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

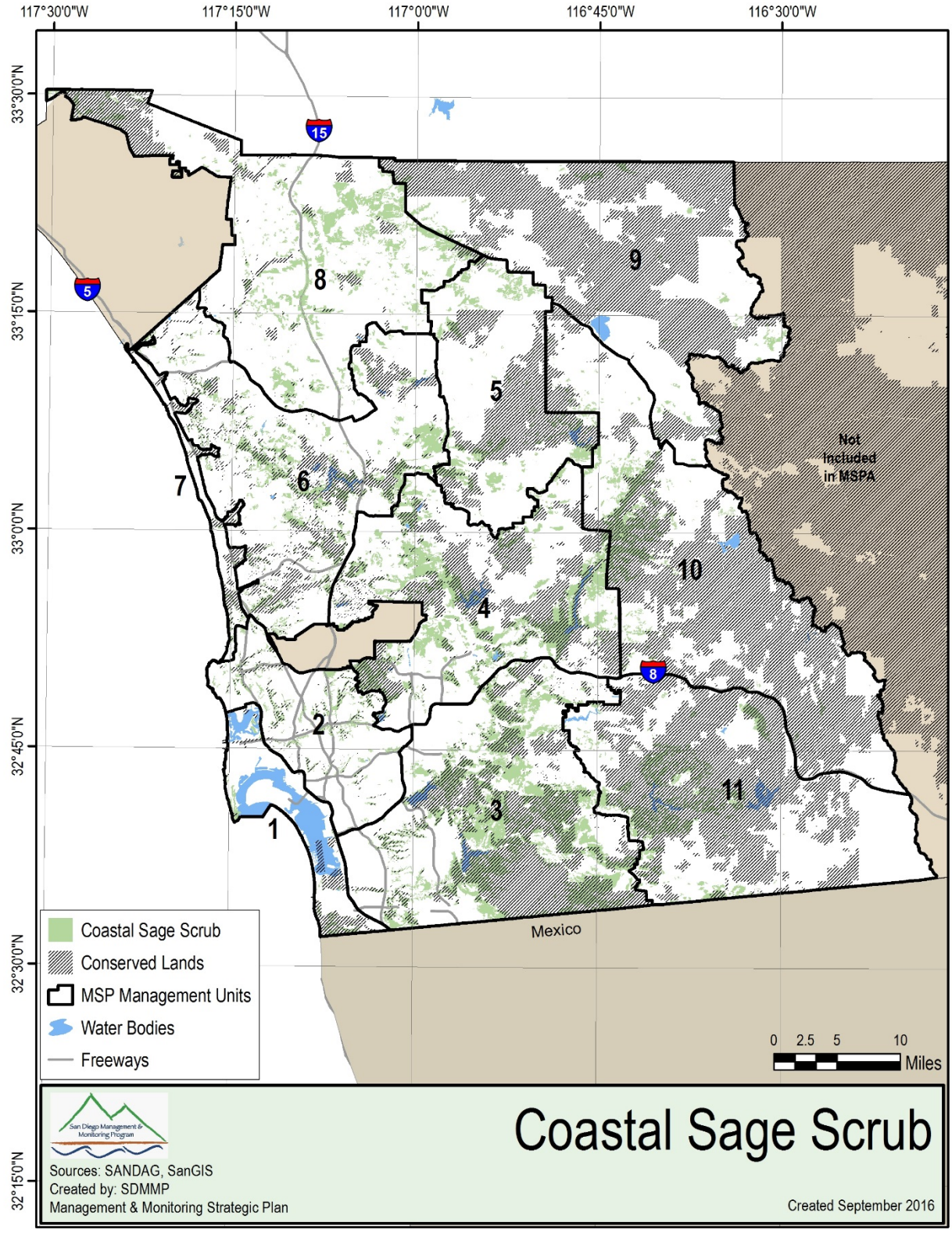

Figure V2C.1-1. Distribution of coastal sage scrub vegetation in the MSPA.

(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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