althouse and Meade used aerial photography, soil testing, vegetation surveys, and other field techniques within the USACE methodology to delineate 263 wetlands comprising 100.87 acres within the Study Area, as well as an additional 775 wetlands throughout the rest of Dangermond Preserve. These wetlands included three-parameter federal jurisdictional wetlands (mapped as “Federal Wetlands” or “Federal Wetland Waters”) and one- or two-parameter wetlands (mapped as “State Wetlands”).

In spring and early summer of 2025, the Cheadle Center conducted field surveys of the Study Area to assess the function and health of each wetland, provide restoration recommendations, and adjust delineation boundaries where appropriate. Since the previous survey by Althouse and Meade, the federal regulation of wetlands was restricted by the Supreme Court of the United States in a 2023 case, *Sackett v. Environmental Protection Agency*. The Court ruled that the Clean Water Act only protects traditionally navigable waters and their adjacent wetlands, where “adjacent” refers only to those with a continuous surface connection to such waterways. As a result, the vast majority of the wetlands that Althouse and Meade had identified as “Federal Wetlands” no longer fall under federal jurisdiction, though are still protected by California regulations under the oversight of the California Coastal Commission. Rather than a

jurisdictional approach to delineation, Cheadle Center staff identified how many and which of the three parameters were met by each wetland and described adjacency to waterways where relevant. These data can be used in determining jurisdiction should permitting be required, even in the event of future regulatory changes. In association with the wetland study, a burrowing owl survey was conducted to identify opportunities for conservation.

Cojo Terrace is a large area with varying topography, soils, habitat, and infrastructure, so distinct zones are referred to throughout this report using the names listed in Figure 1 and mapped in Figure 2.

Zone Name	Description
A	North of ravine, sandy loam
B	Northern deep ravine, shaly clay loam
C	North-central section behind the dunes and between two ravines, characterized by loamy sand, sandy loam, and flat wetlands
D	Duneland along Point Conception, sandy soil
E	Central section of Cojo Terrace south of the railroad, characterized by wet meadows and loamy sand
F	Northeast of Cojo Road, cow pasture, loamy sand
G	Between Cojo Road and railroad, cow pasture, loamy sand, veldt grass dominated
H	South-central section near Government Point, characterized by wet meadows and loamy sand
I	Eastern section of terrace, loamy sand dominated by veldt grass

Figure 1: Description of zones shown in Figure 2 dividing the Study Area by shared characteristics and/or physical barriers.

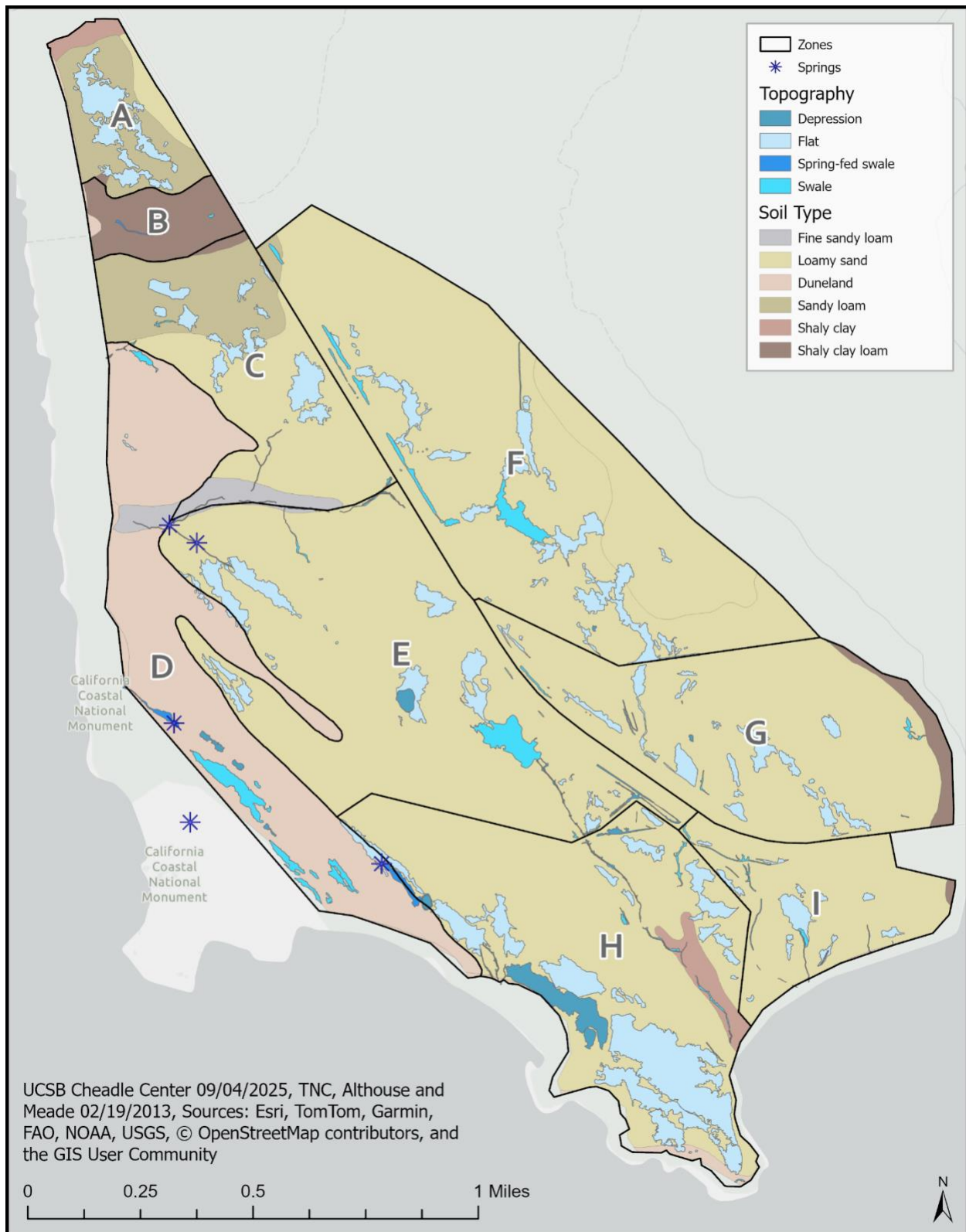


Figure 2: Map showing the wetlands delineated in 2025 categorized by topography type and Natural Resource Conservation Service (NRCS) soil descriptions.

OVERVIEW

Wetland mapping in 2025 was conducted using ESRI Field Maps and a sub-meter-accurate Juniper Geode GNS3m GNSS receiver. Surveyors used 2012 wetland boundaries as a reference and updated them based on current field conditions, assessing hydrology, vegetation, and, when necessary, soil indicators in accordance with USACE criteria. In total, 270 wetlands were mapped in 2025, compared to 263 in 2012. The total of both state and federal wetlands increased from 100.87 acres in 2012 to 112.59 acres in 2025—a net increase of 11.72 acres, or approximately 11.6%.

Within the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979), the majority of wetlands within the Study Area were palustrine systems, characterized as “nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens” including marshes, ponds, vernal pools, and prairies. One riverine system was mapped in a deep gorge in the northwest of the Study Area. Riverine systems are defined as “wetlands and deepwater habitats contained within a channel, except those dominated by trees, shrubs, persistent emergents, emergent mosses, or lichen and habitats with water containing ocean-derived salts of 0.5 ppt or greater.” The habitat within the channel, where water flow consistently excludes plant growth is riverine, while adjacent wetlands dominated by emergent vegetation is palustrine. Due to the relatively dry conditions in 2025, very little flow was recorded throughout the Study Area, even within channels that were previously mapped as Federal Wetland Waters. These intermittent and ephemeral streams sometimes had saturated soils, but water was only observed in a total of nine wetlands. A more detailed classification using the Cowardin taxonomy is warranted. For the purposes of this study, we categorized wetlands into more general topography types: swale, spring-fed swale, flat, and depression.

After mapping was completed, habitat assessments were conducted for each wetland, documenting the topography and dominant plant species. An analysis of vegetation data across all surveyed wetland topographies reveals a consistent trend in the dominance of a limited number of plant species—both native and non-native—regardless of landscape position. Across swale, spring-fed swale, flat, and depression wetlands, the most common species were relatively few in number and included both native wetland specialists and invasive generalists. Notably, brown-headed rush (*Juncus phaeocephalus*) emerged as the single most dominant species overall in three out of four topography types. Its widespread dominance suggests both a strong ecological tolerance for a range of wetland conditions and possibly a decline in competition from other native species in disturbed or simplified habitats.

Non-native species *Carpobrotus edulis* and perennial veldt grass (*Ehrharta calycina*) exhibited substantial cover in multiple wetland types, indicating that ecological degradation and disturbance have facilitated their broad establishment. These invasive species often occurred in high concentrations and in some cases—particularly in flat wetlands—surpassed native

vegetation in total absolute cover. In general, native cover was highest in more hydrologically stable and isolated systems such as spring-fed swale and depression wetlands, while non-native species were most abundant in flat wetlands, where hydrology is less predictable and habitat heterogeneity is limited.

The habitat assessment data demonstrates a pattern of ecological homogenization in which a handful of species dominate across diverse landscapes. This reduction in floristic diversity, particularly among native species, is indicative of landscape-level stressors such as historical disturbance, hydrologic alteration, and lack of physical complexity. The presence of non-native species in nearly every wetland type further supports the conclusion that many of these wetlands are in varying stages of ecological degradation, requiring active restoration to restore native diversity and ecosystem function. Restoration recommendations organized by wetland type can be found in Figure 3 below and are expanded upon throughout this report

Wetland Topography Type	Recommendations
Swale	<ul style="list-style-type: none"> • A combination of invasive species management, hydrological restoration, and ongoing monitoring. • Restoration efforts tailored to site-specific conditions, balancing invasive species control with the preservation of native diversity and informed by each site's unique disturbance history, hydrological function, and microtopography. • In areas dominated by invasive species such as <i>Carpobrotus edulis</i>, prioritize targeted removal or suppression of invasives to reduce competitive pressure on native species. • In areas already dominated by natives (high relative cover of <i>Juncus phaeocephalus</i>, <i>Frankenia salina</i>, and <i>Distichlis spicata</i>), protect and manage to maintain ecological integrity, with minimal intervention beyond monitoring and disturbance prevention. • Hydrological enhancement—such as reestablishing natural drainage patterns, recontouring degraded swales, or reconnecting fragmented hydrological flows—to support native plant recruitment.
Spring-fed Swale	<ul style="list-style-type: none"> • The limited presence of invasive species, combined with strong hydrological stability, makes these wetlands high-priority sites for conservation and restoration.

	<ul style="list-style-type: none"> • Long-term protection, preservation of hydrological integrity, and enhancement through the reintroduction of sensitive native species. Some of these wetlands, particularly FW-271, hold exceptional potential as introduction sites for the critically endangered <i>Arenaria paludicola</i>, exhibiting near-ideal habitat conditions. • Strategic removal of existing invasive species, along with periodic vegetation surveys to detect and respond to early signs of invasive establishment.
Flat	<ul style="list-style-type: none"> • Targeted removal of invasive species, active revegetation with native flora, and physical modifications such as subtle grading to increase depth and construct small mounds to increase topographic and microhabitat complexity. • Due to the homogenous nature of the flat wetlands, across the site more broadly, and the low diversity of native wetland vegetation they support, we recommend considering deepening some of these wetlands for the formation of better functioning wet meadows. • <i>Ehrharta calycina</i> control, especially in wetlands where absolute percent cover exceeds 40% using methods such as grazing, mowing, bagging, and removing or piling the material, or treatment with graminicides. • If logistically possible, implement grazing in the isolated area containing wetlands SW-135 to SW-148 to remove thatch
Depression	<ul style="list-style-type: none"> • Selective invasive removal, coupled with hydrological monitoring and passive revegetation • Control early invasion of <i>Cynodon dactylon</i> in ISW-6 and ISW-11.
Further Research	<p>Entomology study of ant and pollinator species richness and abundance pre- and post-restoration. Anecdotally, Cheadle Center staff encountered a wide diversity of ant species over the course of this study. Pollinators were often observed foraging on iceplant flowers; rapid, large scale iceplant removal may deprive pollinators of an abundant nectar resource they have come to rely upon. Researchers have compiled species lists for plants, mammals, birds, reptiles, and amphibians on Dangermond Preserve, but thus far no one has made the effort to catalog insect diversity. TNC and the National Park Service have undertaken massive efforts to eradicate invasive</p>

	Argentine ants on Santa Cruz Island. Dangermond could present an opportunity to continue this work and safeguard invertebrate biodiversity.
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Figure 3: Restoration recommendations by wetland type.

Swale wetlands exhibited a mixed composition of native and non-native species. *Juncus phaeocephalus* was the most abundant species, followed by *Carpobrotus edulis*, *Festuca perennis*, *Distichlis spicata*, and *Juncus breweri*. Many sites showed high native dominance, while others displayed a prevalence of invasive species, pointing to site-specific variation in disturbance history and hydrological function. The variation in vegetation across swale wetlands suggests that microtopography and moisture gradients play a significant role in shaping plant community structure.

Spring-fed swale wetlands, while limited in number and acreage, were distinct in their botanical composition. Dominated by *Juncus hesperius*, *Frankenia salina* and *Distichlis spicata*, these wetlands featured relatively high native cover and a lower presence of invasive species. Their stable hydrological regime, driven by seasonal or perennial groundwater discharge, appears to suppress invasive plant establishment. These characteristics, combined with their occurrence in sandy, ancient dune soils, make spring-fed swales high-priority candidates for conservation and potential reintroduction of rare wetland taxa such as marsh sandwort (*Arenaria paludicola*), a species which once ranged from Washington to Central Mexico but is currently limited to a single naturally occurring population at Oso Flaco Lake, and three extant outplanted populations in San Luis Obispo and Marin Counties. The resilience of this critically endangered species relies on identifying and exploring reintroduction opportunities in freshwater boggy wetlands with alliances of non-woody hydrophytes.

Flat wetlands, which constitute the largest area and number of sites, were the most heavily invaded by non-native species. Dominance by *Carpobrotus edulis* and *Ehrharta calycina* was particularly pronounced, with native cover often limited to *Juncus phaeocephalus*. The uniform topography and absence of extended ponding likely reduce niche diversity, favoring aggressive colonizers. The low species richness and high invasive dominance suggest that these wetlands have experienced significant ecological simplification. Restoration recommendations include targeted removal of invasive species, active revegetation with native flora, and physical modifications such as subtle grading to increase depth and construct small mounds to increase topographic and microhabitat complexity.

Depression wetlands, though covering a small proportion of the total wetland area, exhibited relatively stable native cover and less invasive dominance than flat wetlands. The extended hydroperiod typical of these closed-basin systems likely favors facultative wetland species and limits certain invaders. *Juncus phaeocephalus* again dominated, while *Juncus mexicanus* and non-native wetland species *Plantago coronopus* were present to a lesser extent. Non-native species *Carpobrotus edulis* and *Ehrharta calycina* also dominated, though generally at lower levels compared to other wetland topography types. These wetlands may require only limited

intervention to support long-term ecological function, focusing primarily on monitoring and selective invasive removal.

Restoration planning should emphasize protection and enhancement of stable, native-dominated systems; suppression of invasive species in heavily altered wetlands; and potential structural interventions to restore habitat heterogeneity, particularly in flat terrain.

BRANCHIOPOD SURVEY

A survey for vernal pool fairy shrimp (*Branchinecta lynchi*) was conducted on March 26, 2025, with the assistance of Alice Abela, Senior Biologist at ManTech SRS. According to the habitat assessment conducted in 2022 by ECORP Consulting, Inc., eight wetlands in the study area were identified as potential habitat for vernal pool fairy shrimp and were included in the survey.

The eight wetlands with suitable or potentially suitable hydrology for vernal pool branchiopods are ISW-17, FW-284, FW-283, FW-273, ISW-8, SW-222 (contiguous with ISW-8), and SW-198. No water was present during the survey, and no evidence of fairy shrimp was observed.

WETLAND DELINEATION

Methods

Wetland mapping was conducted in ESRI Field Maps using a Juniper Geode GNS3m GNSS receiver with sub-meter accuracy. A copy of the polygons representing the 2012 wetland boundaries was used as a base map for field comparisons. When appropriate, the edges of the polygons were edited to reflect current conditions in the field.

The USACE methodology is detailed in the 1987 Corps Wetland Delineation Manual. The 2022 Arid West Regional Supplement Wetland Determination Data Sheet Version 2.0 was utilized to determine appropriate changes to the 2012 wetland boundaries. Forms were completed digitally through Wildnote software. To assess soils for hydric indicators, the surveyor would dig a 12-to-18-inch pit within the potential wetland, detail the soil texture, color, and presence/absence and percentage of redox features within each layer. Refer to the Arid West data sheets in Appendix B for a full list of the hydric soil indicators.

Absolute vegetation percent cover was assessed within a 5-foot by 5-foot plot around the same point as the soil pit. Each plant species is classified by its association with wetland habitats within the National Wetland Plant List: Arid West Region (2022), as either Obligate (OBL), Facultative Wetland (FACW), Facultative (FAC), or Non-Indicator/Upland (NI/UPL). If the number of dominant species that are OBL, FACW, or FAC accounts for over 50% of the total dominant species, the area passes the Dominance Test. In addition, a Prevalence Index is calculated from the weighted percent cover of each indicator class. If the Dominance Test is

passed, hydrophytic vegetation is considered present in the wetland. If not, a Prevalence Index ≥ 3.0 is considered a sufficient hydrophytic vegetation indicator as long as hydric soil and/or wetland hydrology indicators are also present.

Wetland hydrology indicators are miscellaneous characteristics such as presence of surface water, saturated soils, water marks, drift deposits, surface soil cracks, biotic crust, muck surface, hydrogen sulfide odor, drainage patterns, etc. Either one primary indicator is required or at least two secondary indicators are required to determine wetland hydrology presence. Refer to the Arid West data sheets in Appendix B for the full list of wetland hydrology indicators.

In reviewing areas that were delineated as federal wetlands in 2012, if hydrology and vegetation indicators were present, the soil was not assessed, and the boundaries were left as is. However, if hydrophytic vegetation was no longer growing within the boundary or there was no indication of wetland hydrology, surveyors dug a shallow soil pit using a sharpshooter shovel to search for hydric conditions and adjusted the boundaries accordingly. In the case of state wetlands which previously only met one or two of the wetland criteria, the boundaries were often adjusted to follow the current cover of hydrophytic vegetation. If current conditions matched the 2012 mapped boundary within two meters, the boundary was not edited. When no adjustments or only small adjustments were made, a USACE Arid West form was not fully filled out.

While surveying on foot, observers would occasionally encounter previously unmapped areas that met one or more of the wetland criteria. For each of these areas, all three indicators were assessed using the Arid West wetland determination data sheet and the boundary was delineated accordingly. The wetland was given a unique number post-hoc.

The full map of wetlands is available on ArcGIS Online at . Authoritative GIS layers are listed in Figure 4.

Name	Description	Link
Wetlands (2012)	Polygon layer showing the wetland boundaries delineated by Althouse and Meade surveyors 2010-2012.	https://services.arcgis.com/F7DSX1DSNSiWmOqh/arcgis/rest/services/jldp_wetlands_(Public)/FeatureServer/0
Wetlands_Revised_2025	Polygon layer showing the wetland boundaries delineated by the Cheadle Center in spring and summer of 2025. Several different visualizations of the data are shared throughout this report and on the web map to highlight vegetation cover and topography.	https://services1.arcgis.com/4TXrdeWh0RyCqPgB/arcgis/rest/services/Wetlands_Revised_2025/FeatureServer/0

Dangermond Soil Samples	Point layer showing where surveyors dug each soil pit to determine wetland soil indicators. Sample ID was used to cross-reference the relevant Arid West Data Sheet.	https://services1.arcgis.com/4TXrdeWh0RyCqPgB/arcgis/rest/services/Dangermond_Soil_Samples/FeatureServer/0
jldp_springs	Point layer showing springs on Dangermond Preserve, based on 2012-2013 studies.	https://services.arcgis.com/F7DSX1DSNSiWmOqh/arcgis/rest/services/jldp_springs_(Public)/FeatureServer
Dangermond_Streams	Polyline layer showing streams on Dangermond Preserve. A subset of the National Hydrography Dataset (NHD).	https://services1.arcgis.com/4TXrdeWh0RyCqPgB/arcgis/rest/services/Dangermond_Streams/FeatureServer/0
Cojo_NRCS_Soils	Polygon layer showing soil descriptions within the Study Area. A subset of the NRCS soil dataset.	https://services1.arcgis.com/4TXrdeWh0RyCqPgB/arcgis/rest/services/Cojo_NRCS_Soils/FeatureServer/0
Cojo West Study Area	Polyline layer showing the boundary of the Study Area.	https://services1.arcgis.com/4TXrdeWh0RyCqPgB/arcgis/rest/services/Cojo_West_Study_Area/FeatureServer
Cojo Survey 10x10 Grid	Polygon layer showing a grid of 10 meter by 10 meter squares, sequentially numbered. A representative grid square was surveyed in each wetland and the grid ID number was used to cross-reference the habitat assessment survey. The same grid was used in the burrowing owl survey.	https://services1.arcgis.com/4TXrdeWh0RyCqPgB/arcgis/rest/services/Burrow_Survey_10x10_Grid/FeatureServer

Figure 4: List of GIS layers created for this wetland delineation project.

Results

The overall acreage of wetlands within the Study Area was determined to be 11.72 acres greater in 2025 compared to the 2012 study (Figure 5). Although 50 wetlands decreased in size and several were no longer extant, another 108 expanded their footprints and 26 wetlands not mapped in 2012 were delineated in 2025. In some cases, two or more adjacent wetlands with

contiguous hydrology, soils, and hydrophytic vegetation were merged into one wetland. In other cases, there were large gaps in vegetation cover and hydric soils between two areas within a single boundary; these wetlands were split into two polygons to reflect the fragmentation of what was once a single larger wetland.

