# VOLUME 2C: GOALS AND OBJECTIVES FOR VEGETATION FOCUS MANAGEMENT SPECIES

# 1.0 COASTAL SAGE SCRUB

## 1.1 OVERVIEW OF THE COASTAL SAGE SCRUB VEGETATION COMMUNITY

Coastal sage scrub is the second most abundant and widespread vegetation community in the MSPA with 221,798 acres in all MUs, of which 107,042 acres (48%) are conserved (Table V2C.1-1; Figure V2C.1-1, or view an online map at: https://portal.sdmmp.com/map_vegetation.php?taxaid=SDMMP_vegcom_1).
Coastal sage scrub vegetation is composed of a variety of drought-deciduous, soft-leaved, low-growing shrubs typically ≤1 meter tall (Kirkpatrick and Hutchinson 1977; Westman 1981a). The shrubs are well adapted to long, hot, dry summers, and unpredictable winter rainfall of the mediterranean climate region of southern California. This vegetation community occurs from sea level to 1,000 meters in elevation along the California coast, from San Francisco south to El Rosario, Baja California, Mexico (Kirkpatrick and Hutchison 1977; Sproul et al. 2011). Coastal sage scrub tends to grow on southwest-facing slopes with sandy loam soils (Sawyer et al. 2009; Sproul et al. 2011). Fire is a natural process in coastal sage scrub ecosystems, with many shrub and herbaceous understory plants dependent on fire for seed germination and recruitment (Keeley 1986). The MSP Roadmap focuses on coastal sage scrub communities in the western part of San Diego County, including coastal plains, valleys, and foothills. The primary communities include Diegan coastal sage scrub, coastal scrub, maritime succulent scrub, and baccharis-dominated coastal sage scrub (SANDAG 2008).

There are 21 coastal sage scrub alliances in the MSPA that crosswalk to the broader vegetation communities listed above (SANDAG 2012). The Diegan coastal sage scrub community makes up 90% of coastal sage scrub in the MSPA (SANDAG 2012) and includes the most abundant alliances: *Artemisia californica-Eriogonum fasciculaturm, A. californica-Salvia mellifera, Bahiopsis lacinata, Malosma laurina, A. californica,* and *Rhus integrifolia* (Sproul et al. 2011; SANDAG 2012). The maritime succulent scrub community is rare and restricted in distribution along the

**Table V2C.1-1. Total acres of coastal sage scrub and acres of coastal sage scrub on Conserved Lands by MSP Management Units.**

| MU | Total Acres | Acres on Conserved Lands |
|---|---|---|
| 1 | 2,144 | 1,170 |
| 2 | 7,179 | 2,548 |
| 3 | 63,301 | 36,559 |
| 4 | 40,697 | 17,569 |
| 5 | 12,839 | 5,066 |
| 6 | 25,641 | 11,003 |
| 7 | 1,317 | 877 |
| 8 | 27,958 | 4,038 |
| 9 | 4,769 | 2,071 |
| 10 | 16,079 | 10,712 |
| 11 | 19,874 | 15,429 |
| **Grand Total** | **221,798** | **107,042** |

coast from Torrey Pines State Reserve south to the border and includes the *Lycium californicum* provisional alliance and the *Agave shawii* alliance (Sproul et al. 2011; SANDAG 2012). Traditionally, maritime succulent scrub has been mapped farther east into the Otay River Valley and Otay Mesa, but is not distinguished at the alliance level from Diegan coastal sage scrub alliances. Coastal scrub includes *Isocoma menziessi* and *Toxicodendron diversilobum* alliances and baccharis-dominated alliances include *Baccharis pilularis* and B. *sarothroides*.

For more information on coastal sage scrub, go to the MSP Portal Coastal Sage Scrub vegetation summary page: (https://portal.sdmmp.com/view_species.php?taxaid=SDMMP_vegcom_1).

## 1.2 SPECIES USING COASTAL SAGE SCRUB VEGETATION

San Diego County has high biodiversity and the greatest concentration of threatened or endangered species in the U.S. (Dobson et al. 1997). By 1980, an estimated 85% of coastal sage scrub in California had been lost to urbanization

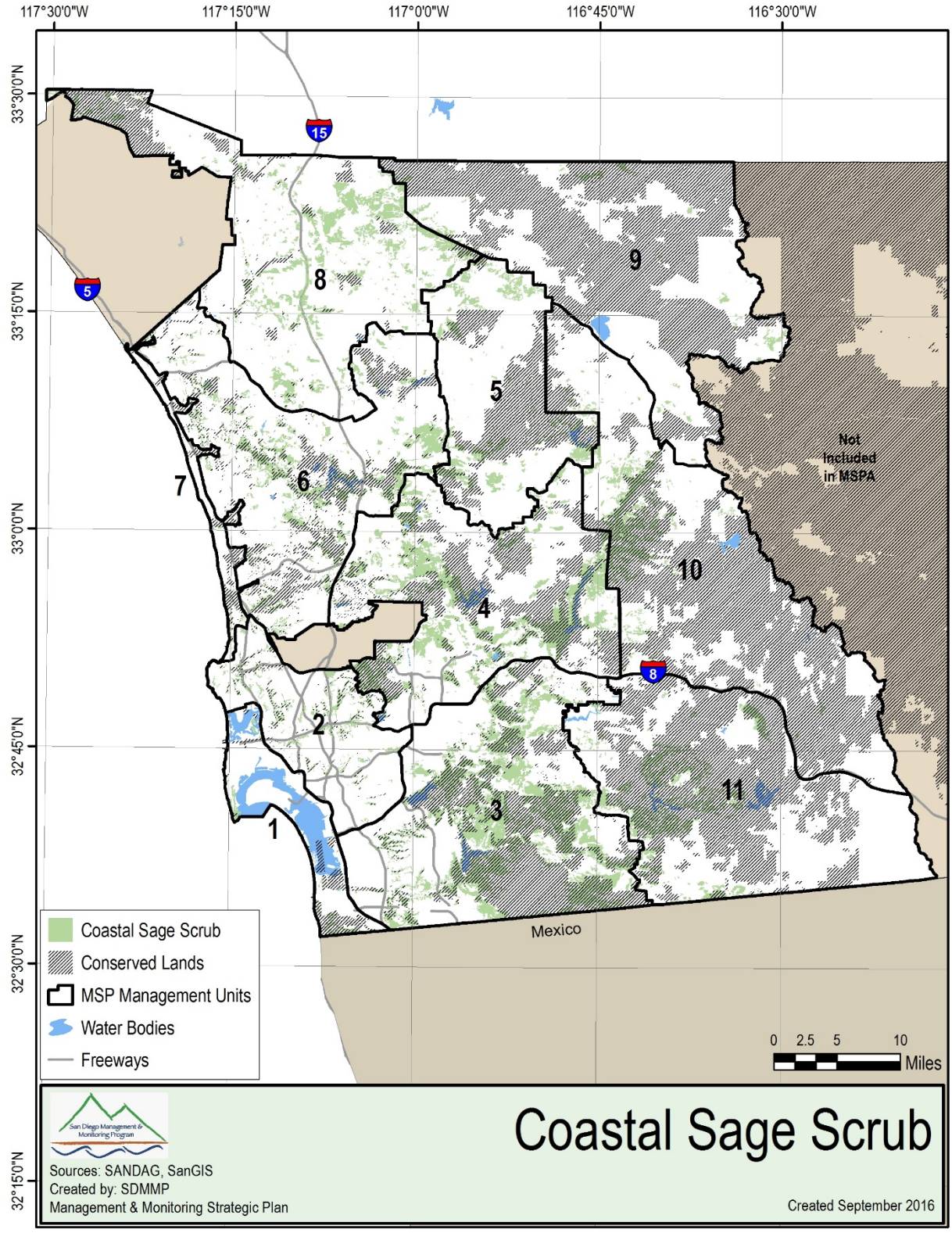


**Figure V2C.1-1. Distribution of coastal sage scrub vegetation in the MSPA.**

(Westman 1981b). Due to the threat of habitat loss to a number of rare and threatened species in the MSPA, several large-scale NCCPs were developed to comply with federal and state laws to protect coastal sage scrub and other natural habitats with rare and endangered species, to preserve biodiversity, and to prevent the decline of more common species. There are 36 MSP species that inhabit only coastal sage scrub or use coastal sage scrub as well as other vegetation types. Seven species are coastal sage scrub VF species that will be managed through management of coastal sage scrub vegetation (Table 2VC.1-2). The remaining 29 SL, SO, SS, VF species from other vegetation types, and VG species will benefit incidentally from coastal sage scrub vegetation management.

## 1.3 THREATS TO COASTAL SAGE SCRUB VEGETATION

Historically, the primary threat to coastal sage scrub vegetation has been loss, fragmentation, and degradation due to urban and agricultural development (Westman 1981b; Minnich and Dezzani 1998). However, simply protecting remaining coastal sage scrub from urban or agricultural development is insufficient to ensure the ecological integrity or biodiversity of this vegetation community.

Currently, the most significant threat to conserved coastal sage scrub is landscape-scale conversion to nonnative grassland (Minnich and Dezzani 1998; Keeley and Brennan 2012). This conversion process is partially the result of an altered fire regime with too frequent fire (Keeley et al. 2005; Keeley and Brennan 2012) and elevated levels of nitrogen deposition from air pollution that enrich conditions for nonnative grasses (Padget et al. 1999; Talluto and Suding 2008; Cox et al. 2014). Climate change may also contribute to this conversion process (Kimball et al. 2014).

An altered fire regime, with a shortened fire return interval of less than 10–15 years (Keeley et al. 2011) can result in vegetation type conversion from coastal sage scrub to nonnative annual grassland (Keeley and Brennan 2012). There were extremely large human-caused Santa Ana wind-driven wildfires in the MSPA in late October 2003 and 2007 (see Vol. 2B, Sec.1.0). In 2003, 4 fires burned simultaneously for a combined total of 369,619 acres and, again in 2007, 8 fires burned concurrently over 314,508 acres. Across the MUs, 95,076 acres (26%) of land that burned in 2003 also burned in 2007. During 2003 and 2007, 124,198 of 222,741 acres (56%) of coastal sage scrub burned. A total of 34,442 acres, or 38% of coastal sage scrub that burned in 2003, burned again in 2007. Coastal sage scrub vegetation communities in MUs 3 and 4 were most impacted by the 2003 and 2007 wildfires. Compared with the historical fire frequency, much of the County has

## Table V2C.1-2. Coastal sage scrub associated MSP species.

| | Scientific name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| **Birds** | | | | |
| | Acanthomintha ilicifolia | San Diego thorn-mint | SO | https://portal.sdmmp.com/view_species.php?taxaid=32426 |
| | Adolphia californica | California adolphia (Spineshrub) | VG | https://portal.sdmmp.com/view_species.php?taxaid=28449 |
| | Agave shawii var shawii | Shaw's agave | SL | https://portal.sdmmp.com/view_species.php?taxaid=810342 |
| | Ambrosia pumila | San Diego ambrosia | SO | https://portal.sdmmp.com/view_species.php?taxaid=36517 |
| | Aphanisma blitoides | Aphanisma | SL | https://portal.sdmmp.com/view_species.php?taxaid=20679 |
| | Atriplex coulteri | Coulter's saltbush | VF | https://portal.sdmmp.com/view_species.php?taxaid=20523 |
| | Bloomeria clevelandii | San Diego goldenstar | SS | https://portal.sdmmp.com/view_species.php?taxaid=509575 |
| | Brodiaea orcuttii | Orcutt's brodiaea | SO | https://portal.sdmmp.com/view_species.php?taxaid=42815 |
| | Chorizanthe orcuttiana | Orcutt's spineflower | SL | https://portal.sdmmp.com/view_species.php?taxaid=21019 |
| | Clinopodium chandleri | San Miguel savory | SL | https://portal.sdmmp.com/view_species.php?taxaid=565077 |
| | Cylindropuntia californica var. californica | Snake cholla | VF | https://portal.sdmmp.com/view_species.php?taxaid=913470 |
| | Deinandra conjugens | Otay tarplant | SS | https://portal.sdmmp.com/view_species.php?taxaid=780273 |
| | Dudleya blochmaniae | Blochman's dudleya | SL | https://portal.sdmmp.com/view_species.php?taxaid=502165 |

| | Scientific name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| | Dudleya brevifolia | Short-leaved dudleya | SL | https://portal.sdmmp.com/view_species.php?taxaid=502166 |
| | Dudleya variegata | Variegated dudleya | SS | https://portal.sdmmp.com/view_species.php?taxaid=502182 |
| | Dudleya viscida | Sticky dudleya | SS | https://portal.sdmmp.com/view_species.php?taxaid=502185 |
| | Ericameria palmeri ssp. palmeri | Palmer's goldenbush | VF | https://portal.sdmmp.com/view_species.php?taxaid=527914 |
| | Erysimum ammophilum | Coast wallflower | SL | https://portal.sdmmp.com/view_species.php?taxaid=22928 |
| | Euphorbia misera | Cliff spurge | VF | https://portal.sdmmp.com/view_species.php?taxaid=28104 |
| | Ferocactus viridescens | San Diego barrel cactus | VF | https://portal.sdmmp.com/view_species.php?taxaid=19801 |
| | Hazardia orcuttii | Orcutt's hazardia | SL | https://portal.sdmmp.com/view_species.php?taxaid=502882 |
| | Monardella viminea | Willowy monardella | SL | https://portal.sdmmp.com/view_species.php?taxaid=833060 |
| | Nolina cismontana | Chaparral nolina | SL | https://portal.sdmmp.com/view_species.php?taxaid=507567 |
| | Rosa minutifolia | Small-leaved rose | SS | https://portal.sdmmp.com/view_species.php?taxaid=504824 |
| | Tetracoccus dioicus | Parry's tetracoccus | SS | https://portal.sdmmp.com/view_species.php?taxaid=28420 |
| **Invertebrates** | | | | |
| | Euphydryas editha quino | Quino checkerspot butterfly | SL | https://portal.sdmmp.com/view_species.php?taxaid=779299 |
| | Lycaena hermes | Hermes copper | SL | https://portal.sdmmp.com/view_species.php?taxaid=777791 |
| **Amphibians** | | | | |
| | Spea hammondii | Western spadefoot toad | VF | https://portal.sdmmp.com/view_species.php?taxaid=206990 |
| **Reptiles** | | | | |
| | Aspidoscelis hyperythra | Orange-throated whiptail | VG | https://portal.sdmmp.com/view_species.php?taxaid=914116 |

| | Scientific name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| | Crotalus ruber | Red diamond rattlesnake | VG | https://portal.sdmmp.com/view_species.php?taxaid=174316 |
| | Phrynosoma blainvillii | Blainville's horned lizard (Coast horned lizard, San Diego horned lizard) | VF | https://portal.sdmmp.com/view_species.php?taxaid=208819 |
| **Birds** | | | | |
| | Accipiter cooperii | Cooper's hawk | VG | https://portal.sdmmp.com/view_species.php?taxaid=175309 |
| | Aimophila ruficeps canescens | Southern California rufous-crowned sparrow | VG | https://portal.sdmmp.com/view_species.php?taxaid=179383 |
| | Campylorhynchus brunneicapillus sandiegensis | Coastal cactus wren | SO | https://portal.sdmmp.com/view_species.php?taxaid=917698 |
| | Polioptila californica californica | Coastal California gnatcatcher | VF | https://portal.sdmmp.com/view_species.php?taxaid=925072 |
| **Mammals** | | | | |
| | Antrozous pallidus | Pallid bat | SL | https://portal.sdmmp.com/view_species.php?taxaid=180006 |
| | Lepus californicus bennettii | San Diego black-tailed jackrabbit | VF | https://portal.sdmmp.com/view_species.php?taxaid=900973 |
| | Puma concolor | Mountain lion | SL | https://portal.sdmmp.com/view_species.php?taxaid=552479 |
| | Taxidea taxus | American badger | SL | https://portal.sdmmp.com/view_species.php?taxaid=180565 |

burned too frequently since 2000, especially in the inland valleys and foothills. These recent fires have been shown to degrade coastal sage scrub vegetation, with a loss of native shrubs and prevalence of nonnative grasses (see Vol. 2B, Sec.1.0 for more detail).

Air pollution has caused elevated levels of inorganic nitrogen deposition across southern California and is contributing to landscape-scale conversion of coastal sage scrub to nonnative grassland, both with and without an altered fire regime (Talluto and Suding 2008; Cox et al. 2014). Climate change is projected to lead to a warming climate with more frequent, intense and prolonged droughts in California (Diffenbaugh et al. 2015). Coastal sage scrub shrubs are adapted to semi-arid conditions, although there can be considerable shrub mortality during intensive and prolonged droughts (Minnich and Dezzani 1998; Keeley et al. 2009; Kimball et al. 2014). The combination of drought and nitrogen deposition has been experimentally shown to slow or alter post-fire recovery of coastal sage scrub and to facilitate conversion to nonnative grassland (Kimball et al. 2014). Thus, fire, drought, and nitrogen deposition acting alone and in concert are threatening large-scale type conversion of coastal sage scrub to annual grassland in the MSPA.

## 1.4 MANAGEMENT AND MONITORING APPROACH

This section provides the rationale for management and monitoring objectives for coastal sage scrub vegetation and for MSP species assigned to the coastal sage scrub VF group. Conversion of coastal sage scrub to nonnative grassland as a result of altered fire regime, nitrogen deposition, and changing climate is the greatest threat that needs to be monitored and potentially managed in coastal sage scrub vegetation communities. The management and monitoring approach is based on an adaptive management framework, in which a science-based, information-gathering process includes monitoring management targets and testing the effectiveness of management actions to provide information to inform the management strategy and the actions necessary to achieve management goals. This iterative process is intended to refine and improve the effectiveness of the management strategy over time, and of the management actions to implement that strategy. See Vol. 1, Sec. 2.0 and Vol. 2A for further details on the overall management and monitoring approach.

The management goal for coastal sage scrub vegetation is to maintain, enhance, and restore coastal sage scrub on Conserved Lands in the MSPA that support or has the potential to support VF species, and to incidentally benefit a diverse array of other MSP species, so that the vegetation community has high ecological integrity.

These species are resilient to environmental stochasticity, catastrophic disturbances, and threats and will be likely to persist over the long term (>100 years).

The primary monitoring objective is to establish a long-term vegetation monitoring program to determine the distribution, composition, structure, ecological integrity, habitat associations, and threat risks of burned and unburned coastal sage scrub vegetation plots in a mosaic of chaparral and grassland vegetation communities across the MSPA. Ecological integrity and other attributes of coastal sage scrub communities will be tracked over time in response to multiple, potentially interacting threats such as an altered fire regime, changing climate, nitrogen deposition, and invasive nonnative plant species. The intent is to determine how different, often interacting threats and environmental conditions are associated with changes in vegetation community attributes and how these responses are affected by management. The ecological integrity of coastal sage scrub vegetation will be defined by cover, density, and richness of native shrubs and cover of exotic nonnative grasses and forbs. Other measures of ecological integrity can be added to the vegetation monitoring program to assess the overall integrity of the coastal sage scrub ecosystem. Potential measures of the ecological integrity of the coastal sage scrub ecosystem include monitoring the diversity and abundance of other taxonomic groups (e.g., invertebrates, reptiles, birds, small mammals, etc.), evaluating important ecological processes (e.g., pollination services, food webs, soil biogeochemical cycles), and tracking abiotic conditions (e.g., climate, soil temperature and moisture).

A second monitoring objective is to test and develop BMPs to control invasive nonnative plants at a landscape scale, particularly annual grasses that pose a risk of vegetation type conversion of coastal sage scrub to nonnative grassland. Large-scale management experiments will be implemented to test the effectiveness of different invasive plant control methods including grazing, prescribed fire, herbicide, and mechanical methods.

A third monitoring objective is to determine the distribution, status, habitat associations, threats, and management needs of the 7 coastal sage scrub VF species. Monitoring plans will be developed and integrated as feasible into the vegetation monitoring. Monitoring will be conducted to gather information that will be used to identify the management needs of VF species in coastal sage scrub communities in the MSPA.

