Geographic distribution, habitat association, and the importance of host quality for one of the rarest butterflies in North America: Thorne's hairstreak (*Mitoura thornei*)

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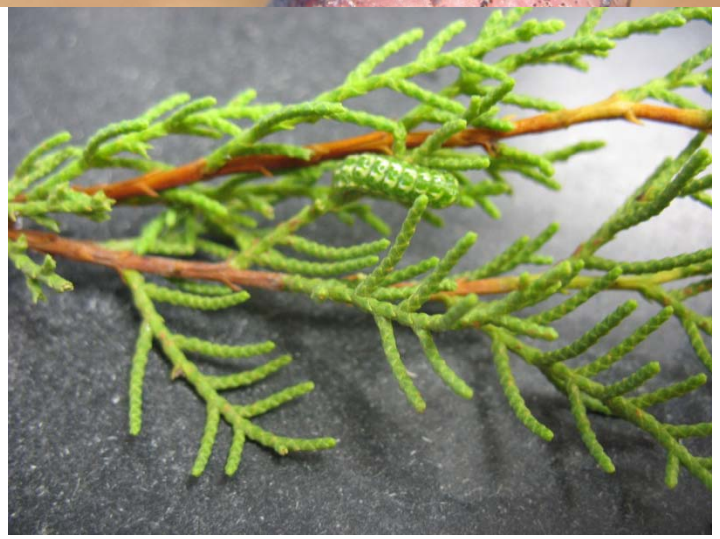
Funding provided by SANDAG

Thank you…

SANDAG

Thorne's Hairstreak (*Mitoura thornei*)

- Rare
- "Recently" discovered
- Bivoltine
- Larvae feed exclusively on *H. forbesii* (Tecate cypress)



Tecate cypress

- Serotinous
- Obligate seeder
- Fire intervals
- TH habitat
- Status

Stands of Tecate cypress

TH History

- 1984- listed
- 1995- Category abolished
- 1991-2009 USFWS sued by various organizations
- 2012- ?????


California
Crescent City
Trinidad Head
Eureka
Redding
Paradise
Chico
Yuba City
Roseville
Woodland
Davis
Santa Rosa
Napa
Fairfield
Vallejo
Concord
Antioch
Stockton
Oakland
Berkeley
San Francisco
Daly City
Modesto
Turlock
Merced
Fremont
Sunnyvale
San Jose
Los Gatos
Gilroy
Los Banos
Madera
Santa Cruz
Hollister
Fresno
Salinas
Monterey
Visalia
Hanford
Porterville
Delano
Bakersfield
Atascadero
San Luis Obispo
Santa Maria
Lompoc
Lancaster
Victorville
Hesperia
Santa Barbara
Ventura
Santa Clara
San Bernardino
Oxnard
Los Angeles
Riverside
Palm Springs
Long Beach
Santa Ana
San Clemente
Oceanside
Carlsbad
Escondido
El Centro
El Cajon
Chula Vista
San Diego
MILES
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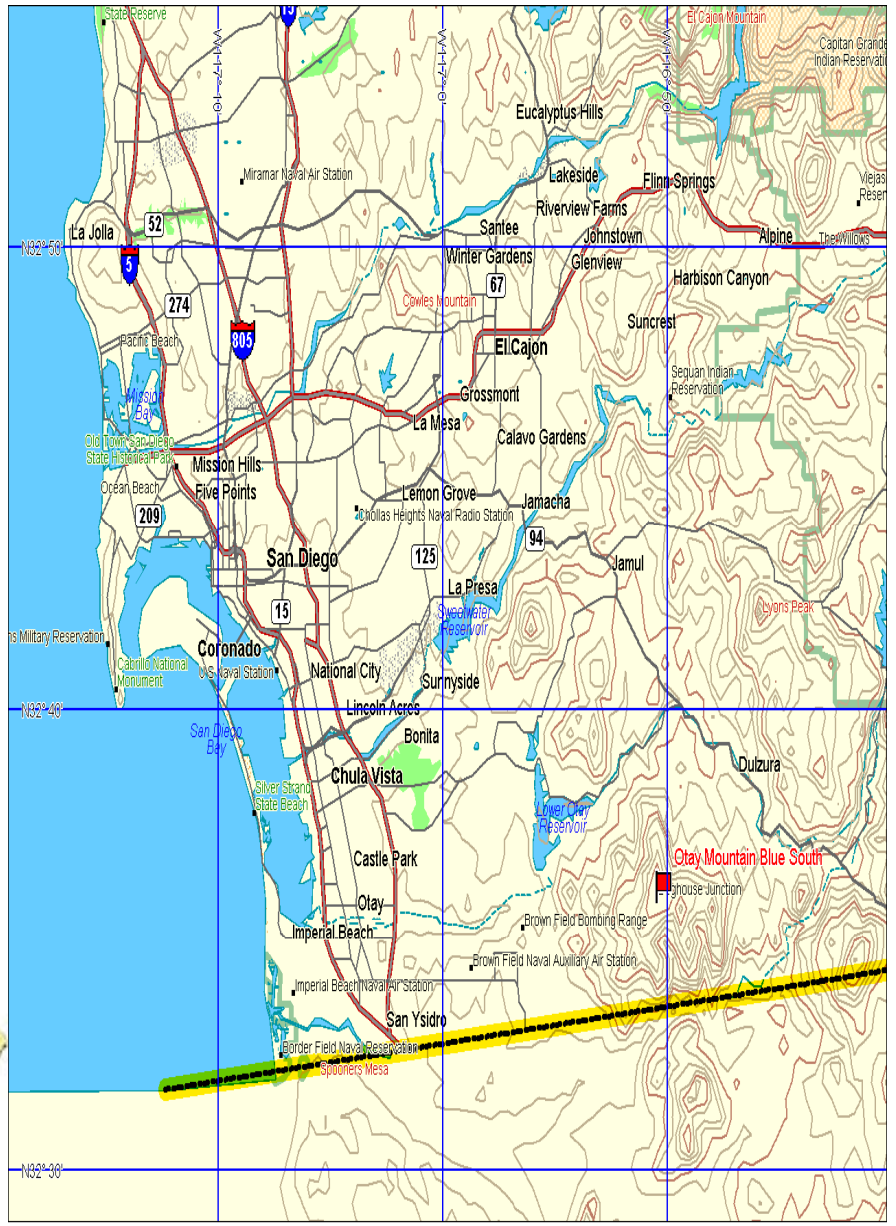

