

## Analysis of Butterfly Survey Data and Methodology from San Bruno Mountain Habitat Conservation Plan (1982-2000)

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### Introduction

- Monitoring is an important component of natural resource management and conservation
- Should be repeatable and able to detect trends that inform or lead to management actions
- Not always the case
  - time, expertise and budget limit implementation

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### Study Area

- San Bruno Mountain
  - 3,600 acres
  - 3 endangered butterfly species
  - Habitat Conservation Plan adopted in 1983


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### Past Surveys


- Thomas Reid Associates
- Wandering Surveys
- Recorded:
  - Number of visits
  - Total length of surveys
  - Presence of butterfly
  - Sex
  - Timing
  - Weather conditions

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### Endangered Species




mission blue butterfly



lupine



Callippe silverspot butterfly



California golden violet

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### Research Questions

- Survey Methodology
  - What areas were surveyed frequently and infrequently?
  - What was the relationship between survey frequency and occupancy?
- Distribution Patterns
  - Has either species exhibited secular trends in total area occupied?
  - What areas have exhibited secular trends in occupancy?
  - What areas have exhibited large and small variability in occupancy?
  - Has either species exhibited hilltopping behavior?

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### Methodology

- Overlaid 250 m square grid cells
- "Surveyed" if lengths totaled  $\geq 250$  m

Map showing a 250 m square grid overlaid on a landscape. A red line indicates the HCP Boundary, and a blue line indicates the 1983 Survey boundary. A legend identifies the HCP Boundary, 1983 Survey, and 250 m grid cells. A scale bar shows 0, 250, and 500 meters.

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### Methodology (cont.)

- Logistic regression of occupancy with  $p < 0.20$
- Investigate geographic pattern (e.g. ELEVRESIDGRID)

Two maps are shown. The left map is a topographic map with elevation contours. The right map is a map of elevation residuals (ELEVRESIDGRID) with a legend showing high, medium, and low values. A scale bar shows 0, 250, and 500 meters.

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### Number of Years Surveyed

Two maps showing the number of years surveyed for different transect sizes. The left map is for a 100m transect size, and the right map is for a 250m transect size. Both maps use a color scale from light yellow (1-5 years) to dark brown (6-10 years). A legend identifies the transect size and the number of years surveyed. A scale bar shows 0, 250, and 500 meters.

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### Survey Bias

- Tendency for surveyors to stop searching for butterflies in areas that had negative results

Two scatter plots showing a negative correlation between survey length and the number of cells surveyed with Callippe silverspot absent. The left plot shows 'Cells Surveyed with CSB Absent' vs 'Year' (1980-2000) with a red regression line. The right plot shows 'Total Survey Length (m)' vs 'Year' (1980-2000) with a red regression line. A legend indicates Callippe silverspot.