These 3 types of monitoring data will be analyzed and the results used to develop and implement a management strategy for coastal sage scrub vegetation. A

management plan will be developed that identifies and prioritizes management actions to maintain, enhance, or restore the ecological integrity of coastal sage scrub in areas that support or have the potential to support coastal sage scrub VF species, high biodiversity, and important ecological processes. The management plan will include a monitoring component to determine the effectiveness of management actions and the overall management strategy.

2017–2021 Planning Cycle Management and Monitoring Approach

For the 2017–2021 planning cycle, the focus will be to gather information to characterize coastal sage scrub vegetation communities, to develop BMPs and to assess coastal sage scrub VF species. The monitoring plan will be based on a conceptual model to identify covariates to collect in assessing habitat conditions and threats to identify and prioritize management needs in future planning cycles. The monitoring plan will utilize a sampling design that incorporates ecological integrity classes mapped across the entire MSPA using remote imagery. Permanent sampling plots will be established along north-to-south and east-to-west gradients across the MSPA to capture the full range of environmental conditions and vegetation community characteristics. To further characterize spatial variation, there will also be a subset of sampling plots that are monitored on a rotating basis. Coastal sage scrub VF species monitoring data will be collected to provide information to determine whether management is needed to restore or enhance sites that support or have potential to support MSP species. Development and testing of BMPs are important in determining management actions to be included in development of a management plan for coastal sage scrub. Prioritization and implementation of management actions are planned for the 2022–2026 planning cycle after all the monitoring components have been implemented and information is available to guide management planning and decision making.

### 1.4.1 General Approach Objectives

Below is a summary of the management and monitoring objectives for coastal sage scrub vegetation. For the most up-to-date goals, objectives, and actions, go to the MSP Portal: https://portal.sdmmp.com/tracker.php?Target=veg+community&Species=SDMMP_vegcom_1&ActionStatus=&ManagementUnit=&ObjectiveType=&Year=&Preserve=&Short=Long&submit=Submit.

There are currently 5 objectives included for coastal sage scrub vegetation monitoring in the MSP Roadmap 2017–2021 planning cycle. Three objectives involve establishing and implementing the long-term monitoring program. The first objective includes developing a monitoring plan that includes permanent sampling plots with a rotating panel of plots to expand spatial sampling. The sampling design will be informed by the second objective of mapping integrity classes at the landscape scale based upon remote imagery (satellite imagery, high resolution aerial photographs, and LIDAR). The third objective is to implement the monitoring. In the first year, pilot monitoring will be conducted to test the ecological integrity classifications and evaluate the monitoring protocols and sampling design. Data from the pilot monitoring will be used to finalize the vegetation monitoring plan. After the plan is finalized, there will be 3 years of monitoring to gather information on annual variability in coastal sage scrub vegetation community attributes and to increase the spatial distribution with the rotating panel of sample plots. Monitoring data will then be analyzed to identify management needs for coastal sage scrub communities across the MSPA and to determine the frequency of future monitoring.

The other 2 vegetation monitoring objectives are to develop and implement a plan to test grazing, prescribed fire, and other methods of landscape-scale control of invasive annual grasses and forbs in coastal sage scrub vegetation. This plan will test the effectiveness of management methods and their effects on the vegetation community, MSP species, measures of ecological integrity, and other monitoring targets to determine beneficial and adverse effects of the different management methods. After testing the methods detailed in the grazing management plan and analyzing the results, BMPs will be developed to guide large-scale management of invasive annual grasses in coastal sage scrub vegetation.

### 1.4.2 Species-Specific Approach Objectives

There are 7 coastal sage scrub VF species: 4 plant species, and 1 amphibian, 1 bird. and 1 mammal species with monitoring objectives in the 2017–2021 planning cycle (Table V2C.1-2). Management objectives will be implemented in the 2022–2026 planning cycle with the development and implementation of a coastal sage scrub management plan. View all relevant goals, objectives, and actions here: https://portal.sdmmp.com/tracker.php?Target=veg+community&Species=SDMMP_vegcom_1&MonMgtObjType=&ActionStatus=&ManagementUnit=&ObjectiveType=&Year=&Preserve=&Short=Long&submit=Submit.

The 4 plant species—cliff spurge, Palmer's goldenbush, San Diego barrel cactus, and snake cholla—all have an objective to use the regional "Inspect and Manage" protocol to record abundance and collect habitat and threat covariate data to determine management needs at occurrences. This information is intended to inform routine and intensive management actions identified in the Coastal Sage Scrub Management Plan in the 2022–2026 planning cycle.

For Blainville's horned lizard, there is an objective to continue a next-generation DNA sequencing study that began in 2015 to determine connectivity of this species in southern California. This information is important in determining small vertebrate connectivity in the MSPA. There are objectives to develop and implement a monitoring plan to determine the distribution, status, habitat associations, and level of threats to occurrences of this species in the MSPA. The results of monitoring will be integrated into the identification and prioritization of management actions in the coastal sage scrub management plan.

For the black-tailed jackrabbit, there are objectives to prepare and implement a monitoring plan to track their distribution and status and to assess habitat and threat risks. This plan is intended to integrate to the extent feasible into the vegetation monitoring program and results will be used to develop the coastal sage scrub management plan in the next planning cycle.

Coastal California Gnatcatcher Objectives

The coastal California gnatcatcher is the flagship species for the creation of NCCPs to protect coastal sage scrub habitats in southern California. A regional long-term monitoring program was developed in 2015 and implemented in 2016 to determine the percent area occupied (PAO) by California gnatcatchers across their southern California range, to collect vegetation covariate data to better understand their habitat relationships, and to track changes in PAO over time. This monitoring program will allow a range-wide assessment of the status of this species over time and determine if there is a need to manage coastal sage scrub vegetation to increase the PAO. The MSPA includes more sampling locations, based on modeled gnatcatcher habitat, than any other subregion and sample sizes are sufficient to allow a subregional analysis of gnatcatcher PAO within the MSPA. The monitoring plan was implemented in 2016 and the results are currently being analyzed. The 2017–2021 planning cycle includes an objective to implement another round of regional/subregional California gnatcatcher monitoring as part of the long-term tracking of changes in PAO and documenting colonization and extinction rates in relation to habitat covariates. It is anticipated the second round

of monitoring would occur in 2020 or 2021, with the exact timing to be determined based upon the results of the 2016 monitoring.

Within the MSPA, there is also an objective to continue a study implemented in 2015 and 2016 to study recovery of California gnatcatcher populations and coastal sage scrub following wildfires in 2003, 2007, and 2014. This monitoring would be conducted in conjunction with the regional/subregional monitoring in 2020 or 2021. The results of both monitoring objectives will be used to develop specific management recommendations to include in the Coastal Sage Scrub Management Plan to be developed in the 2022–2026 planning cycle.

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# 2.0 CHAPARRAL

## 2.1 OVERVIEW OF THE CHAPARRAL VEGETATION COMMUNITY

Chaparral is the most abundant and widespread vegetation community in the MSPA with 709,024 acres in all MUs, of which 406,270 acres are conserved (Table V2C.2-1; Figure V2C.2-1, or view an online map at: https://portal.sdmmp.com/map_vegetation.php?taxaid=SDMMP_vegcom_3).
Chaparral vegetation is composed of a variety of evergreen, sclerophyllus, 1- to 4-meter-tall, drought- and fire-tolerant shrubs (Quinn and Keeley 2006). The shrubs are well adapted to long, hot, dry summers, and unpredictable winter rainfall of the mediterranean climate region of San Diego County. Chaparral shrubs typically grow on steep, rocky, dry slopes with granitic and mafic or metavolcanic soils, although these shrubs also occur in more mesic conditions, on sandy soils or shallower slopes. Chaparral vegetation is often dense with an understory of shorter-lived small shrubs and forbs and small openings with bare soil. Fire is a natural process in chaparral ecosystems, and is required for germination of some shrub species while other shrubs recover by stump sprouting. The MSP Roadmap focuses on chaparral communities in the western part of San Diego County, including coastal plains, valleys, and foothills, but not the mountains. These communities include southern mixed chaparral (granitic southern mixed chaparral and mafic southern mixed chaparral), northern mixed chaparral, chamise chaparral, scrub oak chaparral, southern maritime chaparral, and coastal sage-chaparral transition (Oberbauer et al. 2008).

There are 15 chaparral alliances in the MSPA that crosswalk to the broader vegetation communities listed above (SANDAG 2012). The southern mixed chaparral community includes some of the most abundant chaparral alliances: *A. fasciculatum-Xylococcus bicolor, Arctostaphylos glandulosa*, and *Cenothus tomentosus* (Sproul et al. 2011; SANDAG 2012). The chamise chaparral community with the *A. fasciculatum* alliance is second most abundant, followed by the scrub oak chaparral community with the *Quercus (berberidifolia x acutidens)* and *Q. (berberidifolia x acutidens)-A. fasciculatum* alliances. Southern maritime chaparral is a low and fairly open chaparral found in the coastal fog belt (Oberbauer et al. 2008). It is dominated by sensitive MSP plant species, including *Ceanothus verrucosus* and *Arctostaphylos glandulosa* ssp. *crassifolia*. Southern maritime chaparral occurs in weathered sands. The coastal sage-chaparral transition community is an intermediate between coastal scrub and chaparral communities

and is usually a post-fire successional community (Oberbauer et al. 2008). It is a mix of sclerophyllous species, woody chaparral species, and drought-deciduous, malacophyllous sage scrub species. *A. fasciculatum* and *Artemisia californica* are codominants.

**Table V2C.2-1. Total acres of chaparral and acres of chaparral on Conserved Lands by MSP Management Units.**

| MU | Total Acres | Acres on Conserved Lands |
|---|---|---|
| **1** | 195 | 16 |
| **2** | 1,579 | 436 |
| **3** | 52,635 | 29,270 |
| **4** | 70,473 | 35,162 |
| **5** | 56,188 | 27,827 |
| **6** | 33,408 | 14,764 |
| **7** | 895 | 693 |
| **8** | 49,511 | 15,910 |
| **9** | 141,785 | 97,002 |
| **10** | 140,373 | 95,223 |
| **11** | 161,982 | 89,966 |
| **Grand Total** | **709,024** | **406,270** |

For more information on chaparral, go to the MSP Portal Chaparral vegetation summary page: (https://portal.sdmmp.com/view_species.php?taxaid=SDMMP_vegcom_3).

## 2.2 SPECIES USING CHAPARRAL VEGETATION

Chaparral vegetation communities support a rich diversity of plant and animal species, some of which are only found in chaparral and others that use a variety of vegetation types. There are 50 MSP species that inhabit or use chaparral, 9 of which are chaparral VF species that will be managed through management of chaparral vegetation (Table 2VC.2-1). The remaining 41 SL, SO, SS, VF species from other vegetation types, and VG species will benefit incidentally from chaparral vegetation management.

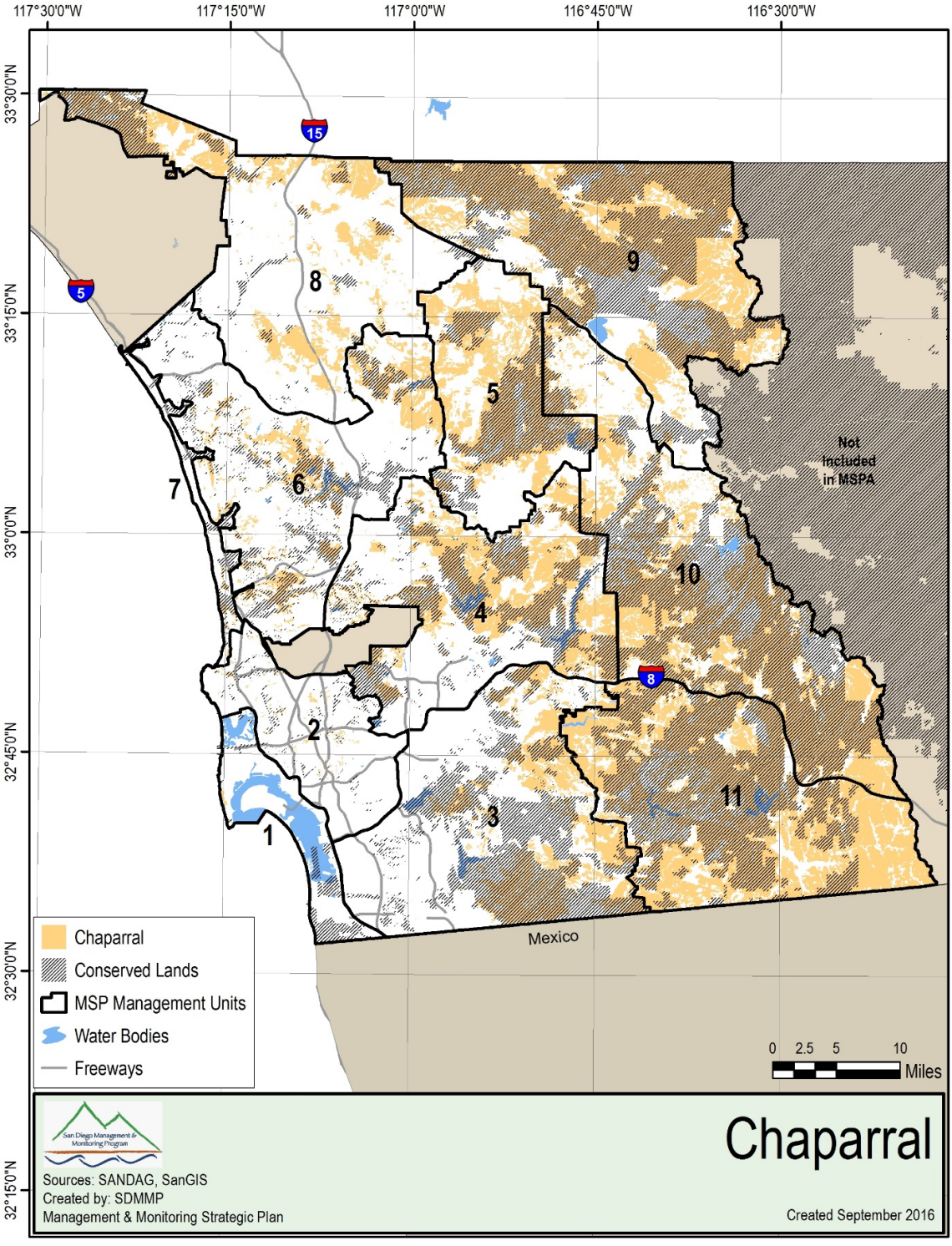


**Figure V2C.2-1. Distribution of chaparral vegetation in the MSPA.**

## 2.3 THREATS TO CHAPARRAL VEGETATION

An altered fire regime, with a shortened fire return interval of less than 30 years (Keeley et al. 2011) can threaten chaparral through vegetation type conversion from chaparral to nonnative annual grassland (Keeley and Brennan 2012). Extremely large human-caused Santa Ana wind-driven wildfires occurred in the MSPA in late October 2003 and 2007 (see Vol. 2B, Sec. 1.0). In 2003, 4 fires burned simultaneously for a combined total of 369,619 acres and, again in 2007, 8 fires burned concurrently over 314,508 acres. Across the MUs, 95,076 acres (26%) of land that burned in 2003 also burned in 2007. During 2003 and 2007, 250,616 acres of chaparral burned once and over 41,251 acres burned in both years. Compared with the historical fire frequency, much of the County has burned too frequently since 2000, especially in the inland valleys and foothills. Areas that have burned less frequently than the historical record include higher mountain slopes at the east edge of the MSPA in MUs 10 and 11; areas of MUs 6 and 8; and fragments within the urban matrix in MUs 2, 3, and 6.

Loss of habitat to urban development is another threat to chaparral vegetation communities in the MSPA. Chaparral near urban development may also experience disturbances such as habitat alteration, as well as other disturbances from the creation of road and trails (Sauvajot et al. 1998). Climate change is projected to lead to a warming climate with more frequent, intense, and prolonged droughts in California (Diffenbaugh et al. 2015). Chaparral shrubs are adapted to semi-arid conditions, although there can be considerable shrub mortality during intensive and prolonged droughts (Kelly and Goulden 2008; Keeley et al. 2009). Regional changes in climate have been attributed to elevational shifts in chaparral shrub species in the Santa Rosa Mountains of southern California (Kelly and Goulden 2008). The mechanism involves shrub mortality during drought at lower elevations with warmer, drier conditions and warmer minimum temperatures at higher elevations allowing shrubs to move upslope into more mesic areas that were formerly too cold.

## 2.4 MANAGEMENT AND MONITORING APPROACH

This section provides the rationale for management and monitoring objectives for chaparral vegetation and for MSP species assigned to the chaparral VF group. An altered fire regime and changing climate contributing to type conversion of chaparral to nonnative grassland are the greatest threats that need to be monitored and potentially managed in chaparral vegetation communities. The approach is based on an adaptive management framework, in which a science-

based, information-gathering process informs, refines, and improves the effectiveness of a management strategy and of the management actions to implement that strategy.

The management goal for chaparral vegetation is to maintain, enhance, and restore chaparral on Conserved Lands that supports or has the potential to support VF species and to incidentally benefit a diverse array of other species so that the vegetation community has high ecological integrity, and these species are resilient to environmental stochasticity, catastrophic disturbances, and threats to persist over the long term (>100 years).

The monitoring objectives are to establish and implement a long-term vegetation monitoring program to assess the distribution, composition, structure, ecological integrity, habitat associations, and threat risks of burned and unburned chaparral vegetation in a mosaic of coastal sage scrub and grassland vegetation communities across the MSPA (see Vol. 2C.1 and Vol. 1, Sec. 2A for further details on the monitoring plan). The purpose of the monitoring program is to track ecological integrity in chaparral communities over time in response to multiple, potentially interacting threats such as an altered fire regime, changing climate, and invasive nonnative plant species.

For the 2017–2021 planning cycle, the focus will be to gather information to characterize chaparral vegetation communities, habitat conditions, and threats in order to identify and prioritize management needs in future planning cycles. The monitoring plan will utilize a sampling design that incorporates ecological integrity classes mapped across the entire MSPA using remote imagery. Permanent sampling plots will be established along north-to-south and east-to-west gradients across the MSPA to capture the full range of environmental conditions and vegetation community characteristics. To further characterize spatial variation, a subset of sampling plots will also be monitored on a rotating basis. The monitoring program will provide information to determine whether management is needed to restore or enhance sites that support or have potential to support MSP species, high biodiversity, and important ecosystem functions. Prioritization and implementation of management actions is planned for the 2022–2026 planning cycle after monitoring the chaparral VF species to gather data on their distributions, status, habitat associations, threat risks, and management needs.

Monitoring chaparral VF species is delayed until the 2022–2026 planning cycle, as these species are considered more stable at this time than species from other vegetation communities.

### 2.4.1 General Approach Objectives

Below is a summary of the management and monitoring objectives for chaparral vegetation. For the most up-to-date goals, objectives, and actions, go to the MSP Portal:
https://portal.sdmmp.com/tracker.php?Target=veg+community&Species=SDMMP_vegcom_3&MonMgtObjType=&ActionStatus=&ManagementUnit=&ObjectiveType=&Year=&Preserve=&Short=Long&submit=Submit.

There are currently 3 objectives included for chaparral vegetation monitoring in the MSP Roadmap 2017–2021 planning cycle. Objectives to establish the long-term monitoring program include developing a monitoring plan (see Vol. 1, Sec. 2A and Vol. 2, Sec. 2C for further details on the monitoring plan) that includes permanent sampling plots with a rotating panel of plots to expand spatial sampling. The sampling design will be informed by mapping integrity classes at the landscape scale based upon remote imagery (satellite imagery, high-resolution aerial photographs, and LIDAR). One year of pilot monitoring will be conducted to test the ecological integrity classifications and evaluate the monitoring protocols and sampling design. Data from the pilot monitoring will be used to finalize the vegetation monitoring plan. After the plan is finalized, there will be 3 years of monitoring to gather information on annual variability in chaparral vegetation community attributes and to increase the spatial distribution with the rotating panel of sample plots. Monitoring data will then be analyzed to identify management needs for chaparral communities across the MSPA and to determine the frequency of future monitoring.