State Reserve
El Cajon Mountain
Capitan Grande Indian Reservation
Eucalyptus Hills
Miramar Naval Air Station
Lakeside
Flinn Springs
Riverview Farms
Santee
Johnstown
Alpine
La Jolla
52
5
Winter Gardens
Glenview
Harbison Canyon
67
274
Cowles Mountain
Pacific Beach
805
El Cajon
Suncrest
Sequan Indian Reservation
Mission Bay
Grossmont
La Mesa
Calavo Gardens
Old Town San Diego State Historical Park
Mission Hills
Five Points
Ocean Beach
Lemon Grove
Jamacha
209
Point Loma Heights Naval Radio Station
94
San Diego
125
Jamul
La Presa
15
Sweetwater Reservoir
Lyons Peak
Coronado
US Naval Station
National City
Sunnyside
Cabrillo National Monument
Lincoln Acres
San Diego Bay
Bonita
Chula Vista
Dulzura
Silver Strand State Beach
Lower Otay Reservoir
Castle Park
Otay Mountain Blue South
Otay
Imperial Beach
Brown Field Bombing Range
Brown Field Naval Auxiliary Air Station
Imperial Beach Naval Air Station
San Ysidro
Border Field Naval Reservation
Spooners Mesa
N32°50'
N32°40'
N32°30'
3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096
1 mi Scale: 1 : 250,000 Detail: 9-0 Datum: NAD27

Why study?

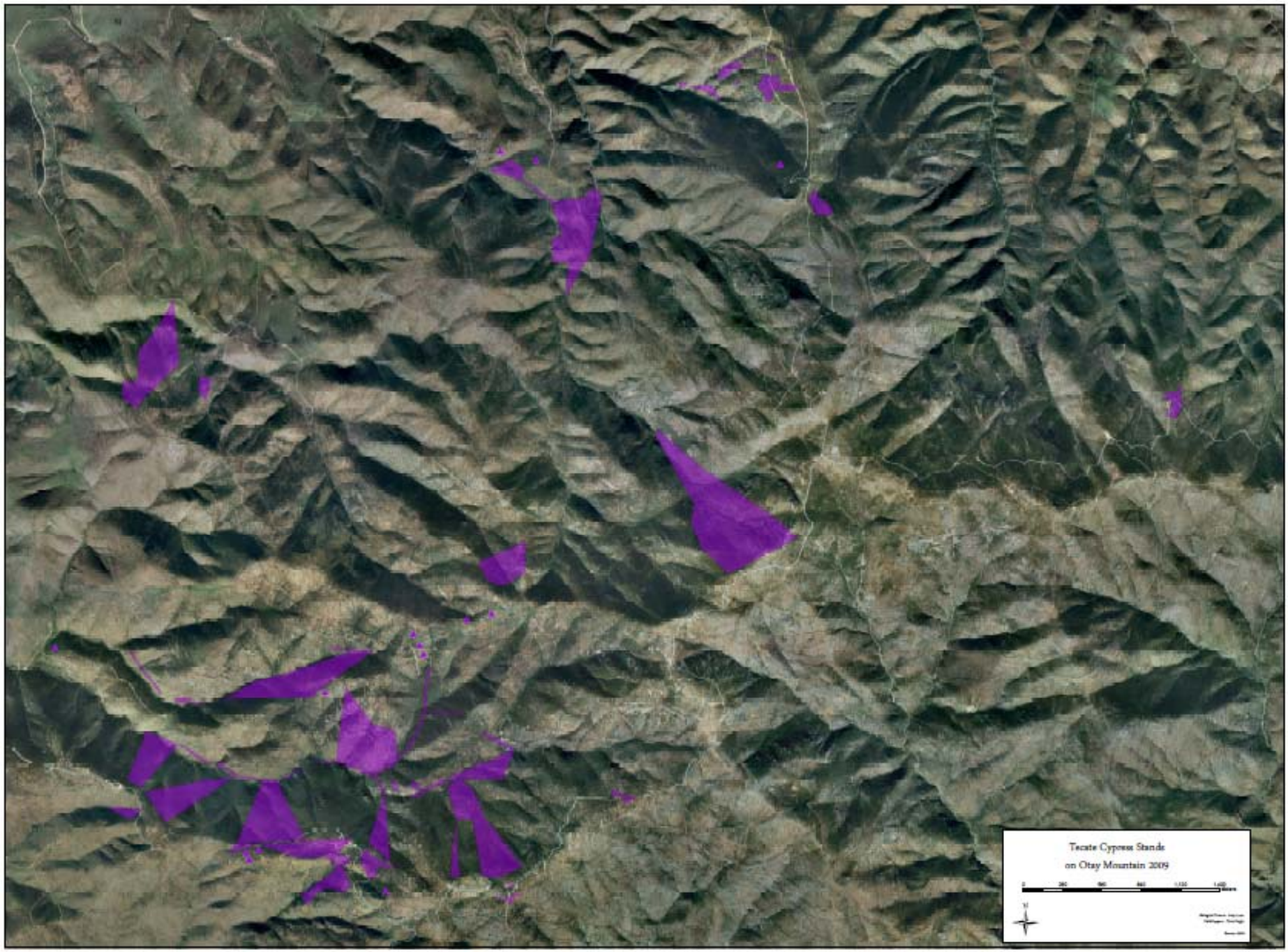
Project questions

- Where does TH live?