There were several wetlands recorded in 2012 without detailed boundaries, where Althouse and Meade surveyors drew circular polygons around points where hydrophytic vegetation or hydric soils were observed. In 2025, more detailed boundaries following the wetland vegetation cover in the surrounding area were created, often extending much further from the original boundaries. While this finer accuracy accounts for some of the expansion in acreage, there were several areas where hydrophytic vegetation cover increased significantly between 2012 and 2025. This expansion was particularly noticeable in Zone F, north of Cojo Road, which was grazed by cattle during the spring and summer of 2025 (Figure 2). It is possible that preferential grazing of non-native, upland grasses allowed brown-headed rush (*Juncus phaeocephalus*), the dominant wetland species, to flourish and expand.

Inversely, the wetland boundaries that shrank significantly were largely due to a reduction in hydrophytic cover in comparison with non-native upland species such as perennial veldt grass (*Ehrharta calycina*) and highway iceplant (*Carpobrotus edulis*). While *J. phaeocephalus* was often co-dominant with young iceplant vines, it struggled to grow through dense mats formed from several years of iceplant thatch. Veldt grass was a vigorous competitor for space, water, and sunlight in Zones E, G, H, and I; several wetlands dominated by *J. phaeocephalus* in 2012 were nearly completely overtaken by fields of veldt grass. Invasive species are discussed in more detail in the Habitat Assessment section.

Hydric soils were found in 36 of the 42 wetlands where soil pits were dug. Sandy Redox was the most common indicator, found in 42.9% of the surveyed wetlands, followed by Redox Dark Surface (28.6%). Depleted Dark Surface and Loamy Gleyed Matrix were each found in a single wetland.

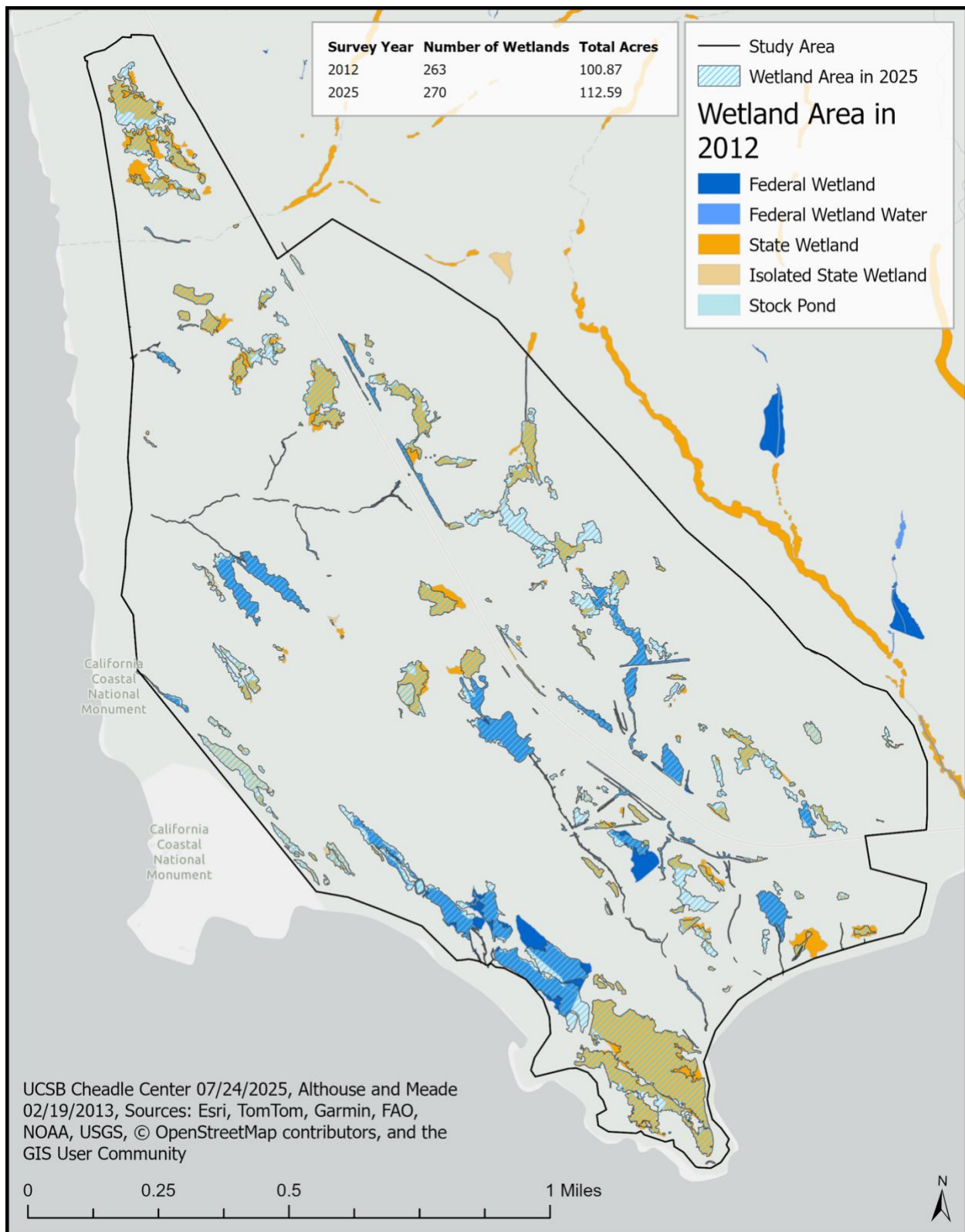


Figure 5: Map of wetland boundaries delineated in spring and summer of 2025 overlaid on the boundaries delineated between 2010-2012 by Althouse and Meade.

A general northwest-southeast trend in wetland shape and alignment was noted throughout most of Cojo Terrace, following the same orientation as a fault just north of Point Conception and various synclinal folds in the sedimentary rock of the surrounding bluffs (Figure 6). The Study Area generally falls between the Government Point Syncline and the Point Conception Anticline. Faults often modify groundwater flow, exerting enough pressure on aquifers to result in springs. Four of the five spring-fed swales are found within the synclinal folds on the western bluff, and the fifth runs along the intersection of two predominant parent materials (Qds - dune sand deposits to the southwest; and Qoa - remnants of weakly consolidated stream terrace and alluvial fan deposits that make up most of the inland study area). It is possible that these springs lie along unmapped fault lines. The strong prevailing wind forms dunes that run in the same northwest-southwest orientation, which may also account for this structural pattern. All the wetlands in the dunes fall in the swales and depressions between them.

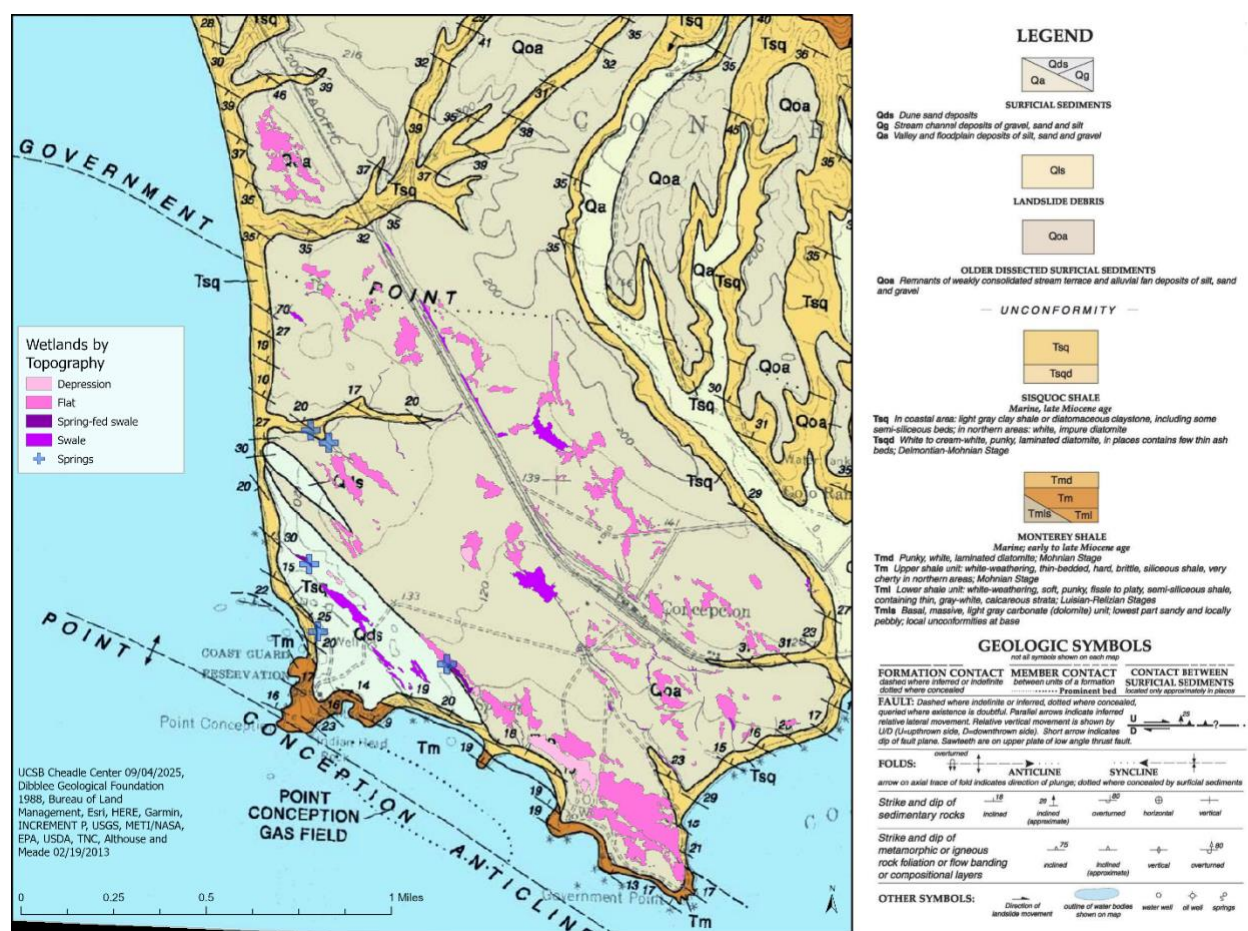


Figure 6: Wetlands overlaid on a geologic map of Point Conception from the USGS National Map Database, created by Dibblee Geological Foundation in 1988 (available at https://ngmdb.usgs.gov/Prodesc/proddesc_201.htm)

Exceptions to this trend occur along roadsides and the railroad. These drainage ditches follow the edge of the road in whatever direction it leads, often at a more acute north-south angle along Cojo Road. They are most likely artificial wetlands created by runoff from the surrounding infrastructure.

The geologic structure of Point Conception and Cojo Terrace should be taken into account when designing wetland restoration projects, following the general northwest to southeast orientation of the surrounding topography. While some soil samples were collected throughout the course of this study, they were relatively shallow, to a depth of 18 inches. Further research is warranted to establish the presence and depth to a perched water table potentially caused by impermeable layers in the wetlands. The absence or presence of these layers would influence the restoration design.

HABITAT ASSESSMENT

To support the assessment of habitat quality and wetland function a habitat assessment of each wetland was performed. This assessment was designed to help inform potential restoration actions and enable us to identify higher and lower functioning wetlands.

Methods

Habitat assessments were conducted for all 270 wetlands within the study area. The habitat assessment surveys involved determining the presence of standing water, documenting the general topography of the wetland (categorized as swale, spring-fed swale, flat, or depression), and recording plant species with $\geq 20\%$ absolute cover. Several particularly challenging weeds, perennial veldtgrass (*Ehrharta calycina*) and bermuda grass (*Cynodon dactylon*), and the federally endangered Gaviota tarplant (*Deinandra increscens* ssp. *villosa*) were recorded regardless of percent cover. Annual invasive grasses were recorded as a single value in areas where no single species exceeded 20%. A full list of wetlands surveyed, organized by topographic type, is attached in Appendix C.

Results & Recommendations

All Wetlands

A total of 270 wetlands were surveyed, covering approximately 112.6 acres. Flat wetlands were the most common, both in number (150 sites) and area (88.6 acres), accounting for 78.7% of the total wetland area. Swale wetlands followed, with 95 sites totaling 14.9 acres (13.2%). Depression wetlands made up 6.8% of the total area (7.7 acres across 20 sites). Spring-fed swales were the least common, representing only 1.2% of the total area with 5 sites covering 1.4 acres. Figures 7 and 8 show the distribution of wetland topographies across the study area.

Topography	Frequency	Area (ac)	Percent of Total Area of Wetlands
Swale	95	14.9	13.2%
Spring-fed Swale	5	1.4	1.2%
Flat	150	88.6	78.7%
Depression	20	7.7	6.8%
Total	270	112.6	100%

Figure 7: Frequency, acreage, and percent area for each wetland topography type.

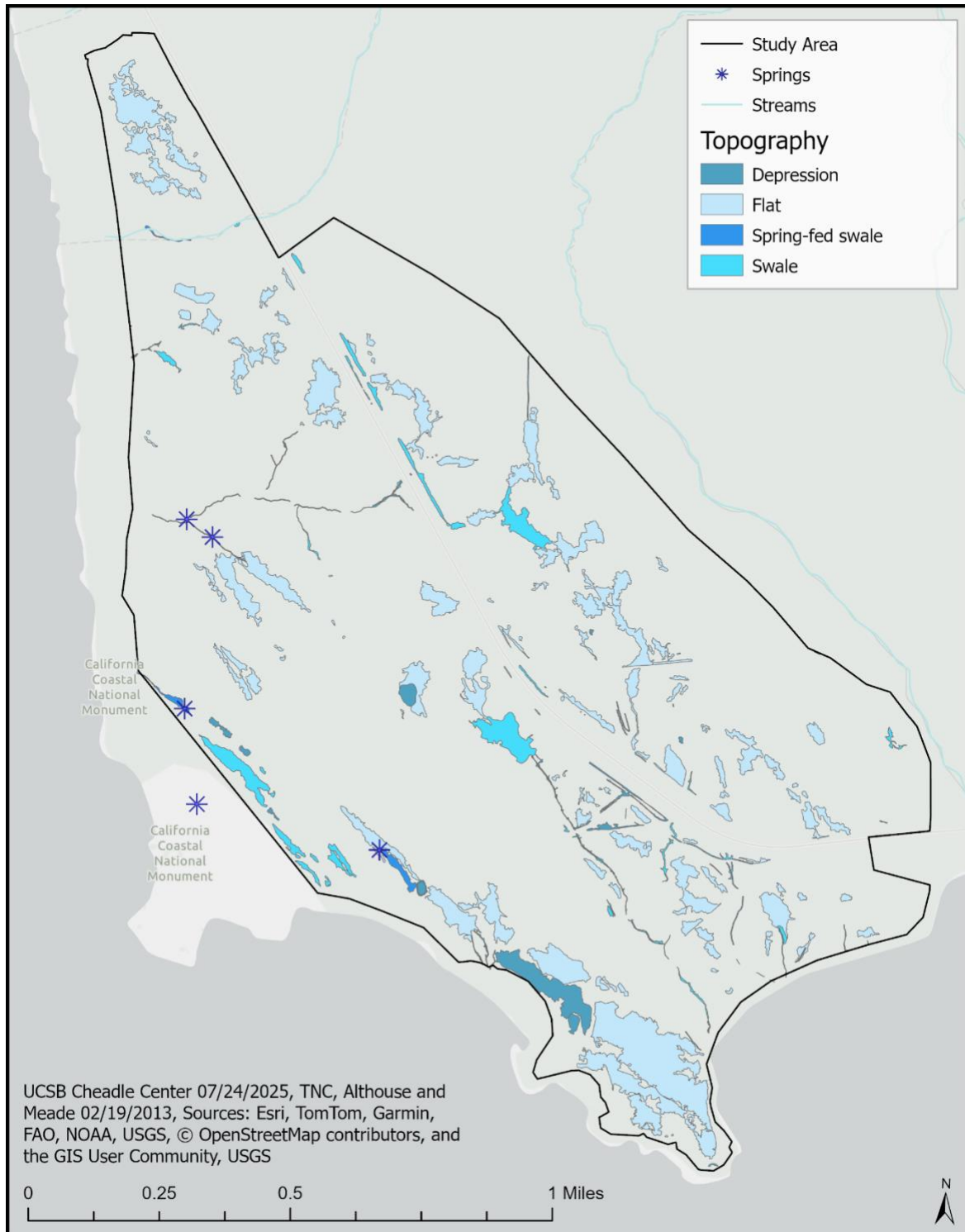


Figure 8: Map of wetland topography types.

Standing water was observed in only 9 wetlands (3.5% by number of wetlands). Of these, four featured swale topography, four were spring-fed swales, and one was classified as a depression wetland (Figure 9).

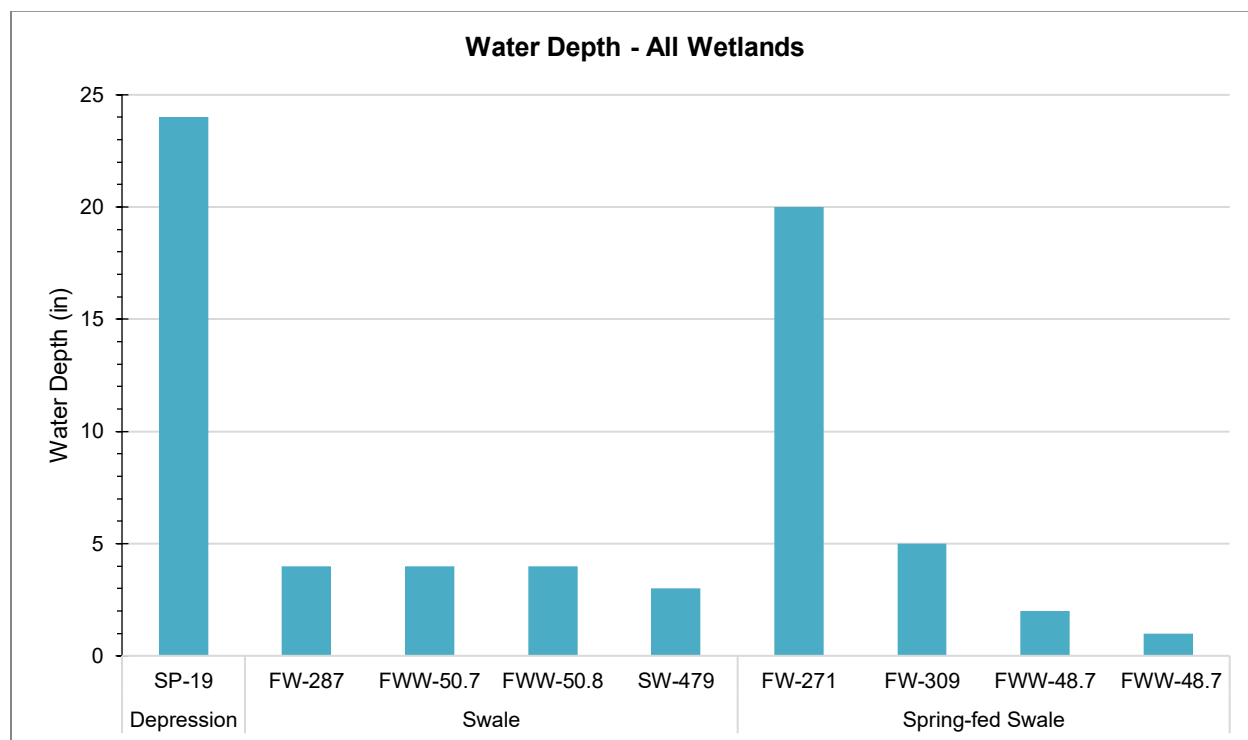


Figure 9: Wetland water presence and depth. The wetland numbers can be found in the table and on the ArcGIS Online map.

It should be noted that 2025 was a drier year than the previous two water years, as well as drier than 2010 and 2011, when Althouse and Meade’s surveys were conducted (Figure 10). In 2025, neighboring stations recorded an average of 8.17 inches of precipitation, compared to 20.89 inches in 2010 and 26.17 inches in 2011. Over the 32 years on record, Point Conception has an average annual rainfall of 13.42 inches. Below average rainfall across the study area may have resulted in shorter periods of soil saturation, lower water depth in depressions and swales, and dry intermittent and ephemeral streams within some swales.

Rainfall data was not recorded at Point Conception between 1972 and 2017, so data from weather stations in the surrounding area are used as proxy for missing years, including Jalama Beach (Station 317), Point Conception (Station 438) (sourced from the Santa Barbara County Flood Control District), Salsipuedes Gaging Station (Station USC00047681), and Lompoc (Station USC00045064) (sourced from Global Historical Climatology Network daily through NOAA’s Climate Data Online portal).