### 2.4.2 Species-Specific Approach Objectives

There are 9 chaparral VF species: 7 plants, 1 amphibian, and 1 bird (Table V2C.2-2). The coastal southern maritime chaparral alliance supports 3 chaparral VF species: Del Mar manzanita, Nuttall's scrub oak, and wart-stemmed ceanothus. Three chaparral VF species have small, restricted distributions in the MSPA: Rainbow manzanita at the northern border, Lakeside ceanothus in the center, and Otay manzanita at the southern border. Other chaparral VF species with a broader range in the MSPA include felt-leaved monardella, California newt, and Bell's sparrow. For more information on the chaparral VF species, see their species profiles (links to profiles in Table V2C.2-2).

## Table V2C.2-2. Chaparral associated MSP species.

| | Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| **Plants** | | | | |
| | Acanthomintha ilicifolia | San Diego thorn-mint | SO | https://portal.sdmmp.com/view_species.php?taxaid=32426 |
| | Ambrosia pumila | San Diego ambrosia | SO | https://portal.sdmmp.com/view_species.php?taxaid=36517 |
| | Arctostaphylos glandulosa ssp. Crassifolia | Del Mar manzanita | VF | https://portal.sdmmp.com/view_species.php?taxaid=183557 |
| | Arctostaphylos otayensis | Otay manzanita | VF | https://portal.sdmmp.com/view_species.php?taxaid=23507 |
| | Arctostaphylos rainbowensis | Rainbow manzanita | VF | https://portal.sdmmp.com/view_species.php?taxaid=507811 |
| | Baccharis vanessae | Encinitas baccharis | SO | https://portal.sdmmp.com/view_species.php?taxaid=183764 |
| | Bloomeria clevelandii | San Diego goldenstar | SS | https://portal.sdmmp.com/view_species.php?taxaid=509575 |
| | Calochortus dunnii | Dunn's mariposa lily | VG | https://portal.sdmmp.com/view_species.php?taxaid=42844 |
| | Ceanothus cyaneus | Lakeside ceanothus | VF | https://portal.sdmmp.com/view_species.php?taxaid=28461 |
| | Ceanothus verrucosus | Wart-stemmed ceanothus | VF | https://portal.sdmmp.com/view_species.php?taxaid=28518 |
| | Chorizanthe orcuttiana | Orcutt's spineflower | SL | https://portal.sdmmp.com/view_species.php?taxaid=21019 |
| | Clinopodium chandleri | San Miguel savory | SL | https://portal.sdmmp.com/view_species.php?taxaid=565077 |

| Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|
| Comarostaphylis diversifolia ssp. Diversifolia | Summer-holly | VG | https://portal.sdmmp.com/view_species.php?taxaid=23640 |
| Cylindropuntia californica var. californica | Snake cholla | VF | https://portal.sdmmp.com/view_species.php?taxaid=913470 |
| Dicranostegia orcuttiana | Orcutt's bird's-beak | SL | https://portal.sdmmp.com/view_species.php?taxaid=834156 |
| Dudleya blochmaniae | Blochman's dudleya | SL | https://portal.sdmmp.com/view_species.php?taxaid=502165 |
| Dudleya brevifolia | Short-leaved dudleya | SL | https://portal.sdmmp.com/view_species.php?taxaid=502166 |
| Dudleya variegata | Variegated dudleya | SS | https://portal.sdmmp.com/view_species.php?taxaid=502182 |
| Dudleya viscida | Sticky dudleya | SS | https://portal.sdmmp.com/view_species.php?taxaid=502185 |
| Ericameria palmeri ssp. Palmeri | Palmer's goldenbush | VF | https://portal.sdmmp.com/view_species.php?taxaid=527914 |
| Erysimum ammophilum | Coast wallflower | SL | https://portal.sdmmp.com/view_species.php?taxaid=22928 |
| Ferocactus viridescens | San Diego barrel cactus | VF | https://portal.sdmmp.com/view_species.php?taxaid=19801 |
| Fremontodendron mexicanum | Mexican flannelbush | SL | https://portal.sdmmp.com/view_species.php?taxaid=21581 |
| Hazardia orcuttii | Orcutt's hazardia | SL | https://portal.sdmmp.com/view_species.php?taxaid=502882 |
| Lepechinia cardiophylla | Heart-leaved pitcher sage | SL | https://portal.sdmmp.com/view_species.php?taxaid=32553 |
| Lepechinia ganderi | Gander's pitcher sage | VG | https://portal.sdmmp.com/view_species.php?taxaid=32555 |
| Monardella hypoleuca ssp. | Felt-leaved monardella | VF | https://portal.sdmmp.com/view_species.php?taxaid=524318 |

| Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|
| Lanata | | | |
| Monardella stoneana | Jennifer's monardella | SL | https://portal.sdmmp.com/view_species.php?taxaid=832834 |
| Monardella viminea | Willowy monardella | SL | https://portal.sdmmp.com/view_species.php?taxaid=833060 |
| Nolina cismontana | Chaparral nolina | SL | https://portal.sdmmp.com/view_species.php?taxaid=507567 |
| Nolina interrata | Dehesa nolina | SO | https://portal.sdmmp.com/view_species.php?taxaid=42992 |
| Packera ganderi | Gander's ragwort | SO | https://portal.sdmmp.com/view_species.php?taxaid=565357 |
| Pinus torreyana ssp. Torreyana | Torrey pine | VF | https://portal.sdmmp.com/view_species.php?taxaid=183392 |
| Quercus dumosa | Nuttall's scrub oak | VF | https://portal.sdmmp.com/view_species.php?taxaid=19323 |
| Quercus engelmannii | Engelmann Oak | VF | https://portal.sdmmp.com/view_species.php?taxaid=19329 |
| Rosa minutifolia | Small-leaved rose | SS | https://portal.sdmmp.com/view_species.php?taxaid=504824 |
| Tetracoccus dioicus | Parry's tetracoccus | SS | https://portal.sdmmp.com/view_species.php?taxaid=28420 |
| **Invertebrates** | | | |
| Euphydryas editha quino | Quino checkerspot butterfly | SL | https://portal.sdmmp.com/view_species.php?taxaid=779299 |
| **Amphibians** | | | |
| Taricha torosa torosa | Coast range newt | VF | https://portal.sdmmp.com/view_species.php?taxaid=208226 |
| **Reptiles** | | | |
| Aspidoscelis hyperythra | Orange-throated whiptail | VG | https://portal.sdmmp.com/view_species.php?taxaid=914116 |
| Crotalus ruber | Red diamond rattlesnake | VG | https://portal.sdmmp.com/view_species.php?taxaid=174316 |

| | Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| | Phrynosoma blainvillii | Blainville's horned lizard (Coast horned lizard, San Diego horned lizard) | VF | https://portal.sdmmp.com/view_species.php?taxaid=208819 |
| **Birds** | | | | |
| | Accipiter cooperii | Cooper's hawk | VG | https://portal.sdmmp.com/view_species.php?taxaid=175309 |
| | Aquila chrysaetos Canadensis | Golden eagle | SO | https://portal.sdmmp.com/view_species.php?taxaid=175408 |
| | Artemisiospiza belli belli | Bell's sparrow | VF | https://portal.sdmmp.com/view_species.php?taxaid=998052 |
| **Mammals** | | | | |
| | Chaetodipus fallax fallax | Northwestern San Diego pocket mouse | VG | https://portal.sdmmp.com/view_species.php?taxaid=900826 |
| | Odocoileus hemionus fuliginata | Southern mule deer | SS | https://portal.sdmmp.com/view_species.php?taxaid=898459 |
| | Plecotus townsendii pallescens | Townsend's big-eared bat | SO | https://portal.sdmmp.com/view_species.php?taxaid=203457 |
| | Puma concolor | Mountain lion | SL | https://portal.sdmmp.com/view_species.php?taxaid=552479 |
| | Taxidea taxus | American badger | SL | https://portal.sdmmp.com/view_species.php?taxaid=180565 |

MSP monitoring or management objectives for chaparral VF species have been delayed to the 2022–2026 MSP Roadmap planning cycle.

## 2.5 CHAPARRAL REFERENCES

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# 3.0 GRASSLAND

## 3.1 OVERVIEW OF THE GRASSLAND VEGETATION COMMUNITY

Grassland is the third most abundant and widespread vegetation community in the MSPA with 135,749 acres in all MUs, 47,731 acres (35%) of which are conserved (Table V2C.3-1; Figure V2C.3-1, or view an online map at: https://portal.sdmmp.com/map_vegetation.php?taxaid=SDMMP_vegcom_2). Grasslands in order of abundance are most prevalent in MUs 9, 10, 3, 5 and 6.

The grassland vegetation community comprises grasslands dominated by native grasses and grasslands that are dominated primarily by nonnative grasses and, to a lesser extent, nonnative forbs. Nonnative grasslands are most prevalent with only a small fraction of native grasslands occurring in the MSPA. Grasslands in the MSPA are managed for different purposes. Native grasslands are managed to increase native grass and forb cover and diversity, while large, expansive nonnative grasslands are managed to provide the optimal structure to support habitat for MSP species. For example, golden eagle and badger need large, undisturbed grasslands with low grass cover that supports prey species, such as rabbits and California ground squirrels. Western burrowing owls also need similar grasslands with ground squirrels that serve as ecosystem engineers and provide burrows (San Diego Zoo Institute for Conservation Research 2016). Shrublands heavily invaded with nonnative grasses are also managed to reduce cover of these species to promote native grasses, forbs, and shrubs and avoid vegetation type conversion to nonnative grassland.

The grassland vegetation community includes 2 native grassland alliances and 5 nonnative semi-natural stands of nonnative grasses and forbs in the western portion of the MSPA that are mapped to the alliance level (SANDAG 2012). A semi-natural stand is a classification similar to an alliance but dominated by nonnative species. The *Nasella pulchra* alliance is mapped on over 1,200 acres (SANDAG 2012) and is dominated by this native bunchgrass or it is present with other native perennial grasses and forbs (Sproul et al. 2011). This alliance occurs from the coast to inland foothills and mountain valleys in heavy soils in valley bottoms that have not been previously tilled and in clay soils on slopes. The *Leymus triticoides* alliance is dominated by this native grass species or codominant with other native and

nonnative grasses and forbs (Sproul et al. 2011). It is mapped on only an acre in the area of the MSPA mapped to alliance level (SANDAG 2012). It can tolerate saline to alkaline soils and is found in moist areas at the edges of salt marshes or riparian terraces (Sproul et al. 2011). Most grassland is classified as Mediterranean California naturalized annual and perennial semi-natural grassland in which nonnative grasses and forbs are dominant over native species. Other semi-natural stands include those dominated by *Avena barbata; Brassica nigra* and other mustards; *Bromus (diandrus, hordaceus)-Brachypodium distachyon*; *Glebionis coronaria*; *Bromus rubens–Schismus (arabicus, barbatus);* and *Pennisetum setaceum* (Sproul et al. 2011).

For more information on the grassland vegetation community, go to the MSP Portal Grassland vegetation summary page: https://portal.sdmmp.com/view_species.php?taxaid=SDMMP_vegcom_2.

**Table V2C.3-1. Total acres of grassland and acres on Conserved Lands by MSP Management Units.**

| MU | Total Acres | Acres on Conserved Lands |
|---|---|---|
| **1** | 1,567 | 909 |
| **2** | 1,578 | 380 |
| **3** | 20,477 | 9,722 |
| **4** | 7,672 | 2,502 |
| **5** | 16,324 | 2,977 |
| **6** | 15,379 | 5,171 |
| **7** | 530 | 307 |
| **8** | 11,924 | 1,020 |
| **9** | 26,757 | 15,924 |
| **10** | 23,355 | 6,516 |
| **11** | 10,186 | 2,303 |
| **Grand Total** | **135,749** | **47,731** |

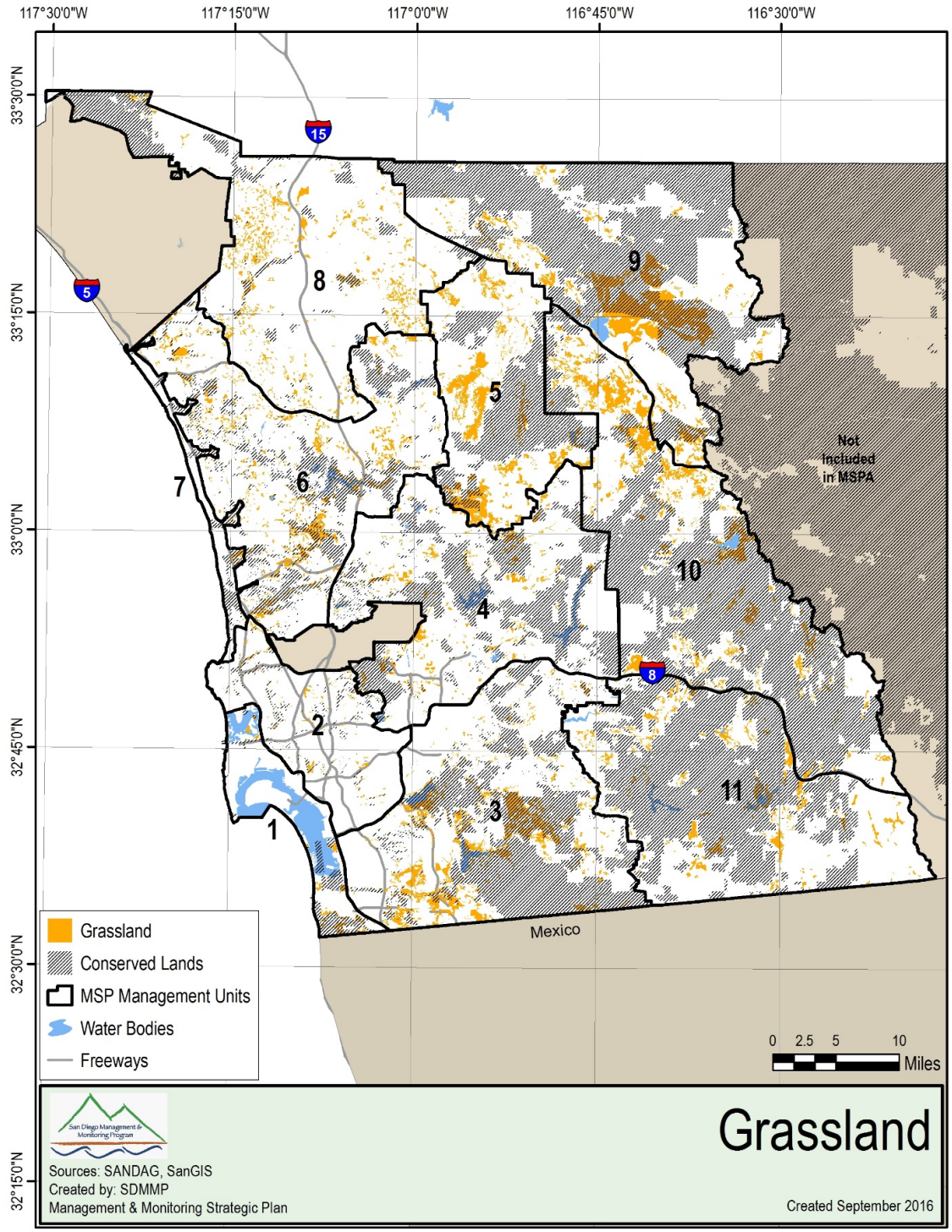


**Figure V2C.3-1. Distribution of grassland vegetation in the MSPA.**

## 3.2 MSP SPECIES USING GRASSLAND VEGETATION

There are 29 MSP species that use grassland habitats; some are closely associated only with native grasslands, while others are affiliated with nonnative grasslands (Table V2C.3-2). There are 2 grassland VF species, grasshopper sparrow and San Diego black-tailed jackrabbit. The remaining 27 SL, SO, SS, VF species from other vegetation types, and VG species will benefit incidentally from grassland vegetation management.

## 3.3 THREATS TO GRASSLAND VEGETATION

A primary threat to native grassland is loss, fragmentation, and degradation due to urban and agricultural development. Agricultural practices such as tilling or overgrazing can lead to the loss of native grasses. Invasive nonnative grasses and forbs are the largest threat to remaining native grasslands. Properly applied grazing, herbicide treatments, and prescribed fire can help to control invasive nonnative annual plants and improve the cover and richness of native grasses and forbs. Nonnative grasslands that provide foraging and burrowing habitat for MSP species can become degraded by tall, dense grasses that dry out and create a thick layer of thatch that becomes unsuitable for ground squirrels (Wisinski et al. 2015). This can decrease suitability of nonnative grasslands for those species that depend on ground squirrels and rabbits for prey.

## 3.4 MANAGEMENT AND MONITORING APPROACH

This section provides the rationale for management and monitoring objectives for grassland vegetation and associated MSP species. The greatest threat to native grasslands is control of nonnative grasses and forbs. For nonnative grassland management for MSP species, the threat is too dense and tall nonnative grasses. The management and monitoring approach for grasslands is based on an adaptive management framework, in which a science-based, information-gathering process includes monitoring management targets and testing the effectiveness of management actions to provide information to inform the management strategy and the actions necessary to achieve management goals. This iterative process is intended to refine and improve the effectiveness of the management strategy over

## Table V2C.3-2. Grassland associated MSP species.

| | Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| **Plants** | | | | |
| | Acanthomintha ilicifolia | San Diego thorn-mint | SO | https://portal.sdmmp.com/view_species.php?taxaid=32426 |
| | Adolphia californica | California adolphia (Spineshrub) | VG | https://portal.sdmmp.com/view_species.php?taxaid=28449 |
| | Ambrosia pumila | San Diego ambrosia | SO | https://portal.sdmmp.com/view_species.php?taxaid=36517 |
| | Atriplex coulteri | Coulter's saltbush | VF | https://portal.sdmmp.com/view_species.php?taxaid=20523 |
| | Atriplex parishii | Parish brittlescale | VF | https://portal.sdmmp.com/view_species.php?taxaid=20554 |
| | Bloomeria clevelandii | San Diego goldenstar | SS | https://portal.sdmmp.com/view_species.php?taxaid=509575 |
| | Brodiaea filifolia | Thread-leaved brodiaea | SS | https://portal.sdmmp.com/view_species.php?taxaid=42806 |
| | Brodiaea santarosae | Santa Rosa brodiaea | SS | https://portal.sdmmp.com/view_species.php?taxaid=810190 |
| | Calochortus dunnii | Dunn's mariposa lily | VG | https://portal.sdmmp.com/view_species.php?taxaid=42844 |
| | Centromadia parryi ssp. Australis | Southern tarplant | VF | https://portal.sdmmp.com/view_species.php?taxaid=780715 |
| | Deinandra conjugens | Otay tarplant | SS | https://portal.sdmmp.com/view_species.php?taxaid=780273 |
| | Dicranostegia orcuttiana | Orcutt's bird's-beak | SL | https://portal.sdmmp.com/view_species.php?taxaid=834156 |
| | Dudleya blochmaniae | Blochman’s dudleya | SL | https://portal.sdmmp.com/view_species.php?taxaid=502165 |
| | Ferocactus viridescens | San Diego barrel cactus | VF | https://portal.sdmmp.com/view_species.php?taxaid=19801 |
| | Lepechinia ganderi | Gander's pitcher sage | VG | https://portal.sdmmp.com/view_species.php?taxaid=32555 |
| | Quercus engelmannii | Engelmann Oak | VF | https://portal.sdmmp.com/view_species.php?taxaid=19329 |
| **Invertebrates** | | | | |
| | Euphydryas editha quino | Quino checkerspot butterfly | SL | https://portal.sdmmp.com/view_species.php?taxaid=779299 |

| | Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| **Birds** | | | | |
| | Agelaius tricolor | Tricolored blackbird | SL | https://portal.sdmmp.com/view_species.php?taxaid=179060 |
| | Ammodramus savannarum perpallidus | Grasshopper sparrow | VF | https://portal.sdmmp.com/view_species.php?taxaid=179336 |
| | Aquila chrysaetos Canadensis | Golden eagle | SO | https://portal.sdmmp.com/view_species.php?taxaid=175408 |
| | Athene cunicularia hypugaea | Western burrowing owl | SL | https://portal.sdmmp.com/view_species.php?taxaid=687093 |
| | Buteo regalis | Ferruginous hawk | VG | https://portal.sdmmp.com/view_species.php?taxaid=175377 |
| | Buteo swainsoni | Swainson's hawk | VG | https://portal.sdmmp.com/view_species.php?taxaid=175367 |
| | Circus cyaneus | Northern harrier | SO | https://portal.sdmmp.com/view_species.php?taxaid=175430 |
| **Mammals** | | | | |
| | Antrozous pallidus | Pallid bat | SL | https://portal.sdmmp.com/view_species.php?taxaid=180006 |
| | Dipodomys stephensi | Stephens' kangaroo rat | SO | https://portal.sdmmp.com/view_species.php?taxaid=180247 |
| | Lepus californicus bennettii | San Diego black-tailed jackrabbit | VF | https://portal.sdmmp.com/view_species.php?taxaid=900973 |
| | Taxidea taxus | American badger | SL | https://portal.sdmmp.com/view_species.php?taxaid=180565 |

time and of the management actions to implement that strategy. See Vol. 1, Sec. 2.0 and Vol. 2A for further details on the overall management and monitoring approach.