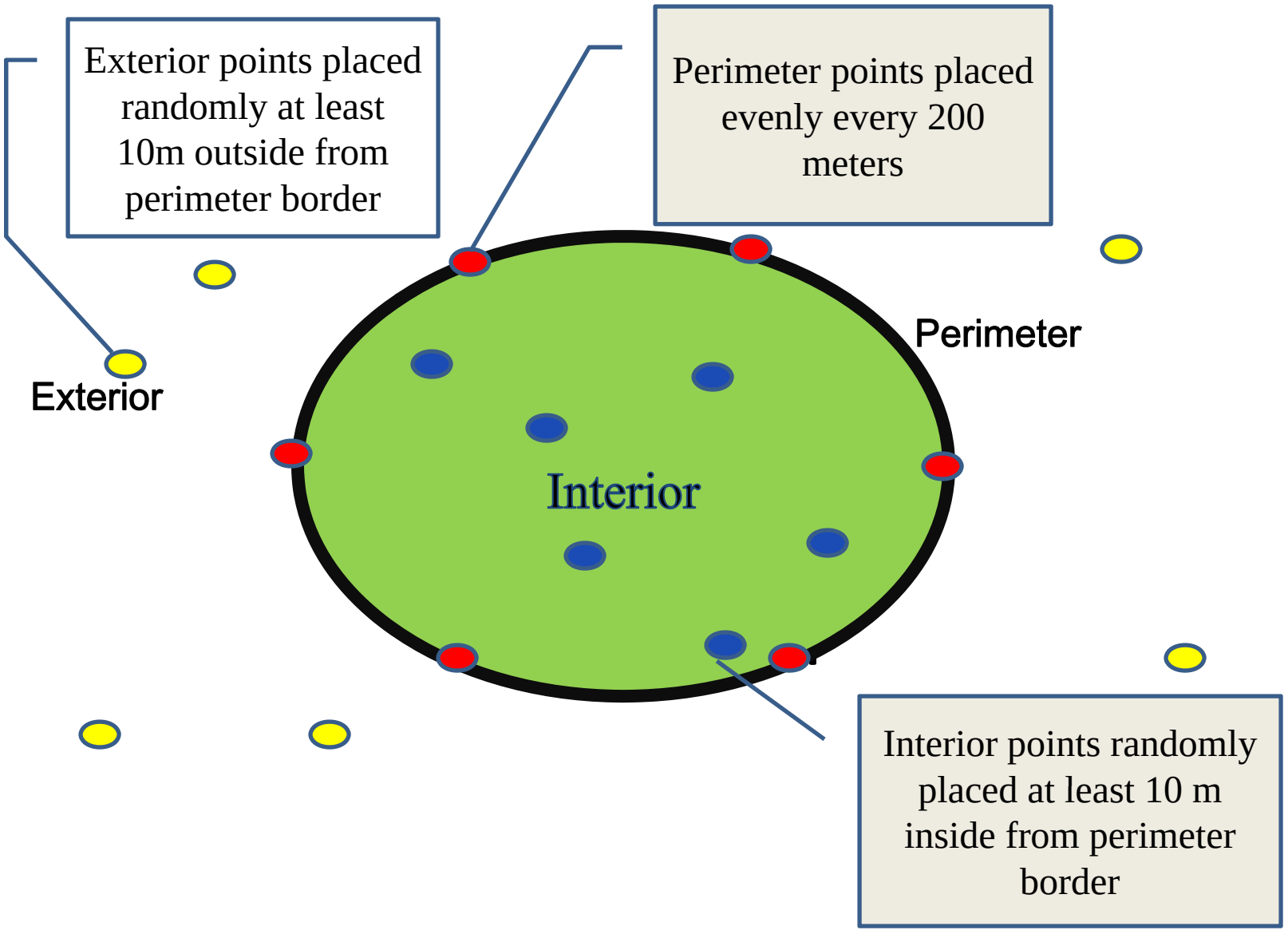
- What predicts where?