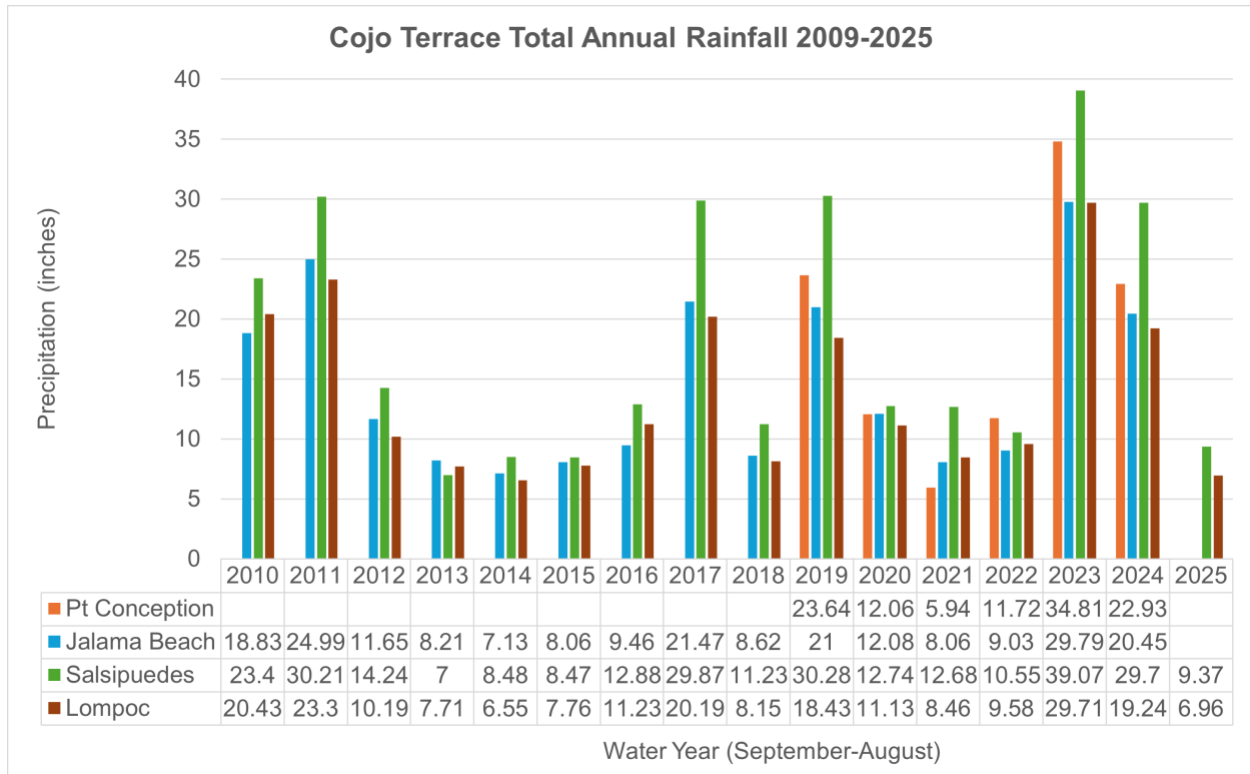


Figure 10: Total annual rainfall recorded at weather stations in and surrounding the study area in recent years. Water Years start in September of the previous year and end in August of the listed year.

Across all wetlands, the dominant native species was *Juncus phaeocephalus*, comprising 44.3% of total cover (Figure 11, 14). Other notable native species included *Juncus breweri* (3.2%), *Frankenia salina* (2.4%), *Distichlis spicata* (2.1%), and *Baccharis glutinosa* (1.3%) (Figure 12). Among non-native species, *Carpobrotus edulis* was the most abundant, accounting for 20.5% of total cover (Figure 13, 15). Other significant non-native species included *Ehrharta calycina* (8.6%) (Figure 16), *Bromus diandrus* (4.7%), *Festuca perennis* (2.7%), and *Plantago coronopus* (1.3%) (Figure 13).

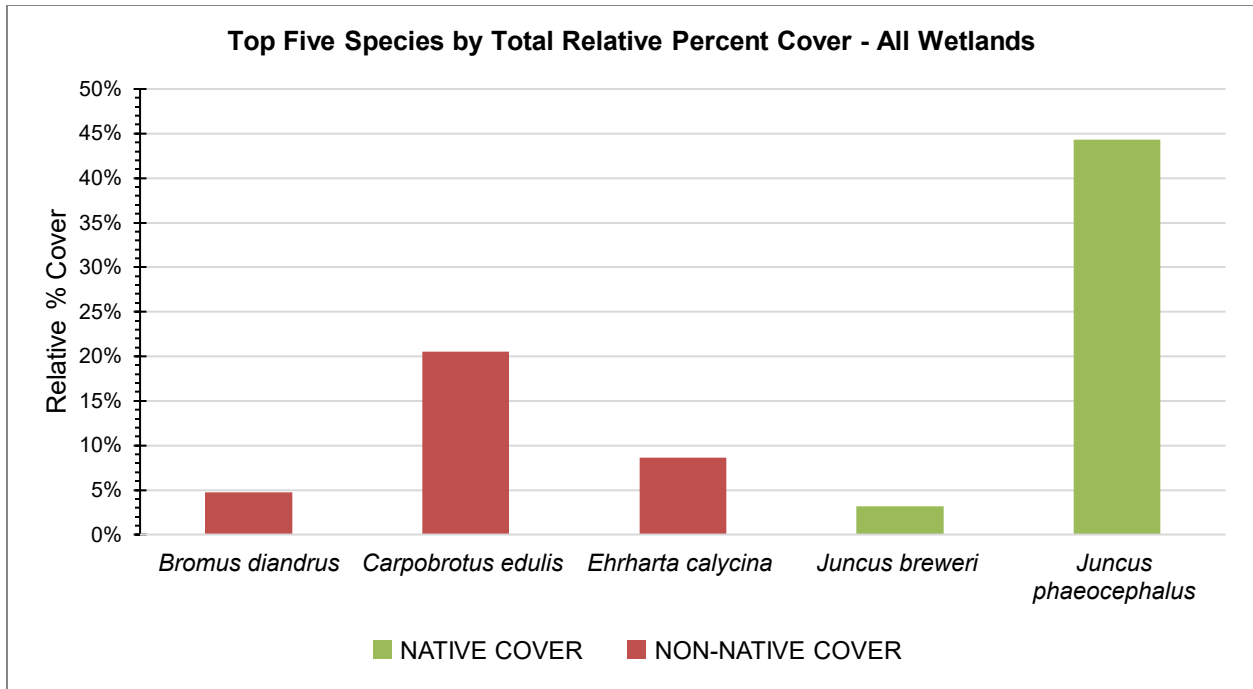


Figure 11: Top five most common native and non-native species across all wetlands in the study area.

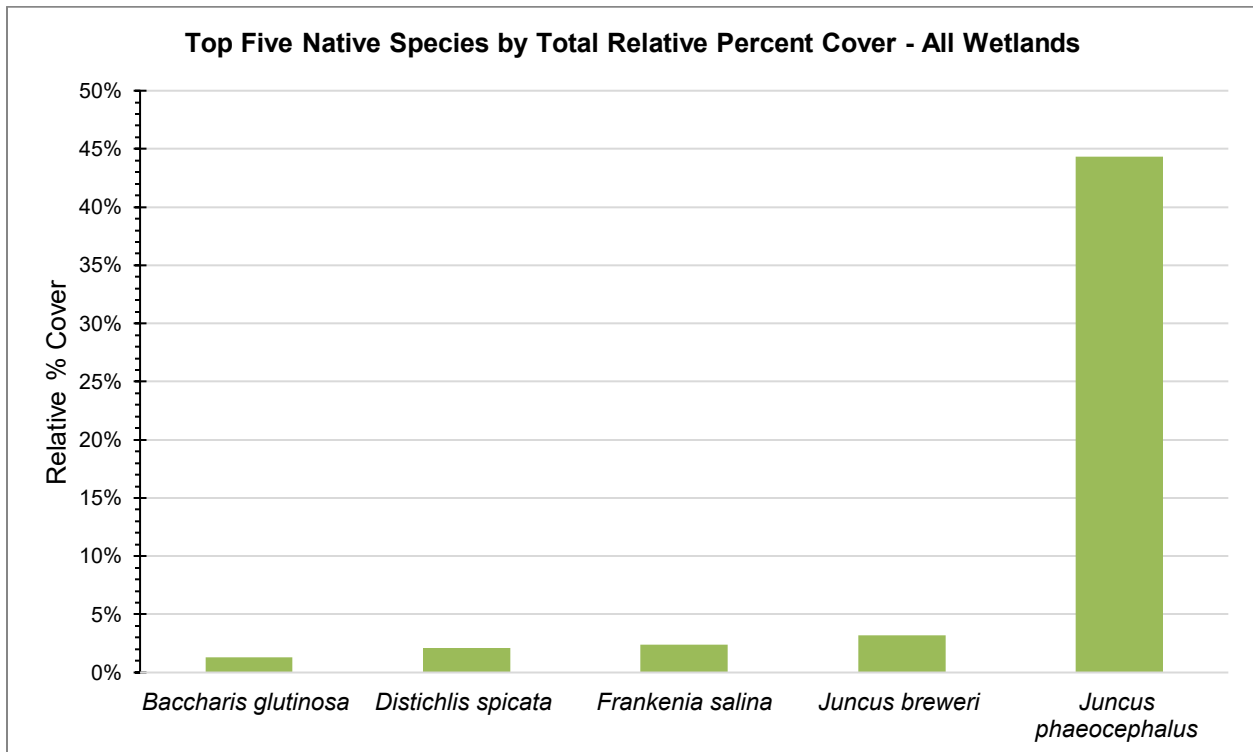


Figure 12: Top five most common native species across all wetlands in the study area.

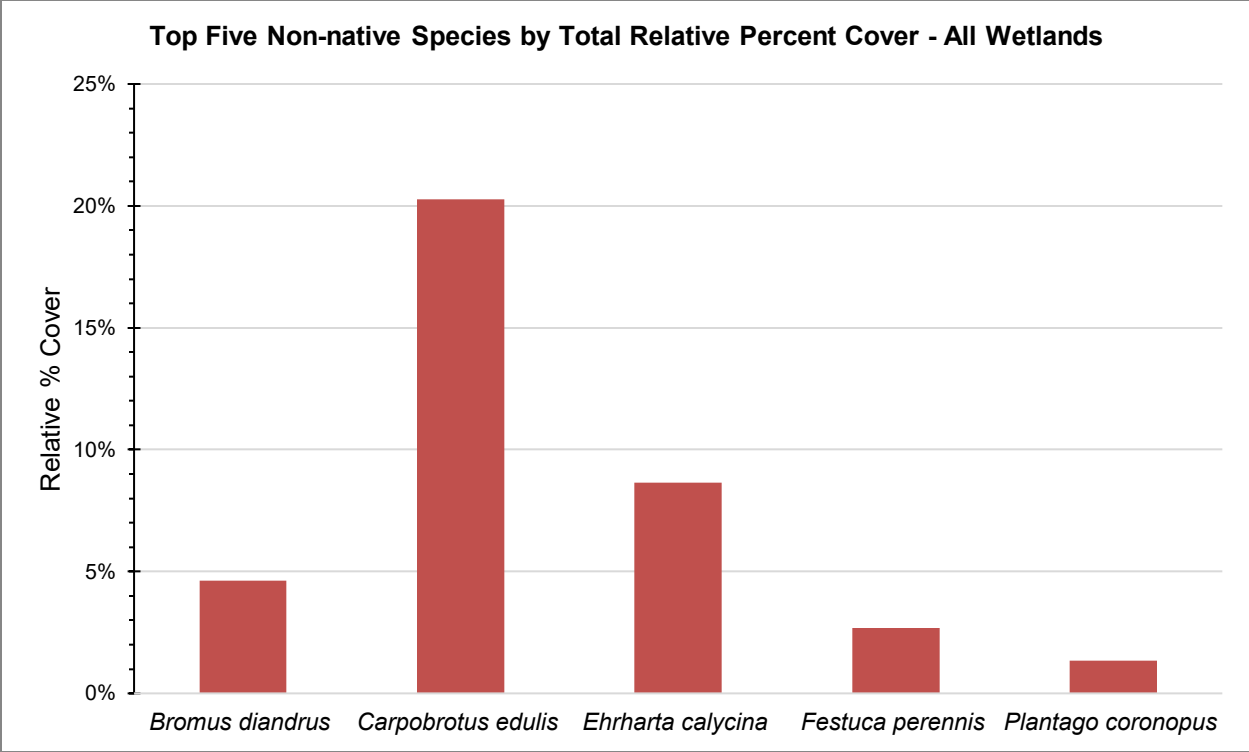


Figure 13: Top five most common non-native species across all wetlands in the study area.

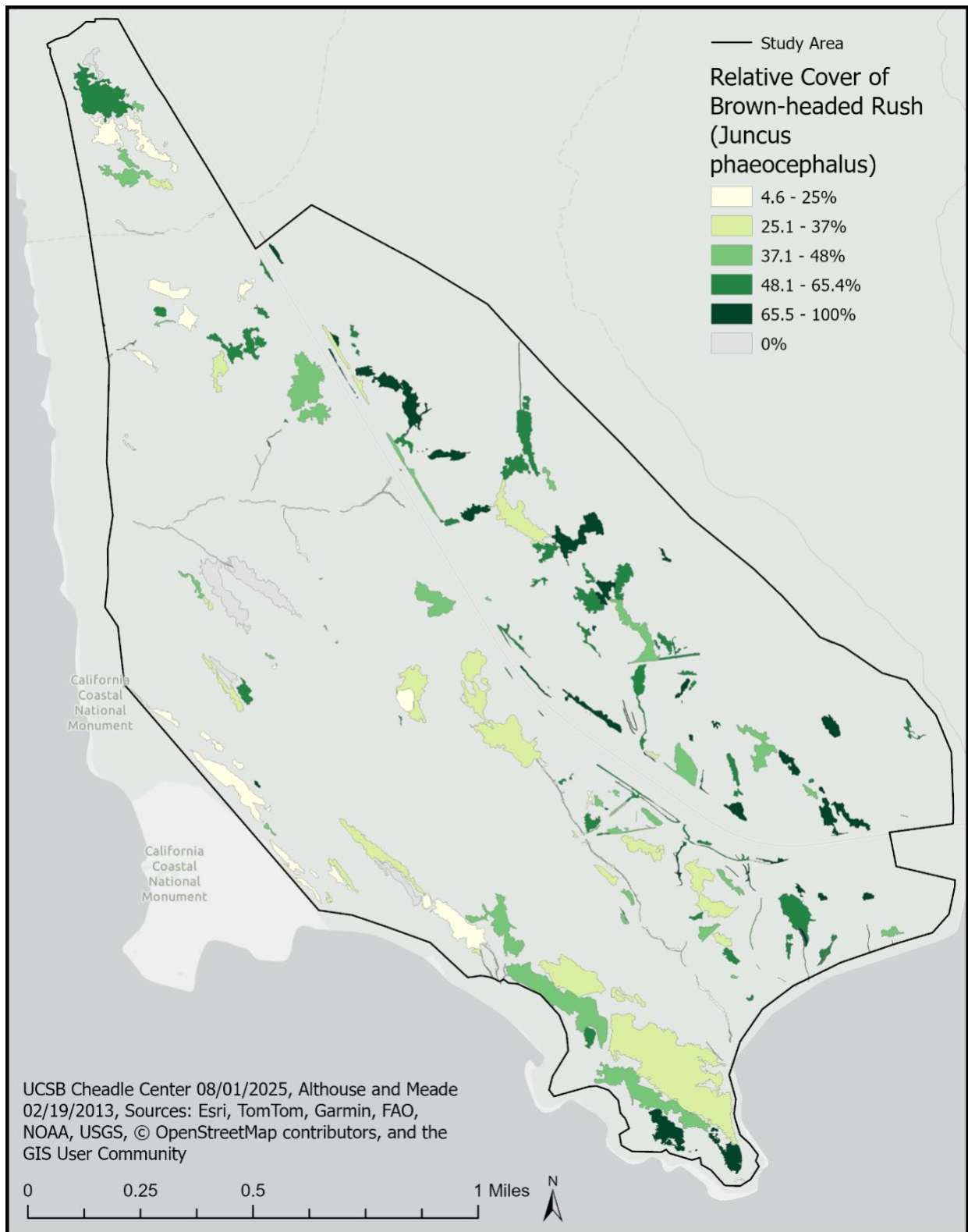


Figure 14: Map of *Juncus phaeocephalus* relative percent cover within wetland features.

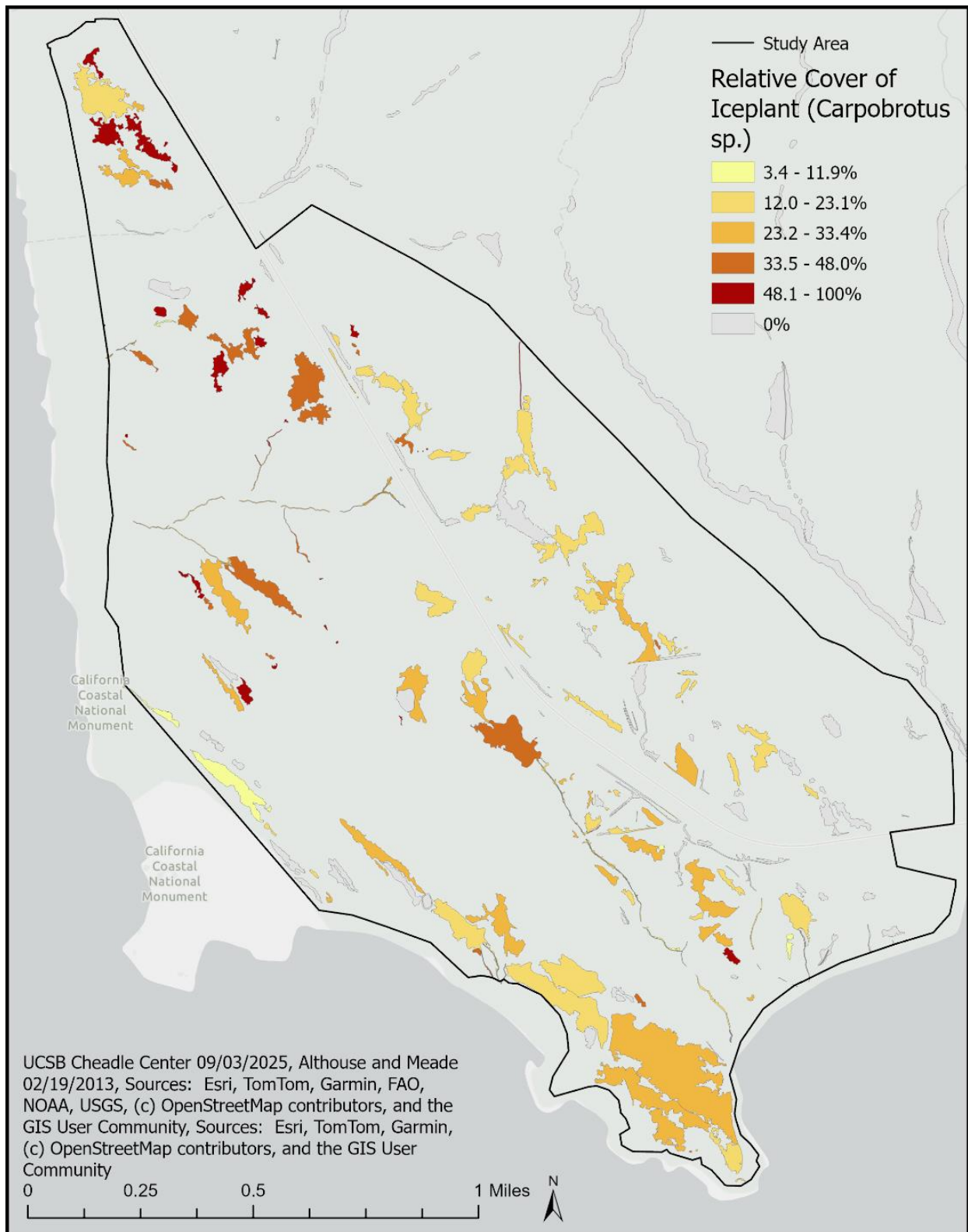


Figure 15: Map of *Caprobrotus edulis* relative percent cover within wetland features.

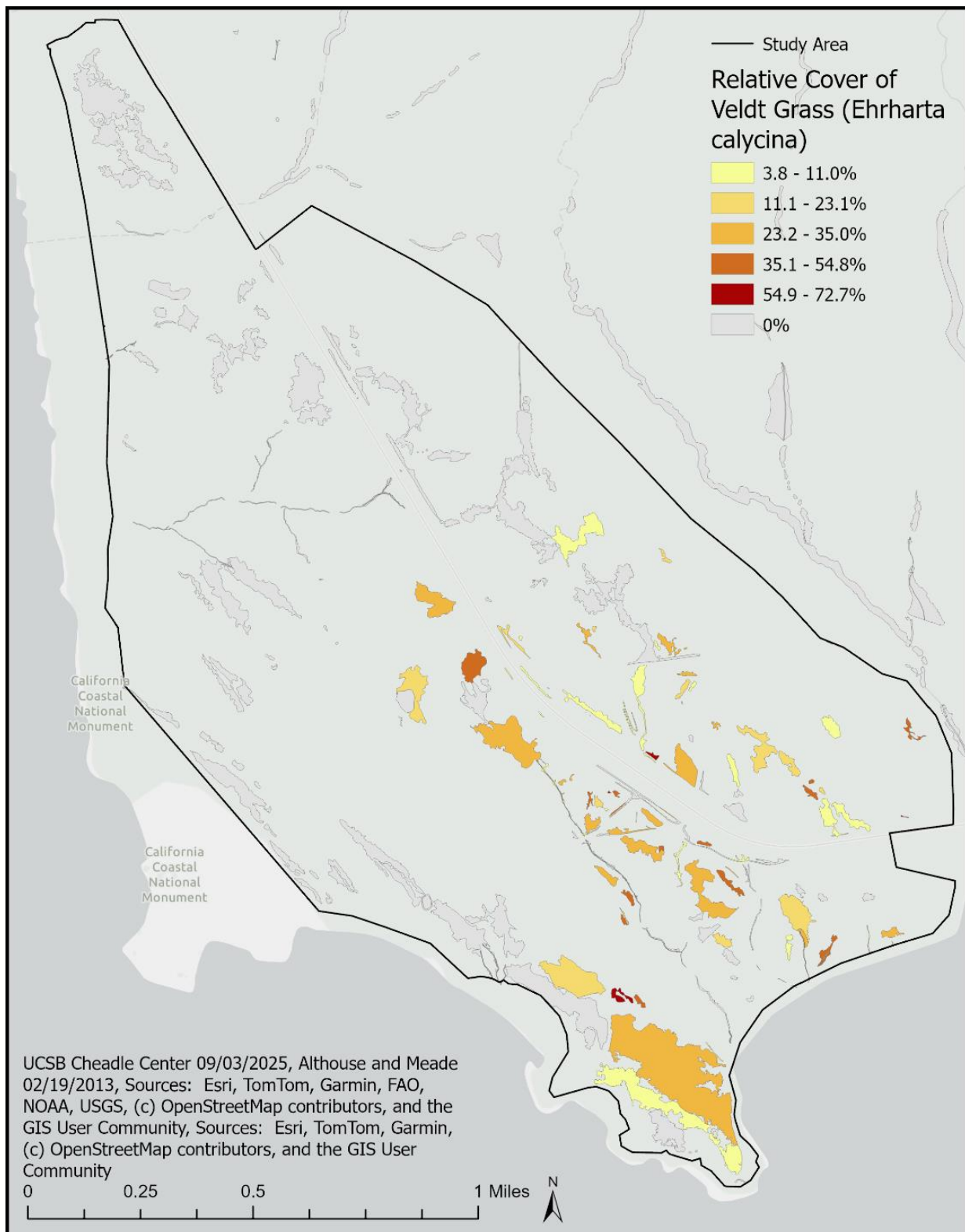


Figure 16: Map of *Ehrharta calycina* relative percent cover within wetland features.

