Report to the Monarch Joint Venture
Monitoring of Monarch Overwintering Sites in California
2011/12 and 2012/13

Photo by Candace Fallon/The Xerces Society

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Introduction

Hundreds of thousands of monarch butterflies spend the winter in groves along the coast of California every year. With an estimated 80% decline in monarch numbers at many of California's overwintering sites since 1997, the future of this incredible migration is suspected to be at risk. The loss and deterioration of monarch overwintering habitat may be contributing to this decline. In order to protect the monarch migration, these overwintering habitats must be identified, preserved, and carefully managed. To better understand the current distribution of overwintering monarchs in California and the quality of their overwintering habitat, the Xerces Society proposed to conduct 125 surveys of monarch overwintering sites during the winters of 2011-12 and 2012-13. This report outlines those surveys, including site selection and survey protocols, survey results, recommendations for future monitoring needs, and a case study.

Site selection

With past support from the Monarch Joint Venture in 2010, Xerces compiled existing information from multiple published and unpublished sources to create a comprehensive Western Monarch Overwintering Site Database, which includes 458 monarch overwintering sites, autumnal sites, transitional sites, and possibly extirpated sites. This project revealed significant gaps in our knowledge. For example, the status of monarchs and monarch habitat at nearly half of the 458 sites was unknown, as those sites had not been visited for over ten years.

Using this database, Xerces staff identified 98 unique sites for which we lacked information, 54 of which were surveyed during the 2011-12 season. Over the 2012-13 season Xerces conducted an additional 71 site visits, revisiting 27 of the sites that were surveyed the prior year. Sites spanned fourteen counties along the California coast, from Sonoma to Los Angeles (Figure 1).

We used the following criteria to select these 98 sites to survey:

- Site had not been visited in the last decade or had intermittent survey coverage
- Site had historically supported large numbers of monarchs (>1000)
- Site was on public land (for ease of access)
- Site had a native tree component

Two other criteria were also considered when selecting sites. For one, if a site was known to be threatened by development or tree trimming, such as Albany Hill and San Leandro Golf Course in Alameda County, we surveyed it. We also selected sites that had been visited by Sakai and Calvert in 1991 or Meade in 1998 so that we could have a baseline against which to compare our data. Two of these comparisons are presented in the case studies.

Survey protocol

At each site, we assessed the condition of the overwintering habitat using the monarch habitat assessment protocol (which was developed with past support from the MJV), conducted monarch counts to estimate monarch abundance at each site, collected GIS location information (including points of trees being used and a polygon of the entire site) and land ownership information, and identified threats and potential threats to each site. We timed the majority of the site visits to occur during three weeks surrounding Thanksgiving, so that the abundance data could contribute to the annual Western Monarch Thanksgiving Count (WMTC). Fifteen sites were visited and assessed by staff from both Xerces

and Monarch Alert over the two year period. An additional 22 sites were visited with other local volunteers and/or site staff with the goal of engaging local volunteers in monitoring additional sites in future years.

Figure 1: Map of overwintering sites visited over a two year period

Data entry

All data from these surveys were entered into the Western Monarch Overwintering Site Database during February and March 2013. This database is scheduled to be put online in 2013/14.

Results of habitat assessment protocol

Site threats

Xerces staff assessed and documented overwintering habitat site characteristics using the Habitat Assessment Protocol over the winters of 2011-12 and 2012-13. Data from these forms were entered into the Xerces Society Database of Western Monarch Overwintering Locations. Using this database, we queried site characteristics to determine primary site threats. Two main threats emerged: tree cutting and old and aging trees. Of the 98 unique sites visited by Xerces staff from 2011-2013, at least 33 (one third of the sites) are affected by tree cutting and removal activities. Approximately 24 sites have a large number of old and aging trees. The loss of trees, due to either human activities or old age, is a serious issue for the health of overwintering groves. Active management is necessary to replace trees and maintain appropriate microhabitat conditions and wind buffers. Ideally, tree trimming and removal activities should not take place until a monarch expert has been consulted.