The management goal for grassland vegetation is to enhance and restore native grasslands and forblands and manage nonnative grasslands on Conserved Lands in the MSPA that support or have the potential to support VF species (i.e., grasshopper sparrow, San Diego black-tailed jackrabbit). This management goal should incidentally benefit a diverse array of other MSP species (e.g., Quino checkerspot butterfly, western burrowing owl, golden eagle, Stephens' kangaroo rat) so that the vegetation communities have high ecological integrity, and so these species are resilient to environmental stochasticity and likely to persist over the long term (>100 years).

The primary monitoring objective is to establish a long-term vegetation monitoring program to determine the distribution and composition of grassland vegetation plots in a mosaic of chaparral and coastal sage scrub vegetation communities across the MSPA. Nonnative grasses are indicative of reduced ecological integrity in the shrubland mosaic, whereas plots with native grasses are indicative of a healthier grassland vegetative component. Attributes of grassland communities will be tracked over time in response to multiple, potentially interacting threats such as an altered fire regime, changing climate, and nitrogen deposition. The intent is to determine how different, often interacting threats and environmental conditions are associated with changes in vegetation community attributes and how these responses are affected by management. The ecological integrity of native grasslands will be defined by cover, density, and richness of native grasses and forbs and the cover of exotic nonnative grasses and forbs. Other measures of ecological integrity can be added to the vegetation monitoring program to assess the overall integrity of the grassland ecosystem. Potential measures of the ecological integrity of the ecosystem include monitoring the diversity and abundance of other taxonomic groups (e.g., invertebrates, reptiles, birds, small mammals, etc.), evaluating important ecological processes (e.g., pollination services, food webs, soil biogeochemical cycles), and tracking abiotic conditions (e.g., climate, soil temperature, and moisture).

A second monitoring objective is to test and develop BMPs to control invasive nonnative grasses and forbs at a landscape scale that degrade habitat for MSP

species or that threaten the integrity of native grasslands. Large-scale management experiments will be implemented to test the effectiveness of different invasive plant control methods including grazing, prescribed fire, herbicide, and mechanical methods.

A third monitoring objective is to determine the distribution, status, habitat associations, threats and management needs of the 2 grassland VF species. Monitoring plans will be developed and integrated as feasible into the vegetation monitoring. Monitoring will be conducted to gather information that will be used to identify the management needs of VF species in grassland communities in the MSPA.

These 3 types of monitoring data will be analyzed and the results used to develop and implement a management strategy for grassland vegetation. A management plan will be developed that identifies and prioritizes management actions to maintain, enhance, or restore the ecological integrity of native grassland, high biodiversity, and important ecological processes. The second focus of the management plan will be to manage nonnative grassland habitat so that it is suitable for MSP species at prioritized sites. The management plan will include a monitoring component to determine the effectiveness of management actions and the overall management strategy.

2017-2021 Planning Cycle Management and Monitoring Approach

For the 2017–2021 planning cycle, the focus will be to gather information on grassland vegetation in a mosaic of coastal sage scrub and chaparral and to develop BMPs. A monitoring plan will be developed for coastal sage scrub, chaparral, and grassland vegetation. It will be based on a conceptual model that identifies covariates to collect in assessing habitat conditions and threats to identify and prioritize management needs in future planning cycles. The monitoring plan will utilize a sampling design that incorporates ecological integrity classes mapped across the entire MSPA using remote imagery. Permanent sampling plots will be established along north-to-south and east-to-west gradients across the MSPA to capture the full range of environmental conditions and vegetation community characteristics. To further characterize spatial variation, there will also be a subset of sampling plots that are monitored on a rotating basis.

A monitoring plan will be prepared for the San Diego black-tailed jackrabbit, a grassland and coastal sage scrub VF species. The monitoring plan will include both coastal sage scrub and grassland sampling and will be integrated into the vegetation monitoring for these 2 vegetation communities. The monitoring will provide information to determine whether management is needed to restore or enhance sites that support or have potential to support black-tailed jackrabbit. Grasshopper sparrow monitoring will be delayed until future planning cycles. Development and testing of large-scale management BMPs are important in determining management actions to be included in development of a management plan for grasslands. Prioritization and development and implementation of a management plan are planned for the 2022–2026 planning cycle, after all the monitoring components have been implemented and information is available to guide management planning and decision making.

### 3.4.1 General Approach Objectives

Below is a summary of the management and monitoring objectives for grassland vegetation. For the most up-to-date goals, objectives, and actions, go to the MSP Portal:
https://portal.sdmmp.com/tracker.php?Target=veg+community&Species=SDMMP_vegcom_2&MonMgtObjType=&ActionStatus=&ManagementUnit=&ObjectiveType=&Year=&Preserve=&Short=Long&submit=Submit.

There are 5 objectives currently included for grassland vegetation monitoring in the MSP Roadmap 2017–2021 planning cycle. Three objectives involve establishing and implementing the long-term monitoring program. The first objective includes developing a monitoring plan that includes permanent sampling plots with a rotating panel of plots to expand spatial sampling. The sampling design will be informed by the second objective of mapping integrity classes at the landscape scale based upon remote imagery (satellite imagery, high resolution aerial photographs and LIDAR). The third objective is to implement the monitoring. In the first year, pilot monitoring will be conducted to test the ecological integrity classifications and evaluate the monitoring protocols and sampling design. Data from the pilot monitoring will be used to finalize the vegetation monitoring plan. After the plan is finalized, there will be 3 years of monitoring to gather information on annual variability in grassland vegetation community attributes

and to increase the spatial distribution with the rotating panel of sample plots. Monitoring data will then be analyzed to identify management needs for coastal sage scrub communities across the MSPA and to determine the frequency of future monitoring.

The other 2 vegetation monitoring objectives are to develop and implement a plan to test grazing, prescribed fire, and other methods of landscape-scale control of invasive annual grasses and forbs in grassland vegetation. This plan will test the effectiveness of management methods and their effects on the vegetation community, MSP species, measures of ecological integrity and other monitoring targets to determine beneficial and adverse effects of the different management methods. After testing the methods detailed in the grazing management plan and analyzing the results, BMPs will be developed to guide large-scale management of invasive annual grasses in a mosaic of native shrubland and grassland vegetation to promote native grasses and forbs.

### 3.4.2 Species-Specific Approach Objectives

The management and monitoring approach; rationale; and goals, objectives, and actions for at-risk MSP species associated with grasslands are presented in the corresponding species sections and species profiles accessible on each species' summary page (see links in Table V2C.3-2).

There are 2 grassland VF species: grasshopper sparrow and San Diego black-tailed jackrabbit. For the black-tailed jackrabbit, there are objectives to prepare and implement a monitoring plan to track their distribution and status and to assess habitat and threat risks. This plan is intended to integrate to the extent feasible into the vegetation monitoring program and results will be used to develop the grassland management plan in the next planning cycle.

Grasshopper sparrow monitoring objectives are delayed until the 2022–2026 planning cycle. At that time, a monitoring plan will be developed and implemented that will integrate as feasible into the coastal sage scrub, chaparral, and grassland vegetation monitoring program. After data have been collected and management recommendations will be developed and included in the Grassland Management Plan in the 2022–2026 planning cycle.

## 3.5 GRASSLAND REFERENCES

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# 4.0 RIPARIAN FOREST AND SCRUB

## 4.1 OVERVIEW OF THE RIPARIAN FOREST AND SCRUB VEGETATION COMMUNITY

Riparian forest and scrub is the fifth largest vegetation community in the MSPA. There are 38,377 acres of riparian vegetation encompassing all MUs, 14,488 acres (38%) of which are conserved (Table V2C.4-1 and Figure V2C.4-1, or view an online map at: https://portal.sdmmp.com/map_vegetation.php?taxaid=SDMMP_vegcom_7).Riparian vegetation is found throughout California growing along streams, in floodplains, and in canyon bottoms. The hydrologic cycle is very important in determining the composition and structure of riparian communities through surface flows, ground water, nutrient cycling, sedimentation, erosion, and water quality (Stromberg 1993; Stohlgren et al. 1998; White and Greer 2002). Many riparian plant species regenerate from seed following flood events (Griggs 2009; Sproul et al. 2011) and the amount and timing of flows can affect species composition and seed regeneration (Stromberg 1993; White and Greer 2002; Griggs 2009; Sproul et al. 2011). Alluvial soils have a lot of nutrients and are fertile growing areas (Griggs 2009).

Riparian forest is dominated by trees such as *Quercus agrifolia*, *Salix gooddingii, Salix lasiolepis, Populus fremontii,* and *Platanus racemosa*. Common understory species are *Baccharis salicifolia, Toxicodendron diversilobum, Sambucus nigra, Anemopsis californica*, and *Carex* spp. Riparian scrub is shrub dominated and dense, often with *B. salicifolia* and *Tamarix* species. Invasive species common in riparian areas are *Arundo donax* and *Tamarix* species.

There are 13 riparian forest and scrub alliances mapped by AECOM (SANDAG 2012) in western San Diego County, not including MUs 9, 10, and 11. The most prevalent riparian forest alliance is *Q. agrifolia* (not including upland woodland associations that are mapped in the coast oak woodland category), followed by *P racemosa, S. gooddingii, S. lasiolepis, S. laevigata*, and *P. freemontii* alliances (Sproul et al. 2011; SANDAG 2012). Riparian scrub is dominated by naturalized warm temperature riparian and wetland semi-natural stands that do not fit into an alliance and in which nonnative species are dominant over native species and do not fit into any

of the alliances dominated by specific nonnative species. *A. donax* and *Tamarix* species dominated alliances are also prevalent in riparian scrub. The only abundant native riparian scrub alliance is the *B. salicifolia* alliance.

For more information on the riparian vegetation community, go to the MSP Portal Riparian Forest and Scrub vegetation summary page: https://portal.sdmmp.com/view_species.php?taxaid=SDMMP_vegcom_7.

**Table V2C.4-1. Total acres of riparian forest and scrub and acres on Conserved Lands by MSP Management Units.**

| MU | Total Acres | Acres on Conserved Lands |
|---|---|---|
| **1** | 1,361 | 1,098 |
| **2** | 1,014 | 499 |
| **3** | 3,264 | 1,611 |
| **4** | 2,986 | 1,021 |
| **5** | 2,351 | 954 |
| **6** | 5,478 | 3,133 |
| **7** | 744 | 626 |
| **8** | 9,129 | 2,037 |
| **9** | 8,088 | 2,317 |
| **10** | 2,828 | 731 |
| **11** | 1,134 | 461 |
| **Grand Total** | **38,377** | **14,488** |

## 4.2 MSP SPECIES USING RIPARIAN VEGETATION

Fourteen MSP species are associated with riparian forest and scrub (Table V2C.4-2). Two species are oak woodland VF species, coast newt and yellow-breasted chat, and will be managed through management of riparian forest and scrub vegetation. The remaining 14 SL, SO, SS, VF species from other vegetation types, and VG species will benefit incidentally from oak woodland vegetation management.

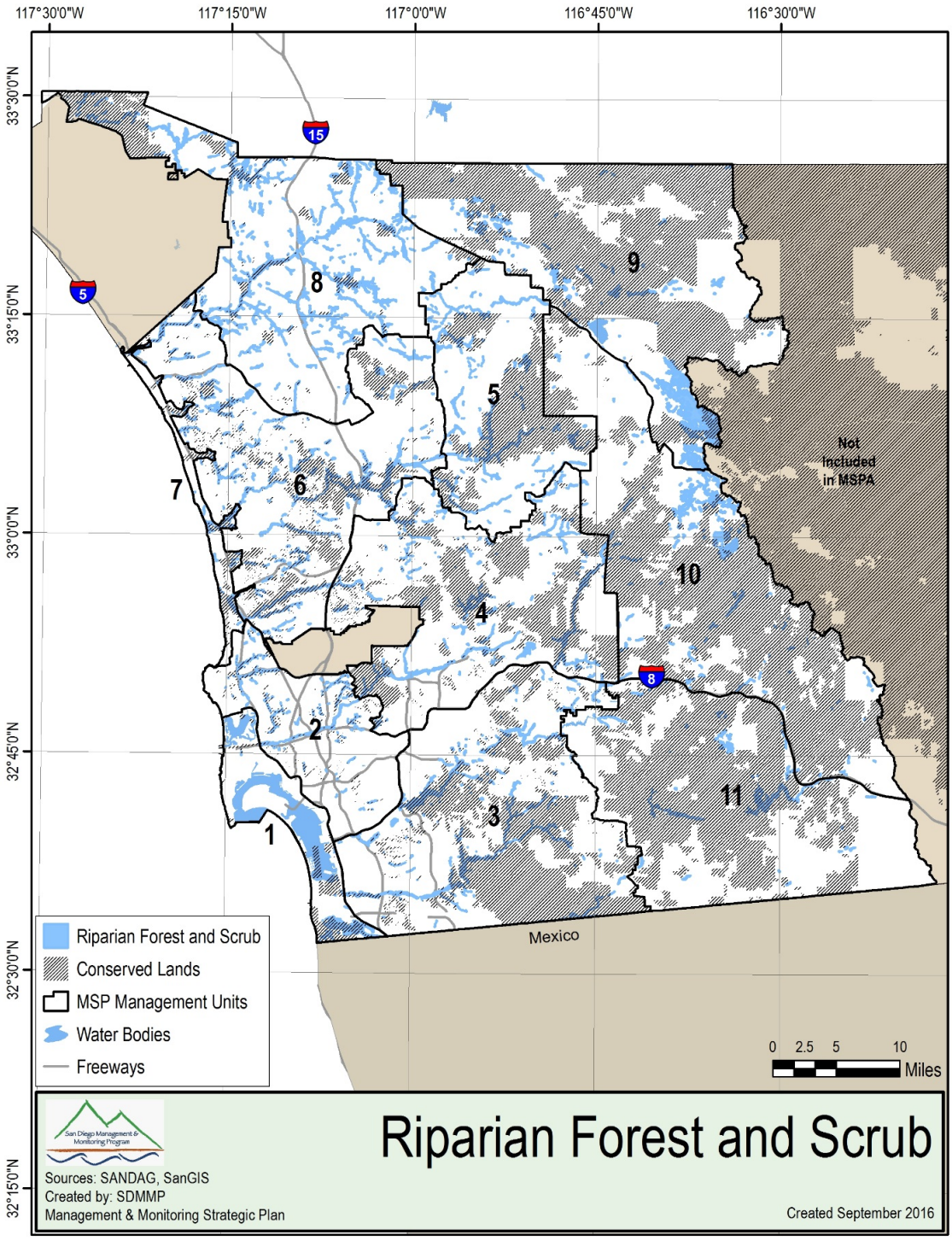


**Figure V2C.4-1. Distribution of riparian forest and scrub vegetation in the MSPA.**

## Table V2C.4-2. Riparian forest and scrub associated MSP species.

| | Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| **Plants** | | | | |
| | Ambrosia pumila | San Diego ambrosia | SO | https://portal.sdmmp.com/view_species.php?taxaid=36517 |
| | Iva hayesiana | San Diego marsh-elder | VG | https://portal.sdmmp.com/view_species.php?taxaid=36037 |
| | Monardella stoneana | Jennifer's monardella | SL | https://portal.sdmmp.com/view_species.php?taxaid=832834 |
| | Monardella viminea | Willowy monardella | SL | https://portal.sdmmp.com/view_species.php?taxaid=833060 |
| **Fish** | | | | |
| | Gila orcuttii | Arroyo chub | SL | https://portal.sdmmp.com/view_species.php?taxaid=553278 |
| **Amphibians** | | | | |
| | Anaxyrus californicus | Arroyo toad | SO | https://portal.sdmmp.com/view_species.php?taxaid=773514 |
| | Taricha torosa torosa | Coast range newt | VF | https://portal.sdmmp.com/view_species.php?taxaid=208226 |
| **Reptiles** | | | | |
| | Emys pallida | Southwestern pond turtle | SL | https://portal.sdmmp.com/view_species.php?taxaid=668677 |
| | Thamnophis hammondii | Two-striped garter snake | VG | https://portal.sdmmp.com/view_species.php?taxaid=209149 |
| **Birds** | | | | |
| | Accipiter cooperii | Cooper's hawk | VG | https://portal.sdmmp.com/view_species.php?taxaid=175309 |
| | Empidonax traillii extimus | Southwestern willow flycatcher | SL | https://portal.sdmmp.com/view_species.php?taxaid=712529 |
| | Icteria virens | Yellow-breasted chat | VF | https://portal.sdmmp.com/view_species.php?taxaid=178964 |
| | Vireo bellii pusillus | Least Bell's vireo | SO | https://portal.sdmmp.com/view_species.php?taxaid=179007 |
| **Mammals** | | | | |
| | Plecotus townsendii pallescens | Townsend's big-eared bat | SO | https://portal.sdmmp.com/view_species.php?taxaid=203457 |
| | Puma concolor | Mountain lion | SL | https://portal.sdmmp.com/view_species.php?taxaid=552479 |

## 4.3 THREATS TO RIPARIAN VEGETATION

Over the last 2 years, significant die-offs of willows have occurred in San Diego County as a result of the polyphagous shot hole borer/*Fusarium* complex (Eskalen 2016; SANDAG 2016; see Vol. 2B, Sec. 6.3.2.6) and more recently from a novel fungal pathogen, *Neofusicoccum parvum* (P. Nolan, pers. comm., 2017). Another large-scale threat to riparian systems is invasive nonnative plants, which is evident in the prevalence of *A. donax* and *Tamarix*-dominated alliances within the MSPA. Riparian vegetation is also threatened by altered hydrology from water management and urbanization. Upstream urbanization increases water flows, even in the dry season, and has resulted in eroded deep cut channels rather than broad, braided channels (Stohlgren et al. 1998; White and Greer 2002; Taniguchi and Biggs 2015). This change in geomorphology can affect species composition and seed regeneration, and allow invasive plants to more easily establish from high water and nutrient levels (Stromberg 1993; White and Greer 2002). Repeated wildfires can degrade riparian communities by opening up the landscape for the expansion of invasive nonnative plants. Prolonged and extended drought can weaken trees to other stressors.

## 4.4 MANAGEMENT AND MONITORING APPROACH

This section provides the rationale for management and monitoring objectives for riparian forest and scrub vegetation and associated MSP species. The management and monitoring approach is based on an adaptive management framework intended to refine and improve the effectiveness of the management strategy over time. See Vol. 1, Sec. 2.0 for further details on the overall MSP management and monitoring approach.