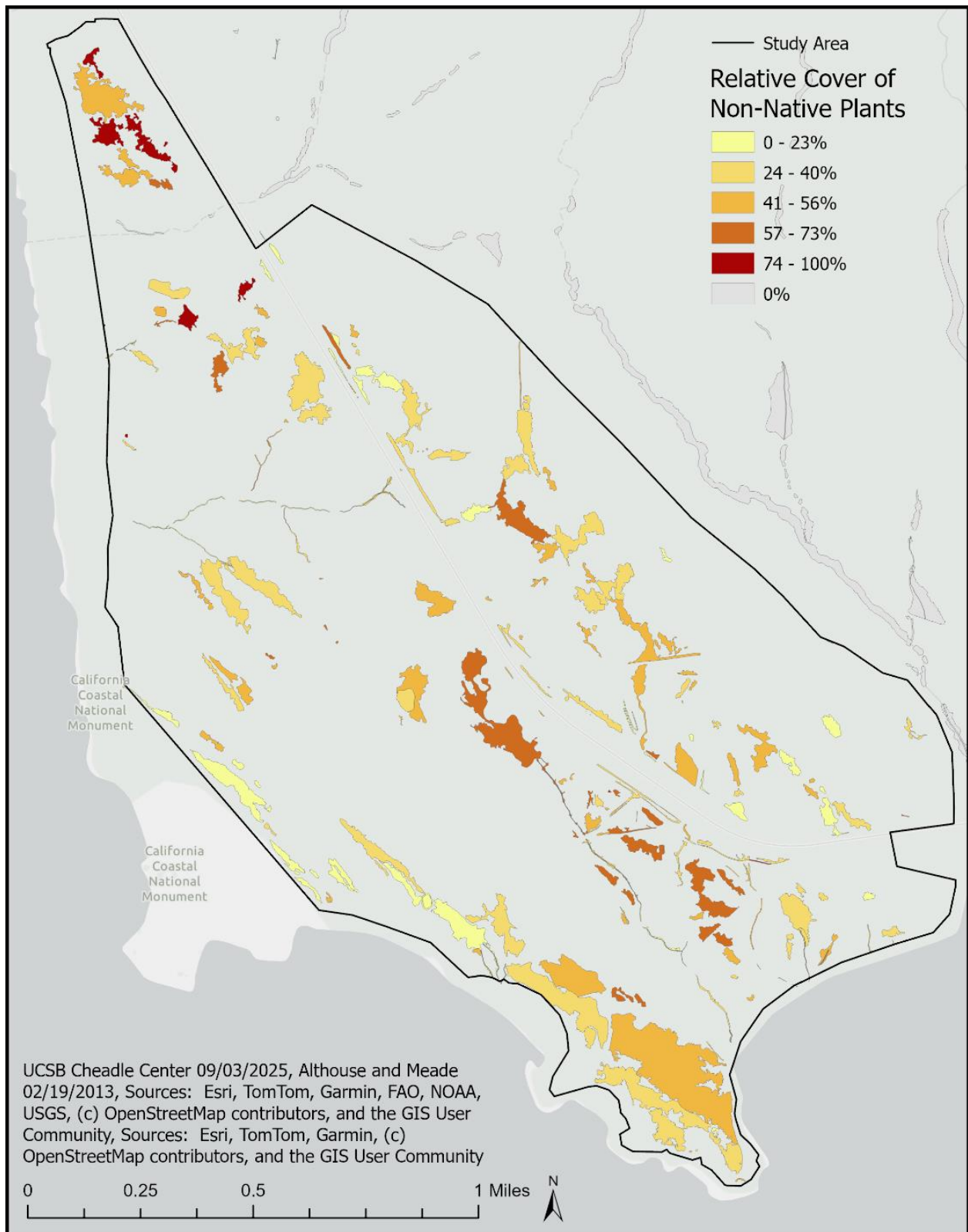


Figure 17: Map of non-native species relative percent cover within wetland features.

When separated by wetland topography, native species accounted for 67.1% in swales, 79.8% in spring-fed swales, 53.5% in flat wetlands, and 60.1% in depressions. In contrast, non-native species comprised 32.9% of cover in swales, 20.2% in spring-fed swales, 46.5% in flats, and 39.9% in depressions (Figure 18, 19, 20).

In the swale, flat, and depression topographic types, *Juncus phaeocephalus* was the most dominant species, with total relative percent cover ranging from 39.9% in swales to 47.2% in flat areas. In contrast, *Juncus hesperius* was dominant in spring-fed swales, comprising 22.9% of the total relative cover. *Carpobrotus edulis* was the most abundant non-native species in all topography types, with 26.1% relative cover in flat wetlands, 13.2% in swale wetlands, 12.8% in spring-fed swales, and 8.6% in depression wetlands (Figure 15).

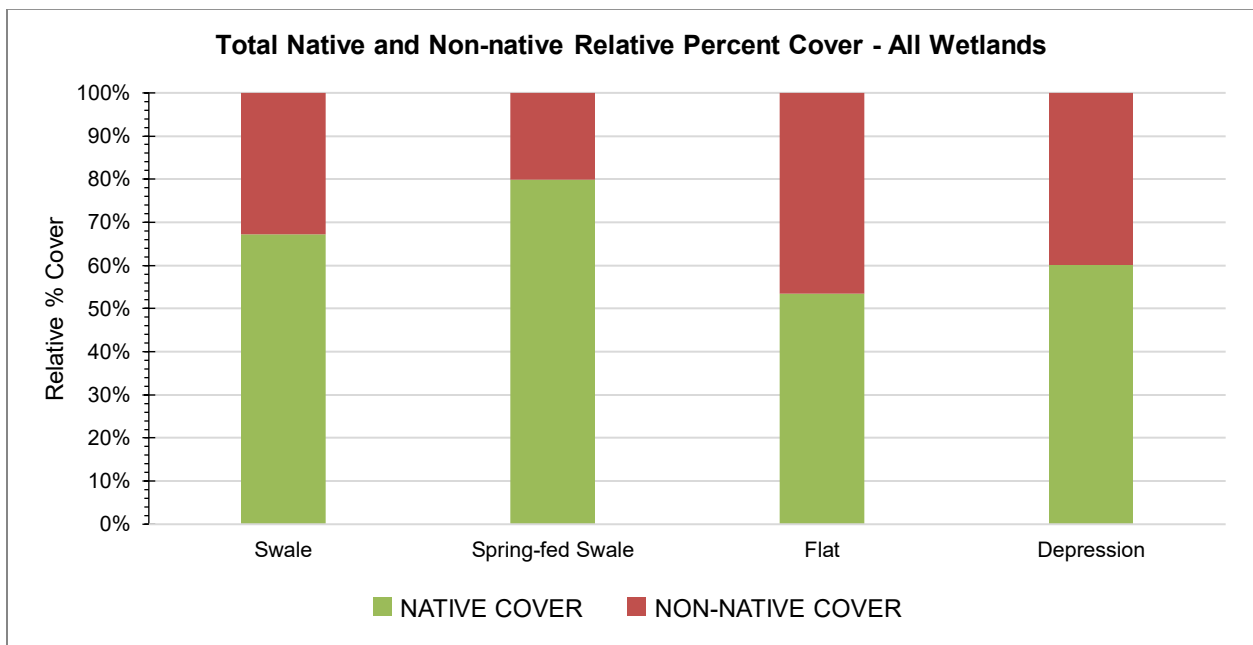


Figure 18: Total relative percent cover for native and non-native species by wetland topography type.

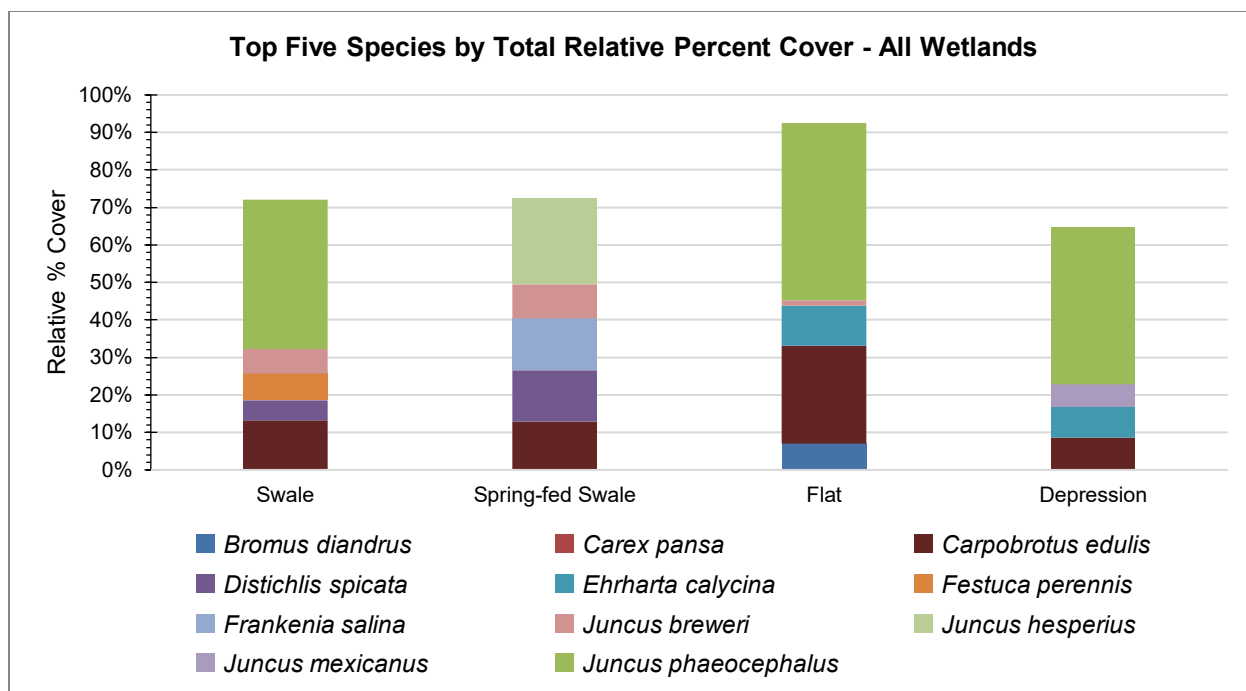


Figure 19: Total relative percent cover for top five species by wetland topography type. Figure 20 below shows the same data in table format.

Species	Swale	Spring-fed Swale	Flat	Depression
<i>Bromus diandrus</i>			6.98%	
<i>Carex pansa</i>				
<i>Carpobrotus edulis</i>	13.19%	12.84%	26.10%	8.60%
<i>Distichlis spicata</i>	5.39%	13.76%		
<i>Ehrharta calycina</i>			10.79%	8.24%
<i>Festuca perennis</i>	7.07%			
<i>Frankenia salina</i>		13.76%		
<i>Juncus breweri</i>	6.57%	9.17%	1.41%	
<i>Juncus hesperius</i>		22.94%		
<i>Juncus mexicanus</i>				5.92%
<i>Juncus phaeocephalus</i>	39.90%		47.20%	42.01%
<i>Plantago coronopus</i>				7.51%

Figure 20: Table showing total relative percent cover for top five species by wetland topography type.

The percentage of wetlands dominated ($\geq 50\%$ cover) by the three most common species (*Juncus phaeocephalus*, *Carpobrotus edulis*, and *Ehrharta calycina*) varied across swale, flat, and depression wetland types (Figure 21). Flat wetlands had the highest proportion of dominance, with over 70% dominated by these three species, primarily *Juncus phaeocephalus*.

Swales and depressions had similar total dominance percentages, around 50%, with *Juncus phaeocephalus* again the most common dominant species. Dominance of non-native species *Carpobrotus edulis* and *Ehrharta calycina* was slightly more pronounced in flats and depressions than in swales.

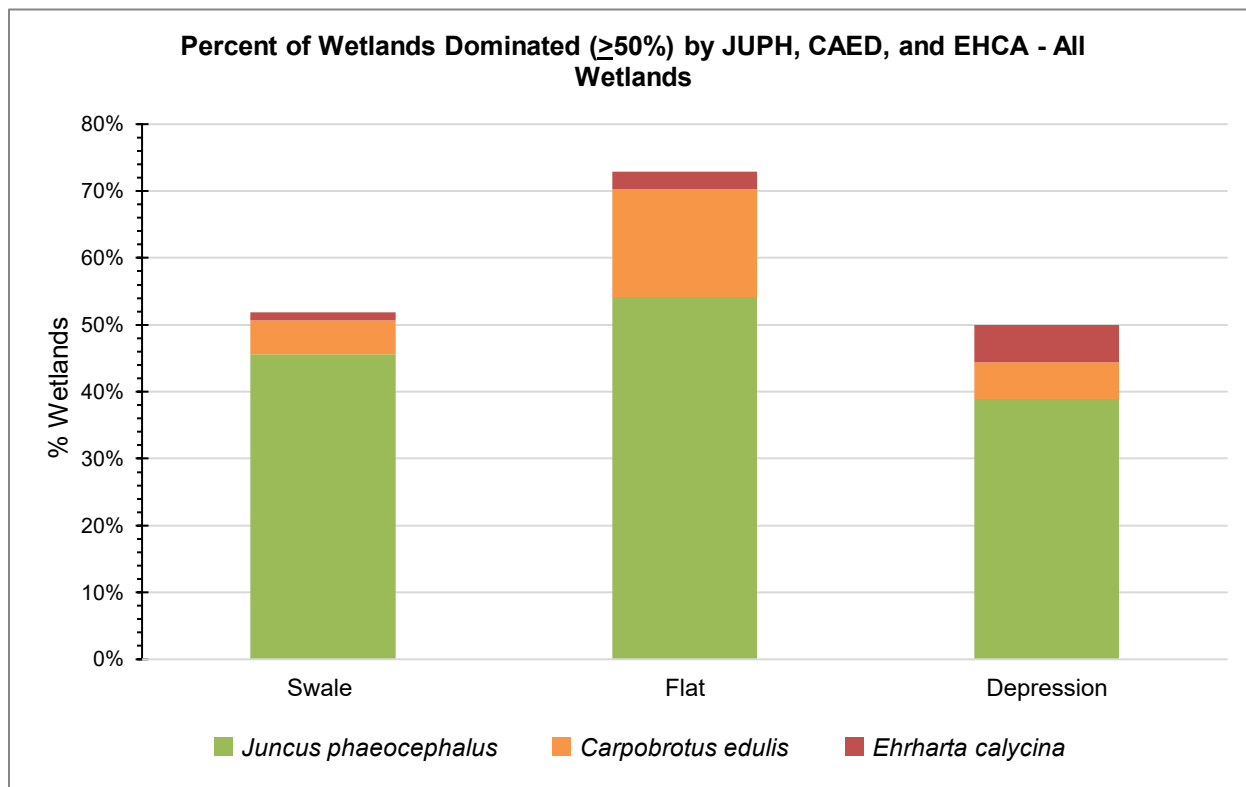


Figure 21: Percent of wetlands dominated by *Juncus phaeocephalus*, *Carpobrotus edulis*, and *Ehrharta calycina*. Spring fed swale wetlands are not included as none of these species dominate.

Swale Wetlands



Figure 22: Aerial photograph of swale wetlands.

Swale wetlands comprised a substantial portion of the study area, with 79 sites covering 14.9 acres and accounting for 13.2% of the total wetland area within the study zone. *Juncus phaeocephalus* dominated these communities with 39.9% relative cover, while *Carpobrotus edulis* was the second most abundant species at 13.2%. *Festuca perennis* contributed 7.1% cover, followed by *Juncus breweri* at 6.6% and *Distichlis spicata* at 5.4% (Figure 23). These species represent the five most common; a complete list of species present is displayed below (Figure 24, 25).

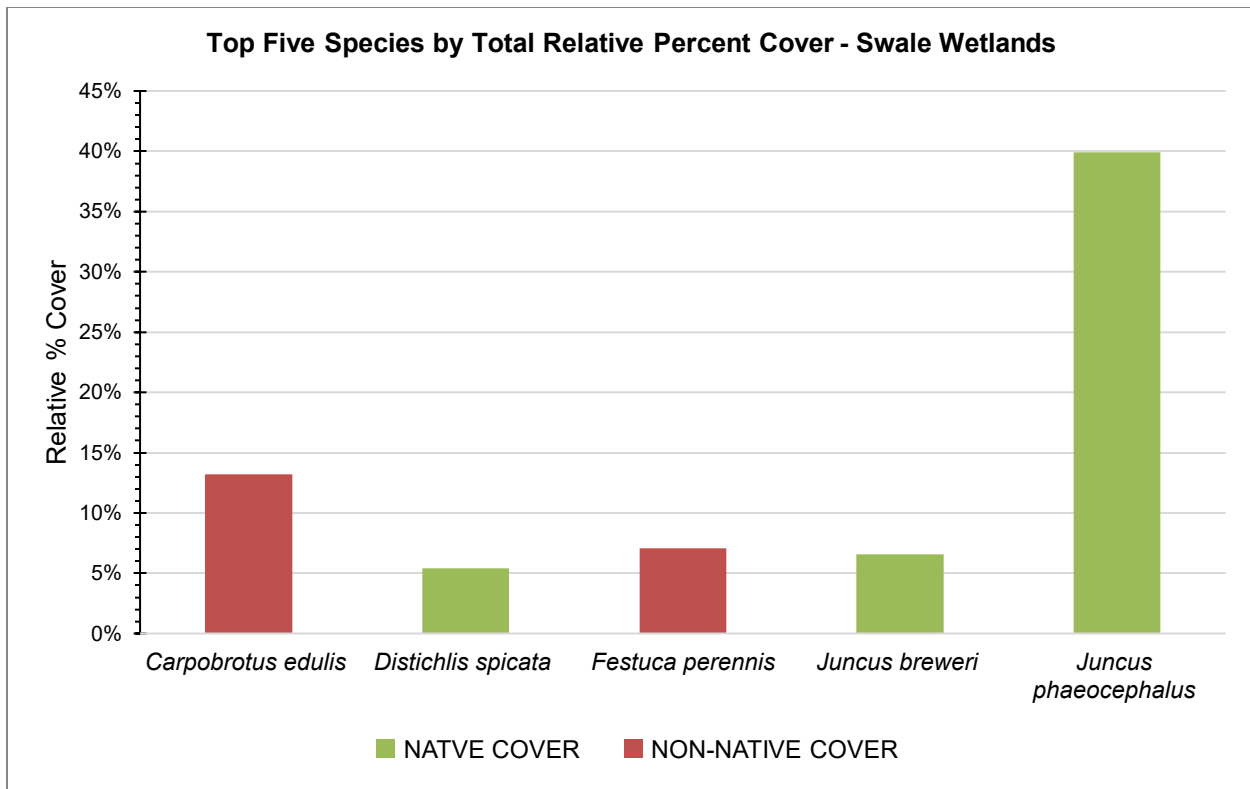


Figure 23: The five species, both native and non-native, with highest relative percent cover in the swale wetlands.

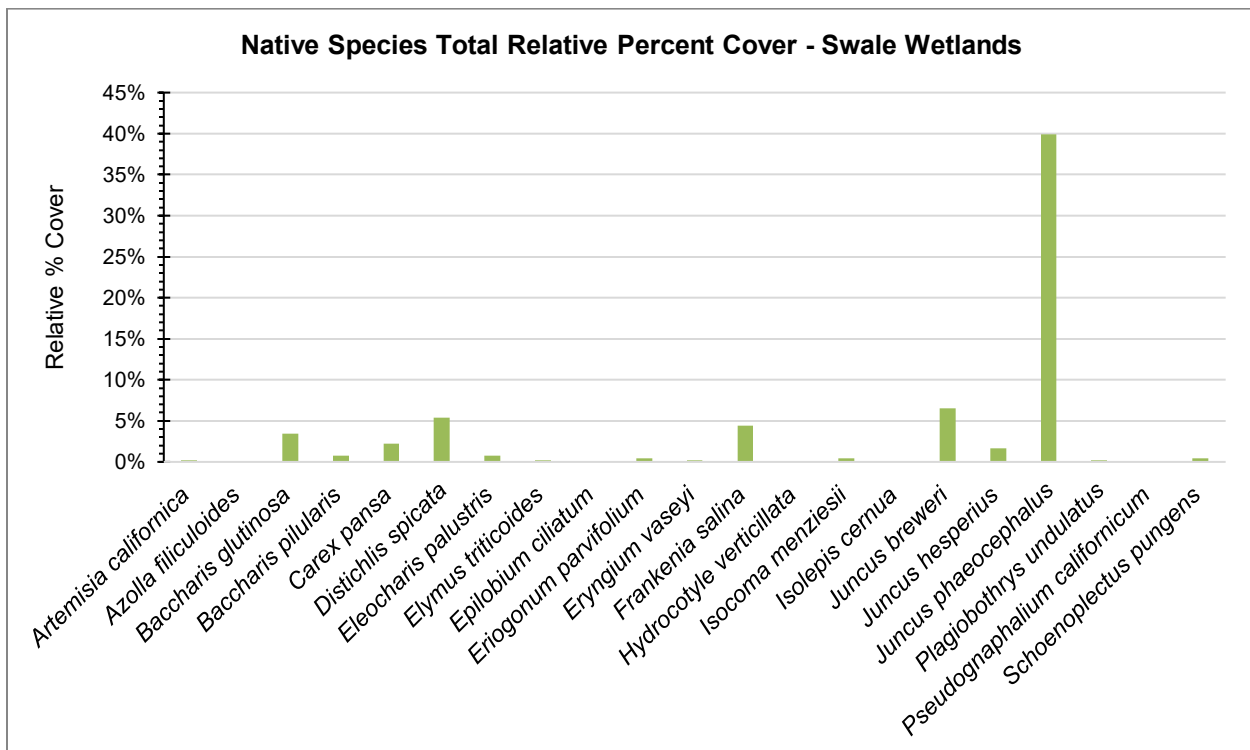


Figure 24: Total relative percent cover for native species in swale wetlands. Note: species present at below 1% relative cover are not visible graphically.