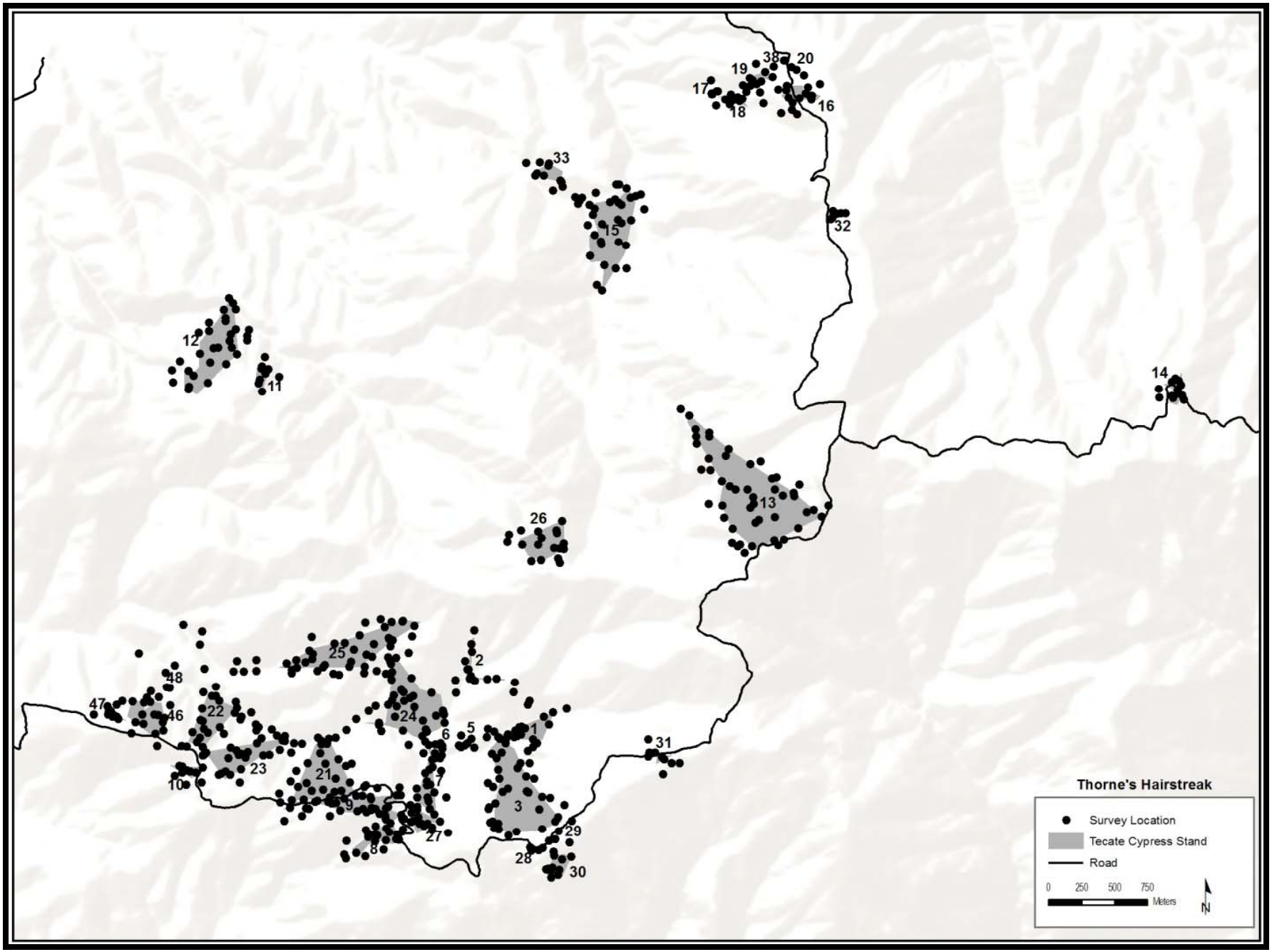
- Is tree age important?

Where does TH live?


Tecate Cypress Stands
on Otay Mountain 2009

Random Points

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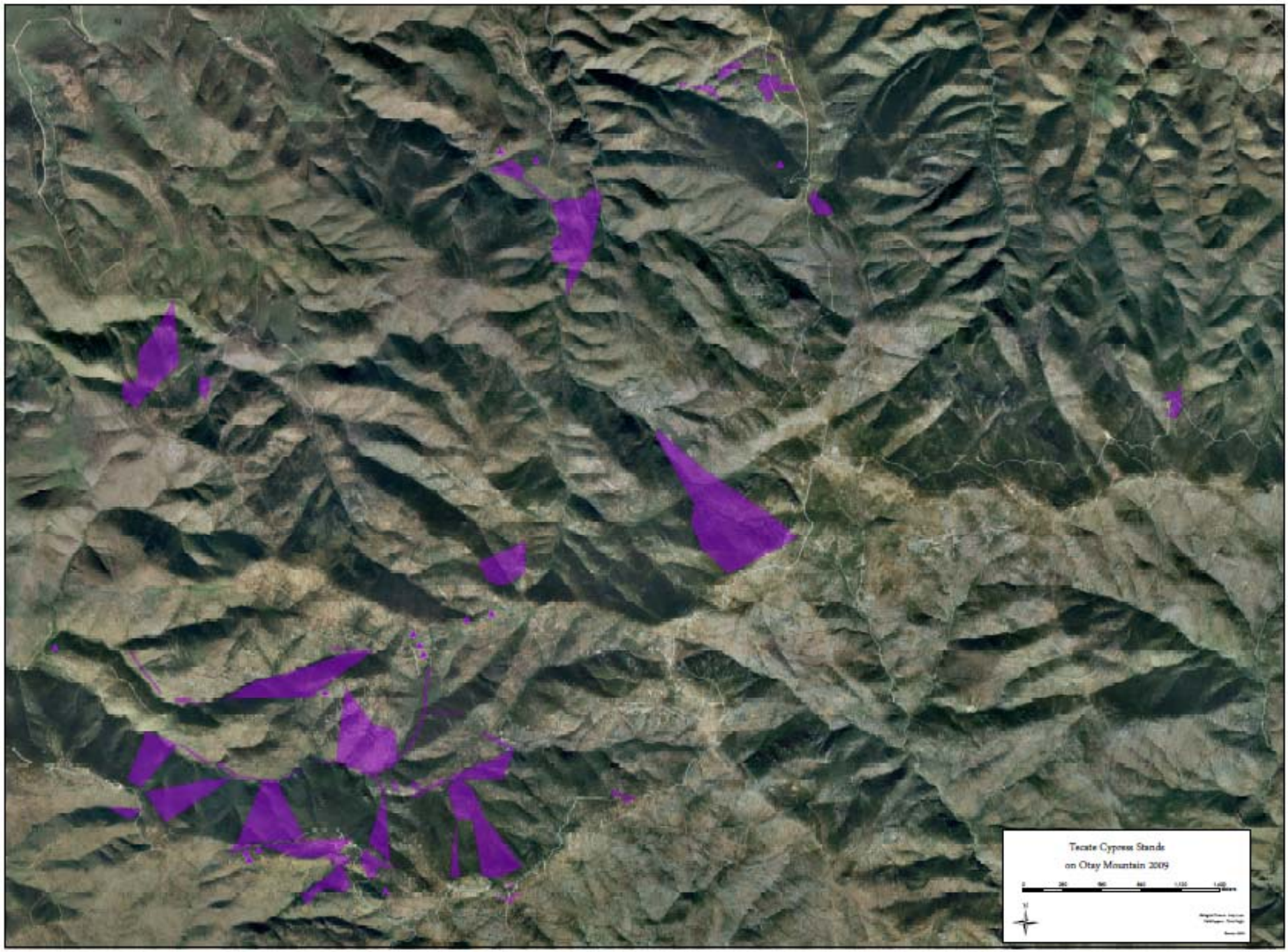
8
28
30
Thorne's Hairstreak
Survey Location
Tecate Cypress Stand
Road
0 250 500 750
Meters
N