The management goal for riparian vegetation is to maintain, enhance, and restore riparian forest and scrub on Conserved Lands in the MSPA that support or have the potential to support VF species (i.e., coast newt, yellow-breasted chat). This management goal should incidentally benefit a diverse array of other MSP species (e.g., arroyo toad, southwestern pond turtle, least Bell's vireo, southwestern willow flycatcher, Townsend's big-eared bat) so that the vegetation community has high ecological integrity, and so these species are resilient to invasive pests and disease pathogens; environmental stochasticity; threats; and catastrophic disturbances,

such as very large wildfires and intense and prolonged drought. With the achieved management goal, the species are likely to persist over the long term (>100 years).

The management and monitoring approach for riparian forest and scrub is to gather information documenting the status, environmental conditions, threats, and ecological integrity of this vegetation community and associated MSP species over time in order to periodically identify and prioritize management needs, to implement high-priority management actions, and to monitor effectiveness and improve management with time.

The first step in the management and monitoring approach is to characterize the current extent of tree mortality in riparian forests in the MSPA as a result of drought, pests, and fungal pathogens. This will be done using remote imagery (e.g., high-resolution aerial photos, LIDAR) to map the current extent of dead trees in riparian forest across the MSPA.

The next step is to develop a long-term MSP Riparian Forest and Scrub Monitoring Plan to assess tree mortality and recruitment over time; to document changes in community composition, structure, and ecological integrity; and to assess environmental conditions and identify threats. The monitoring plan will include a conceptual model; specific monitoring questions; a standardized monitoring protocol; a statistically valid sampling design with sampling locations; a plan for analyzing and managing data; a monitoring schedule; and reporting requirements. The monitoring plan will be based on a conceptual model to identify covariates to collect in assessing environmental conditions and threats to identify and prioritize management needs in future planning cycles. Permanent sampling plots will be established along north-to-south and east-to-west gradients across the MSPA to capture the full range of environmental conditions and tree mortality characteristics in a statistically valid sampling design. The monitoring plan should integrate and be consistent with the oak woodland vegetation monitoring plan as feasible, since the threats faced by both vegetation communities are very similar and both communities can be integrated in the larger landscape matrix. Once the Riparian Forest and Scrub Vegetation Monitoring Plan is completed, then field-based monitoring will be conducted to gather data.

In addition to riparian vegetation monitoring, a monitoring plan and schedule will be developed and implemented for coast range newt, a VF species in chaparral,

oak woodland, and riparian vegetation communities. As feasible, this monitoring will be integrated with riparian vegetation monitoring. Yellow-breasted chat, a second riparian VF species, will be monitored as part of determining the ecological integrity of riparian forest and scrub woodlands. This monitoring will focus on the impact of tree die-offs on bird communities in riparian and oak woodlands (see Vol. 2B, Sec. 9). There will also be monitoring of the impacts of riparian tree die-off on least Bell's vireos and southwestern willow flycatchers, as part of species-specific monitoring strategies (see Vol. 2D). Monitoring and developing BMPs for invasive nonnative pests and fungal pathogens, such as the shot hole borer and *Fusarium* complex, will provide information to be integrated into riparian forest monitoring and management (see Vol. 2B, Sec. 6).

A Riparian Forest and Scrub Management Plan will be prepared with information obtained from vegetation, VF species, species-specific, ecological integrity, and invasive pest monitoring. The management plan will identify and prioritize management needs to maintain, enhance, and restore riparian forests and scrub to ensure recovery from multiple threats, to maintain high ecological integrity, and to support MSP species. The management plan will prioritize the location and type of management actions needed, specify BMPs, develop a management timeline, and provide guidelines for monitoring the effectiveness of management actions. Upon completion of the management plan, high-priority management actions will be completed and monitored for effectiveness according to the timeline prepared for each MSP planning cycle. Long-term vegetation and MSP species monitoring will continue on a scheduled basis and the results, along with management effectiveness monitoring and ecological integrity monitoring, will be used to update and refine the management plan at periodic intervals.

### 4.4.1 General Approach Objectives

Below is a summary of the management and monitoring objectives for riparian forest and scrub vegetation. For the most up-to-date goals, objectives, and actions, go to the MSP Portal: https://portal.sdmmp.com/tracker.php?Target=veg+community&Species=SDMMP_vegcom_7&MonMgtObjType=&ActionStatus=&ManagementUnit=&ObjectiveType=&Year=&Preserve=&Short=Long&submit=Submit.

Three objectives are included for riparian vegetation monitoring in the MSP Roadmap 2017–2021 planning cycle. The focus will be to gather information to characterize riparian forest and scrub vegetation communities. Riparian tree mortality maps across the MSPA will be prepared and a Riparian Forest and Scrub Monitoring Plan will be developed and implemented. Development of a Riparian Forest and Scrub Management Plan and implementation of high-priority management actions is planned for the 2022–2026 planning cycle, after information has been gathered to guide management planning and decision making.

### 4.4.2 Species-Specific Approach Objectives

There are 2 riparian VF species: coast newt and yellow-breasted chat (Table V2C.4-2). Yellow-breasted chat will be monitored as part of the loss of ecological integrity monitoring of riparian bird communities in the current planning cycle. Development of a monitoring plan for coast newt is delayed until the 2022–2026 planning cycle. Management objectives for both species are also delayed until the development and implementation of a Riparian Forest and Scrub Management Plan in the next planning cycle.

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# 5.0 TORREY PINE FOREST

## 5.1 OVERVIEW OF THE TORREY PINE FOREST VEGETATION COMMUNITY

The Torrey pine forest vegetation community has a very limited distribution in the MSPA, occurring almost exclusively in MU7 on 175 acres and with 1 acre in MU6 (SANDAG 2012; Table V2C.5-1, Figure V2C.5-1, or view an online map at: https://portal.sdmmp.com/map_vegetation.php?taxaid=SDMMP_vegcom_8). Distribution of Torrey Pines Forest Vegetation). Over 97% of Torrey pine forest is conserved, primarily at Torrey Pines State Natural Reserve, where 5,394 trees were mapped in 2006 (Franklin and Santos 2011).

Torrey pine forest is the only native coastal southern California forest and is the rarest pine in North America (CDPR 2017). The forest is a remnant population from a period over 10,000 years ago when the climate was wetter and pines were more widespread on the southern California coast. Winter to spring precipitation is most important in annual growth (Biondi et al. 1997). This vegetation community is found only at Torrey Pines State Natural Reserve and on Santa Rosa Island (Sproul et al. 2011). Torrey pines occur on rocky sandstone soils immediately adjacent to the coast (Oberbauer et al. 2008).

Torrey pine forest is classified as *Pinus torreyana* Special Stands, similar to an alliance but dominated by a rare, special-status species (Sproul et al. 2011). It is an open forest with trees <15 meters and with coastal sage scrub and chaparral understories. The stands are associated with many different species and Torrey pines are not diagnostic of a specific floristic composition. The tree canopy is dominated by *P. torreyana* and the shrub canopy is often dominated by *Quercus dumosa, Cneoridium dumosum*, and *Eriogonum fasciculatum* (Oberbauer et al. 2008; Sproul et al. 2011). There are a number of subdominant shrubs in *Pinus torreyana* Special Stands including *Adenostoma fasciculatum, Xylococcus bicolor, Ceanothus verrucosus, Artemisia californica*, and *Salvia mellifera* (Sproul et al. 2011). Torrey pines do not require fire to regenerate, but have serotinous cones that can be stimulated to open and release seeds following a fire (McMaster and Zedler 1981).

For more information on the Torrey pine forest, go to the MSP Portal Torrey Pine Forest vegetation summary page: http://portal.sdmmp.com/view_species.php?taxaid=SDMMP_vegcom_8.

**Table V2C.5-1. Total acres of Torrey pine forest and acres on Conserved Lands by MSP Management Units.**

| MU | Total Acres | Acres on Conserved Lands |
|---|---|---|
| **1** | 0 | 0 |
| **2** | 0 | 0 |
| **3** | 0 | 0 |
| **4** | 0 | 0 |
| **5** | 0 | 0 |
| **6** | 1 | 0 |
| **7** | 175 | 171 |
| **8** | 0 | 0 |
| **9** | 0 | 0 |
| **10** | 0 | 0 |
| **11** | 0 | 0 |
| **Grand Total** | **176** | **171** |

## 5.2 MSP SPECIES USING TORREY PINE FOREST VEGETATION

Three MSP species are associated with Torrey pine forest: Orcutt's spineflower, Shaw's agave, and Torrey pine (see links to species' summary pages in Table V2C.5-2). Torrey pine is a VF species that will be managed through management of Torrey pine forest vegetation. The remaining 2 SL species (Orcutt's spineflower and Shaw's agave) could benefit incidentally from Torrey pine forest vegetation management.

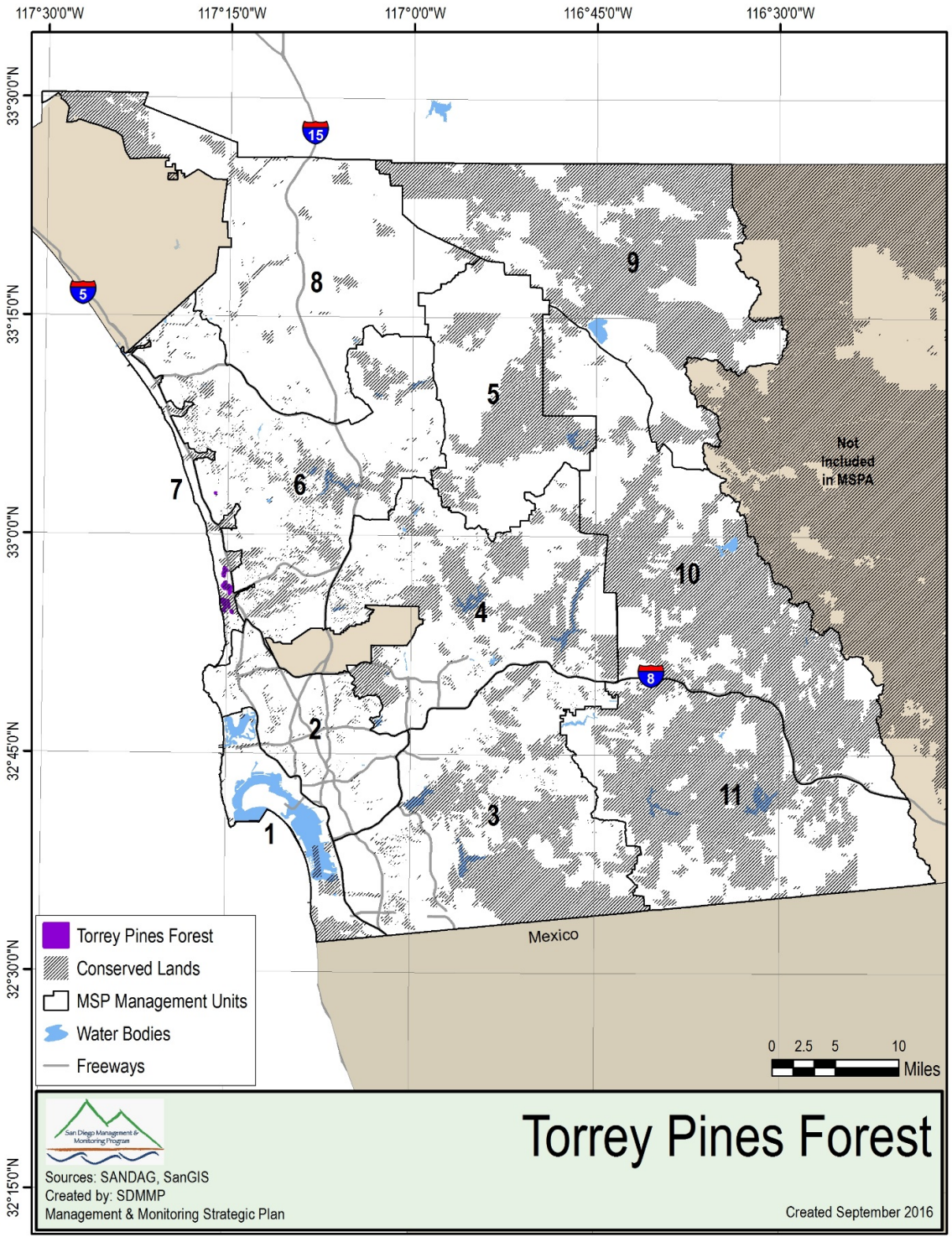


**Figure V2C.5-1. Distribution of Torrey pine forest vegetation in the MSPA.**

## Table V2C.5-2. Torrey pine forest associated MSP species.

| | Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| **Plants** | | | | |
| | Agave shawii var shawii | Shaw's agave | SL | https://portal.sdmmp.com/view_species.php?taxaid=810342 |
| | Chorizanthe orcuttiana | Orcutt's spineflower | SL | https://portal.sdmmp.com/view_species.php?taxaid=21019 |
| | Pinus torreyana ssp. torreyana | Torrey pine | VF | https://portal.sdmmp.com/view_species.php?taxaid=183392 |

## 5.3 THREATS TO TORREY PINE FOREST VEGETATION

A projected warming and drier climate with more frequent, intensive and prolonged droughts (Diffenbaugh et al. 2015) could threaten Torrey pine forests in the future. Torrey pine forest is susceptible to drought as few seedlings survive the summer dry season to reach an age to reproduce (McMaster 1980).

Drought can also weaken adult trees, making them susceptible to bark beetle infestations. A significant infestation occurred in the late 1980s to early 1990s that caused mortality in 12% of adult trees (Esser 1993). The recent intensive and prolonged drought led to another bark beetle infestation in 2014–2016 (CDPR 2014; Sacramento Bee 2015; San Diego Union Tribune 2016). Torrey pines have no genetic variability within the mainland or island populations and differ in only 3% of 59 genes between the two populations, as analyzed using gel electrophoresis (Ledig and Conkle 1983; Ledig 1984). This means there is no genetic variability to adapt to changing conditions, such as prolonged and more intensive droughts, disease, or pests. Air pollution may also pose a threat to this species, particularly ozone (McMaster 1980), and more recently nitrogen deposition has been shown to be a threat to pines in the mountains of southern California (Fenn et al. 2003).

## 5.4 MANAGEMENT AND MONITORING APPROACH

This section provides the rationale for management and monitoring objectives for Torrey pine forest vegetation and associated MSP species. The management and monitoring approach is based on an adaptive management framework intended to refine and improve the effectiveness of the management strategy over time. See Vol. 1, Sec. 2.0 for further details on the overall MSP management and monitoring approach.

The management goal for Torrey pine forest vegetation is to maintain and enhance Torrey pine forest on Conserved Lands in the MSPA so that the vegetation community has high ecological integrity and is resilient to environmental stochasticity; threats; and catastrophic disturbances, such as climate change and invasive pests. With the achieved management goal, the Torrey pine forest vegetation is likely to persist over the long term (>100 years).

The management and monitoring approach is to first gather information on the current status of Torrey pines, including determining the extent of mortality from drought and bark beetle infestations, the two most important current threats. Tree mortality will be mapped using high-resolution aerial imagery and LIDAR. Once this has been accomplished, a long-term Torrey Pine Forest Vegetation Monitoring Plan will be developed to determine changes in vegetation community composition, structure, and ecological integrity; environmental conditions; and threats over time. The monitoring plan will include a conceptual model; specific monitoring questions; a standardized monitoring protocol; a statistically valid sampling design with sampling locations; a plan for analyzing and managing data; a monitoring schedule; and reporting requirements. The conceptual model will be used to identify covariates to collect in assessing environmental conditions and threats to identify and prioritize management needs in future planning cycles.

The monitoring plan will be implemented and data gathered and combined with the tree mortality mapping to develop a Torrey pine forest vegetation management plan. The management plan will identify and prioritize management needs to maintain, enhance, and restore Torrey pine forests to ensure recovery from multiple threats, to maintain high ecological integrity, and to support MSP species. The management plan will prioritize the location and type of management actions needed, specify BMPs, develop a management timeline, and provide guidelines for monitoring the effectiveness of management actions. Upon completion of the management plan, high-priority management actions will be completed and monitored for effectiveness according to the timeline prepared for each MSP planning cycle. Long-term vegetation monitoring will continue on a scheduled basis and the results will be used to update and refine the management plan at periodic intervals.

### 5.4.1 General Approach Objectives

Below is a summary of the management and monitoring objectives for Torrey pine forest vegetation. For the most up-to-date goals, objectives, and actions, go to the MSP Portal: https://portal.sdmmp.com/tracker.php?Target=veg+community&Species=SDMMP_vegcom_8&MonMgtObjType=&ActionStatus=&ManagementUnit=&ObjectiveType=&Year=&Preserve=&Short=Long&submit=Submit.

One objective is currently included for Torrey pine forest in the 2017–2021 planning cycle to map current mortality across the species range in MU7. In the 2022–2026 planning cycle, a monitoring plan will be developed and implemented to gather information important to management. In addition, a management plan will be prepared and implemented in the 2022–2026 planning cycle.

### 5.4.2 Species-Specific Approach Objectives

The management and monitoring approach; rationale; and goals, objectives, and actions for MSP species associated with Torrey pine forest are presented in the corresponding species sections and species profiles accessible on each species' summary page (see links in Table V2C.5-2).

Torrey pine is a VF species and will be the focus of the tree mortality mapping in this planning cycle. It will be included in the Torrey Pine Forest Vegetation Monitoring and Torrey Pine Forest Management Plans that are delayed until the 2022–2026 planning cycle.

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# 6.0 SOUTHERN INTERIOR CYPRESS FOREST

## 6.1 OVERVIEW OF THE SOUTHERN INTERIOR CYPRESS FOREST VEGETATION COMMUNITY

Southern interior cypress forest is dominated by three different cypress species and occurs in isolated stands in the southern Sierra Nevada, Peninsular Ranges, and Santa Ana Mountains in the United States with a few stands in northern Baja California, Mexico (Oberbauer et al. 2008). Southern interior cypress forest in the Sierra Nevada supports Piute cypress *(Hesperocyparis nevadensis).* The range of Tecate cypress (*H. forbesii*) is restricted to 4 disjunct populations in the United States, including a stand in the northern Santa Ana Mountains in Orange County and three stands in San Diego County at Otay Mountain, Guatay Mountain, and Tecate Peak (Sproul et al. 2011). Scattered Tecate cypresses extend 150 kilometers south into northern Baja California, Mexico (Minnich 1987). The Cuyamaca cypress is the rarest of California cypress species and occurs as two isolated populations; the first at Cuyamaca Peak in San Diego County, and the second in Baja California, Mexico (Fanjon 2013).

Southern interior forest vegetation community supporting Tecate cypress (*Hesperocyparis forbesii),* a MSP VF species, has a very limited distribution in the MSPA (Table V2C.6-1; Figure V2C.6-1, or view an online map at: https://portal.sdmmp.com/map_vegetation.php?taxaid=SDMMP_vegcom_9. It occurs only in MU3 on 2,800 acres of which 2,723 acres (97%) are conserved (SANDAG 2012). Cuyamaca cypress encompasses approximately 50 acres on Cuyamaca Mountain on lands owned and managed by Cuyamaca State Park and U.S. Forest Service and is not an MSP species.

The *Hesperocyparis forbesii* alliance *(*synonym = *Callitropsis forbesii* alliance*)* includes Tecate cypress as the dominant species in the tree layer and may occur within a matrix of chaparral shrubs (Sproul et al. 2011). Dominant shrubs include *Adenostoma fasciculatum, Arctostaphylos* spp., *Ceanothus* spp., *Chamaebatia australis*, *Dendromecon rigida*, *Malosma laurina*, *Quercus acutidens*, and *Xylococcus bicolor*. Tecate cypresses are typically <10 meters tall and have open to intermittent canopy, depending on stand age. This alliance occurs on dry, open and often north-facing slopes, ridgetops, and ravines. Tecate cypresses have serotinous

cones and are dependent on fire to open cones and release seeds for large-scale reproduction (Sawyer et al. 2009)

For more information on southern interior cypress forest, go to the MSP Portal Southern Interior Cypress Forest vegetation summary page: https://portal.sdmmp.com/view_species.php?taxaid=SDMMP_vegcom_9.