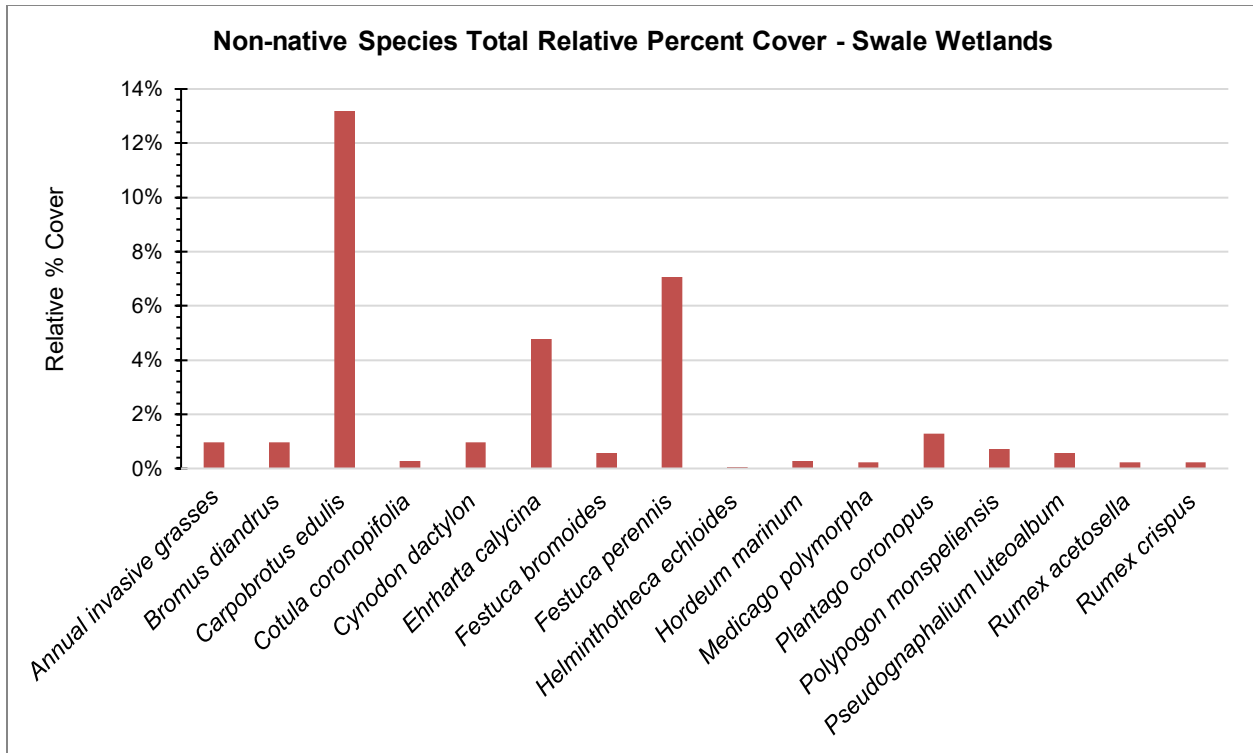


Figure 25: Total relative percent cover for non-native species in swale wetlands.

The plant composition across swale wetlands shows a pattern of variability. Some swales were dominated by native vegetation, suggesting high ecological function and relatively intact hydrology (Figure 26, 27). Others, however, exhibited dominance by invasive species, pointing to localized disturbance or degradation (Figure 28, 29). Of the 79 wetland sites, 58 were dominated by native species, 12 had roughly equal native and non-native cover, and 9 were dominated by invasive species. This heterogeneity likely reflects differences in topographic depth, soil texture, disturbance history, and connectivity to adjacent upland areas.

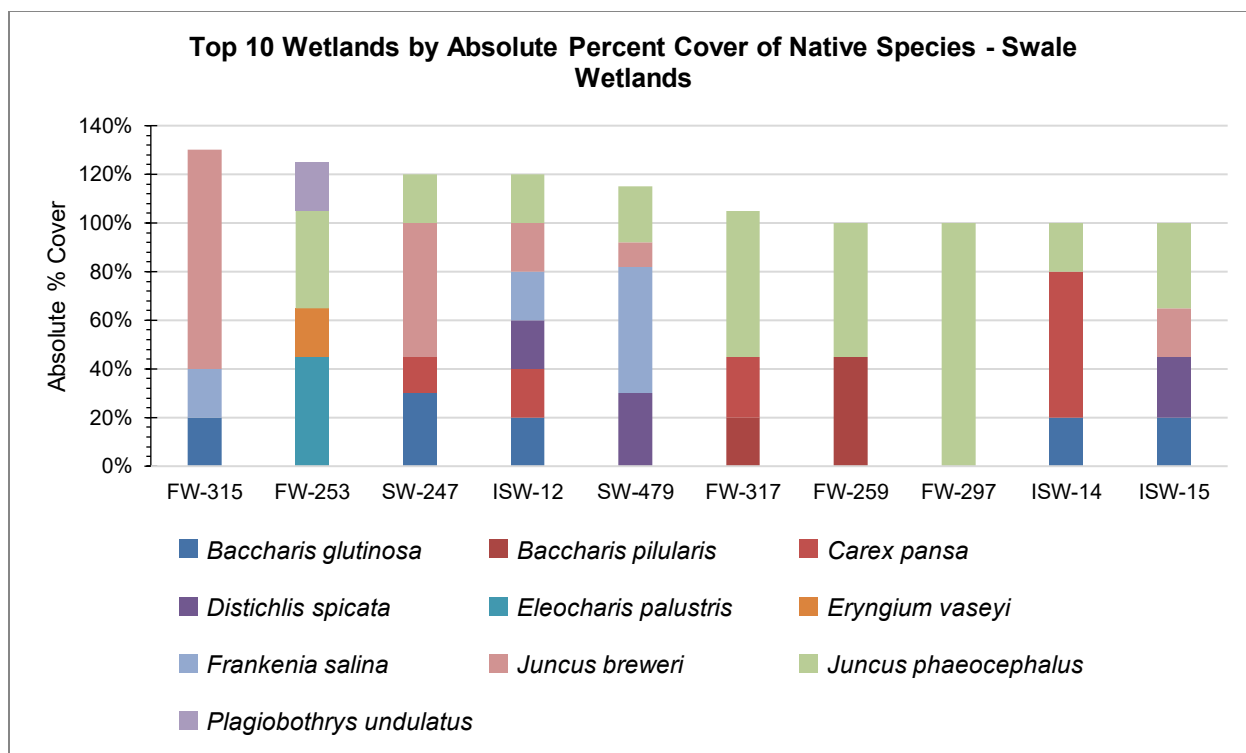


Figure 26: Graph showing plant composition in the ten swale wetlands with highest native percent cover. Figure 27 below shows the same data in table format.

Species	FW-315	FW-253	SW-247	ISW-12	SW-479	FW-317	FW-259	FW-297	ISW-14	ISW-15
<i>Baccharis glutinosa</i>	20%	0%	30%	20%	0%	0%	0%	0%	20%	20%
<i>Baccharis pilularis</i>	0%	0%	0%	0%	0%	20%	45%	0%	0%	0%
<i>Carex pansa</i>	0%	0%	15%	20%	0%	25%	0%	0%	60%	0%
<i>Distichlis spicata</i>	0%	0%	0%	20%	30%	0%	0%	0%	0%	25%
<i>Eleocharis palustris</i>	0%	45%	0%	0%	0%	0%	0%	0%	0%	0%
<i>Eryngium vaseyi</i>	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
<i>Frankenia salina</i>	20%	0%	0%	20%	52%	0%	0%	0%	0%	0%
<i>Juncus breweri</i>	90%	0%	55%	20%	10%	0%	0%	0%	0%	20%
<i>Juncus phaeocephalus</i>	0%	40%	20%	20%	23%	60%	55%	100%	20%	35%
<i>Plagiobothrys undulatus</i>	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%

Figure 27: Table showing plant composition in the ten swale wetlands with highest native percent cover.

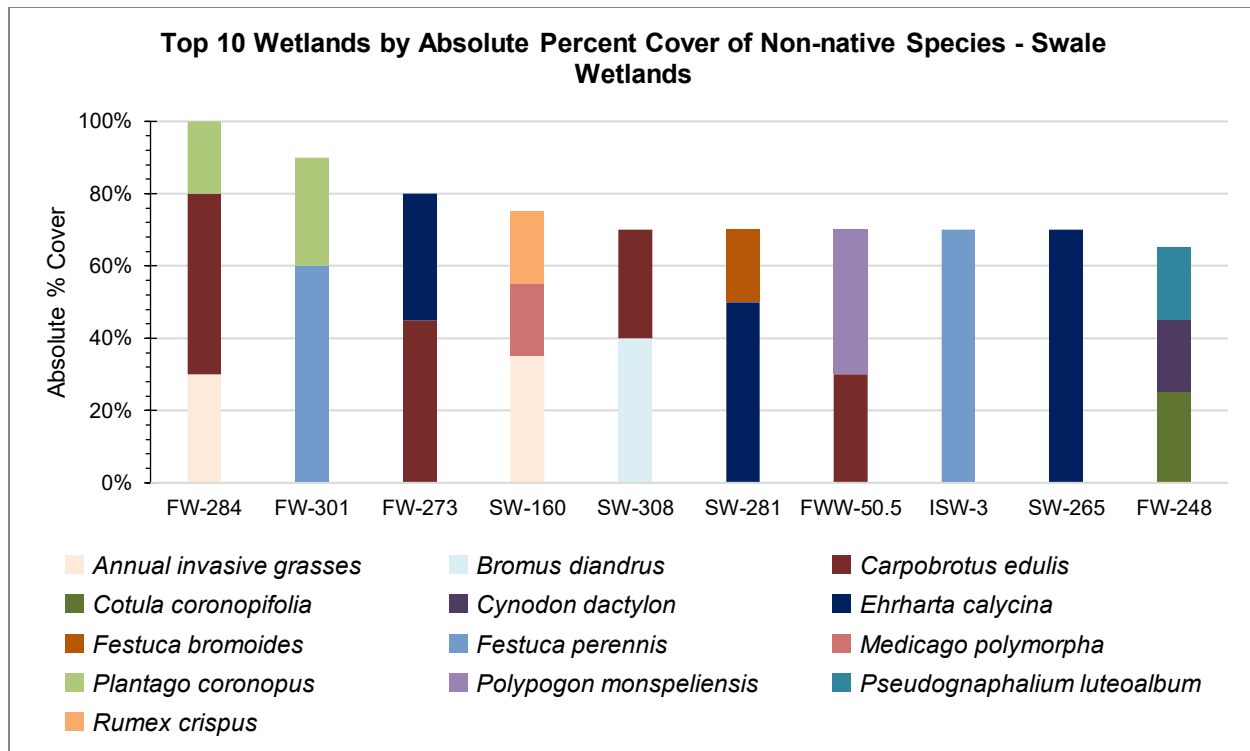


Figure 28: Plant composition in the ten swale wetlands with highest non-native percent cover. Figure 29 below shows the same data in table format.

Species	FW-284	FW-301	FW-273	SW-160	SW-308	SW-281	FWW-50.5	ISW-3	SW-265	FW-248
Annual invasive grasses	30%	0%	0%	35%	0%	0%	0%	0%	0%	0%
Bromus diandrus	0%	0%	0%	0%	40%	0%	0%	0%	0%	0%
Carpobrotus edulis	50%	0%	45%	0%	30%	0%	30%	0%	0%	0%
Cotula coronopifolia	0%	0%	0%	0%	0%	0%	0%	0%	0%	25%
Cynodon dactylon	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%
Ehrharta calycina	0%	0%	35%	0%	0%	50%	0%	0%	70%	0%
Festuca bromoides	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%
Festuca perennis	0%	60%	0%	0%	0%	0%	0%	70%	0%	0%
Medicago polymorpha	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%
Plantago coronopus	20%	30%	0%	0%	0%	0%	0%	0%	0%	0%
Polypogon monspeliensis	0%	0%	0%	0%	0%	0%	40%	0%	0%	0%
Pseudognaphalium luteoalbum	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%
Rumex crispus	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%

Figure 29: Table showing plant composition in the ten swale wetlands with highest non-native percent cover.

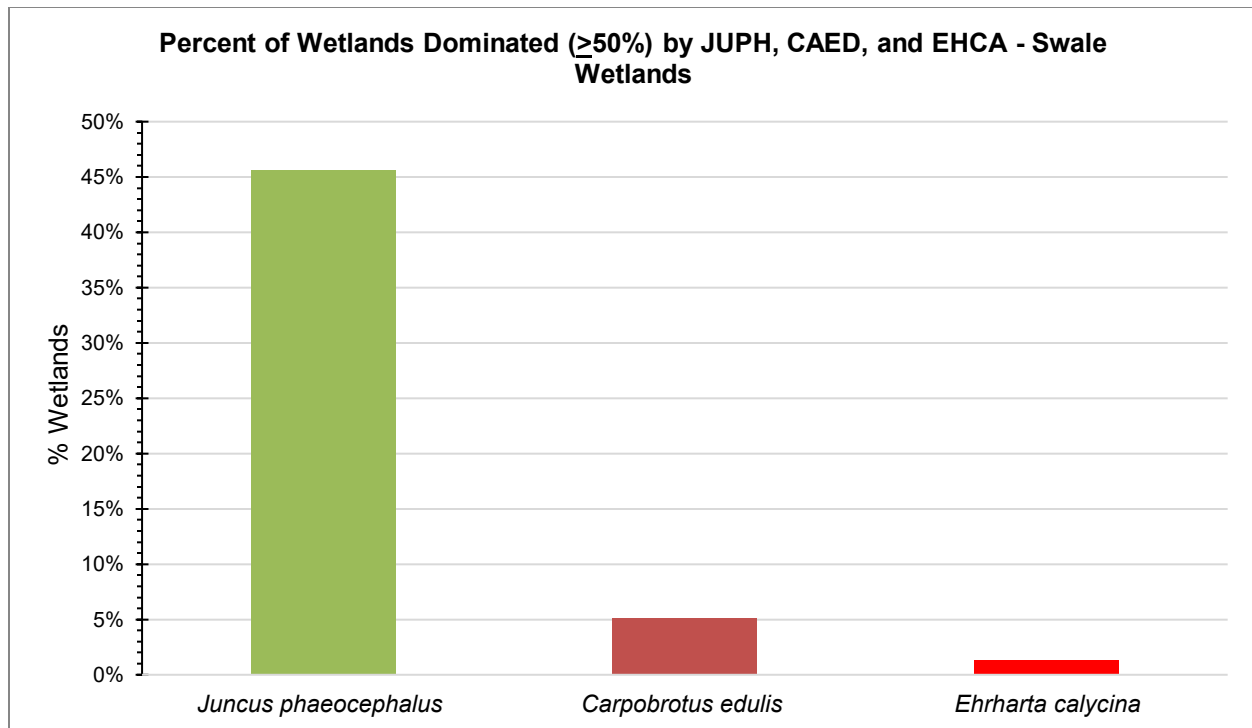


Figure 30: Percent of swale wetlands dominated by *Juncus phaeocephalus*, *Carpobrotus edulis*, and *Ehrharta calycina*.

The diversity of plant community compositions suggests that restoration efforts in swales must be tailored to site-specific conditions, balancing invasive species control with the preservation of native diversity and informed by each site's unique disturbance history, hydrological function, and microtopography. Just over half of swale wetlands were dominated by *Juncus phaeocephalus*, but the top two invasive species across the Study Area (*Carpobrotus edulis* and *Ehrharta calycina*) were dominant in 5% or fewer of swale wetlands, indicating that these target species are not of high concern throughout most swales (Figure 30). In the minority of swales dominated by invasive species such as *Festuca perennis* and *Carpobrotus edulis*, targeted removal or suppression of invasives should be prioritized to reduce competitive pressure on native species. In contrast, swales already dominated by natives—namely those with high relative cover of *Juncus phaeocephalus*, *Frankenia salina*, and *Distichlis spicata*—should be protected and managed to maintain their ecological integrity, with minimal intervention beyond monitoring and disturbance prevention.

Restoration strategies should also consider hydrological enhancement, such as improving soil moisture retention or reestablishing natural drainage patterns, to support native plant recruitment. Given the importance of microtopographic and moisture gradients in shaping plant communities, efforts to recontour degraded swales or reconnect fragmented hydrological flows could further promote native vegetation. These hydrological enhancements can also build resilience to variable water availability, buffering native vegetation against drought or altered rainfall patterns due to climate change. Although future conditions cannot be precisely predicted, incorporating flexible restoration approaches alongside invasive species management and ongoing monitoring will increase the likelihood that native plant communities

persist under changing climate scenarios and support long-term ecological resilience across the swale wetland network.

Spring-fed Swale



Figure 31: Photograph of a spring-fed swale wetland

Spring-fed swale wetlands were the least represented in terms of total area, with six sites comprising 1.4 acres and accounting for just 1.2% of the total wetland area within the study zone. Despite their limited extent, these wetlands were ecologically distinct. Spring-fed swales are hydrologically unique due to their continuous or seasonally prolonged groundwater discharge and were only found in the ancient dune soils. *Juncus hesperius* was the dominant species at 22.9% relative cover, reflecting its preference for saturated soils. Other dominant species were *Frankenia salina* (13.8%), *Distichlis spicata* (13.8%), *Juncus breweri* (9.1%), and *Carpobrotus edulis* (12.8%) (Figure 32). These species represent the five most common; a complete list of species present is displayed below (Figure 33, 34, 35, 36). The low abundance of invasive species suggests that consistent water availability may limit the establishment of species like *Carpobrotus edulis* and *Ehrharta calycina*, which prefer drier or fluctuating moisture regimes.

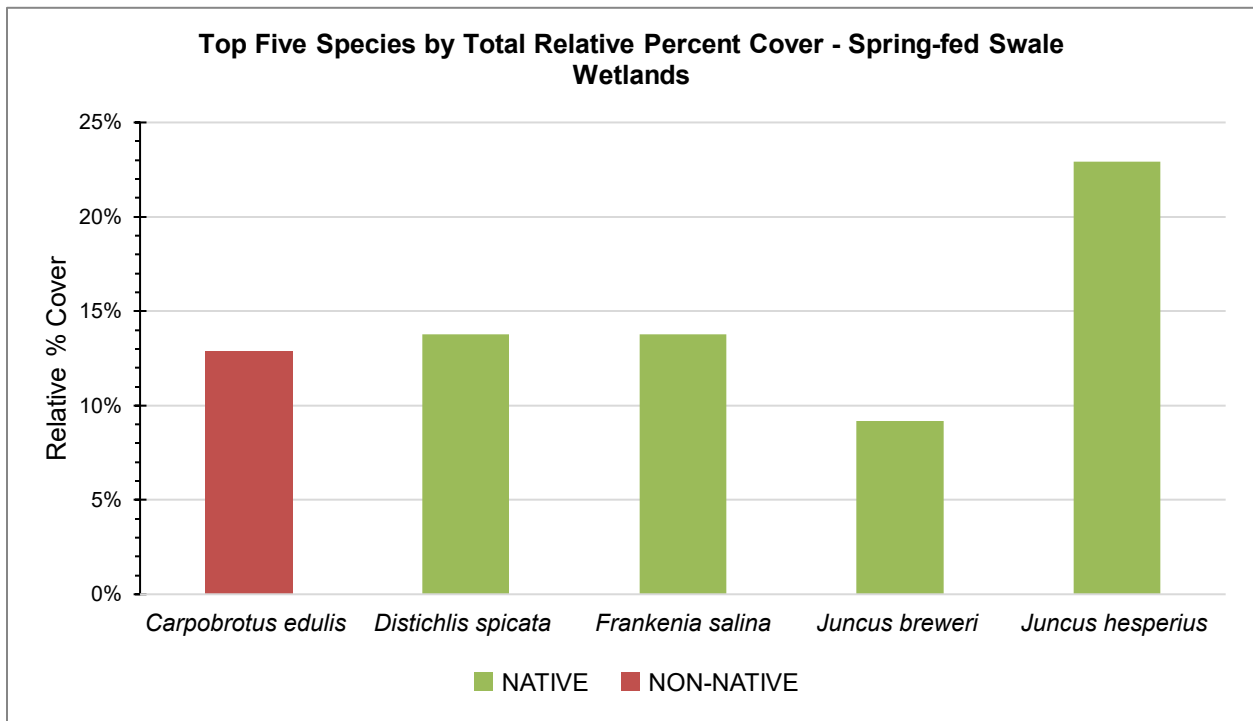


Figure 32: Total relative percent cover for the top five species found in spring-fed swale wetlands.