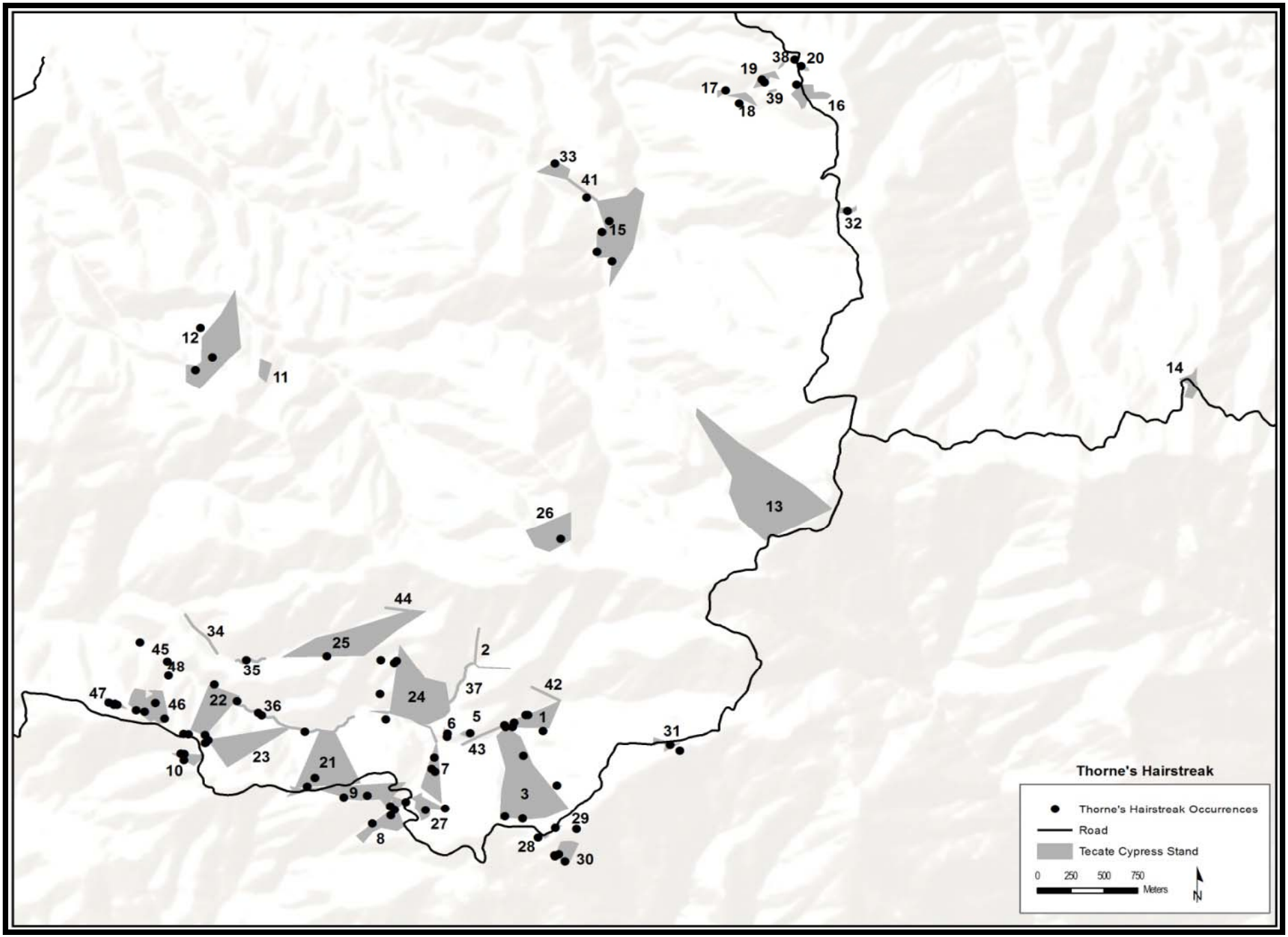
Adult Thorne's hairstreak surveys

- Tap as many Tecate cypress branches and vegetation as possible in 5 m radius for 5 min
- 229 points surveyed
- 118 TH observed