Other common site threats included roads within the overwintering grove (7% of sites visited), groves that were too dense (8% of sites), and dead or dying trees from a non-disease source (7% of sites). Additionally, nearly 20 percent of these groves were heavily affected by Eucalyptus leaf beetle. In fact, eucalyptus leaves displayed some level of the characteristic leaf edge scalloping at almost all sites surveyed in 2012-13. All site threats are documented in Table 1.

Table 1: Site threats

Threat	Number of sites affected
Cut trees/tree removal	33
Old/aging trees	24
Eucalyptus leaf beetle	18
Possibly too dense of trees (i.e., too much shade)	8
Dead/dying trees from non-disease source	7
Road (within the site)	7
High visitation load	5
Buildings	4
Recreation/human use	4
Disease from pitch canker	4
Erosion	3
Insect disease or damage	3
Pavement	3
Picnic area	3
Campsite	2
Fire	2
Cattle grazing	2

Threat	Number of sites affected
Parking lot	2
Construction	1
Development	1
Drought	1
Management practices/maintenance	1
Railroad tracks	1
Understory trimming/clearing	1
Extensive trails	1
Mowing/plowing of nectar plants	1

Tree species composition

Xerces also collected information on tree species composition at each grove, including cluster tree species. At actively clustering sites, the cluster trees were predominantly blue gum eucalyptus (*Eucalyptus globulus*). Table 2 displays all species used as cluster trees at the 98 sites Xerces surveyed in 2011-12 and 2012-13. In addition to these six cluster tree species, other tree species at these sites included *Quercus agrifolia*, *Platanus racemosa*, other *Pinus* species, and *Salix* species.

Table 2: Aggregation species at sites surveyed

Species	Number of sites
Eucalyptus globulus	28
Pinus radiata	4
Cupressus macrocarpus	2
Sequoia sempervirens	2
Eucalyptus camadulensis	1
Eucalyptus spp.	1

Nectar species composition

As part of the habitat assessment, Xerces staff recorded nectar species present at each site. Blue gum eucalyptus was the most common nectar plant available during these survey periods.

Table 3: Nectar species

Species	Number of sites
Eucalyptus globulus	41
Aster sp.	5
Mesembryanthemum sp.	5
Delairea odorata	5
Baccharis pilularis	4
Brassica sp.	4
Baccharis glutinosa	3
Brassica nigra	3

Species	Number of sites
Rubus ursinus	3
Vinca major	3
Stachys bullata	3
Hedera helix	2
Senecio blochmaniae	2
Eucalyptus camaldulensis	2
Taraxacum officinale	2
Ceanothus thyrsiflorus	1
Lantana sp.	1
Ceanothus megacarpus	1
Ericameria ericoides	1
Heteromeles arbutifolia	1
Callistemon sp.	1
Monardella crispa	1
Solanum sp.	1

Recommendations for future monitoring needs for California overwintering sites

While these surveys have greatly increased our understanding of the status of monarch overwintering sites in California, several gaps in our knowledge remain. We recommend the following monitoring needs be addressed in the near future:

Cooperate with private landowners to access and survey sites on their lands.

Private land owners manage approximately 25 percent of all known monarch overwintering sites (Xerces Society Database of Western Monarch Overwintering Locations 2013). In Santa Barbara County alone 51 sites (roughly 38% in the county) are under private management, demonstrating a need to reach out to these land owners to facilitate site visits and annual surveys.

Collaborate with large land managers on site-specific management plans.

A number of monarch overwintering sites fall under one large land manager, making these entities especially important to work with on site-specific management plans. For example, California State Parks manages approximately 50 overwintering sites. Vandenberg Air Force Base manages another 29 sites (see case study, below). Working with large land managers such as these can provide a unique opportunity to influence the conservation and management of a large number of sites at once. Reaching out to such land managers should be a priority.

Encourage increased participation by WMTC volunteers in underserved areas.