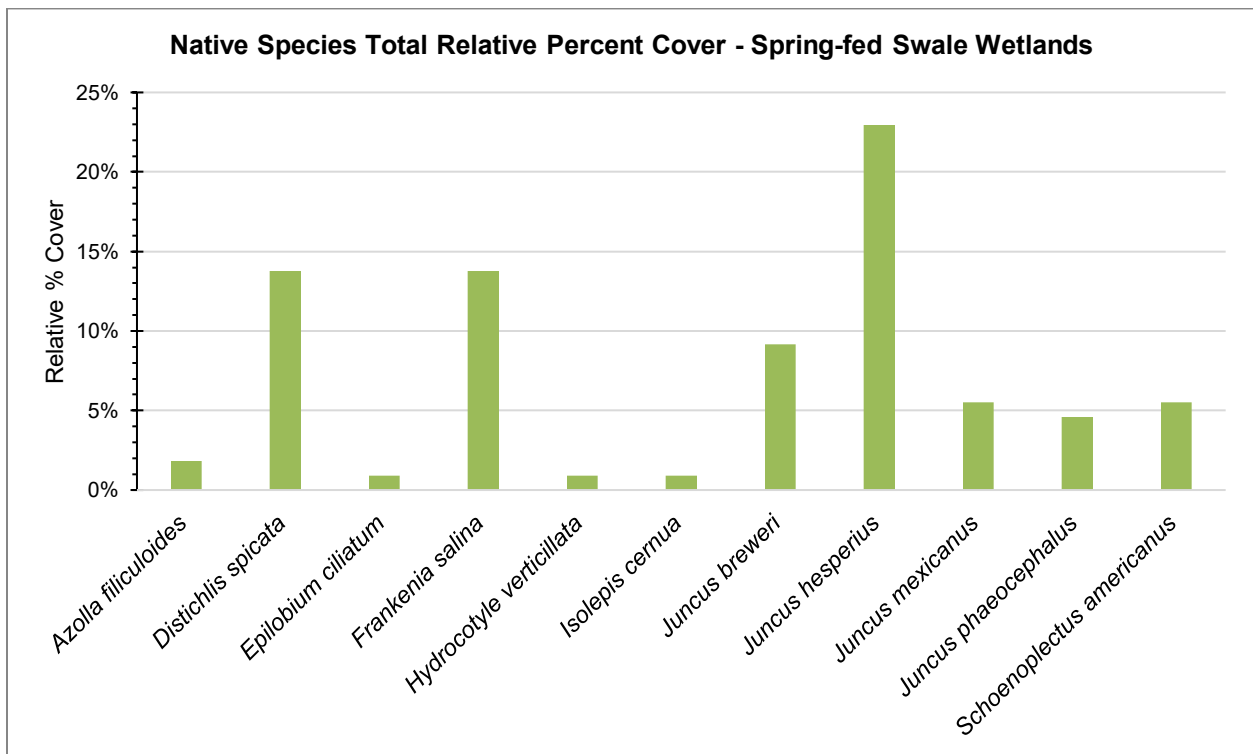


Figure 33: Total relative percent cover for native species in spring-fed swale wetlands.

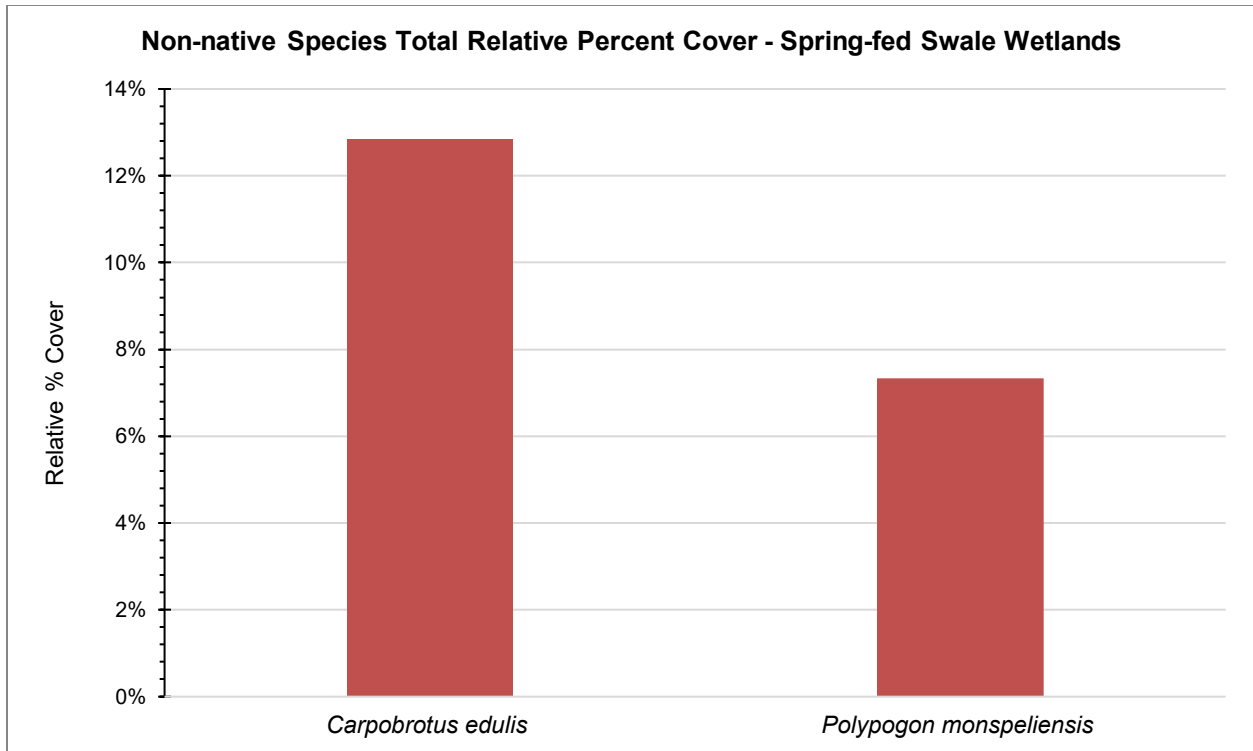


Figure 34: Total relative percent cover for non-native species in spring-fed swale wetlands. Some of these wetlands, particularly FW-271, hold exceptional potential as introduction sites for the critically endangered *Arenaria paludicola*, exhibiting near-ideal habitat conditions. These include perennial moisture, minimal hydrological fluctuation, sandy substrates free of anoxic conditions, presumably high dissolved oxygen levels, location within the coastal fog belt, and abundant extant vegetation that provides low shade and structural support for *Arenaria*'s characteristic “leaning and clambering” growth.

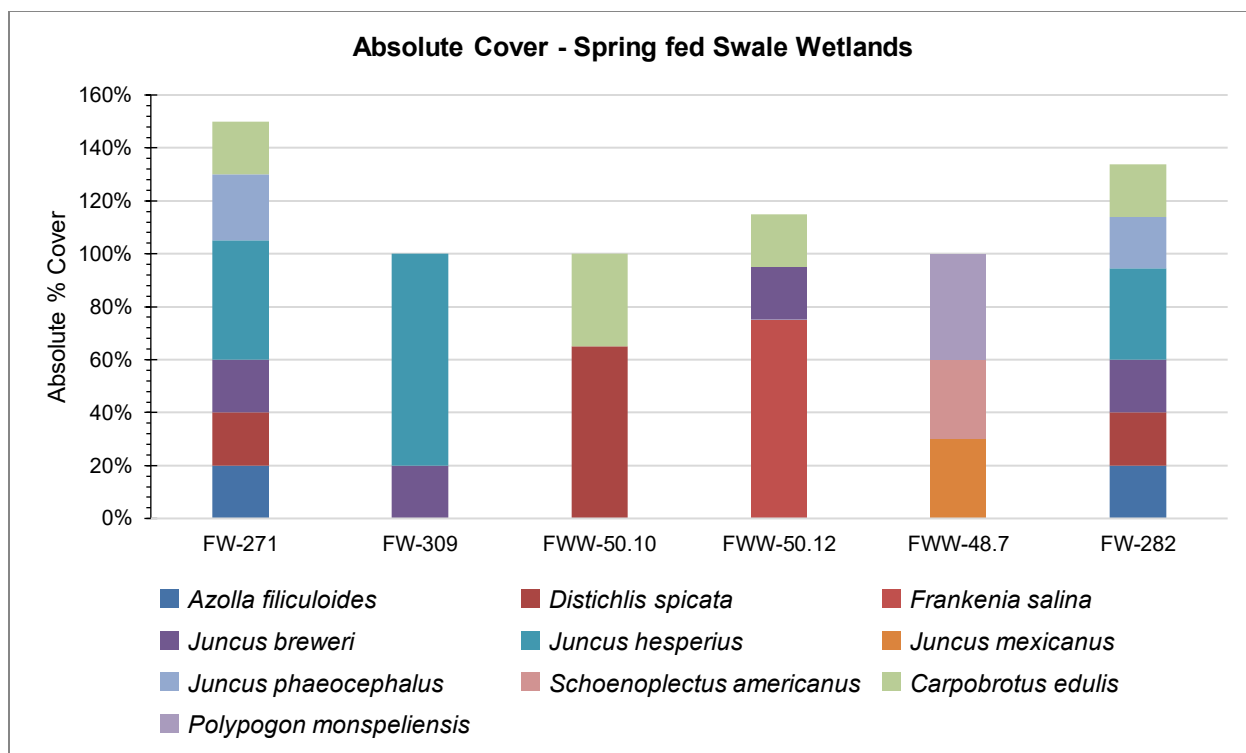


Figure 35: Graph showing plant composition in spring-fed swale wetlands. Figure 36 below shows the same data in table format.

Species	FW-271	FW-309	FWW-50.10	FWW-50.12	FWW-48.7	FW-282
<i>Azolla filiculoides</i>	20%	0%	0%	0%	0%	20%
<i>Distichlis spicata</i>	20%	0%	65%	0%	0%	20%
<i>Frankenia salina</i>	0%	0%	0%	75%	0%	0%
<i>Juncus breweri</i>	20%	20%	0%	20%	0%	20%
<i>Juncus hesperius</i>	45%	80%	0%	0%	0%	35%
<i>Juncus mexicanus</i>	0%	0%	0%	0%	30%	0%
<i>Juncus phaeocephalus</i>	25%	0%	0%	0%	0%	19%
<i>Schoenoplectus americanus</i>	0%	0%	0%	0%	30%	0%
<i>Carpobrotus edulis</i>	20%	0%	35%	20%	0%	20%
<i>Polypogon monspeliensis</i>	0%	0%	0%	0%	40%	0%

Figure 36: Table showing plant composition in spring-fed swale wetlands. The limited presence of invasive species, combined with strong hydrological stability, makes these wetlands high-priority sites for conservation and restoration. Management efforts should focus on long-term protection, preservation of hydrological integrity, and enhancement through the sensitive reintroduction of native species. Strategic removal of existing invasive species is recommended, along with periodic vegetation surveys to detect and respond to early signs of invasive establishment.

Flat Wetlands



Figure 37: Aerial photograph of flat wetlands.

Flat wetlands constituted the majority of the surveyed wetland area, with 156 sites covering 88.6 acres and representing 78.7% of total wetland area within the study zone. These systems occur on level to gently sloping terrain and are subject to uniform saturation following precipitation events. It is likely the relatively xeric adaptations of the extant wetland species and the proximity to the Pacific Ocean and fog belt that allows for such abundant cover, since standing water is either ephemeral or absent. The vegetation in flat wetlands was heavily skewed toward a few highly dominant species, including a mixture of native and non-native taxa.

Juncus phaeocephalus was the dominant species, comprising 47.2% total relative cover—the highest recorded across all topography types. *Carpobrotus edulis* followed at 26.1%, resulting in a combined dominance of nearly 70% by just two species. *Ehrharta calycina* accounted for 10.8%, *Bromus diandrus* for 7.0%, and *Juncus breweri* appeared minimally at 1.4% (Figure 38). These five species were the most prevalent; a complete list of species is presented below (Figure 39, 40).

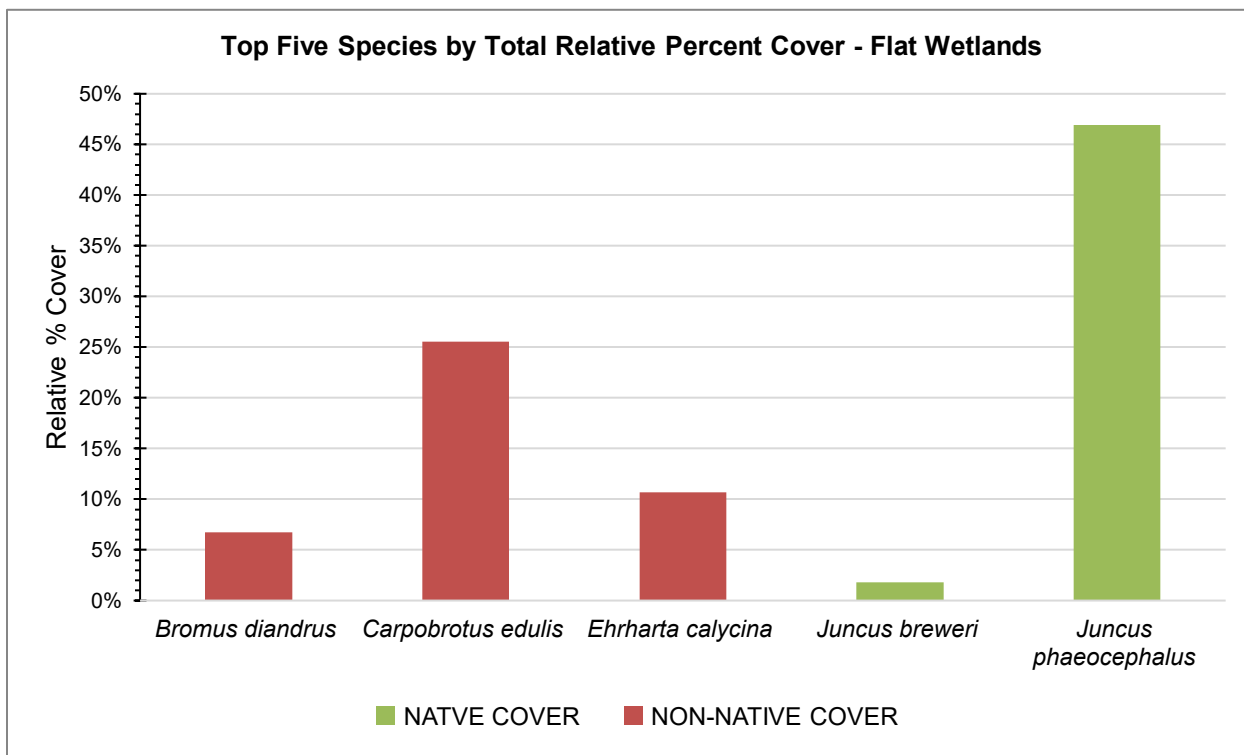


Figure 38: The five species, both native and non-native, with highest relative percent cover in flat wetlands.

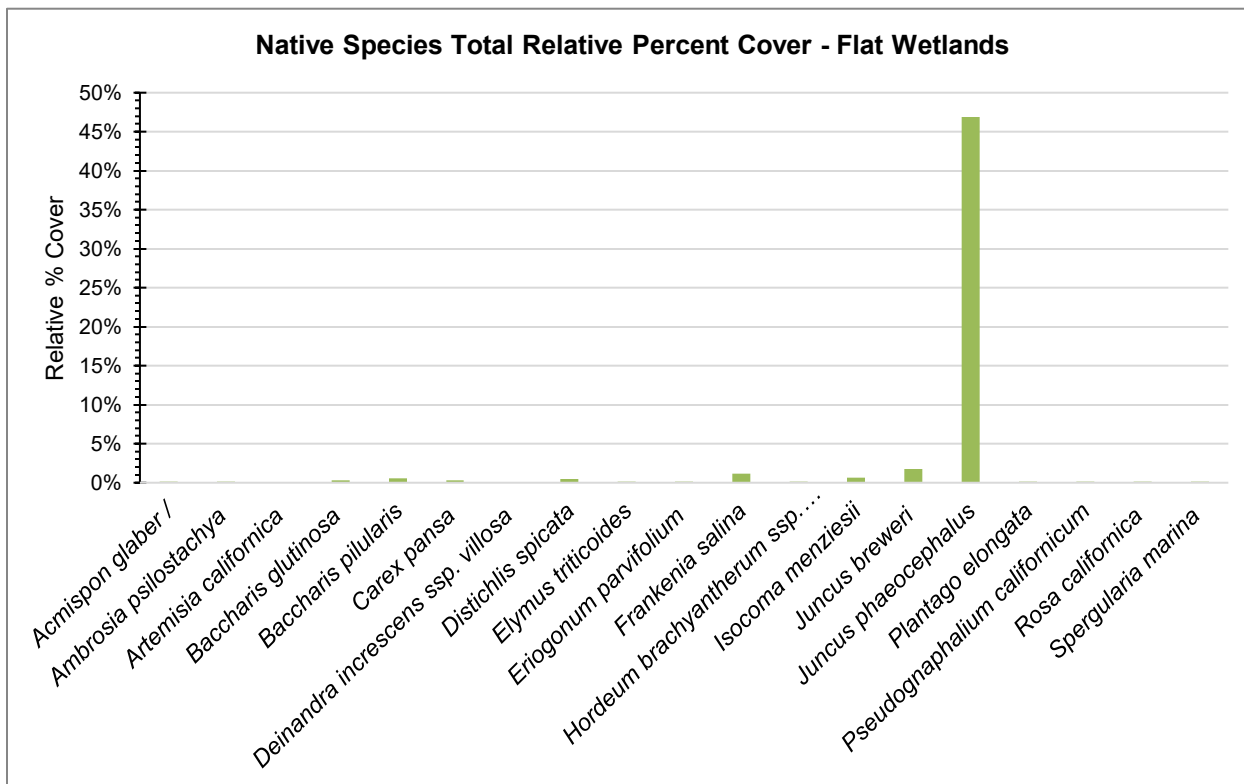


Figure 39: Total relative percent cover for native species in flat wetlands.

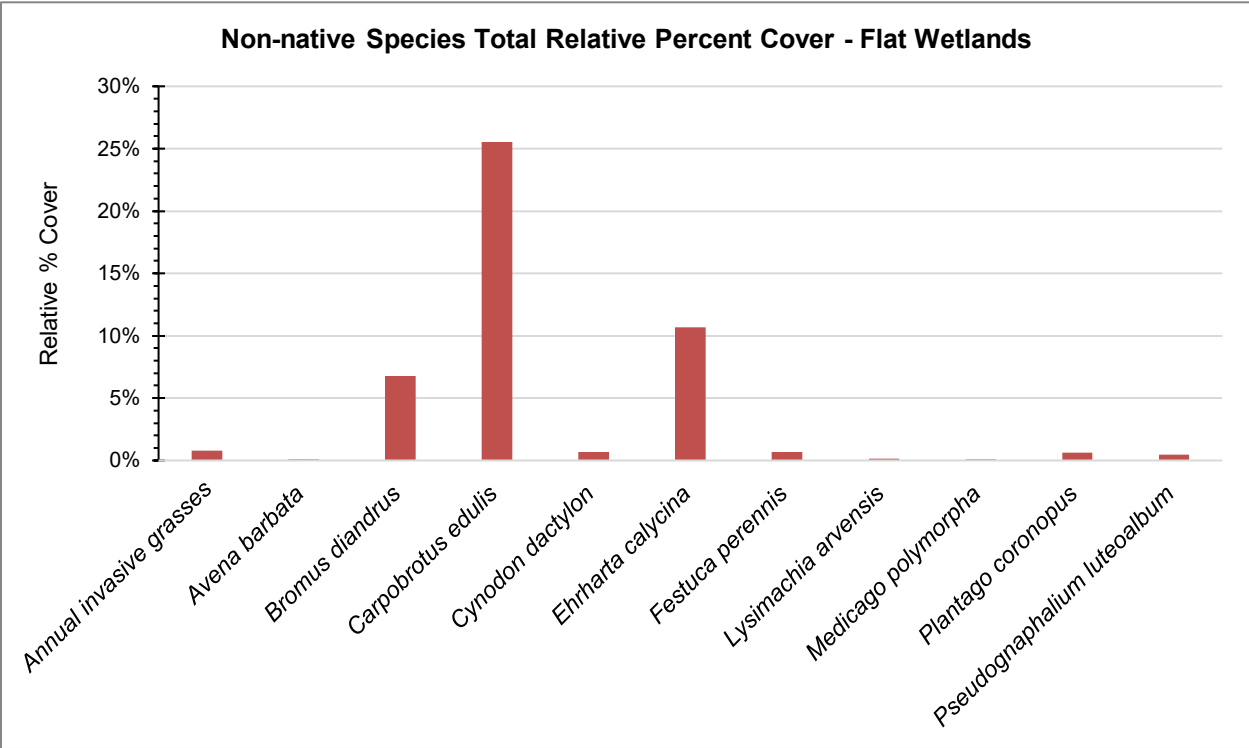


Figure 40: Total relative percent cover for non-native species in flat wetlands.