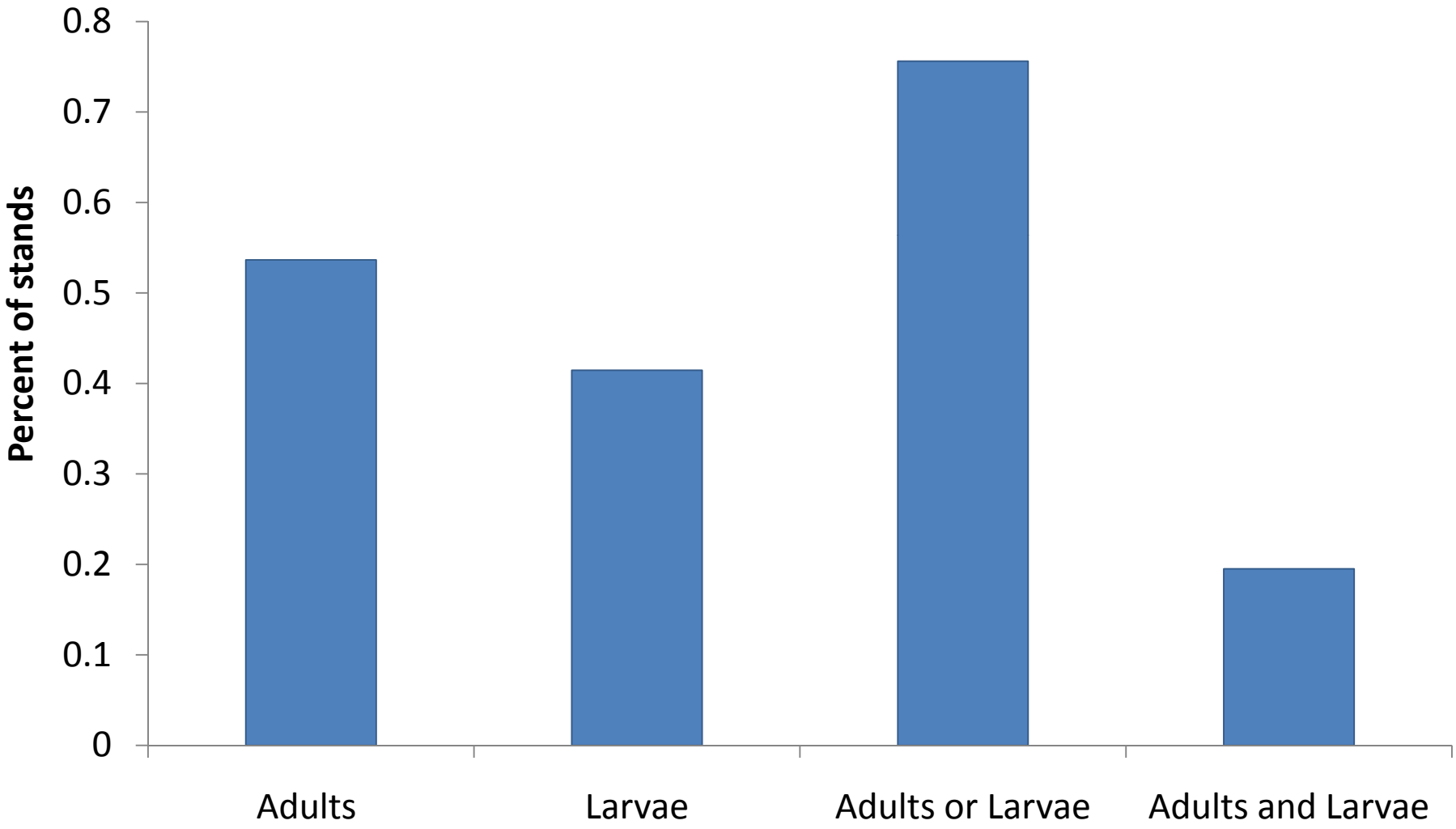
Larval survey protocol

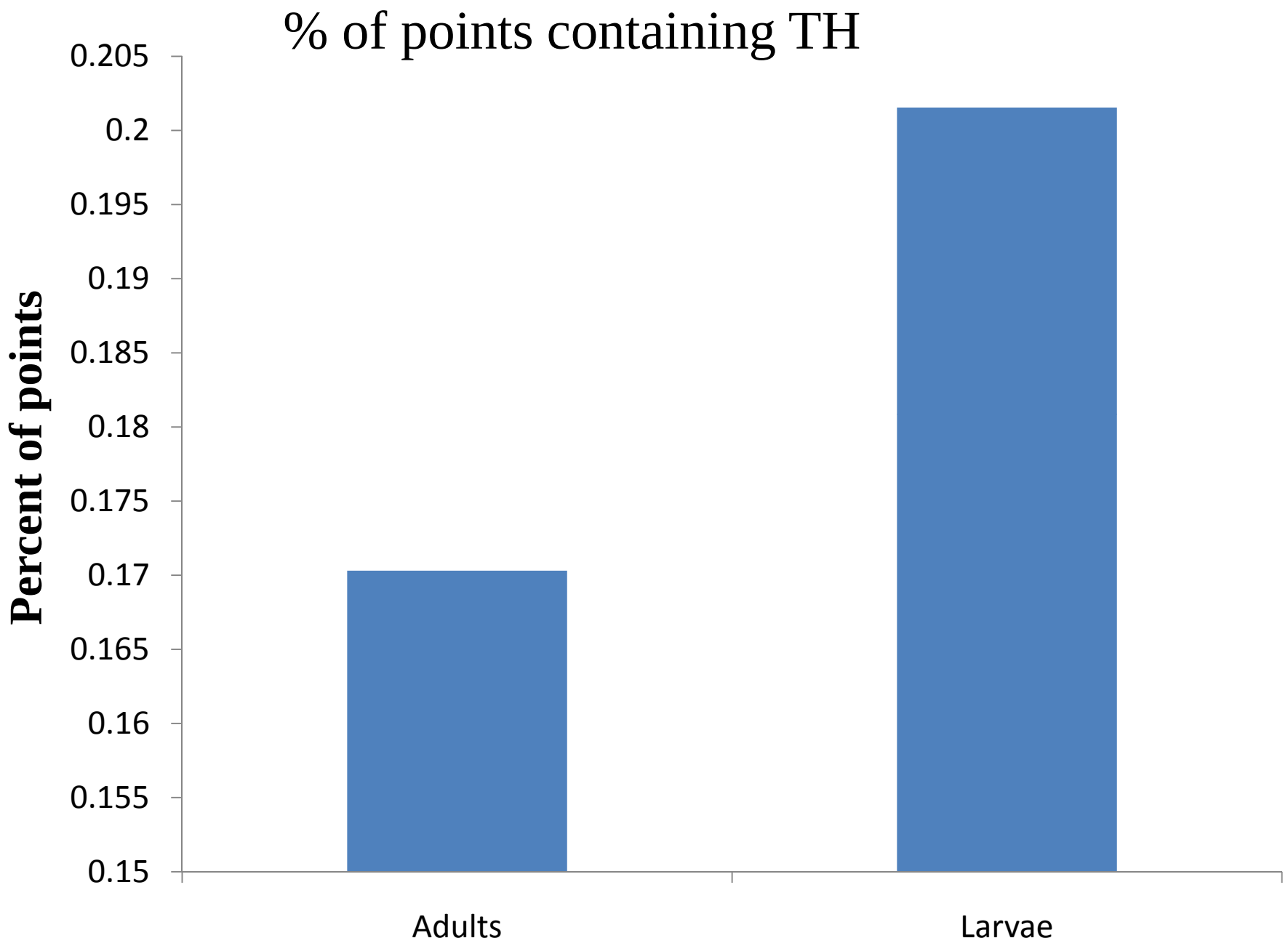
- Survey 8 Tecate cypress per point
- 129 points surveyed
- 38 larvae found