**Table V2C.6-1. Total acres of southern interior cypress forest and acres on Conserved Lands by MSP Management Units.**

| MU | Total Acres | Acres on Conserved Lands |
|---|---|---|
| **1** | 0 | 0 |
| **2** | 0 | 0 |
| **3** | 2,800 | 2,723 |
| **4** | 0 | 0 |
| **5** | 0 | 0 |
| **6** | 0 | 0 |
| **7** | 0 | 0 |
| **8** | 0 | 0 |
| **9** | 0 | 0 |
| **10** | 0 | 0 |
| **11** | 0 | 0 |
| **Grand Total** | **2,800** | **2,723** |

## 6.2 MSP SPECIES USING SOUTHERN INTERIOR CYPRESS FOREST VEGETATION

Seven MSP species are associated with southern interior cypress forest. Tecate cypress and Thorne's hairstreak are VF species that will benefit from the management of southern interior cypress forest vegetation (Table V2C.6-2). The remaining 5 SL, SO and VG species could benefit incidentally from southern interior cypress forest vegetation management.

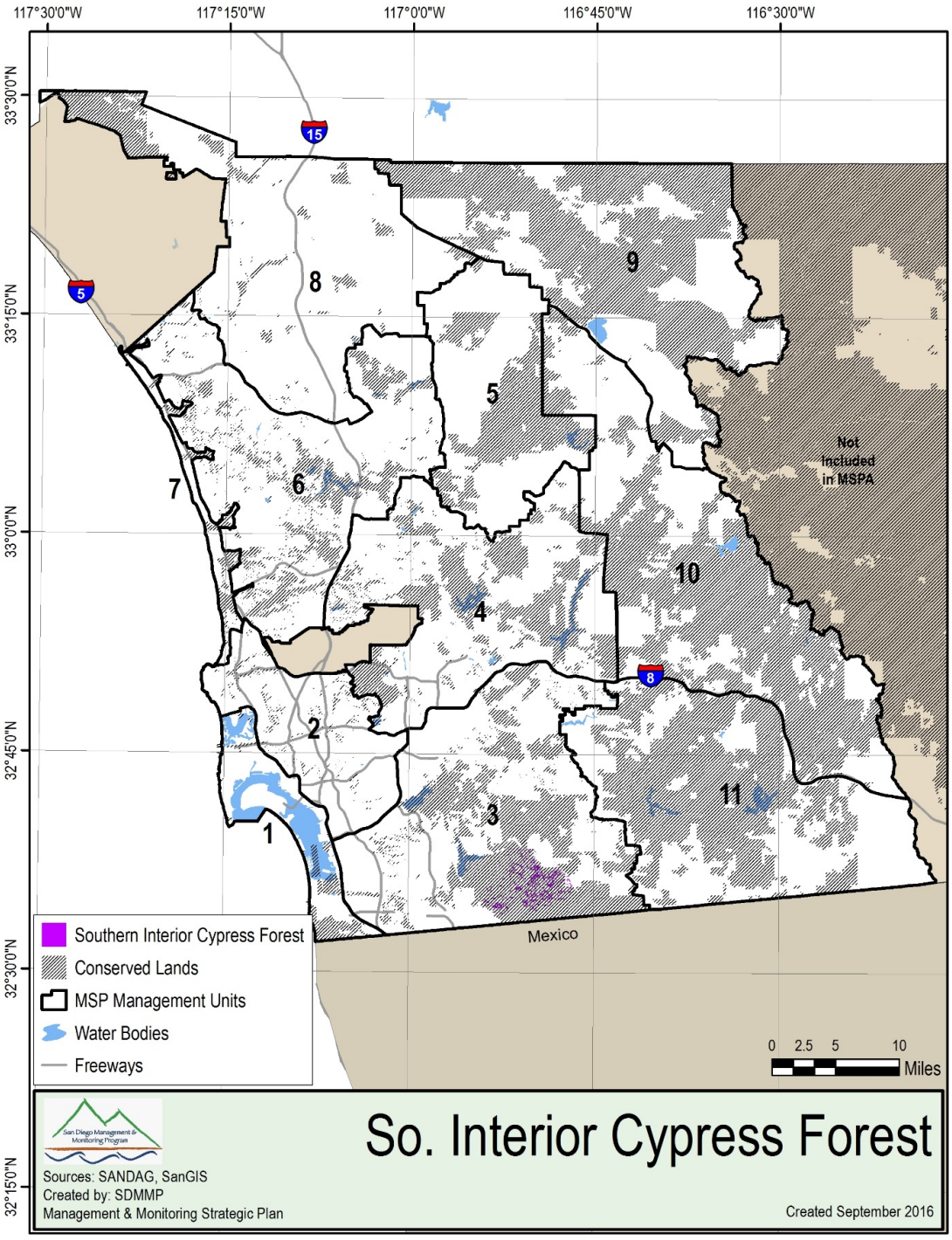


**Figure V2C.6-1. Distribution of southern interior cypress forest vegetation in the MSPA.**

## 6.3 THREATS TO SOUTHERN INTERIOR CYPRESS FOREST VEGETATION

The biggest threat to southern interior cypress forest supporting Tecate cypress is fire return intervals of less than 35–40 years (Markovchick-Nicholls 2007; Rodriguez-Buritica et al. 2010). During wildfires, most Tecate cypress trees are destroyed and, if they burn again in less than 35 years, there is insufficient time for replacement trees to mature and produce sufficient seed for the population to persist. Current fire return intervals are shorter than historic intervals in significant portions of Tecate cypress stands on Otay Mountain (see Vol. 2B, Sec. 1.0), with most of the population burning in 2003 or 2007. Another wildfire in the next few decades could threaten the population. There have also been reports of Tecate cypress mortality from the 2011–2016 prolonged and intensive drought. A warming climate is projected to increase the frequency, intensity, and duration of droughts, which could threaten future Tecate cypress populations.

## 6.4 MANAGEMENT AND MONITORING APPROACH

This section provides the rationale for management and monitoring objectives for southern interior cypress forest vegetation and associated MSP species. The management and monitoring approach is based on an adaptive management framework intended to refine and improve the effectiveness of the management strategy over time. See Vol. 1, Sec. 2.0 for further details on the overall MSP management and monitoring approach.

The management goal for southern interior cypress forest vegetation is to maintain and enhance southern interior cypress forest supporting Tecate cypress on Conserved Lands in the MSPA so that the vegetation community has high ecological integrity and is resilient to environmental stochasticity; threats; and catastrophic disturbances, such as altered fire regime and climate change. With the achieved management goal, the southern interior cypress forest vegetation community is likely to persist over the long term (>100 years).

The management and monitoring approach is to first gather information on the current status of Tecate cypress, including determining the extent of mortality from drought. Tree mortality will be mapped using high-resolution aerial imagery and LIDAR. Once this has been accomplished, a long-term Southern Interior Cypress Vegetation Monitoring Plan will be developed for stands with Tecate cypress to

determine changes in vegetation community composition, structure, and ecological integrity; environmental conditions; and threats over time. The monitoring plan will include a conceptual model; specific monitoring questions; a standardized monitoring protocol; a statistically valid sampling design with sampling locations; a plan for analyzing and managing data; a monitoring schedule; and reporting requirements. The conceptual model will be used to identify covariates to collect in assessing environmental conditions and threats to identify and prioritize management needs in future planning cycles.

The monitoring plan will be implemented and data gathered and combined with the tree mortality mapping to develop a Southern Interior Cypress Forest Vegetation Management Plan for stands supporting Tecate cypress. The management plan will identify and prioritize management needs to maintain, enhance, and restore Tecate cypress stands to ensure recovery from multiple threats, to maintain high ecological integrity, and to support MSP species. The Southern Interior Cypress Forest Management Plan will prioritize the location and type of management actions needed, specify BMPs, develop a management timeline, and provide guidelines for monitoring the effectiveness of management actions. Upon completion of the management plan, high-priority management actions will be completed and monitored for effectiveness according to the timeline prepared for each MSP planning cycle. Long-term vegetation monitoring will continue on a scheduled basis and the results will be used to update and refine the management plan at periodic intervals.

### 6.4.1 General Approach Objectives

Below is a summary of the management and monitoring objectives for southern interior cypress forest vegetation. For the most up-to-date goals, objectives, and actions, go to the MSP Portal: https://portal.sdmmp.com/tracker.php?Target=veg+community&Species=SDMMP_vegcom_9&MonMgtObjType=&ActionStatus=&ManagementUnit=&ObjectiveType=&Year=&Preserve=&Short=Long&submit=Submit.

One objective is included for southern interior cypress forest in the 2017–2021 planning cycle to map current mortality of Tecate cypress across the species range in MU3. In the 2022–2026 planning cycle, a monitoring plan will be developed and

implemented to gather information important to management. A management plan will be prepared and implemented in a future planning cycle.

### 6.4.2 Species-Specific Approach Objectives

Descriptions of the management and monitoring approach and rationale, and goals, objectives, and actions for at-risk MSP species associated with Tecate cypress are presented in the corresponding species sections and species profiles accessible on each species' summary page (see links in Table V2C.6-2).

Tecate cypress is a VF species and will be the focus of the southern interior cypress forest tree mortality mapping in this planning cycle. It will be included in the Southern Interior Cypress Forest Vegetation Monitoring and Management Plans in future planning cycles. Thorne's hairstreak is also a southern interior cypress forest VF species. Monitoring and management objectives for this species are delayed to future planning cycles and will be incorporated into southern interior cypress forest monitoring and management objectives.

## Table V2C.6-2. Southern interior cypress forest associated MSP species.

| | Scientific Name | Common Name | Management Category | Summary Link |
|---|---|---|---|---|
| **Plants** | | | | |
| | Dicranostegia orcuttiana | Orcutt's bird's-beak | SL | https://portal.sdmmp.com/view_species.php?taxaid=834156 |
| | Fremontodendron mexicanum | Mexican flannelbush | SL | https://portal.sdmmp.com/view_species.php?taxaid=21581 |
| | Hesperocyparis forbesii | Tecate cypress | VF | https://portal.sdmmp.com/view_species.php?taxaid=822589 |
| | Lepechinia ganderi | Gander's pitcher sage | VG | https://portal.sdmmp.com/view_species.php?taxaid=32555 |
| | Monardella stoneana | Jennifer's monardella | SL | https://portal.sdmmp.com/view_species.php?taxaid=832834 |
| **Invertebrates** | | | | |
| | Callophrys thornei | Thorne's hairstreak butterfly | VF | https://portal.sdmmp.com/view_species.php?taxaid=777843 |

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# 7.0 OAK WOODLAND

## 7.1 OVERVIEW OF THE OAK WOODLAND VEGETATION COMMUNITY

Oak woodland is the fourth largest vegetation community in the MSPA. There are 78,395 acres of oak woodland in MUs 2,3,4,5,6,8,9,10, and 11, of which 23,582 acres (30%) are conserved (Table V2C.7-1 and Figure V2C.7-1, or view an online map at: https://portal.sdmmp.com/map_vegetation.php?taxaid=SDMMP_vegcom_10). The MSP Roadmap focus is on coast live oak (*Quercus agrifolia*) and Engelmann oak (*Q. engelmannii*) woodland and does not include monitoring or management objectives for black oak (*Q. kelloggii*) or canyon oak (*Q. chrysolepis*) woodlands that occur at higher elevations in the mountains.

Engelmann oak woodland is restricted to southern California and is distributed in the foothills of the Peninsular Range in San Diego County and the Santa Ana Mountains of San Diego and Riverside Counties. It often occupies the ecotone between grassland and surrounding shrublands (Oberbauer et al. 2008) and occurs on relatively moist sites with fine-textured soils on gentle slopes and valley bottoms (Sproul et al. 2011). It forms a single alliance, the *Q. engelmannii* alliance, and *Q. engelmannii* is the dominant or codominant species in the tree canopy with *Juglans californica*, *Q. agrifolia*, and *Q. kelloggii* sometimes present as associates. In this alliance, trees are usually less than 18 meters tall, and the canopy is open to closed. The shrub layer is sparse to open and the herbaceous layer is spare and often dominated by grass species. Alliance level mapping was conducted by AECOM (SANDAG 2012) for the western part of San Diego County but does not include MUs 9, 10, and 11. The *Q. engelmannii* alliance is most prevalent in MU5, followed in order of prevalence by MUs 6, 8, 3, and 4.

Coast live oak woodlands are distributed west of the Sierra Nevada from Mendocino County, California, south to northwest Baja California, Mexico. In southern California, they are distributed along the South Coast Ranges and coastal slopes of the Transverse and Peninsular Ranges (Oberbauer et al. 2008). These woodlands are typically found on north-facing slopes and shaded ravines in the south (Oberbauer et al. 2008). Stands may be found in mesic uplands or riparian or semi-riparian settings where fluvial processes affect regeneration (Sproul et al. 2011). The coast live oak association *Q. agrifolia/Salix lasiolepis* is designated as riparian forest and is included in the riparian forest vegetation category and not in the coast live oak woodland category. Coast live oaks live for more than 200–300

years and are usually less than 30 meters tall. In the *Q. agrifolia* alliance, *Q. agrifolia* is the dominant or codominant species and the canopy is open to continuous (Sproul et al. 2011). Associated tree species in the upland *Q. agrifolia* alliance can include *Q. engelmannii*, *Q. berberidifolia* x *acutidens*, and *Q. kelloggii* (Sproul et al. 2011). The shrub layer is poorly developed but may include *Heteromeles arbutifolia, Ribes* sp., *Malosma laurina*, or *Sambucus mexicana*. The herb component is continuous and dominated by *Bromus diandrus* and several other introduced taxa (Oberbauer et al. 2008). Alliance level mapping was conducted for the western part of the County by AECOM (SANDAG 2012) and does not include MUs 9, 10, and 11. The *Q. agrifolia* alliance was most widely distributed in MU8, followed in order of prevalence by MUs 4, 5, 3, 6, and 2.

For more information on oak woodlands, go to the MSP Portal Oak Woodland vegetation summary page: https://portal.sdmmp.com/view_species.php?taxaid=SDMMP_vegcom_10.

**Table V2C.7-1. Total acres of oak woodland and acres of oak woodland on Conserved Lands by MSP Management Units.**

| MU | Total Acres | Acres on Conserved Lands |
|---|---|---|
| **1** | 0 | 0 |
| **2** | 308 | 196 |
| **3** | 3,866 | 831 |
| **4** | 4,482 | 1,338 |
| **5** | 12,089 | 1,590 |
| **6** | 4,872 | 1,416 |
| **7** | 0 | 0 |
| **8** | 6,618 | 660 |
| **9** | 12,764 | 6,522 |
| **10** | 25,399 | 8,040 |
| **11** | 7,996 | 2,989 |
| **Grand Total** | **78,394** | **23,582** |

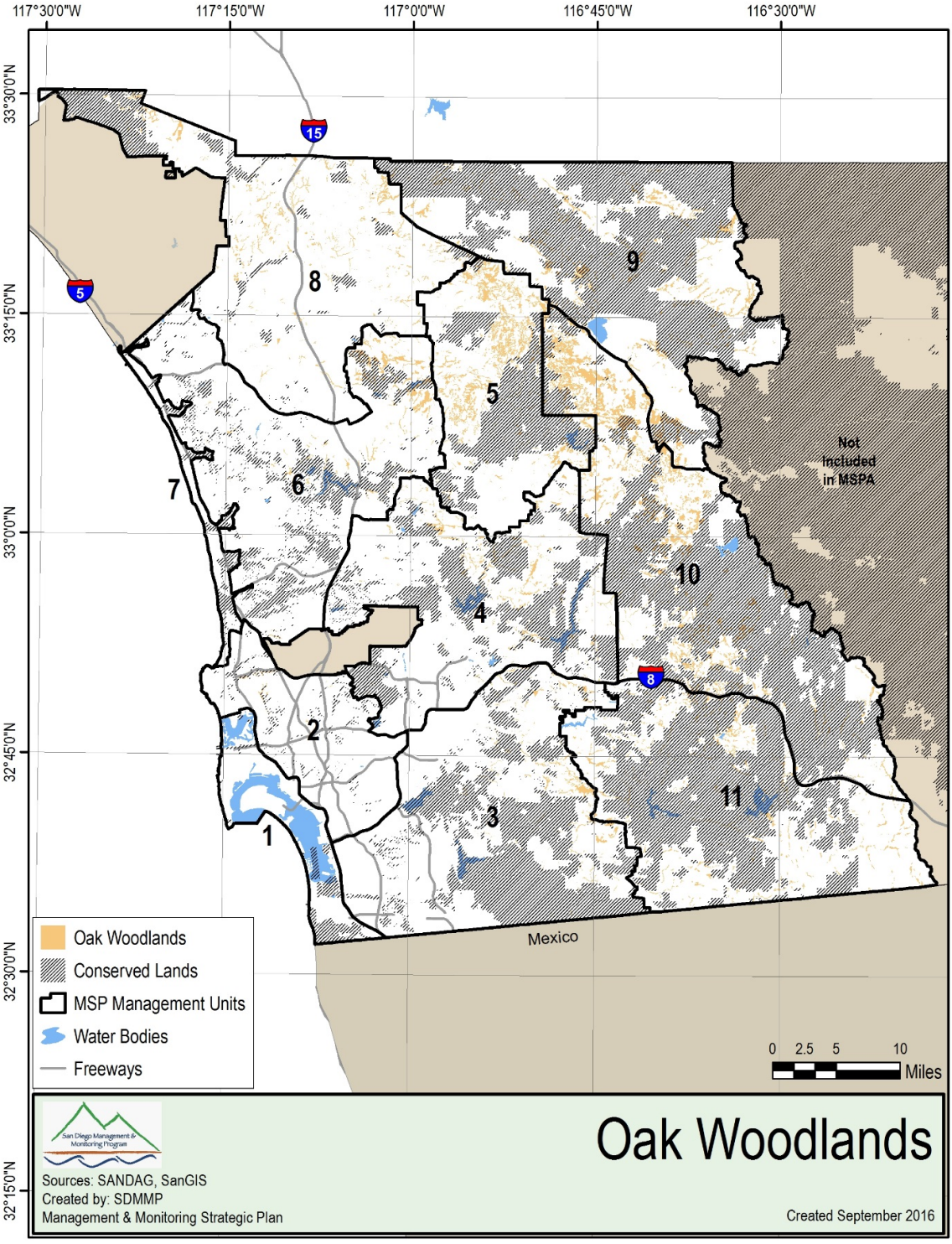


**Figure V2C.7-1. Distribution of oak woodland vegetation in the MSPA.**

## 7.2 MSP SPECIES USING OAK WOODLAND VEGETATION

Sixteen MSP species are associated with oak woodlands (Table V2C.7-2). Two species are oak woodland VF species (Engelmann oak and coast newt) that will be managed through management of oak woodland vegetation. The remaining 14 SL, SO, SS, VF species from other vegetation types, and VG species will benefit incidentally from oak woodland vegetation management.

## 7.3 THREATS TO OAK WOODLAND VEGETATION

Over the last decade, significant die-offs of oaks have occurred in southern California as a result of several interacting threats. Multiple years of drought have killed trees and made them more vulnerable to other threats such as fire, nonnative pests, and fungal pathogens. Coast live oaks have suffered large-scale mortality as a result of the golden-spotted oak borer and fungal pathogens, and more recently are threatened by the polyphagous shot hole borer/Fusarium complex (see Vol. 2B, Sec. 6.3.2.5 and Sec. 6.3.2.6). Fire is the primary natural process affecting upland stands of oak woodlands and short fire return intervals can eliminate coast live oak woodland stands (Sproul et al. 2011). Engelmann oak stands with grassy understories are typically resilient to fire while stands with shrub understories can be top-killed, although trees may recover by resprouting.

## 7.4 MANAGEMENT AND MONITORING APPROACH

This section provides the rationale for management and monitoring objectives for oak woodland vegetation and associated MSP species. The management and monitoring approach is based on an adaptive management framework intended to refine and improve the effectiveness of the management strategy over time. See Vol. 1, Sec. 2.0 for further details on the overall MSP management and monitoring approach.