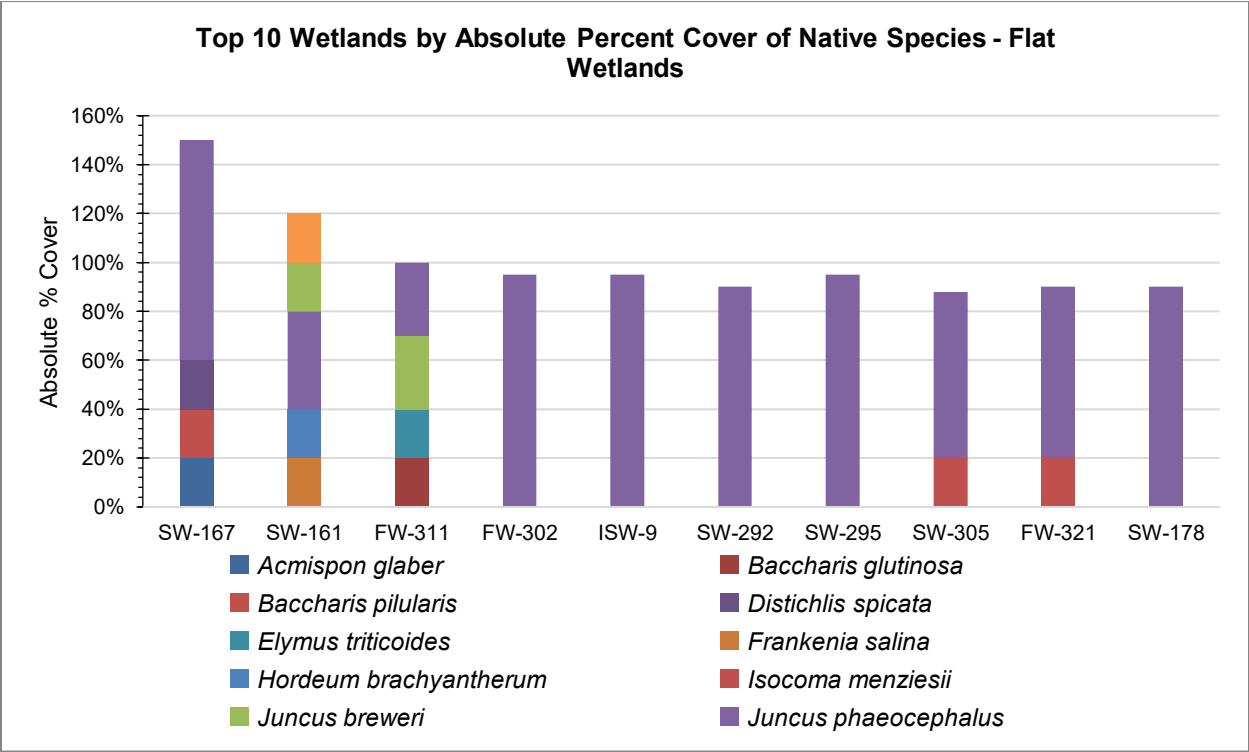


Figure 41: Graph showing native plant composition in the ten flat wetlands with highest native absolute percent cover. Figure 42 below shows the same data in table format.

Species	SW-167	SW-161	FW-311	FW-302	ISW-9	SW-292	SW-295	SW-305	FW-321	SW-178
<i>Acmispon glaber</i>	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<i>Baccharis glutinosa</i>	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%
<i>Baccharis pilularis</i>	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<i>Distichlis spicata</i>	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<i>Elymus triticoides</i>	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%
<i>Frankenia salina</i>	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
<i>Hordeum brachyantherum</i>	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
<i>Isocoma menziesii</i>	0%	0%	0%	0%	0%	0%	0%	20%	20%	0%
<i>Juncus breweri</i>	0%	0%	30%	0%	0%	0%	0%	0%	0%	0%
<i>Juncus phaeocephalus</i>	90%	40%	30%	95%	95%	90%	95%	68%	70%	90%
<i>Plantago elongata</i>	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
<i>Spergularia marina</i>	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%

Figure 42: Table showing native plant composition in the ten flat wetlands with highest native absolute percent cover.

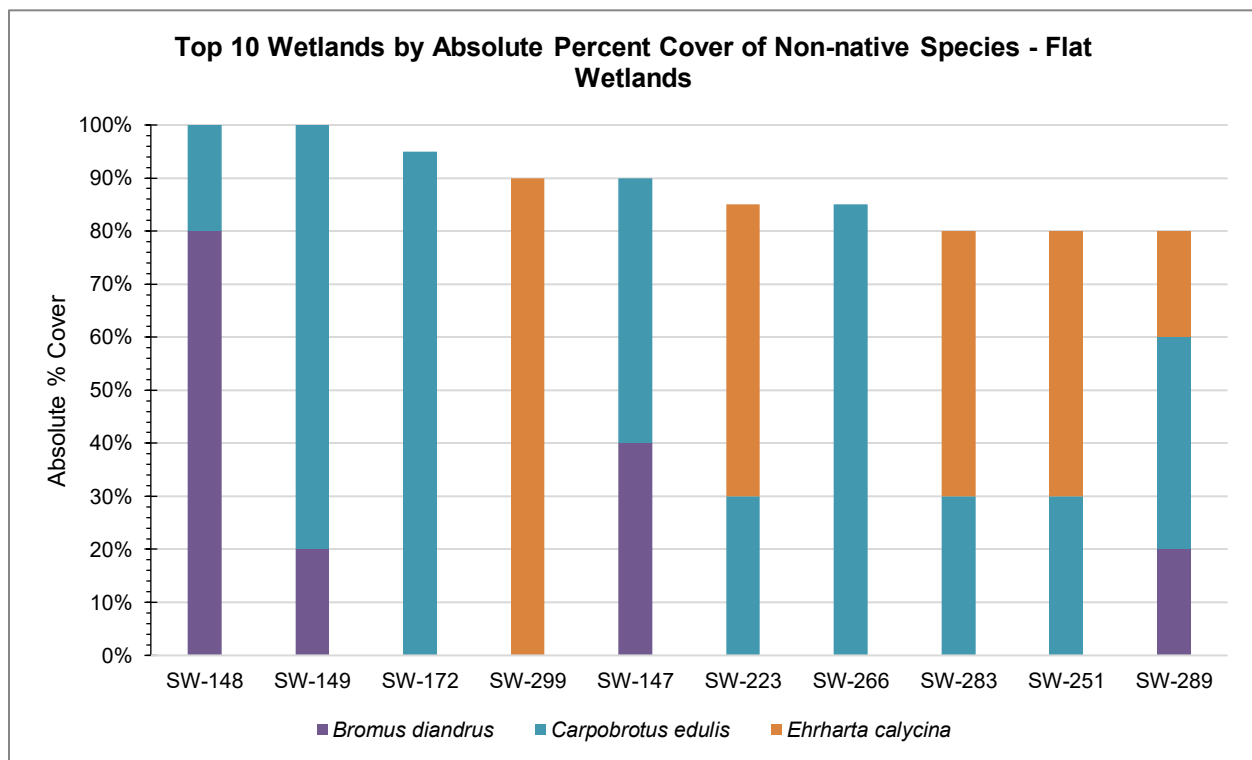


Figure 43: Graph showing non-native plant composition in the ten flat wetlands with highest non-native absolute percent cover. Figure 44 below shows the same data in table format.

Species	SW-148	SW-149	SW-172	SW-299	SW-147	SW-223	SW-266	SW-283	SW-251	SW-289
<i>Bromus diandrus</i>	80%	20%	0%	0%	40%	0%	0%	0%	0%	20%
<i>Carpobrotus edulis</i>	20%	80%	95%	0%	50%	30%	85%	30%	30%	40%
<i>Ehrharta calycina</i>	0%	0%	0%	90%	0%	55%	0%	50%	50%	20%

Figure 44: Table showing non-native plant composition in the ten flat wetlands with highest non-native absolute percent cover.

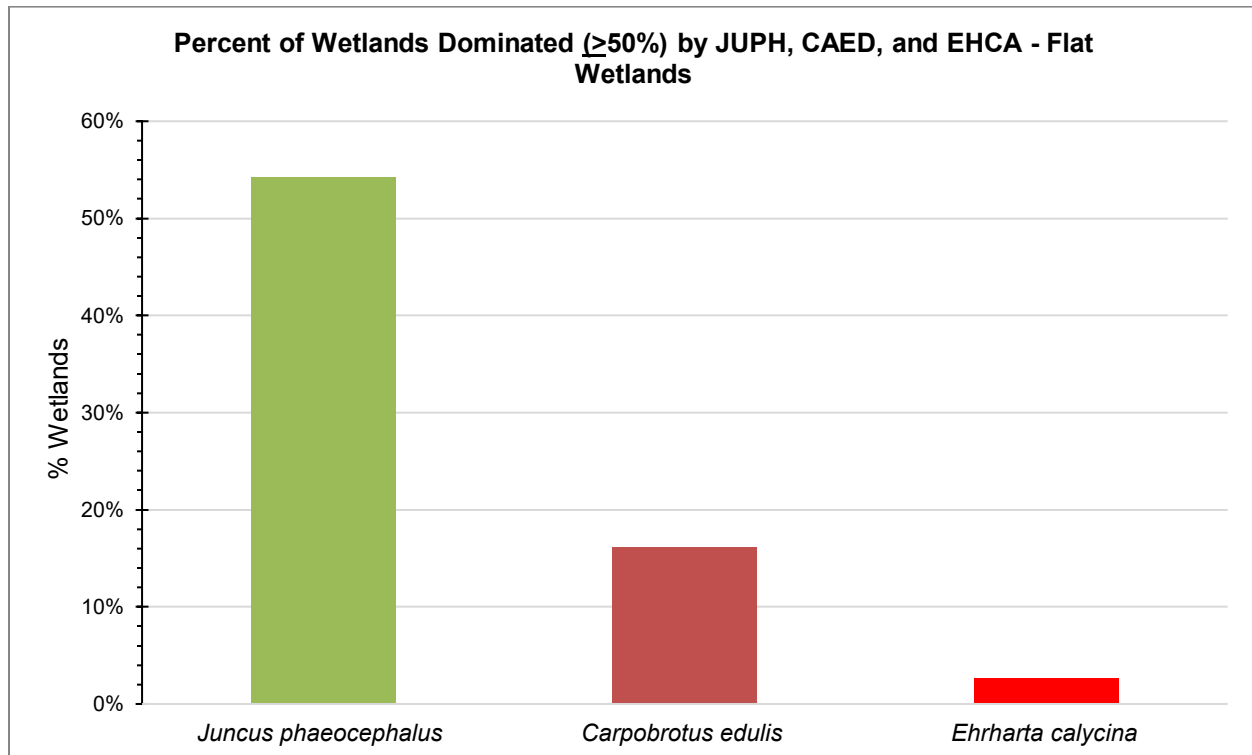


Figure 45: Percent of flat wetlands dominated by *Juncus phaeocephalus*, *Carpobrotus edulis*, and *Ehrharta calycina*.

Non-native species were especially prevalent in flat wetlands. *Carpobrotus edulis*, *Ehrharta calycina*, and *Bromus diandrus* together contributed over 40% relative cover, reinforcing the trend of dominance by a limited number of species (Figure 43, 44). This high proportion of non-native species reflects significant ecological disturbance. The spatial homogeneity of flat wetlands may reduce competitive exclusion, enabling invasive species to establish and spread. The low native plant diversity (Figure 41, 42) suggests a need for targeted restoration to reduce invasive cover, increase ecosystem function and potential, and encourage native plant recruitment and abundance. These wetlands have high restoration potential due to their scale, but also require the greatest effort due to the extent of invasive plant establishment and ecosystem degradation.

We recommend *Ehrharta calycina* control be implemented, especially in wetlands where absolute percent cover exceeds 40%. Although the issue is fairly severe, a number of methods

may work towards decreasing its density and abundance, if not its eradication. These include grazing, mowing, bagging, and removing or piling the material, or treatment with graminicides. Graminicides should be used with caution and only in the dry season. Most grass-specific products are not approved for wetland use due to groundwater leaching; depth to groundwater should be established in proposed treatment areas.

Ehrharta calycina has been controlled at the Nipomo Mesa for several years by the SLO Land Conservancy and the State Parks, and their experience could be valuable in developing a management plan.

In the northernmost portion of the terrace (Zone A, Figure 2), where wetlands SW-135 to SW-148 are located, there is a particularly dense accumulation of dry, grey thatch from non-native annual grasses such as *Festuca perennis* and *Bromus diandrus*. This buildup likely inhibits native plant recruitment, reduces overall primary productivity, and diminishes ecosystem function. It may also negatively impact burrowing owls, as pocket gophers are likely more abundant beneath the thatch and more difficult for owls to successfully hunt.

Also on this terrace, along the slope's edge at the ecotone between coastal sage scrub and grassland (Zone B, Figure 2), several notable plant species were observed. These included the only recorded *Dipterostemon capitatus* on the preserve, as well as *Stipa pulchra*, *Hordeum brachyantherum*, and *Plantago erecta*—the latter representing a new record for the site.

Although access for grazing may be logistically difficult to arrange, we recommend its implementation for thatch management in this area. Given the unique flora along the slope edges, grazing in that narrow strip may pose risks and should be carefully monitored. Nevertheless, the broader mesa and wetlands SW-135 to SW-148 would likely benefit from this management strategy.

Additionally, due to the homogenous nature of the flat wetlands, across the site more broadly, and the low diversity of native wetland vegetation they support, we recommend considering deepening some of these wetlands for the formation of better functioning wet meadows. This could potentially achieve several goals: The creation of depression wetlands that may provide improved or diversified wildlife use of the site, such as winter foraging habitat for long-billed curlews and other shorebirds during high tide and high surf events, increased support of native plant species, reduced vulnerability to invasive plants, and improved burrowing owl support. The heterogeneity created by scraping and deepening these wetlands would be further enhanced by using the excavated soils to construct small mounds, similar to mima mounds. Soil studies should be conducted in areas proposed for wetland deepening to ensure that the deeper soils have the properties necessary for success.

These mounds would be ideal places upon which to either place microstructures such as rock piles on or around, or for burying artificial burrow structures beneath them. Mounds alone are preferentially sought out by burrowing owls for their improved sightlines, and especially so when

combined with underground refuge opportunities. The deepening of flat wetlands may also increase the prevalence and diversity of important food items such as voles, mice, and invertebrates. The subtle lowering and elevating of soils thereby works synergistically to improve burrowing owl habitat.

Depression Wetlands



Figure 46: Aerial photograph of depression wetlands in the dune habitat.

Depression wetlands totaled 18 sites comprising 7.7 acres and representing 6.8% of total wetland area within the study zone. These small, closed basins typically have extended hydroperiods and limited inflow or outflow. This extended water presence appears to support a more resilient native plant community.

Vegetation was again dominated by *Juncus phaeocephalus* at 42.0% relative cover. *Carpobrotus edulis* and *Ehrharta calycina* followed at 8.6% and 8.2%, respectively, while *Plantago coronopus* (7.5%) and *Juncus mexicanus* (5.9%) were also notable (Figure 47). These species represent the five most common; a complete list of species present is displayed below (Figure 48, 49).

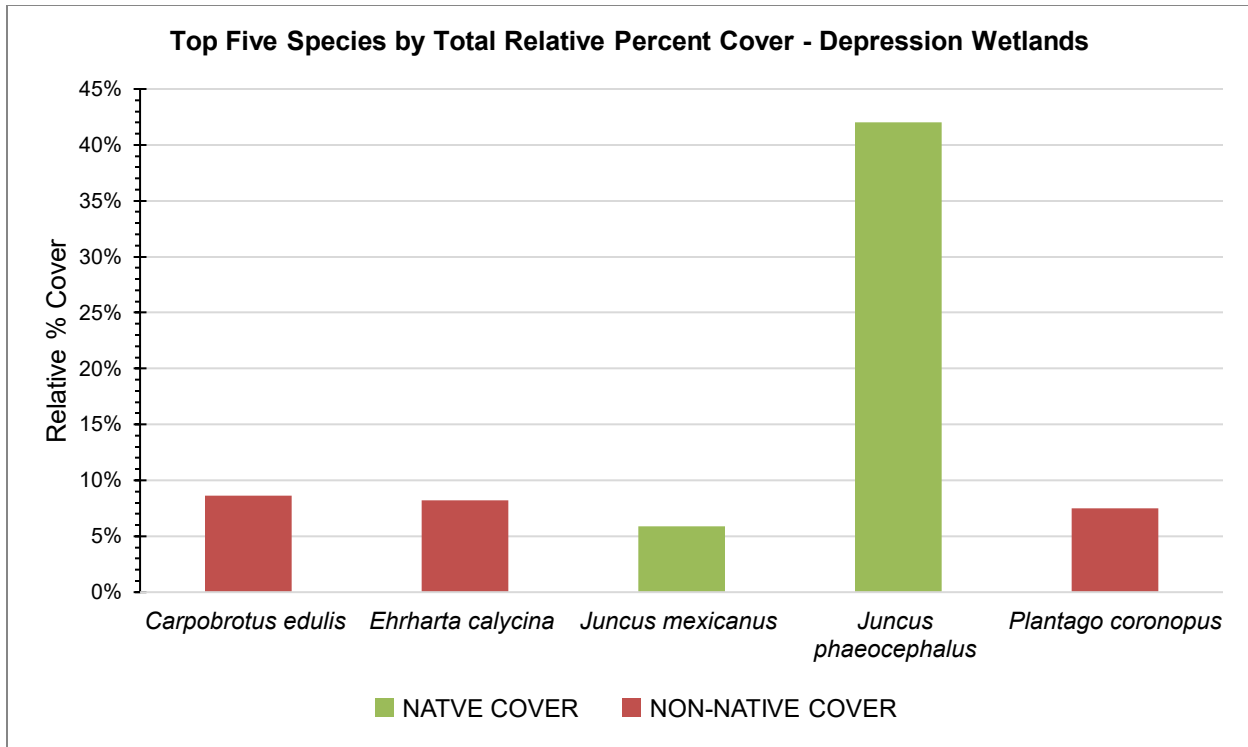


Figure 47: The five species, both native and non-native, with highest relative percent cover in the depression wetlands.

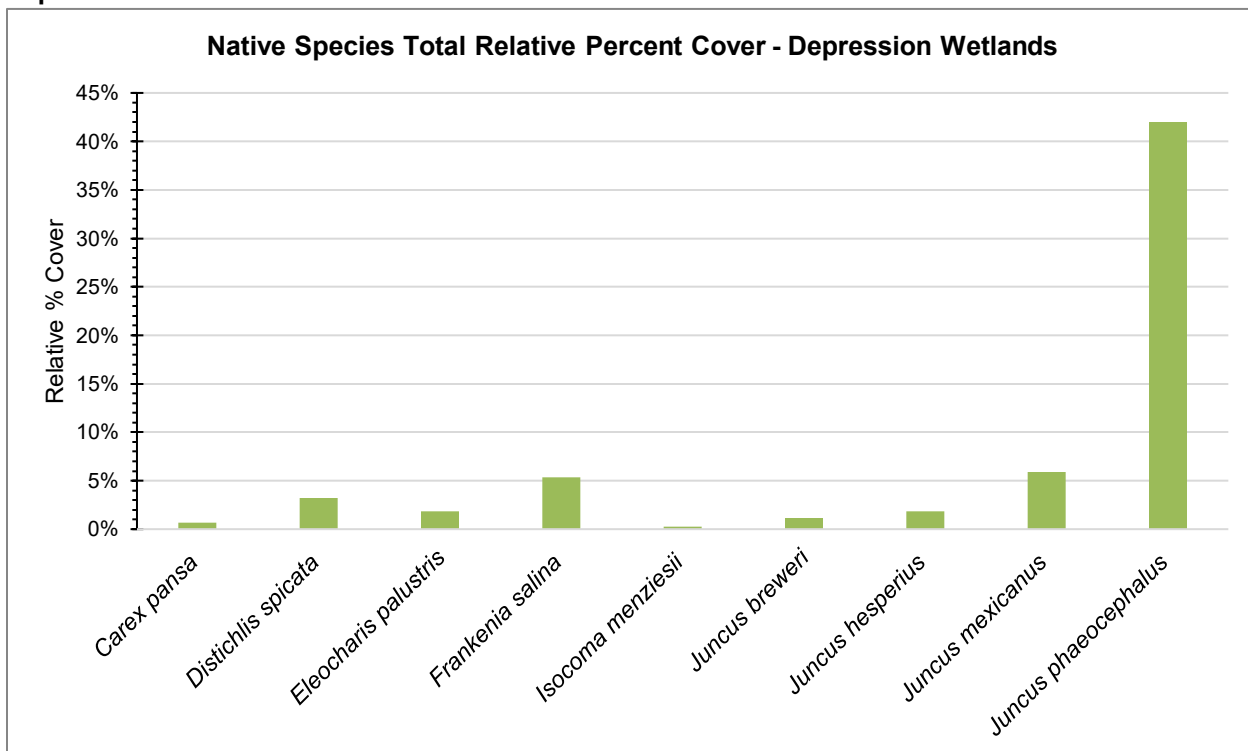


Figure 48: Total relative percent cover for native species in depression wetlands.

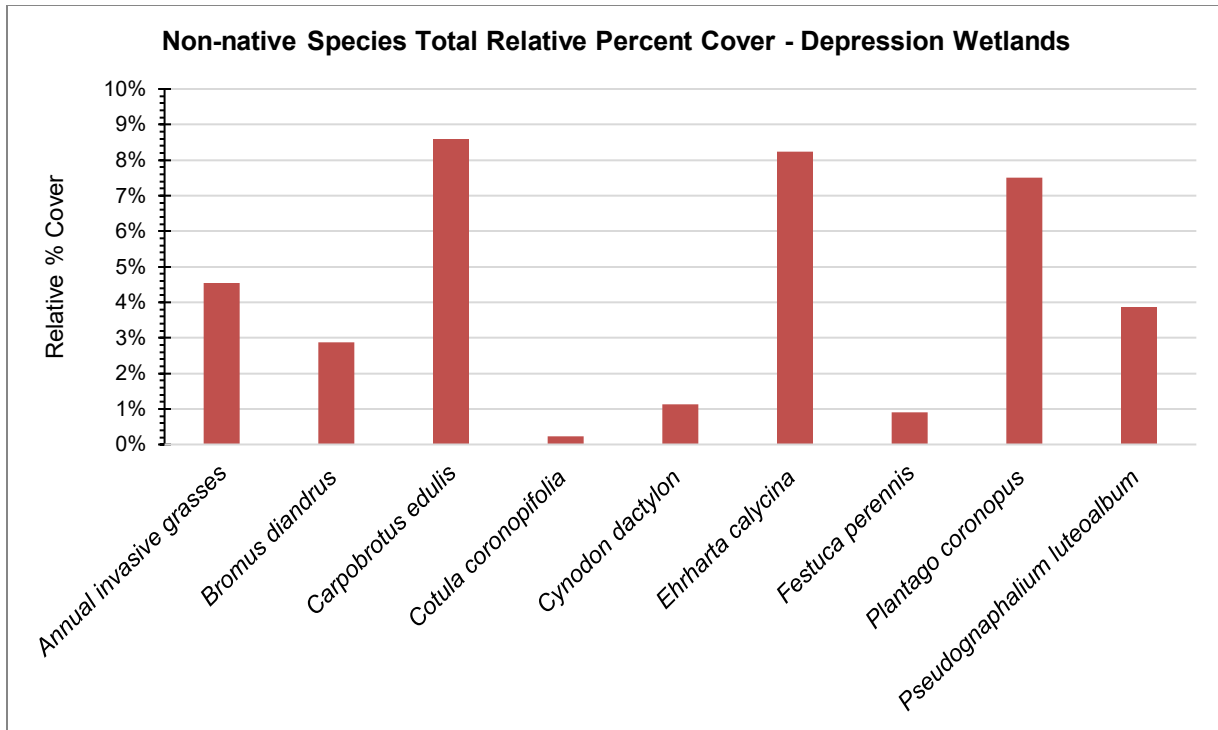


Figure 49: Total relative percent cover for non-native species in depression wetlands.