Tecate Cypress Stands
on Otay Mountain 2009


Thorne's Hairstreak
Thorne's Hairstreak Occurrences
Road
Tecate Cypress Stand
0 250 500 750
Meters
N

TH found in 76% of stands




% of points containing TH
Percent of points
0.205
0.2
0.195
0.19
0.185
0.18
0.175
0.17
0.165
0.16
0.155
0.15
Adults
Larvae

Perimeter vs. Interior vs. Exterior: Adults

- Exterior: 6%
- Perimeter: 48%
- Interior: 46%

Perimeter vs. Interior: Larvae

- Perimeter: 55 %
- Interior: 45%

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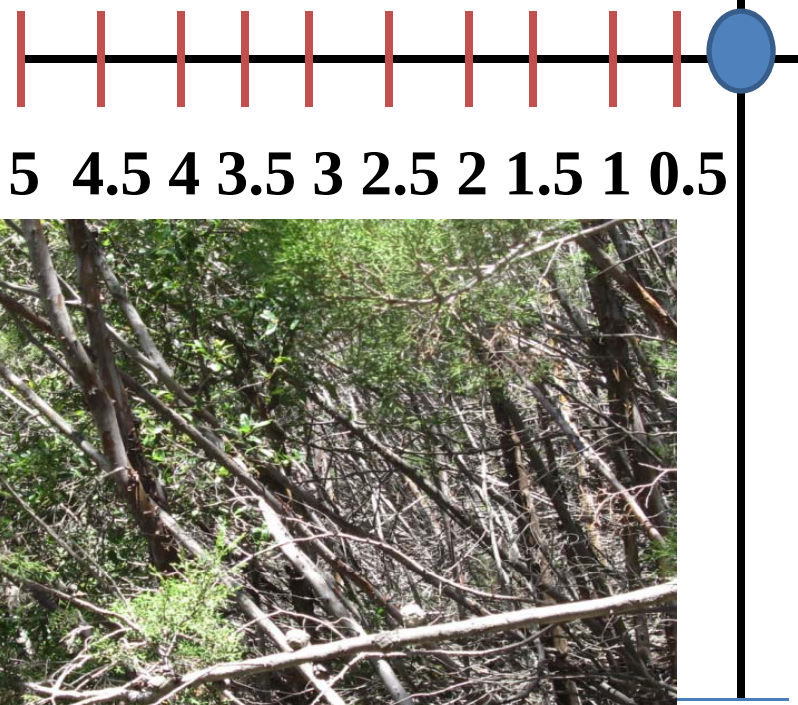
Vegetation Sampling Protocol

360 points surveyed



Environmental Variables

- Tecate cypress DBH
- Tecate cypress density
- Woody richness
- Herbaceous richness
- Density of woody plants
- Herbaceous density
- Density of grasses
- Density of leaf litter, rock, and bare ground
- Slope of stands
- Distance between stands
- Size of stand

Levels of analysis

	Point	Stand
Larvae	Presence/Absence	Fractional presence
	Abundance	Abundance
Adults	Presence/Absence	Fractional presence
	Abundance	Abundance

Point-level analysis

Larvae	Presence/Absence
	Abundance
Adult	Presence/Absence
	Abundance

Levels of analysis

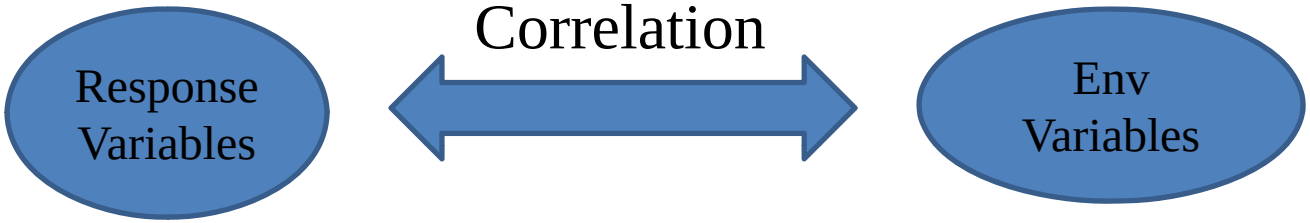
	Point	Stand
Larvae	Presence/Absence	Fractional presence
	Abundance	Abundance
Adults	Presence/Absence	Fractional presence
	Abundance	Abundance