Annual participation in the WMTC varies from county to county, with some counties receiving excellent coverage (i.e., San Luis Obispo County), and others receiving little to no coverage (i.e., Los Angeles County). The last comprehensive effort in Los Angeles (LA) County was a decade ago, in 2003, and coverage has been intermittent to nonexistent since (Table 4). While LA is on the southern edge of the overwintering range and sees far fewer monarchs than the larger sites in Santa Barbara and San Luis Obispo counties (Xerces Society Database of Western Monarch Overwintering Locations 2013), it may

be especially important to document annual monarch abundance at these sites if western monarchs are, as suspected, experiencing a contraction in their overwintering range.

Table 4: Los Angeles County Annual WMTC Estimates since 2003 (compiled from Monroe et al 2012). Note that a 'zero' indicates that a volunteer visited the site and counted the number of monarchs present; a blank cell indicates that no site visit was made.

SITE NAME	2003	2004	2005	2006	2007	2008	2009	2010	2011
Ballona Wetlands, Playa Del Rey	80								
Banning Park, Wilmington	6					20			
Busch Dr. & Pacific Coast Hwy., Malibu	535		2300		3600	2000		1000	
Chevron Refinery, El Segundo (Kansas St.)	10								
Encinal Canyon, Malibu	10					0			
El Dorado Nature Center, Long Beach (#1)	8			25	25	40		30	30
El Dorado Nature Center, Long Beach (#2)	0								5
Heartwell Park, Lakewood									
Leo Carrillo State Beach, Malibu	155		35		10	40		15	
Malibu Creek (Serra Rd.), Malibu	300				15	4			
Old Kinney-Stahly Place, Malibu									
Recreation Park (north), Long Beach	0					25			
Recreation Park (south), Long Beach	3					120			
Schabarum Co. Park, Rowland Heights					6	25			
Via La Selva & Via Capay, Palos Verdes	3								
Wilderness Park, Redondo Beach	20				12	2			
Woodlawn Cemetery, Santa Monica	30					30		75	
27540 Hwy. 1, Malibu	25								
2817 Via La Selva, Palos Verdes	6								

In recognition of this need to attract more volunteers in the southern counties, the Xerces Society (with funding from the Monarch Joint Venture, and in partnership with Monarch Alert and the Monarch Program) held a one-day workshop at San Clemente State Beach in Orange County, CA, on December 1, 2012. The goal was to train WMTC volunteers and draw interested citizen scientists from Orange, Los Angeles and San Diego Counties. However, a show of hands during the workshop revealed only participants from Orange and San Diego Counties, with no representatives from LA County. Additional efforts should be made to cultivate a dedicated volunteer group in the LA area and other counties with intermittent survey coverage.

Determine the best time for monitoring monarchs.

Since its beginning in 1997, the WMTC has taken place for approximately three weeks surrounding the Thanksgiving holiday. However, as we try to capture the peak population for all these sites, we must consider whether this time period gives us the most accurate data. While this time period may be appropriate for some permanent or climax sites, we miss important data on temporary sites used at the beginning of the season and climax sites that form later in the season. We need to consider whether the count should also occur in late October and/or late December to early January.

Case Study: Vandenberg Air Force Base

Below we present a case study of monarch overwintering sites managed by Vandenberg Air Force Base. We discuss the land ownership and habitat quality at these sites and compare monarch counts over several years. We also discuss current and historic site threats and specific management needs.

Vandenberg Air Force Base (VAFB) encompasses 98,400 acres on California's central coast in northern Santa Barbara County. The base is owned and operated by the Department of Defense (DOD) and acts as headquarters for the 30th Space Wing, which manages DOD space and missile testing and the placing of satellites into polar orbit from the west coast. Vandenberg has extensive eucalyptus forests with 29 documented monarch overwintering sites (Figure 2) within its boundaries (Meade 1999).