The management goal for oak woodland vegetation is to maintain, enhance, and restore oak woodlands on Conserved Lands in the MSPA that support or have the potential to support VF species (i.e., Engelmann oak, coast newt). This management goal should incidentally benefit a diverse array of other MSP species (e.g., Harbison's dun skipper, pallid bat, mountain lion), so that the vegetation

## Table V2C.7-2. Oak woodland associated MSP species.

| | Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| **Plants** | | | | |
| | Arctostaphylos otayensis | Otay manzanita | VF | https://portal.sdmmp.com/view_species.php?taxaid=23507 |
| | Clinopodium chandleri | San Miguel savory | SL | https://portal.sdmmp.com/view_species.php?taxaid=565077 |
| | Dicranostegia orcuttiana | Orcutt's bird's-beak | SL | https://portal.sdmmp.com/view_species.php?taxaid=834156 |
| | Lepechinia cardiophylla | Heart-leaved pitcher sage | SL | https://portal.sdmmp.com/view_species.php?taxaid=32553 |
| | Monardella hypoleuca ssp. lanata | Felt-leaved monardella | VF | https://portal.sdmmp.com/view_species.php?taxaid=524318 |
| | Quercus engelmannii | Engelmann Oak | VF | https://portal.sdmmp.com/view_species.php?taxaid=19329 |
| **Invertebrates** | | | | |
| | Euphyes vestris harbisoni | Harbison's dunn skipper | SL | https://portal.sdmmp.com/view_species.php?taxaid=707282 |
| **Amphibians** | | | | |
| | Taricha torosa torosa | Coast range newt | VF | https://portal.sdmmp.com/view_species.php?taxaid=208226 |
| **Birds** | | | | |
| | Accipiter cooperii | Cooper's hawk | VG | https://portal.sdmmp.com/view_species.php?taxaid=175309 |
| | Aquila chrysaetos canadensis | Golden eagle | SO | https://portal.sdmmp.com/view_species.php?taxaid=175408 |
| | Sialia mexicana | Western bluebird | VG | https://portal.sdmmp.com/view_species.php?taxaid=179806 |
| **Mammals** | | | | |
| | Antrozous pallidus | Pallid bat | SL | https://portal.sdmmp.com/view_species.php?taxaid=180006 |
| | Odocoileus hemionus fuliginata | Southern mule deer | SS | https://portal.sdmmp.com/view_species.php?taxaid=898459 |
| | Plecotus townsendii pallescens | Townsend's big-eared bat | SO | https://portal.sdmmp.com/view_species.php?taxaid=203457 |
| | Puma concolor | Mountain lion | SL | https://portal.sdmmp.com/view_species.php?taxaid=552479 |

communities have high ecological integrity, and so these species are resilient to invasive pests and disease pathogens; environmental stochasticity; threats; and catastrophic disturbances, such as very large wildfires and intense and prolonged drought. With the achieved management goal, the species are likely to persist over the long term (>100 years).

The management and monitoring approach for oak woodlands is to gather information documenting the status, environmental conditions, threats, and ecological integrity of this vegetation community and associated MSP species over time in order to periodically identify and prioritize management needs, to implement high-priority management actions, and to monitor effectiveness and improve management with time.

The first step in the strategy is to characterize the current extent of tree mortality in coast live oak and Engelmann oak woodlands in the MSPA as a result of drought, pests, fungal pathogens, and fire. There was extensive mapping of oak mortality in southern California based upon aerial imagery in 2014 (UCANR 2017). Since that time, continued die-off has occurred so it is important to update the existing mapping and fill in gaps with an analysis of remote imagery (e.g., high-resolution aerial photos, LIDAR) to map the current extent of dead oak trees across the MSPA.

The next step is to develop a long-term MSP Oak Woodland Monitoring Plan to assess coast live oak and Engelmann oak mortality and recruitment over time; to document changes in community composition, structure, and ecological integrity; and to assess environmental conditions and identify threats. The monitoring plan will include a conceptual model; specific monitoring questions; a standardized monitoring protocol; a statistically valid sampling design with sampling locations; a plan for analyzing and managing data; a monitoring schedule; and reporting requirements. The monitoring plan will be based on a conceptual model to identify covariates to collect in assessing environmental conditions and threats to identify and prioritize management needs in future planning cycles. Permanent sampling plots will be established along north-to-south and east-to-west gradients across the MSPA to capture the full range of environmental conditions and tree mortality characteristics in a statistically valid sampling design. The monitoring plan will incorporate sufficient sampling of Engelmann oaks to determine the status of this VF species and its management needs. The monitoring plan should integrate and

be consistent with the riparian vegetation monitoring plan as feasible, since the threats faced by both vegetation communities are very similar and both communities can be integrated in the larger landscape matrix. Once the Oak Woodland Vegetation Monitoring Plan is completed, then field-based monitoring will be conducted to gather data.

In addition to oak woodland vegetation monitoring, a monitoring plan and schedule will be developed and implemented for coast newt, a VF species in chaparral, oak woodland, and riparian vegetation communities. This monitoring will be integrated with vegetation monitoring as feasible. There will be monitoring to determine the impact of oak die-offs on bird communities, as part of the loss of integrity threat monitoring conducted in riparian and oak woodlands (see Vol. 2B, Sec. 9). Monitoring and developing BMPs for invasive nonnative pests and fungal pathogens, such as the shot hole borer and Fusarium complex, will provide information to be integrated into oak woodland monitoring and management (see Vol. 2B, Sec. 6). There is also a species-specific monitoring objective for Harbison's dun skipper to collect data on oak woodland habitats during surveys for this species (see Vol. 2D).

An Oak Woodland Management Plan will be prepared with information obtained from vegetation, ecological integrity, invasive pests, and species-specific monitoring. The management plan will identify and prioritize management needs to maintain, enhance, and restore oak woodlands to ensure recovery from multiple threats, to maintain high ecological integrity, and to support MSP species. The management plan will prioritize the location and type of management actions needed, specify BMPs, develop a management timeline, and provide guidelines for monitoring the effectiveness of management actions. Upon completion of the management plan, high-priority management actions will be completed and monitored for effectiveness according to the timeline prepared for each MSP planning cycle. Long-term vegetation and MSP species monitoring will continue on a scheduled basis and the results, along with management effectiveness monitoring and ecological integrity monitoring, will be used to update and refine the management plan at periodic intervals.

### 7.4.1 General Approach Objectives

Below is a summary of the management and monitoring objectives for oak woodland vegetation. For the most up-to-date goals, objectives, and actions, go to the MSP Portal: https://portal.sdmmp.com/tracker.php?Target=veg+community&Species=SDMMP_vegcom_10&ActionStatus=&ManagementUnit=&ObjectiveType=&Year=&Preserve=&Short=Long&submit=Submit.

There are 3 objectives included for oak woodland vegetation monitoring in the MSP Roadmap 2017–2021 planning cycle. The focus will be to gather information to characterize oak woodland vegetation communities, including Engelmann oak, a VF species (see link in Table V2C.7-2).

An existing oak mortality GIS map across the MSPA will be updated and an Oak Woodland Monitoring Plan will be developed and implemented. Development of an Oak Woodland Management Plan and implementation of high-priority management actions is planned for the 2022–2026 planning cycle, after information has been gathered to guide management planning and decision making.

### 7.4.2 Species-Specific Approach Objectives

The management and monitoring approach; rationale; and goals, objectives, and actions for at-risk MSP species associated with oak woodlands are presented in the corresponding species sections and species profiles accessible on each species' summary page (see links in Table V2C.7-2).

There are 2 oak woodland VF species: Engelmann oak and coast newt. Engelmann oak will be monitored as part of the Oak Woodland Monitoring Plan in the current planning cycle. Development of a monitoring plan for coast newt is delayed until the 2022–2026 planning cycle. Management objectives for both species are also delayed until the development and implementation of an Oak Woodland Management Plan in the next planning cycle.

## 7.5 OAK WOODLAND REFERENCES

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# 8.0 VERNAL POOL AND ALKALI PLAYA

## 8.1 OVERVIEW

Vernal pool and alkali playa vegetation make up 2,244 acres in the MSPA, 877 (39%) of which are conserved (Table V2C.8-1). Vernal pools are seasonal wetlands that contain ponded water from a week to a few months and then are dry in summer and fall (City of San Diego 2015). Vernal pools are located in MUs 2, 3, 4, 5, 6, 7, 8, 9, and 10 (Figure V2C.8-1 or view an online map at https://portal.sdmmp.com/map_vegetation.php?taxaid=SDMMP_vegcom_4). They are most abundant in MUs 3, 10, 6, 4, and 5 (listed in order of decreasing abundance). Vernal pools mapped in MU10 surround Lake Cuyamaca and do not meet the requirements for vernal pools in this plan but are included in the acreages in this section because they are classified as vernal pools in the SANDAG vernal pool spatial layer. Alkali playas comprise 93 acres in the MSPA and 71 (96.3%) are conserved. Alkali playas are also dry lakes or edges of dry lakes that typically undergo periods of temporary inundation during the wet season and have high concentrations of alkali salts (Holland 1986). Alkali playas are most abundant in MUs 6, 3, and 5.

Vernal pool ecosystems are found in the western United States from southern Oregon south into northern Baja California, Mexico (City of San Diego 2015). When rain falls, pools form in depressions that have an underlying impervious soil layer or have poorly drained soils (USFWS 1998). Vernal pools often occur on flat mesa tops or in valleys in lower parts of watersheds (Bauder 1996). Vernal pool systems have differences in the duration and pattern of ponding, water and soil chemistry, and temperature and rainfall regimes (Hanes and Stromberg 1998). In the MSPA, vernal pools are found primarily in the Huerhuero, Stockpen, Redding, and Olivenhain soil series (Bauder 1996, 2000; City of San Diego 2015). Vernal pools can form complexes of interconnected basins with a relatively large shared watershed or can occur as single pools with no watershed that are dependent entirely on rainfall filling the pools directly (City of San Diego 2015). Vernal pools vary in size and depth depending on geomorphology and hydrological conditions. Small rounded hummocks called mima mounds are characteristic of many vernal pools in San Diego County. Vernal pool vegetation is short in stature and consists primarily of annual plants that grow while the pools are inundated or as they are beginning

to dry up. Species associated with vernal pools in central San Diego County include *Crassula connata, C. aquatica, Deschampsia danthonioides, Downingia cuspidata, Elocharis macrostachya, Lilaea scilloides, Pilularia americana, Psilocarphus brevissimus,* and *Psilocarphus tenellus* (Bauder 2000).

**Table V2C.8-1. Total acres of vernal pool and alkali playa and acres on Conserved Lands by MSP Management Units.**

| MU | Vernal Pool Total Acres | Vernal Pool Acres on Conserved Lands | Alkali Playa Total Acres | Alkali Playa Acres on Conserved Lands |
|---|---|---|---|---|
| 1 | 0 | 0 | 14.1 | 14.1 |
| 2 | 311 | 4 | 0.8 | 0 |
| 3 | 663 | 386 | 4.4 | 1.5 |
| 4 | 158 | 80 | 0 | 0 |
| 5 | 140 | 52 | 0 | 0 |
| 6 | 308 | 179 | 38.0 | 38.0 |
| 7 | 5 | 1 | 35.7 | 17.4 |
| 8 | 2 | 0 | 0 | 0 |
| 9 | 18 | 16 | 0 | 0 |
| 10 | 640 | 160 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 |
| **Grand Total** | **2,244** | **877** | **93.0** | **71.0** |

Alkali playas undergo periods of inundation followed by rapid evaporation with accumulation of salts and minerals in the poorly drained soil (Bauder et al. 2009). They have high salinity and/or alkalinity (County of San Diego 2005). Alkali playas can be found in dry lakes and in swales in vernal pools where they are hydrologically connected to vernal pools within a shared watershed but the inundation is less. Some species supported in alkali playas in the MSPA include *Atriplex parishii, A. coulteri, Lepidium latipes, Plantago bigelovii, Hordeum depressum* and *Centromadia parryi* ssp. *australis* (Ecological Ventures California 2003; County of San Diego 2005).

For more information on vernal pools and alkali playas, see the vegetation profiles on the MSP Portal: https://portal.sdmmp.com/view_species.php?taxaid=SDMMP_vegcom_4.

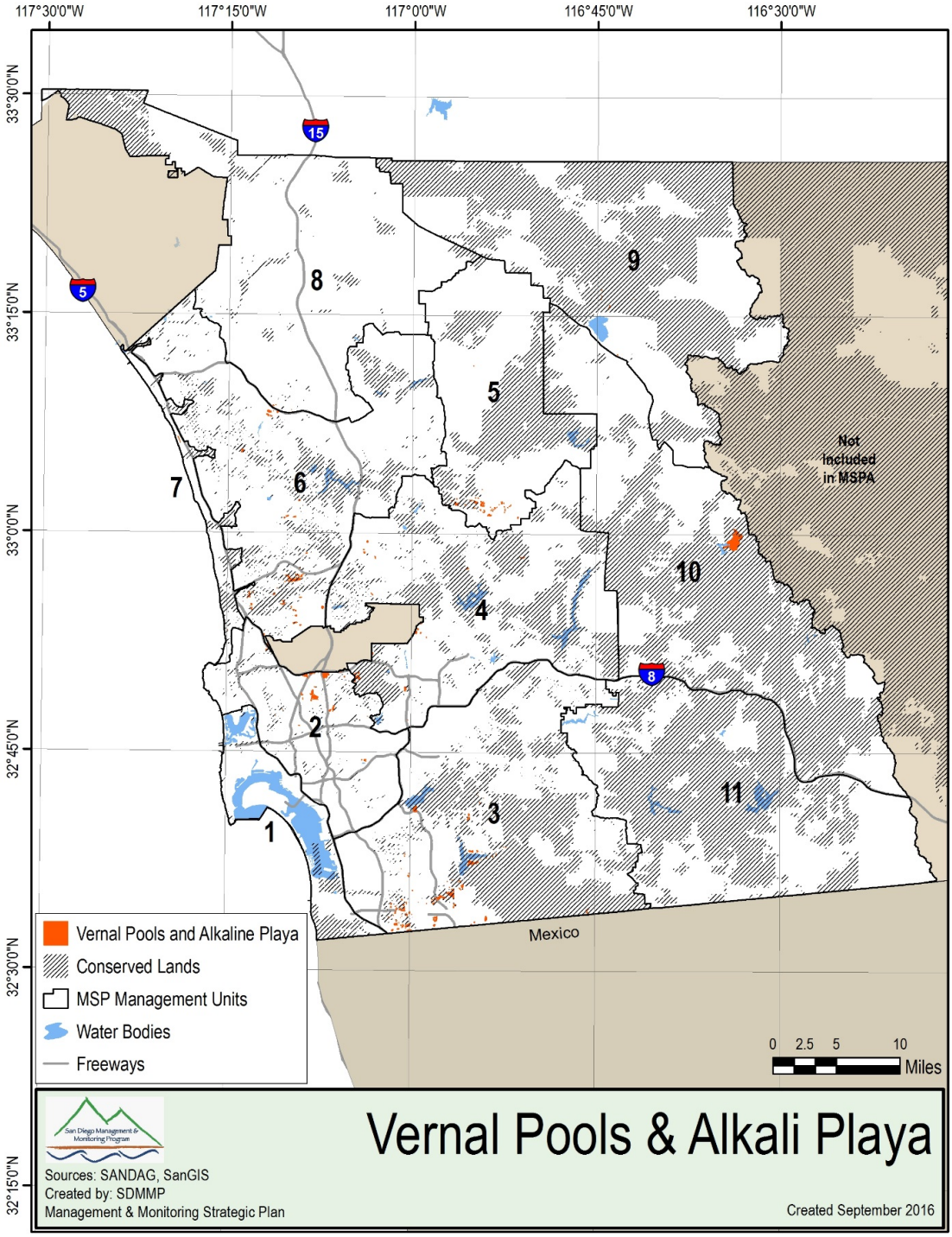


**Figure V2C.8-1. Distribution of vernal pool and alkali playa vegetation in the MSPA.**

## 8.2 SPECIES USING VERNAL POOL AND ALKALI PLAYA VEGETATION

Nineteen MSP species are associated with vernal pools and alkali playas. Eleven species are vernal pool and alkali playa VF species that will be managed through management of vernal pools and alkali playas (Table V2C.8-2). Five MSP rare plant, 2 invertebrates and an amphibian are classified as vernal pool VF species. Three MSP rare plant species are categorized as VF species in alkali playa and alkali vernal swale vegetation communities. The remaining 7 SL, SO, and SS species and VF species in other vegetation categories will benefit incidentally from vernal pool and alkali playa vegetation management.

## 8.3 THREATS TO VERNAL POOL AND ALKALI PLAYA VEGETATION

Threats to vernal pools and alkali playa in the MSPA include the loss, degradation, and fragmentation of habitat; off-road vehicles; altered hydrology; modified watersheds; soil compaction; erosion; invasive nonnative plant and animal species; and human disturbance (USFWS 1998; Bauder 2005). Disruptions to hydrological cycles and impacts to watersheds can create barriers to dispersal so that reproduction and pollination of species can be inhibited (Bauder 1996). Other threats include indirect effects of pesticides, water and air pollution, and fire suppression (USFWS 1998). Drought may also depress native plant populations and provide openings for nonnative plant species to invade pools and adjacent watersheds (MSP-MOM 2016). Future climate is projected to have more frequent, intensive, and prolonged droughts, which could affect vernal pool species (see Vol. 2B, Sec. 3).

## 8.4 MANAGEMENT AND MONITORING APPROACH

This section provides the rationale for management and monitoring objectives for vernal pool and alkali playa vegetation and MSP VF species assigned to this group. The management and monitoring approach is based on an adaptive management framework intended to refine and improve the effectiveness of the management strategy over time. See Vol. 1, Sec. 2.0 for further details on the overall MSP management and monitoring approach.

## Table V2C.8-2. MSP plant and animal species with vernal pool and alkali playa vegetation communities.

| | Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| **Plants** | | | | |
| | Atriplex coulteri | Coulter's saltbush | VF | https://portal.sdmmp.com/view_species.php?taxaid=20523 |
| | Atriplex parishii | Parish brittlescale | VF | https://portal.sdmmp.com/view_species.php?taxaid=20554 |
| | Bloomeria clevelandii | San Diego goldenstar | SS | https://portal.sdmmp.com/view_species.php?taxaid=509575 |
| | Brodiaea filifolia | Thread-leaved brodiaea | SS | https://portal.sdmmp.com/view_species.php?taxaid=42806 |
| | Brodiaea santarosae | Santa Rosa brodiaea | SS | https://portal.sdmmp.com/view_species.php?taxaid=810190 |
| | Centromadia parryi ssp. Australis | Southern tarplant | VF | https://portal.sdmmp.com/view_species.php?taxaid=780715 |
| | Dicranostegia orcuttiana | Orcutt's bird's-beak | SL | https://portal.sdmmp.com/view_species.php?taxaid=834156 |
| | Dudleya variegata | Variegated dudleya | SS | https://portal.sdmmp.com/view_species.php?taxaid=502182 |
| | Eryngium aristulatum var. parishii | San Diego button-celery | VF | https://portal.sdmmp.com/view_species.php?taxaid=528066 |
| | Ferocactus viridescens | San Diego barrel cactus | VF | https://portal.sdmmp.com/view_species.php?taxaid=19801 |
| | Navarretia fossalis | Spreading navarretia | VF | https://portal.sdmmp.com/view_species.php?taxaid=31328 |
| | Orcuttia californica | California orcutt grass | SL | https://portal.sdmmp.com/view_species.php?taxaid=41970 |
| | Pogogyne abramsii | San Diego mesa mint | VF | https://portal.sdmmp.com/view_species.php?taxaid=32639 |
| | Pogogyne nudiuscula | Otay mesa mint | SL | https://portal.sdmmp.com/view_species.php?taxaid=32643 |
| **Invertebrates** | | | | |
| | Branchinecta sandiegonensis | San Diego fairy shrimp | SL | https://portal.sdmmp.com/view_species.php?taxaid=624043 |
| | Euphydryas editha quino | Quino checkerspot butterfly | SL | https://portal.sdmmp.com/view_species.php?taxaid=779299 |
| | Streptocephalus wootoni | Riverside fairy shrimp | SL | https://portal.sdmmp.com/view_species.php?taxaid=624020 |

| | Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| **Amphibians** | | | | |
| | Spea hammondii | Western spadefoot toad | VF | https://portal.sdmmp.com/view_species.php?taxaid=206990 |
| **Birds** | | | | |
| | Athene cunicularia hypugaea | Western burrowing owl | SL | https://portal.sdmmp.com/view_species.php?taxaid=687093 |

The overall goal is to protect, enhance. and restore vernal pool and alkali playa habitat on Conserved Lands in the MSPA that supports or has the potential to support VF and SL species (i.e., California Orcutt grass, Coulter's saltbush, Otay mesa mint, Parish brittlescale, San Diego button-celery, San Diego mesa mint, southern tarplant, spreading navarretia, Riverside fairy shrimp, San Diego fairy shrimp, and western spadefoot) so that the vegetation community has high ecological integrity, and these species are resilient to environmental stochasticity and threats such as altered hydrology, climate change, and invasive plants, and will likely persist over the long term (>100 years).

