Chapter 1

PISMO WIND STUDY (WORKING TITLE)

1.1 Abstract

1.2 Introduction

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1.3 Materials and Methods

1.3.1 Study Site

Pismo State Beach Monarch Butterfly Grove (hereafter "Pismo") is located in San Luis Obispo County, California (35.12940° N, 120.628° W). The site encompasses approximately 5 hectares (12.4 acres) and is characterized by a mature grove of blue gum eucalyptus (*Eucalyptus globulus*). The grove is situated approximately 0.5 km from the Pacific Ocean, which lies directly to the west.

The grove's eucalyptus trees are the dominant vertical feature in the local landscape. To the west, between the Pacific Ocean and Pismo, lies the North Beach Campground and Pismo Beach Golf Course, both minimally developed with scattered trees and open grassy areas. The northern and eastern boundaries are adjacent to medium-density residential neighborhoods with single and two-story buildings. To the south extends the Oceano Dunes Natural Preserve State Park, characterized by mature coastal dune scrub habitat with low rolling dunes and perennial vegetation. The site is managed by California State Parks.

1.3.2 Site Selection Rationale

Pismo was selected as the primary study site for several key characteristics. The site consistently supports one of the largest aggregations of overwintering monarch butterflies (*Danaus plexippus*) in California, routinely ranking among the top ten overwintering sites by population size [1]. Even during years of low monarch abundance, such as 2024, Pismo maintains a presence of butterflies while many other sites remain vacant.

The site's physical characteristics make it particularly suitable for wind analysis. The western exposure to the Pacific Ocean provides an unobstructed wind corridor, minimizing confounding topographical effects. The surrounding terrain is predominantly flat, and nearby anthropogenic structures do not exceed two stories in height, representing less than 20% of the canopy height of the grove's mature eucalyptus trees.

Additionally, Pismo's extensive history of monarch butterfly research and consistent population monitoring provides valuable historical context for this study. The site's well-documented population counts, conducted at regular intervals, offer opportunities for correlating wind patterns with butterfly abundance and distribution patterns.

1.3.3 Data Loggers

- To monitor wind conditions within the grove, twelve anememoters, or wind meters, were installed at various locations within the Pismo grove. - We used RainWise WindLog Wind Data Loggers for this project. - - anemomoter sensor locations were mounted to trees non-destructively through the use of tie down straps and metal wire. The locations were selected opportunistically based on what could be accessed via a cherry picker and professional arborist team. Sensor locations were chosen to have varying heights (add range of heights here) and locations within the grove. Care was taken to ensure that no anemometers overhanged areas where pedestrians would walk, incase one were to fall. - wind meters were programmed to collect infomation on average wind speed, maximum gusts, and wind direction every minute. - wind meters were deployed for two monarch overwintering seasons, 2023-2024, and 2024-2025. - - For the 2023 season, sensor issues resulted in several meters having reading issues at various times throughout the sampling period. Data was cleaned and only periods of time that have complete, or near complete observations were used in the analysis. - - -

Study Area

Figure 1.1. Clear, descriptive caption explaining what the figure shows and its significance.

1.4 Results

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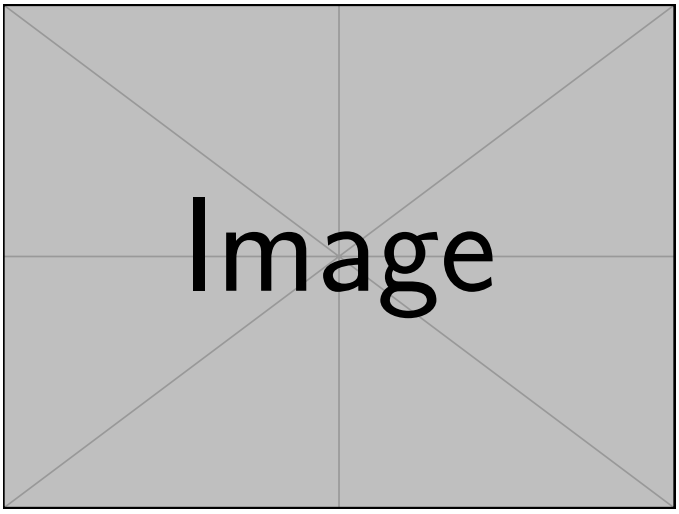

Figure 1.2. Clear, descriptive caption explaining what the figure shows and its significance.

1.5 Discussion

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1.6 References

BIBLIOGRAPHY

[1] The Xerces Society for Invertebrate Conservation. *Western Monarch Thanksgiving Count and New Year's Count Data, 1997-2023*. 2024.