Native and non-native species cover within the depression wetlands reflect a relatively balanced vegetation structure, with several sites maintaining high native cover and moderate species richness (Figure 50, 51). The extended hydroperiod likely provides a refuge from certain invasive plants that prefer drier or more variable conditions.

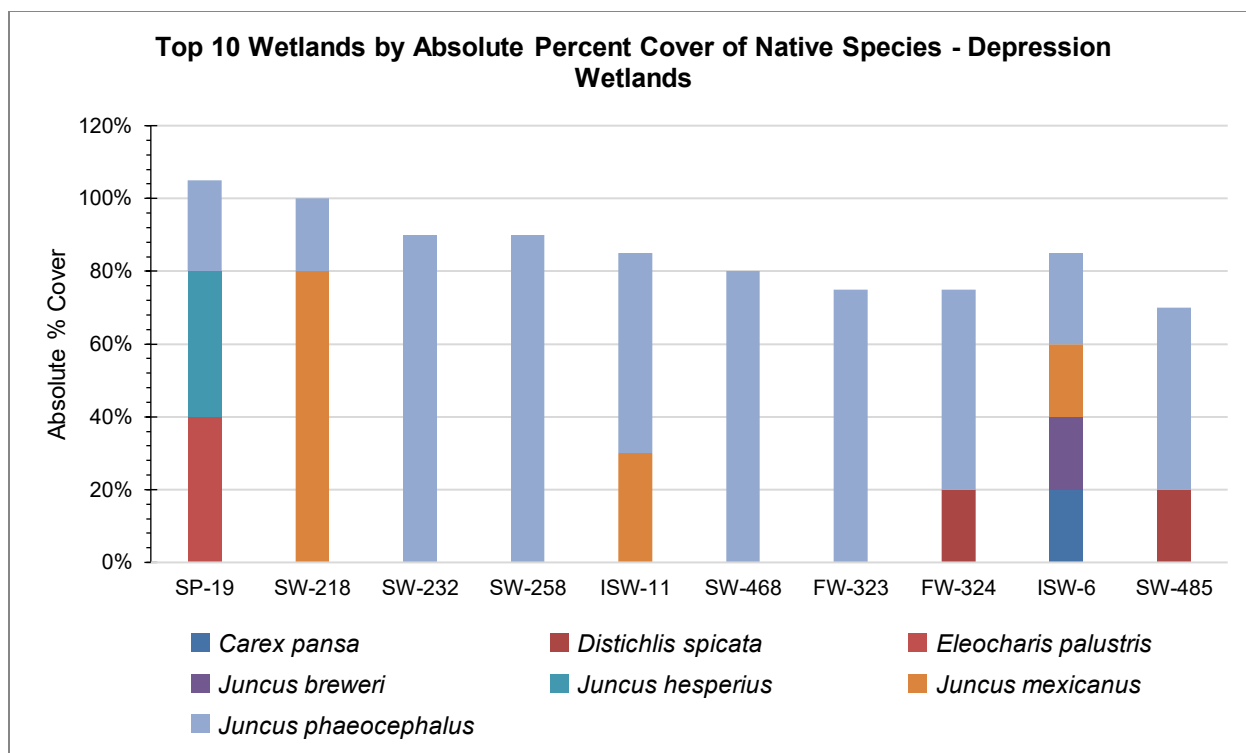


Figure 50: Graph showing native plant composition for the ten depression wetlands with highest native absolute percent cover. Figure 51 below shows the same data in table format.

Species	SP-19	SW-218	SW-232	SW-258	ISW-11	SW-468	FW-323	FW-324	ISW-6	SW-485
<i>Carex pansa</i>	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%
<i>Distichlis spicata</i>	0%	0%	0%	0%	0%	0%	0%	20%	0%	20%
<i>Eleocharis palustris</i>	40%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<i>Juncus breweri</i>	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%
<i>Juncus hesperius</i>	40%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<i>Juncus mexicanus</i>	0%	80%	0%	0%	30%	0%	0%	0%	20%	0%
<i>Juncus phaeocephalus</i>	25%	20%	90%	90%	55%	80%	75%	55%	25%	50%

Figure 51: Table showing native plant composition for the ten depression wetlands with highest native absolute percent cover.

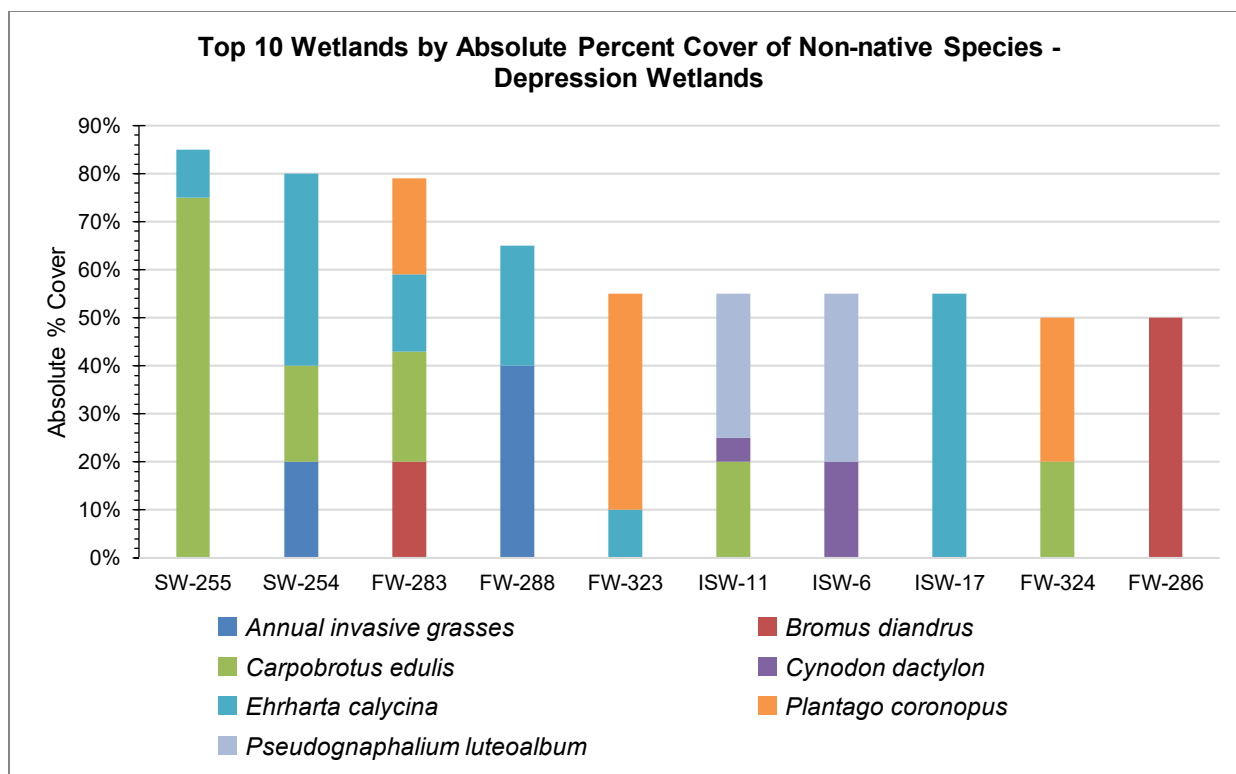


Figure 52: Graph showing non-native plant composition for the ten depression wetlands with highest non-native absolute percent cover. Figure 53 below shows the same data in table format.

Species	SW-255	SW-254	FW-283	FW-288	FW-323	ISW-11	ISW-6	ISW-17	FW-324	FW-286
<i>Annual invasive grasses</i>	0%	20%	0%	40%	0%	0%	0%	0%	0%	0%
<i>Bromus diandrus</i>	0%	0%	20%	0%	0%	0%	0%	0%	0%	50%
<i>Carpobrotus edulis</i>	75%	20%	23%	0%	0%	20%	0%	0%	20%	0%
<i>Cynodon dactylon</i>	0%	0%	0%	0%	0%	5%	20%	0%	0%	0%
<i>Ehrharta calycina</i>	10%	40%	16%	25%	10%	0%	0%	55%	0%	0%
<i>Plantago coronopus</i>	0%	0%	20%	0%	45%	0%	0%	0%	30%	0%
<i>Pseudognaphalium luteoalbum</i>	0%	0%	0%	0%	0%	30%	35%	0%	0%	0%

Figure 53: Table showing non-native plant composition for the ten depression wetlands with highest non-native absolute percent cover.

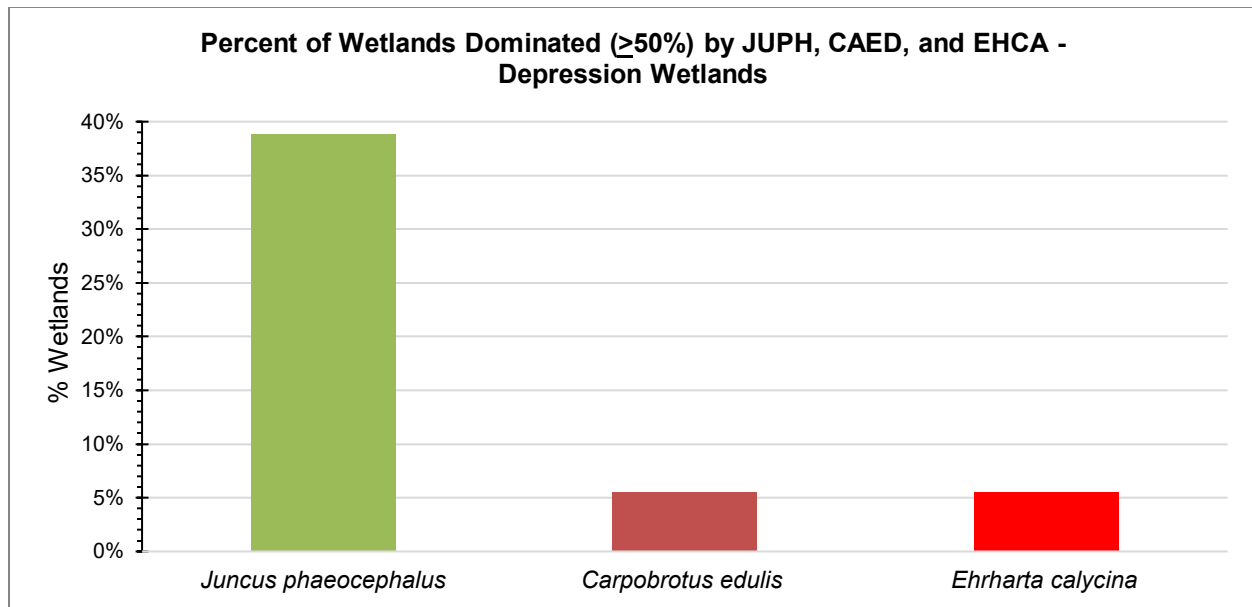


Figure 54: Percent of depression wetlands dominated by *Juncus phaeocephalus*, *Carpobrotus edulis*, and *Ehrharta calycina*.

While less degraded than flat wetlands, depression wetlands still warrant management to prevent further invasive spread and maintain ecological function. In the more degraded depressions, *Carpobrotus edulis*, *Ehrharta calycina*, and various annual grasses dominate (Figure 52, 53). While Bermuda grass (*Cynodon dactylon*) has relatively low cover, it has 20% cover in ISW-6 and 5% in ISW-11, both located in the dunes. This early invasion of a particularly difficult-to-control weed should be addressed as soon as possible, before it becomes a larger issue. Otherwise, selective invasive removal, coupled with hydrological monitoring and passive revegetation, may be sufficient to preserve the integrity of these systems. Their relatively intact condition and functional hydrology make them strong candidates for low-intervention restoration and long-term protection.

The stock pond (SP-19), classified as a depression wetland based on its topography, may represent a suitable site for the introduction of California red-legged frog (CRLF). Although the habitat conditions appear favorable, the site is likely too isolated from other wetlands to allow for natural dispersal, which may explain the current absence of CRLF. Two CRLF egg masses were observed in FWW-48.7 (see photo below), although one appeared to be impacted by sedimentation, and the stream at that location was shallow.



Figure 55: CRLF egg mass observed in FWW-48.7.

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APPENDIX A - PLANT LIST

Below is the list of plant species identified and recorded within either the wetland habitat assessments or the USACE Arid West forms. When delineating new wetlands or making large adjustments to previously mapped boundaries, a thorough catalog of species was recorded within a 5 foot by 5 foot plot around a soil pit. During wetland habitat assessment, only the dominant species and species of special concern, such as invasive or endangered species, were recorded. Therefore, this is not an exhaustive list of all plant species richness within the Study Area.

A 2019 botanical survey by TNC and WRA Environmental Consultants produced a comprehensive list of plant species present throughout the Dangermond Preserve. During the survey, specimens were collected and preserved in local herbaria for most species. While conducting wetland delineation and habitat assessments, Cheadle Center surveyors continued the previous vouchering effort for species that had not been collected, and recorded several species not observed at all in the 2019 survey. Rows highlighted in green represent vouchers collected in 2025. Specimens will be dried, processed, and added to the UC Santa Barbara Herbarium.

Scientific Name	Common Name	Family	Native Status	Invasive Status	Indicator	CA Rare Plant Rank	CAL-IPC Rating
<i>Acmispon glaber</i>	Deerweed, California broom	Fabaceae	Native				
<i>Ambrosia psilostachya</i>	Ragweed, Western ragweed	Asteraceae	Native		FACU		

<i>Artemisia californica</i>	Coastal sage brush, California sagebrush	Asteraceae	Native		NI		
<i>Avena barbata</i>	Slim oat, Slender wild oat	Poaceae	Non-native	Invasive	NI		Moderate, California Invasive Plant Council
<i>Azolla filiculoides</i>	Mosquito fern	Azollaceae	Native		OBL		
<i>Baccharis glutinosa</i>	Marsh baccharis	Asteraceae	Native		FACW		
<i>Baccharis pilularis</i>	Coyote brush	Asteraceae	Native		NI		
<i>Bromus diandrus</i>	Ripgut brome, Ripgut grass	Poaceae	Non-native	Invasive	NI		Moderate, Weed Science Group, University of California, Davis
<i>Bromus hordeaceus</i>	Soft chess	Poaceae	Non-native	Invasive	FACU		Limited, California Invasive Plant Council
<i>Carex pansa</i>	Sand dune sedge, Sand dune sedge	Cyperaceae	Native		FACU		
<i>Carpobrotus edulis</i>	Iceplant, Freeway iceplant	Aizoaceae	Non-native	Invasive	NI		High, California Invasive Plant Council
<i>Cirsium vulgare</i>	Bullthistle, Bull thistle	Asteraceae	Non-native	Invasive	FACU		Moderate, California Invasive Plant Council
<i>Cotula coronopifolia</i>	Brass buttons, Brass-buttons	Asteraceae	Non-native	Invasive	OBL		Limited, California Invasive Plant Council
<i>Cynodon dactylon</i>	Bermuda grass	Poaceae	Non-native	Invasive	FACU		Moderate, Catalina Island Conservancy
<i>Deinandra increscens</i> ssp. <i>villosa</i>	Gaviota tarplant	Asteraceae	Native		NI	1B.1	
<i>Distichlis spicata</i>	Salt grass	Poaceae	Native		FAC		
<i>Ehrharta calycina</i>	Perennial veldt grass	Poaceae	Non-native	Invasive	NI		High, Natural Resources Division, California State Parks
<i>Eleocharis palustris</i>	Common spikerush	Cyperaceae	Native		OBL		
<i>Eleocharis parishii</i>	Parish's spike rush	Cyperaceae	Native		FACW		

<i>Elymus triticoides</i>	Beardless wild rye	Poaceae	Native		FAC		
<i>Epilobium ciliatum</i>	Slender willow herb	Onagraceae	Native		FACW		
<i>Eriogonum parvifolium</i>	Sea cliff buckwheat, Seacliff wild buckwheat	Polygonaceae	Native		NI		
<i>Erodium botrys</i>	Big heron bill	Geraniaceae	Non-native		FACU		
<i>Erodium cicutarium</i>	Coastal heron's bill, Redstem filaree	Geraniaceae	Non-native	Invasive	NI		Limited, California Invasive Plant Council
<i>Eryngium vaseyi</i>	Coyote thistle, Coyote-thistle	Apiaceae	Native		FACW		
<i>Extriplex californica</i>	California orach	Amaranthaceae	Native		FAC		
<i>Festuca bromoides</i> *	Brome fescue	Poaceae	Non-native		FACU		
<i>Festuca perennis</i> **	Italian rye grass	Poaceae	Non-native	Invasive	FAC		Moderate, UC Davis
<i>Festuca myuros</i> ***	Rattail fescue	Poaceae	Non-native		FACU		
<i>Frankenia salina</i>	Yerba reuma, Alkali heath	Frankeniaceae	Native		FACW		
<i>Hordeum brachyantherum</i> ssp. <i>brachyantherum</i>	Meadow barley, Northern barley	Poaceae	Native		FACW		
<i>Hordeum marinum</i>	Seaside barley	Poaceae	Non-native	Invasive	FAC		Moderate, California Invasive Plant Council
<i>Hydrocotyle verticillata</i>	Whorled marsh pennywort	Apiaceae	Native		OBL		
<i>Hypochaeris glabra</i>	Smooth cats ear, Smooth cat's-ear	Asteraceae	Non-native	Invasive	NI		California Invasive Plant Council
<i>Isocoma menziesii</i>	White flowered goldenbush, Coastal goldenbush	Asteraceae	Native		FACU		
<i>Isolepis cernua</i>	Low bulrush	Cyperaceae	Native		OBL		

<i>Juncus breweri</i>	Brewer's rush, Salt or brewer's rush	Juncaceae	Native		FACW		
<i>Juncus bufonius</i>	Common toad rush, Toad rush	Juncaceae	Native		FACW		
<i>Juncus hesperius****</i>	Coast or bog rush, Coast or bog rush	Juncaceae	Native		FACW		
<i>Juncus mexicanus</i>	Mexican rush, Mexican rush	Juncaceae	Native		FACW		
<i>Juncus phaeocephalus</i>	Brown headed rush	Juncaceae	Native		FACW		
<i>Lepidium nitidum</i>	Shining pepper grass	Brassicaceae	Native		FAC		
<i>Lysimachia arvensis</i>	Scarlet pimpernel	Primulaceae	Non-native		FAC		
<i>Lythrum hyssopifolia</i>	Hyssop loosestrife	Lythraceae	Non-native	Invasive	OBL		
<i>Malvella leprosa</i>	Alkali mallow, Alkali-mallow, White-weed	Malvaceae	Native		FACU		
<i>Medicago polymorpha</i>	California burclover	Fabaceae	Non-native	Invasive	FACU		Limited, Dept. of Agriculture/Weights and Measures, County of San Diego
<i>Plagiobothrys undulatus</i>	Coast allocarya, Wavy-stemmed popcornflower	Boraginaceae	Native		OBL		
<i>Plantago coronopus</i>	Cut leaf plantain	Plantaginaceae	Non-native		FAC		
<i>Plantago elongata</i>	Coastal plantain	Plantaginaceae	Native		FACW		
<i>Polygonum aviculare</i>	Prostrate knotweed, Knotweed, Knotgrass	Polygonaceae	Non-native		FAC		
<i>Polypogon monspeliensis</i>	Annual beard grass, Annual beard grass, Rabbitfoot grass	Poaceae	Non-native	Invasive	FACW		Limited, California Invasive Plant Council
<i>Pseudognaphalium californicum</i>	Ladies' tobacco	Asteraceae	Native		NI		
<i>Pseudognaphalium luteoalbum</i>	Jersey cudweed	Asteraceae	Non-native		FAC		

Rosa californica	California wild rose, California rose	Rosaceae	Native		FAC		
Rumex acetosella	Sheep sorrel	Polygonaceae	Non-native	Invasive	FACU		Moderate, California Native Plant Society
Rumex crispus	Curly dock	Polygonaceae	Non-native	Invasive	FAC		Limited, Saint Mary's College of California
Rumex salicifolius	Willow leaved dock, Willow dock	Polygonaceae	Native		FACW		
Schoenoplectus americanus	Chairmaker's bulrush	Cyperaceae	Native		OBL		
Schoenoplectus pungens	Common threesquare	Cyperaceae	Native		OBL		
Sonchus oleraceus	Sow thistle, Common sow thistle	Asteraceae	Non-native		UPL		
Spergularia marina	Salt sand spurry, Saltmarsh sand- spurrey	Caryophyllaceae	Native		OBL		
Spergularia rubra	Purple sand spurry, Red sand-spurrey	Caryophyllaceae	Non-native		FAC		
Spergularia villosa	Villous sand spurry, Hairy sand-spurrey	Caryophyllaceae	Non-native		NI		

*Synonym: Vulpia bromoides

**Synonym: Lolium perenne

***Synonym: Vulpia myuros

****Synonym: Juncus effusus var. brunneus