The management and monitoring approach for vernal pool and alkali playa vegetation is based upon the City of San Diego Vernal Pool Habitat Conservation Plan (VPHCP); City of San Diego 2015). A conceptual model was developed to document understanding of vernal pool systems and to identify monitoring components and management triggers. In the VPHCP, management standards were identified and, if not met, then more intensive management and monitoring are required to achieve these standards under the Vernal Pool Monitoring and Management Plan (VPMMP; City of San Diego 2015). The standards include "preventing an average decline of 1 cover class for conserved (MSP) plant species over 3 years; preventing a 20% decline in shrimp species presence over 3 years; preventing an average of at least 1 cover class of total nonnative cover over 3 years in complexes with at least 10% total nonnative cover; and maintaining vernal pool hydrological network and water storage functions" (City of San Diego 2015).

Under the VPMMP (City of San Diego 2015), Level 1 is classified as stewardship and is the lowest tier of monitoring and management to maintain existing conditions and conserved species populations (including MSP species) within conserved vernal pool complexes. Level 2 requires more rigorous monitoring and an intermediate level of management to stabilize conserved species through habitat enhancement to achieve habitat and species objectives. The highest intensity of management is Level 3, in which habitat is restored to increase declining conserved species (including MSP species) populations as identified in the species objectives and standards.

### 8.4.1 General Approach Objectives

Below is a summary of the management and monitoring objectives for vernal pool and alkali playa vegetation. For the most up-to-date goals, objectives, and actions, go to the MSP Portal: https://portal.sdmmp.com/tracker.php?Target=veg+community&Species=SDMMP_vegcom_4&MonMgtObjType=&ActionStatus=&ManagementUnit=&ObjectiveType=&Year=&Preserve=&Short=Long&submit=Submit.

There are 3 general monitoring and 3 general management objectives for vernal pools during the 2017–2021 planning cycle that follow the City of San Diego's VPMMP (City of San Diego 2015). The first monitoring objective is to conduct annual qualitative monitoring to document threats such as trampling, dumping, topographic and hydrological disturbance, and invasive plants and to determine management needs. The second monitoring objective is to conduct baseline quantitative hydrological surveys to characterize the hydrology of each basin within a vernal pool complex. The third objective is to conduct a topographic disturbance assessment as needed and indicated by the qualitative monitoring and to compare the results with the baseline hydrological assessment. These results will inform management recommendations, and the monitoring will be repeated as management is implemented to determine if hydrological functions are met.

The first management objective is to conduct annual routine stewardship to maintain vernal pool habitat and existing MSP species populations. This Level 1 management includes routine access patrols, trash removal, edge effects maintenance, maintaining fencing and signage, and low intensity control of invasive nonnative plants. The second management objective is to implement Level 2 management as needed to enhance and stabilize vernal pool habitat and MSP species populations. Level 2 management includes implementing Level 1 management actions plus additional actions to repair moderate topographic disturbance, dethatching pools with MSP species and surrounding 20-foot buffers, seed collection, bulking and redistribution to enhance declining MSP plant species populations, and actions to collect and redistribute cysts of MSP shrimp species for population enhancement. This latter action stipulates no collection of shrimp cysts from pools containing Lindahl's fairy shrimp. The final management objective is to implement Level 3 management as needed to restore vernal pool habitat and MSP species that are in decline or poor condition based upon management triggers.

Level 3 management includes all Level 1 actions, in addition to restoring existing pools to increase MSP species, mechanized and hand repair of extensive topographic disturbances, dethatching pools with MSP species and 35-foot surrounding watershed, invasive plant control, reestablishing or enhancing MSP plant species populations through seed collection, bulking and redistribution and container plantings, and collecting MSP fairy shrimp cysts to enhance existing populations or establish new populations.

Additional monitoring objectives for VF vernal pool and alkali playa species are included in the species-specific approach.

### 8.4.2 Species Specific Approach Objectives

There are 11 vernal pool and alkali playa VF species (Table V2C.8-2). The 5 vernal pool VF plant species have annual surveys in occupied, historically occupied, and potentially suitable habitat to determine cover classes in each basin and of nonnative species to determine if Level 1, 2, or 3 management is required. There are qualitative surveys to determine the presence of 2 MSP fairy shrimp species to determine whether Level 1, 2, or 3 management actions are needed. There is an objective to conduct annual surveys of western spadefoot in vernal pools to determine distribution and status, and to assess habitat and threats to determine management needs. The 3 MSP rare plant species classified as VF species in alkali playa will have "inspect and manage" monitoring in 2018 to determine occurrence status and distribution, and to assess habitat and threats to inform management needs.

## 8.5 VERNAL POOL AND ALKALI PLAYA REFERENCES

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# 9.0 SALT MARSH

## 9.1 OVERVIEW OF THE SALT MARSH VEGETATION COMMUNITY

Salt marsh vegetation comprises 2,700 acres in the MSPA, 2,296 acres (85%) of which are conserved (Table V2C.9-1). Salt marsh vegetation community is found along the coast in estuaries, lagoons, and bays in MUs 1, 2, 3, 6, and 7 (Figure V2C.9-1, or view an online map at: https://portal.sdmmp.com/map_vegetation.php?taxaid=SDMMP_vegcom_6). It is most abundant in MU1 followed by MU7.

Southern salt marsh extends from Point Conception south to the Mexican border (Holland 1986). It is a productive vegetation community of herbaceous, salt-tolerant plants less than 1 meter tall (Holland 1986). Some species unique to southern salt marsh include *Atriplex watsonii, Batis maritima*, *Lycium californicum*, *Distichlis littoralis*, *Suaeda californica*, and *Arthrocnemum subterminale* (Oberbauer et al. 2008). Other species commonly found in salt marsh include *Frankenia grandifolia*, *Heliotropium curassavicun*, *Juncus acutus*, *Limonium californicum*, *Salicornia bigelovii*, and *Spartina foliosa*. Soils are subject to tidal inundation by salt water at least part of the year (Holland 1986).

For more information on the salt marsh community, go to the MSP Portal Salt Marsh vegetation summary page: https://portal.sdmmp.com/view_species.php?taxaid=SDMMP_vegcom_6.

## 9.2 MSP SPECIES USING SALT MARSH VEGETATION

Fifteen MSP species are associated with salt marsh (Table V2C.9-2). Two species are salt marsh VF species (wandering skipper and Belding's savannah sparrow) that will be managed through management of salt marsh vegetation. The remaining 15 SL, SO, SS, VF species from other vegetation types, and VG species will benefit incidentally from salt marsh vegetation management.

**Table V2C.9-1. Total acres of salt marsh and acres on Conserved Lands by MSP Management Units.**

| MU | Total Acres | Acres on Conserved Lands |
|---|---|---|
| 1 | 1,558 | 1,260 |
| 2 | 15 | 2 |
| 3 | 10 | 1 |
| 4 | 0 | 0 |
| 5 | 0 | 0 |
| 6 | 42 | 39 |
| 7 | 1,075 | 994 |
| 8 | 0 | 0 |
| 9 | 0 | 0 |
| 10 | 0 | 0 |
| 11 | 0 | 0 |
| **Grand Total** | **2,700** | **2,296** |

## 9.3 THREATS TO SALT MARSH VEGETATION

Threats to southern salt marsh include urbanization; since 1850, 75% of southern California's salt marshes have been lost to development (Stein et al. 2014). Salt marshes have been significantly altered with habitat isolation, fragmentation, increases in subtidal water, and declines in intertidal and vegetated wetlands. Other threats include invasion by nonnative plant species, loss of transitional upland habitats, and changes to sediment and hydrological processes (Callaway and Zedler 2004). Climate change is causing large-scale changes and impacts with rising sea level (Holgate and Woodworth 2004; Kemp et al. 2011); changing precipitation patterns (Hamlet and Lettenmaier 2007; Bengtsson et al. 2009); erosion; and an increasing frequency and intensity of storms (Emanuel 2005; Webster et al. 2005).

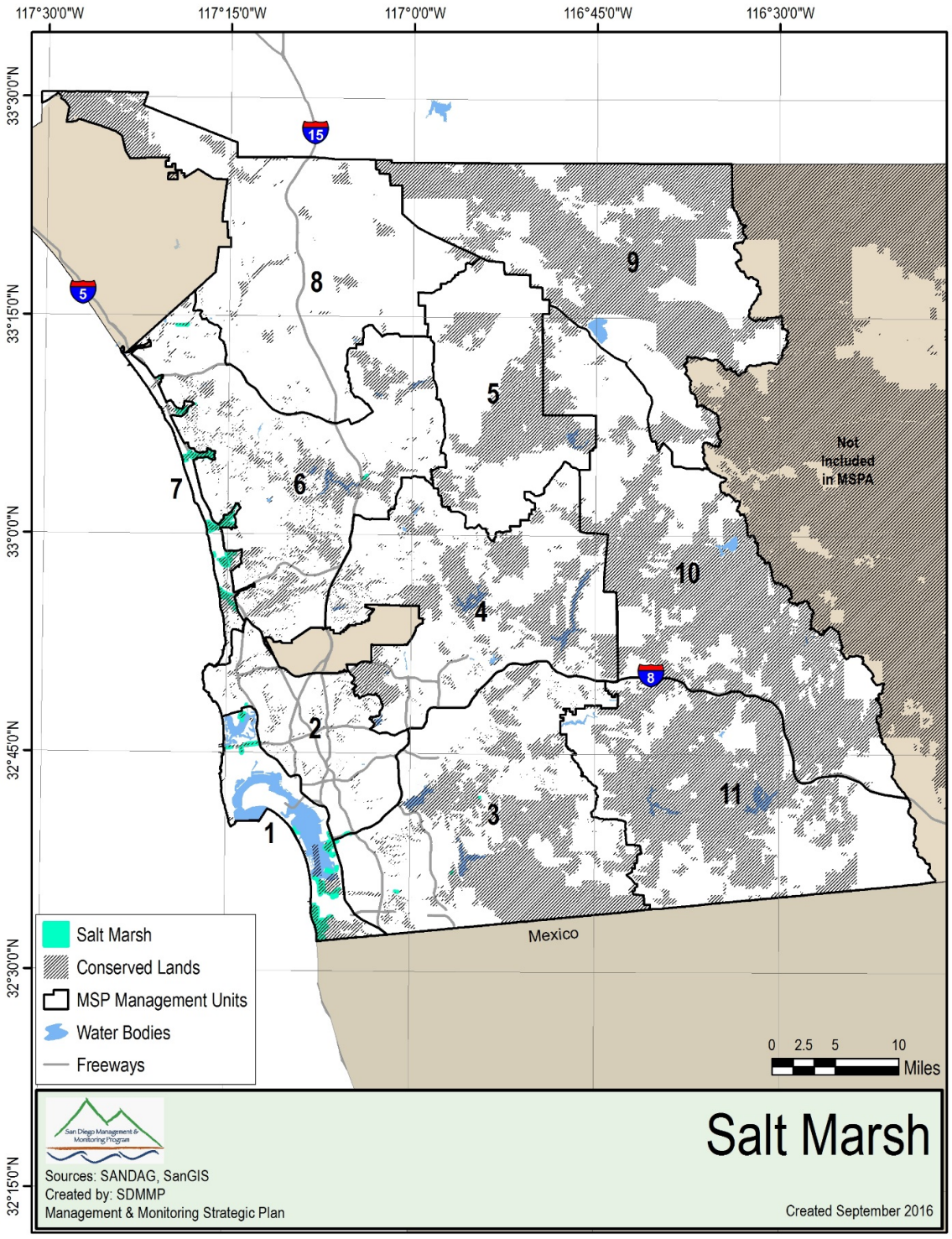


**Figure V2C.9-1. Distribution of salt marsh vegetation in the MSPA.**

## Table V2C.9-2. Salt marsh associated MSP species.

| | Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| **Plants** | | | | |
| | Centromadia parryi ssp. australis | Southern tarplant | VF | https://portal.sdmmp.com/view_species.php?taxaid=780715 |
| | Chloropyron maritimum ssp. maritimum | Salt marsh bird's-beak | SL | https://portal.sdmmp.com/view_species.php?taxaid=834234 |
| **Invertebrates** | | | | |
| | Panoquina errans | Wandering skipper | VF | https://portal.sdmmp.com/view_species.php?taxaid=706557 |
| **Birds** | | | | |
| | Branta canadensis | Canada goose | VG | https://portal.sdmmp.com/view_species.php?taxaid=174999 |
| | Egretta rufescens | Reddish egret | VG | https://portal.sdmmp.com/view_species.php?taxaid=174824 |
| | Falco peregrinus anatum | American peregrine falcon | VG | https://portal.sdmmp.com/view_species.php?taxaid=175605 |
| | Haliaeetus leucocephalus | Bald eagle | VG | https://portal.sdmmp.com/view_species.php?taxaid=175420 |
| | Numenius americanus | Long-billed curlew | VG | https://portal.sdmmp.com/view_species.php?taxaid=176593 |
| | Pandion haliaetus | Osprey | VG | https://portal.sdmmp.com/view_species.php?taxaid=175590 |
| | Passerculus sandwichensis beldingi | Belding's savannah sparrow | VF | https://portal.sdmmp.com/view_species.php?taxaid=179325 |
| | Passerculus sandwichensis rostratus | Large-billed savannah sparrow | VG | https://portal.sdmmp.com/view_species.php?taxaid=179330 |
| | Pelecanus occidentalis californicus | California brown pelican | VG | https://portal.sdmmp.com/view_species.php?taxaid=174688 |

| | Scientific Name | Common Name | Management Category | Summary Page Link |
|---|---|---|---|---|
| | Rallus obsoletus levipes | Light-footed Ridgway's rail | SO | https://portal.sdmmp.com/view_species.php?taxaid=176211 |
| | Sternula antillarum browni | California least tern | SO | https://portal.sdmmp.com/view_species.php?taxaid=825084 |
| | Thalesseus elegans | Elegant tern | VG | https://portal.sdmmp.com/view_species.php?taxaid=176931 |

## 9.4 MANAGEMENT AND MONITORING APPROACH

This section provides the rationale for management and monitoring objectives for salt marsh vegetation and associated MSP species. The management and monitoring approach is based on an adaptive management framework intended to refine and improve the effectiveness of the management strategy over time. See Vol. 1, Sec. 2.0 for further details on the overall MSP management and monitoring approach.

The management goal is to maintain, enhance, and restore salt marsh vegetation on Conserved Lands in the MSPA that supports or has the potential to support VF species (i.e., wandering skipper, Belding's savannah sparrow). This management goal should incidentally benefit other MSP species (e.g., salt marsh bird's-beak, Ridgway's light-footed rail) so that the vegetation community has high ecological integrity, and so these species are resilient to environmental stochasticity and threats such as climate change. With the achieved management goal, the species are likely to persist over the long term (>100 years).

The management and monitoring approach for salt marsh vegetation is to gather information documenting the status, environmental conditions, threats, and ecological integrity of this vegetation community and associated VF species over time in order to periodically identify and prioritize management needs, to implement high-priority management actions and to monitor effectiveness and improve management with time. It is also important to use models of future potential conditions as a result of climate change to plan for the long-term management of this vegetation community.

The first step in the strategy is to evaluate existing salt marsh monitoring programs with land managers, scientists, wildlife agencies, and other stakeholders to determine if there are gaps in existing monitoring programs or information needs. If needed, a long-term MSP Salt Marsh Monitoring Plan will be developed to document changes in community composition, structure, and ecological integrity, and to assess environmental conditions and identify threats. The monitoring plan will include a conceptual model; specific monitoring questions; a standardized monitoring protocol; a statistically valid sampling design with sampling locations; a plan for analyzing and managing data; a monitoring schedule; and reporting requirements. The monitoring plan will be based on a conceptual model to identify

covariates to collect in assessing environmental conditions and threats to identify and prioritize management needs in future planning cycles. Permanent sampling plots will be established in coastal estuaries, lagoons, and bays on Conserved Lands. The sampling design and protocols will take into account rising sea levels and models projecting future conditions to provide information important for managing under climate change. The monitoring plan will be implemented according to the recommended schedule, data analyzed, and the results incorporated into existing management programs. As high-priority management actions are implemented, monitoring will be employed to determine the effectiveness of management actions and whether changes or adjustments are needed to improve management.

In addition to the salt marsh vegetation monitoring, a monitoring plan and schedule will be developed and implemented for the wandering skipper. This monitoring will be integrated with salt marsh vegetation monitoring as feasible. Belding's savannah sparrow populations are being monitored as part of a program conducted by CDFW. The objective is to develop a standardized protocol to integrate habitat assessments and threat monitoring into the existing sparrow monitoring program and as feasible with the salt marsh vegetation monitoring. Data collected on the VF species and habitat assessments and threat evaluations will be used to develop management recommendations to incorporate into existing management programs.

If there are preserves without vegetation management plans or that need to update existing plans, then a Salt Marsh Vegetation Management Plan can be developed to fill the gaps for the benefit of salt marsh vegetation and VF species.

### 9.4.1 General Approach Objectives

Below is a summary of the management and monitoring objectives for salt marsh vegetation. For the most up-to-date goals, objectives, and actions, go to the MSP Portal:
https://portal.sdmmp.com/tracker.php?Target=veg+community&Species=SDMMP_vegcom_6&MonMgtObjType=&ActionStatus=&ManagementUnit=&ObjectiveType=&Year=&Preserve=&Short=Long&submit=Submit.

There is 1 objective for salt marsh vegetation monitoring in the MSP Roadmap 2017–2021 planning cycle. The focus is to evaluate existing monitoring programs and develop a Salt Marsh Vegetation Monitoring Plan if gaps are present in existing efforts.

If there is a need to develop a Salt Marsh Vegetation Monitoring Plan in the 2017–2021 planning cycle, then it will be implemented in the 2022–2026 planning cycle. Data collected from monitoring will be available to develop management recommendations to incorporate into existing programs. A Salt Marsh Vegetation Management Plan can be developed in future planning cycles if such a plan is needed to cover gaps in existing efforts.

### 9.4.2 Species-Specific Approach Objectives

The management and monitoring approach; rationale; and goals, objectives, and actions for at-risk MSP species associated with salt marsh are presented in the corresponding species sections and species profiles accessible on each species' summary page (see links in Table V2C.9-2).

There are 2 salt marsh VF species: wandering skipper and Belding's savannah sparrow. A Wandering Skipper Monitoring Plan will be developed in the current planning cycle and integrated into salt marsh vegetation monitoring as feasible. A habitat and threat assessment plan will be developed for Belding's savannah sparrow and integrated as practical into existing population monitoring and the salt marsh vegetation monitoring. Habitat and threats monitoring will be conducted in the 2017–2021 planning cycle; the monitoring year will depend on the timing of CDFW's Belding's savannah sparrow monitoring.

## 9.5 SALT MARSH REFERENCES

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