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### Survey Bias

- Transect location and efforts were not fixed year to year

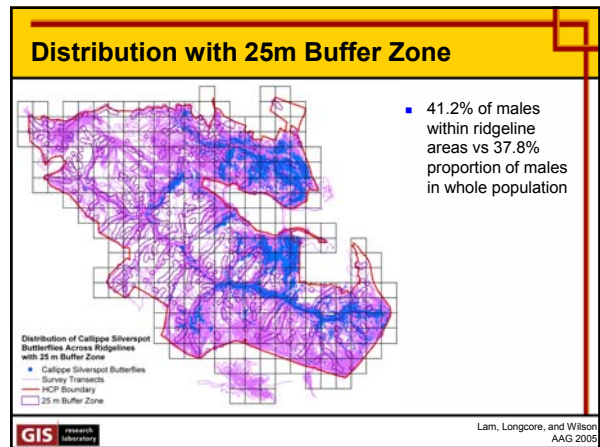
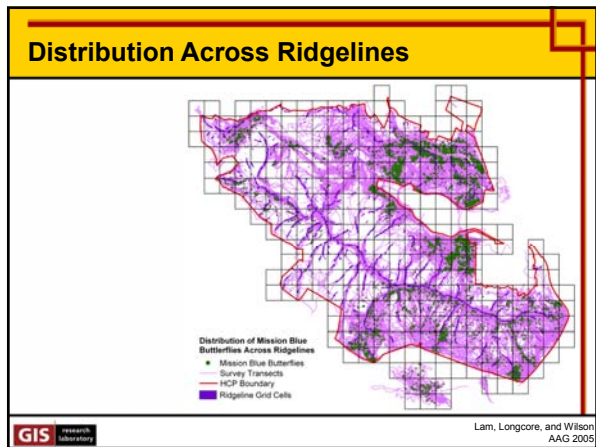
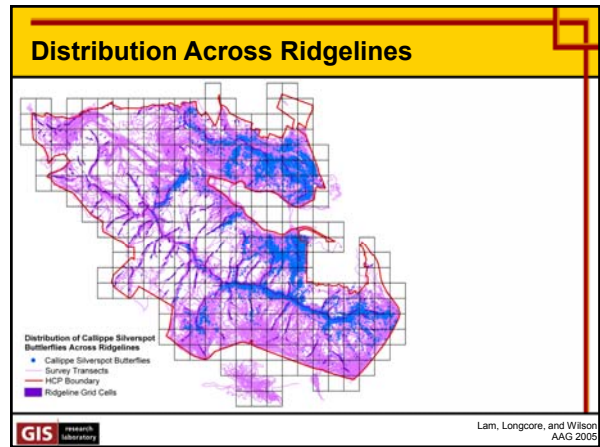
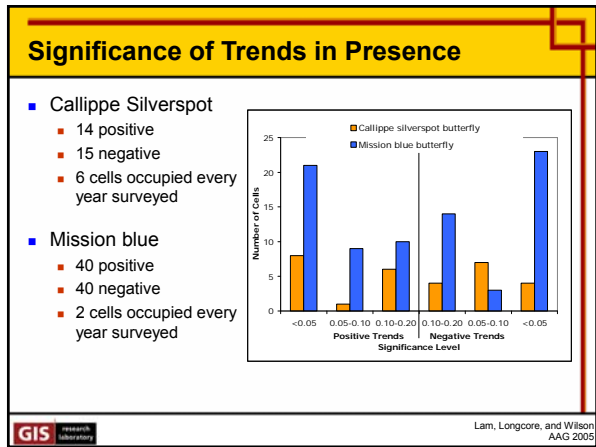
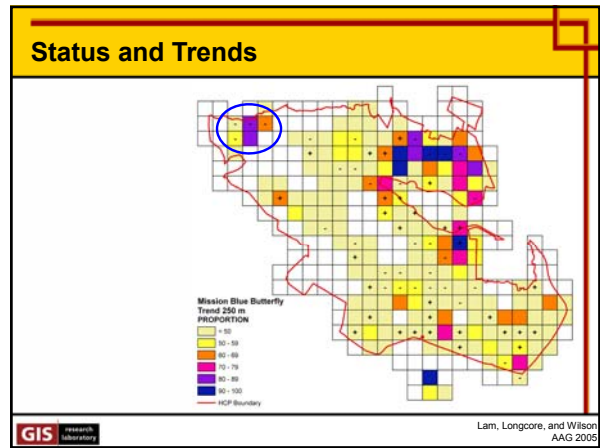
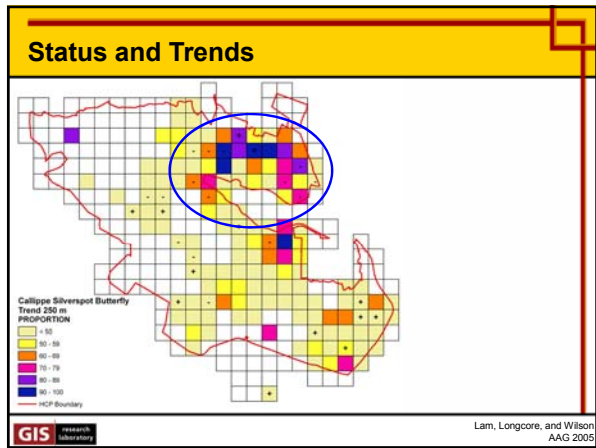
Two scatter plots showing trends in butterfly density and proportion of cells surveyed over time. The left plot shows 'Butterflies per meter' vs 'Year' (1980-2000) with a red regression line. The right plot shows 'Proportion Cells Surveyed' vs 'Year' (1980-2000) with a red regression line. A legend indicates Callippe silverspot.

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### Cell-by-cell Trend Analysis

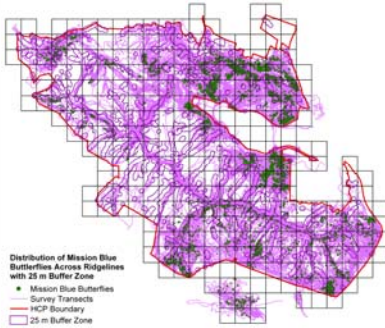
Two scatter plots showing trends in total cells surveyed and proportion of cells occupied over time. The left plot shows 'Total Cells with CSB Present' vs 'Year' (1980-2000). The right plot shows 'Proportion of Cells Occupied' vs 'Year' (1980-2000) with a green horizontal line at approximately 0.5. A legend indicates Callippe silverspot.

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## Distribution with 25m Buffer Zone

- 68.9% of males within ridgeline areas vs 68.3% proportion of males in whole population



## Conclusions

- Some information from “wandering surveys” were valuable
- For every part of the landscape where butterfly counts increased, there was one part where it decreased
- If survey transects were fixed, could get trends more quickly and presumably more accurately