Over the winters of 2011-12 and 2012-13, Xerces staff revisited 15 of the sites that were monitored by D. Meade in 1999 (Table 5) to conduct habitat assessments and estimate monarch abundance. These 15 sites were selected because they had high numbers of monarchs in the past and were relatively easy to access. The other 14 sites had low (often, less than 100) monarchs in the past or were difficult to access.

Figure 2: VAFB Monarch Overwintering Sites Surveyed in 2011/2012 and 2012/2013

We were joined by staff biologists or a local volunteer at all but one of the sites (Marshalia Golf Course). Of these 15 sites, 9 were visited in 1998-99, 2011-12, and 2012-13 (once by Meade and twice by Xerces staff). Table 5 and Figure 3 display these counts. The mean number of monarchs counted per site changed from 2,609 in 1998-99 to 988 in 2011-12 to 330 in 2012-13; representing an approximate 87% decline in abundance between 1998-99 and 2012-13.

Table 5: Vandenberg AFB overwintering sites visited by D. Meade and Xerces staff. A blank cell indicates no site visit was made. Cells in white were counted by other monitors (not Xerces or Meade).

Site Name	1989-90	1990-91	1997-98	1998-99 (Meade)	1999-00	2000-01	2001-02	2005-06	2006-07	2011-12 (Xerces)	2012-13 (Xerces)
35th Street				180						0	788
Airfield Rd	1,100			3,500						303	0
Archery Range			17,000	7,200	250		575			3	0
Bear Creek				275							24
Cross Rd				2,290	0					15	10
Dry Creek Canyon	0			370							0
Family Camp	0		600	1,410						0	
Marshalia Golf Course				4,400						15	35
Mesa Rd/Ag Rd	4,000		6,500	1,650	1,210	2,800	410			2,642	774
Rancho Lateral Road		1,000		18						0	
Spring Canyon	8,000		50,000	6,300	5,780	8,830	4,800	700	2,899	6,015	1,025
Tangair Rd	6,000		25,500	8,100	3,860		0	5,095	329	2,563	692
Umbra Rd				1,800						1	
Upper Spring Canyon	2,500		60,000	1,200				60			1
Water Treatment Plant	0			450						302	613
Total # of monarchs	21,600	1,000	159,600	39,143	11,100	11,630	5,785	5,855	3,228	11,859	3,962
Mean # of monarchs per site (# of sites monitored**)**	**2,700** (8)	**1,000** (1)	**26,600** (6)	**2,609** (15)	**2,220** (5)	**5,815** (2)	**1,446** (4)	**1,951** (3)	**1,614** (2)	**988** (12)	**330** (12)

