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.

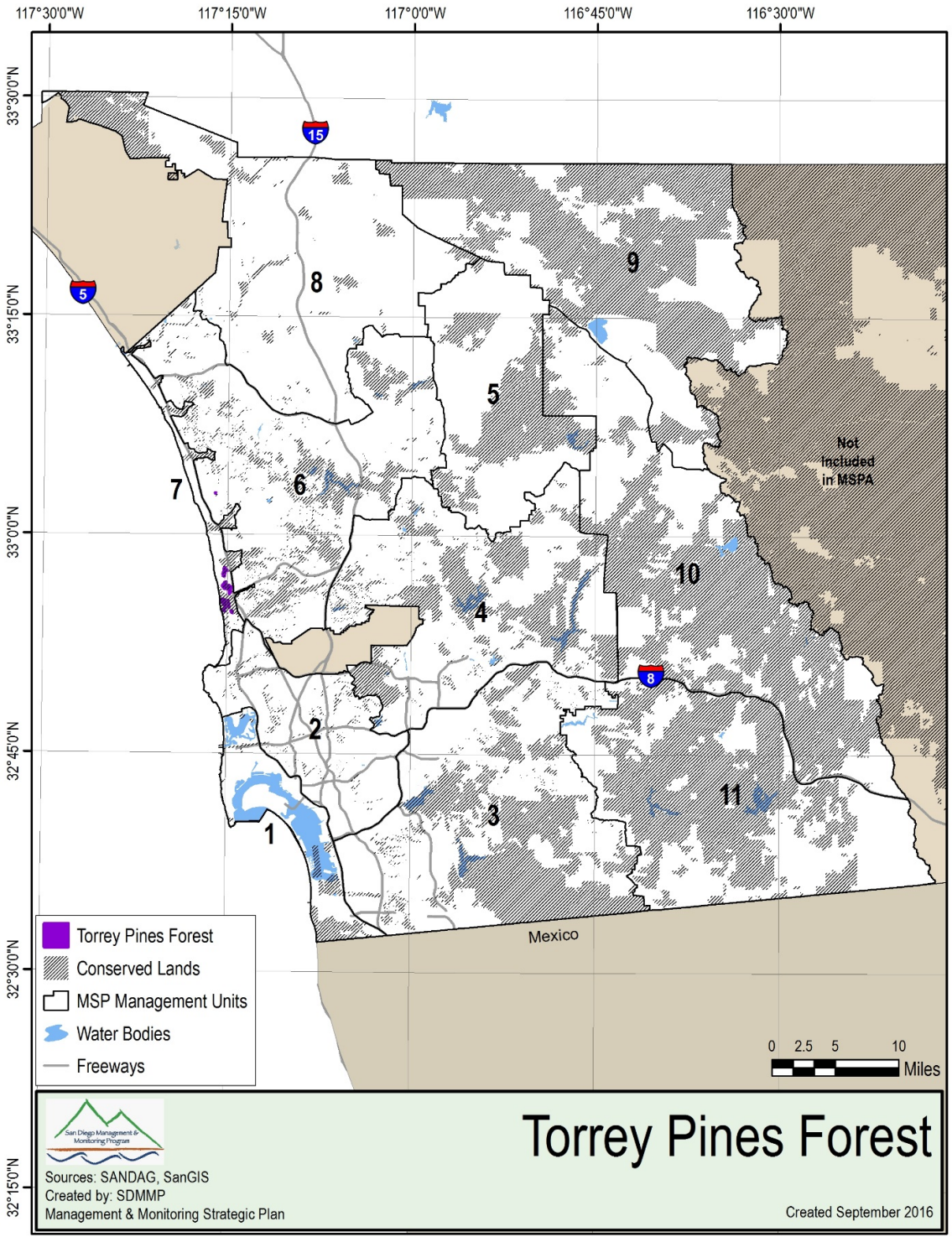

Figure V2C.5-1. Distribution of Torrey pine forest vegetation in the MSPA.

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.

5.5 TORREY PINE FOREST REFERENCES

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