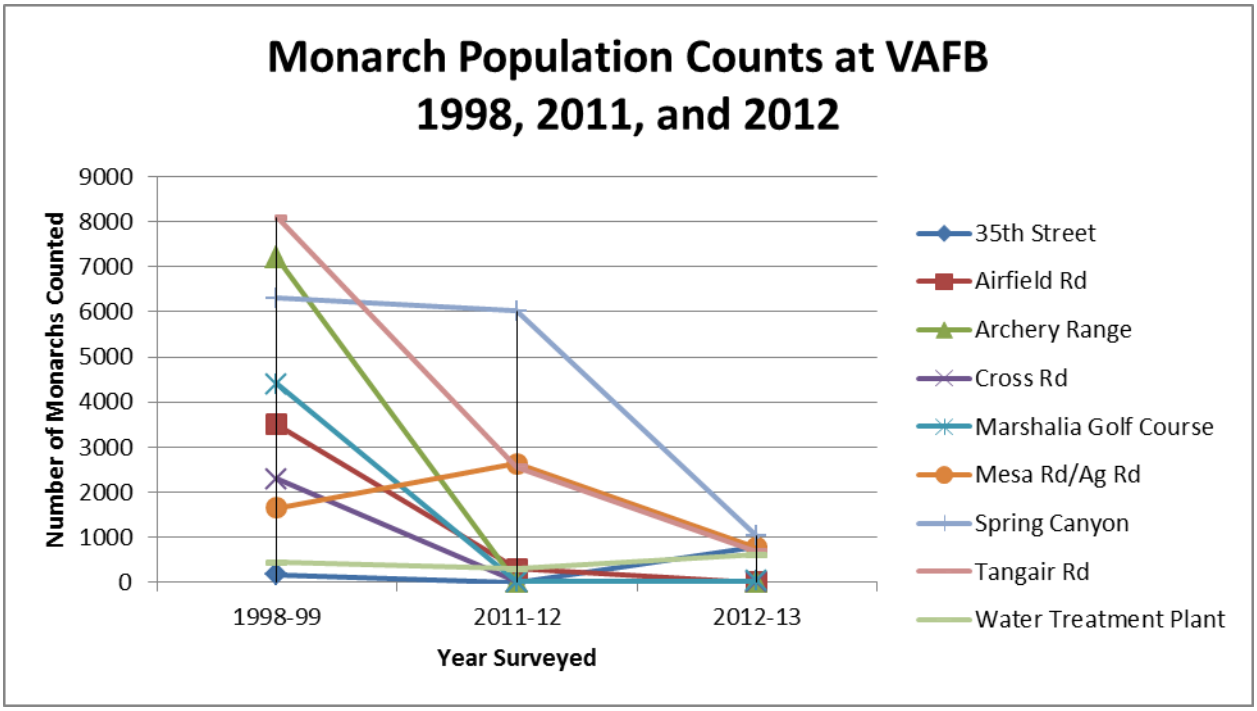

Figure 3: Monarch population counts at VAFB over three survey seasons

Management opportunities and specific site threats

The following management recommendations stem from specific site threats noted in the habitat assessments.

1) Create wind buffers

Our habitat assessments and notes from Meade's surveys reveal three primary threats common to Vandenberg overwintering sites: old and aging trees, cut or trimmed trees, and lack of wind protection. Surveys in 2012 revealed two sites (35th Street and Dry Creek Canyon) with recent tree removals, most likely due to their occurrence under power lines. Neither of these sites has been replanted. In all cases, planting new trees to replace dead and cut trees and create a wind buffer should be a management priority.

2) Search for new groves

Given the large amount of area to cover, additional surveys should be conducted to determine if all overwintering sites have been discovered. It is possible that fluctuations in monarch counts from year to year reflect shifts of monarchs from known groves to unknown ones, rather than an overall decline in population numbers.

3) Establish a dedicated WMTC volunteer presence

While Vandenberg hosts a number of sizeable overwintering sites (including at least five with populations >500), very few comprehensive surveys have been conducted. Many of the sites initially discovered and counted by Calvert and Meade had not been revisited until Xerces staff began monitoring the base in 2011. The Xerces Society has reached out to Vandenberg staff to see if they are interested in working together on site-specific management plans, but natural resources staff is limited and they do not have the capacity to initiate their own annual counts. They are however open to

volunteers counting at their sites, as long as the volunteer goes through the necessary steps to gain base access. Xerces attempted to find local volunteers to take on these sites in 2012, but the distance from Santa Barbara and the large amount of poison oak on base has made this task difficult.

Literature Cited

Meade, D.E. 1999. Monarch butterfly overwintering sites in Santa Barbara County California. Althouse and Meade Biological and Environmental Services, November 1999. 114 pp.

Monroe, M., D. Frey, and S. Stevens. 2012. Western Monarch Thanksgiving Count Data from 1997-2011. Available at: http://www.xerces.org/western-monarch-thanksgiving-count/ (Accessed March 2013)

Sakai, W.H. and W.C. Calvert. 1991. Statewide monarch butterfly management plan for the state of California Department of Parks and Recreation. Final Report, June 1991. Interagency Agreement No. 88-11-050 between California Department of Parks and Recreation and Santa Monica College. 160 pp.

Xerces Society Database of Western Monarch Overwintering Locations. 2013. The Xerces Society for Invertebrate Conservation.