Stand-level analysis

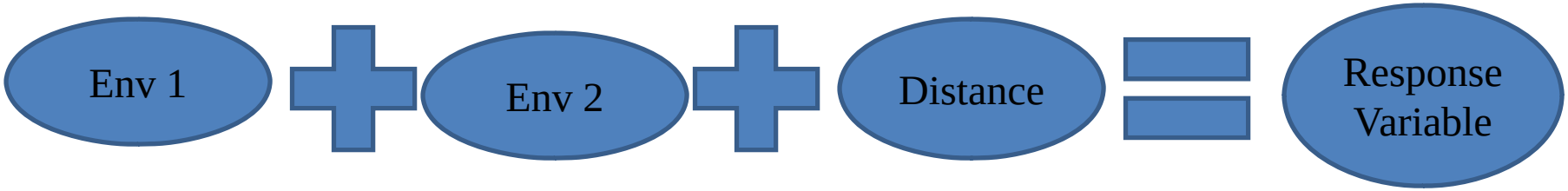
Larvae	Fractional Seen
	Abundance
Adult	Fractional Seen
	Abundance

Statistical Methods

- Pairwise Mantel



- Multiple Mantel

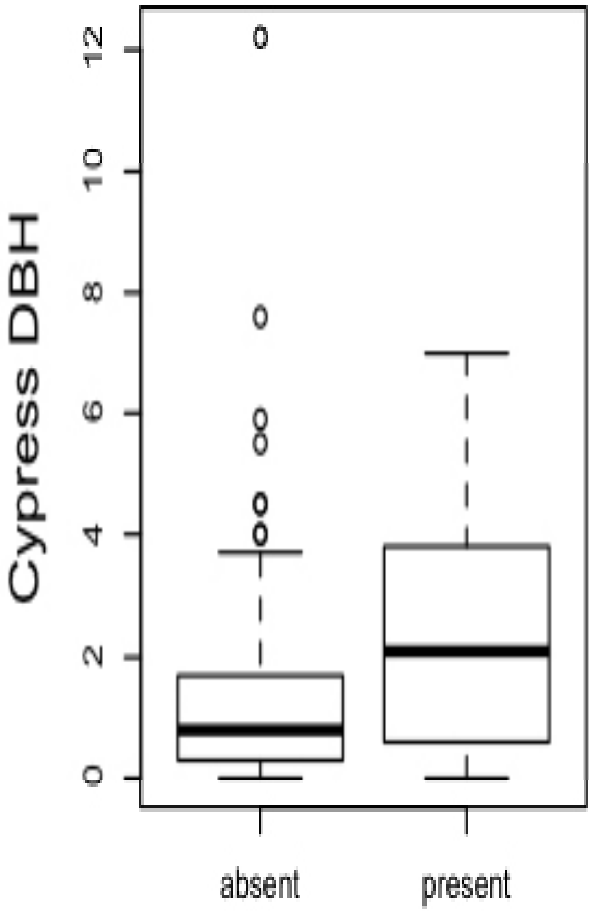


Pairwise Mantel Results

	Point	Stand
Larvae	Presence/Absence *TC DBH & Density, Distance b/w points	Fractional presence *TC DBH
	Abundance *None	Abundance *None
Adults	Presence/Absence *TC DBH & Density, slope, Herb Density, Distance b/w points	Fractional presence *TC density
	Abundance *None	Abundance *Size of stand, Woody richness

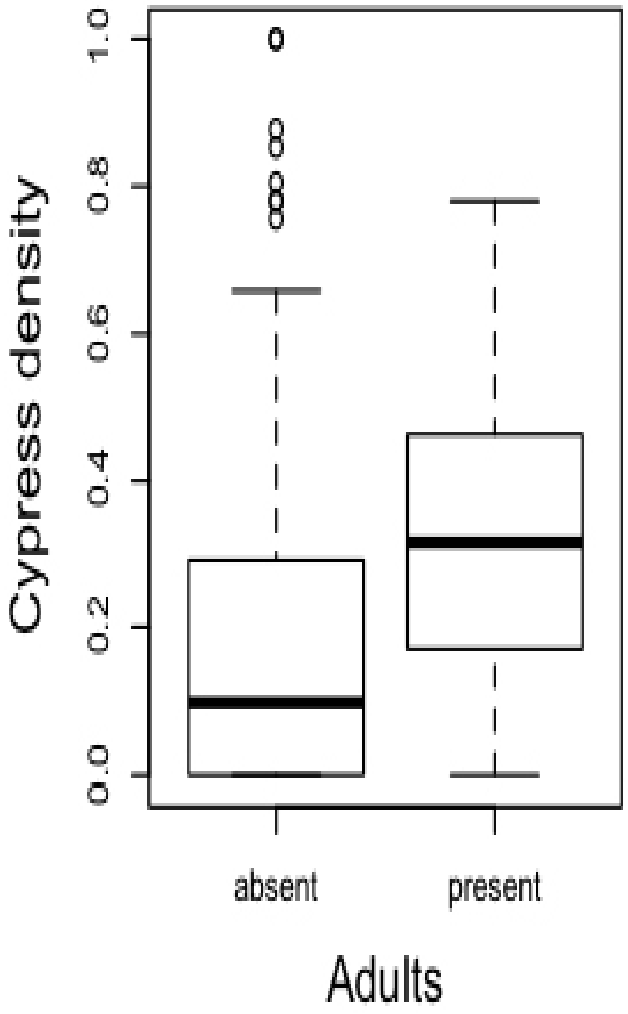
Multiple Mantel test results at the point level

		F	Coefficient	P	R^2
Larvae P/A	Whole model	72.54		0.021	0.026
				P	
	TC DBH		3.45 e-02	**0.018**	
	% Tecate		1.81 e-02	0.89	
	Distance		-1.24 e-05	0.14	



Multiple Mantel test results at the point level

		F	Coefficient	P	R^2
Adults P/A	Whole model	114.17		0.0030	0.017
				P	
	Slope		3.77 e-03	**0.017**	
	Density of herbaceous plants		-2.02 e-01	**0.044**	
	Density of *H. forbesii*		1.43 e-01	**0.049**	



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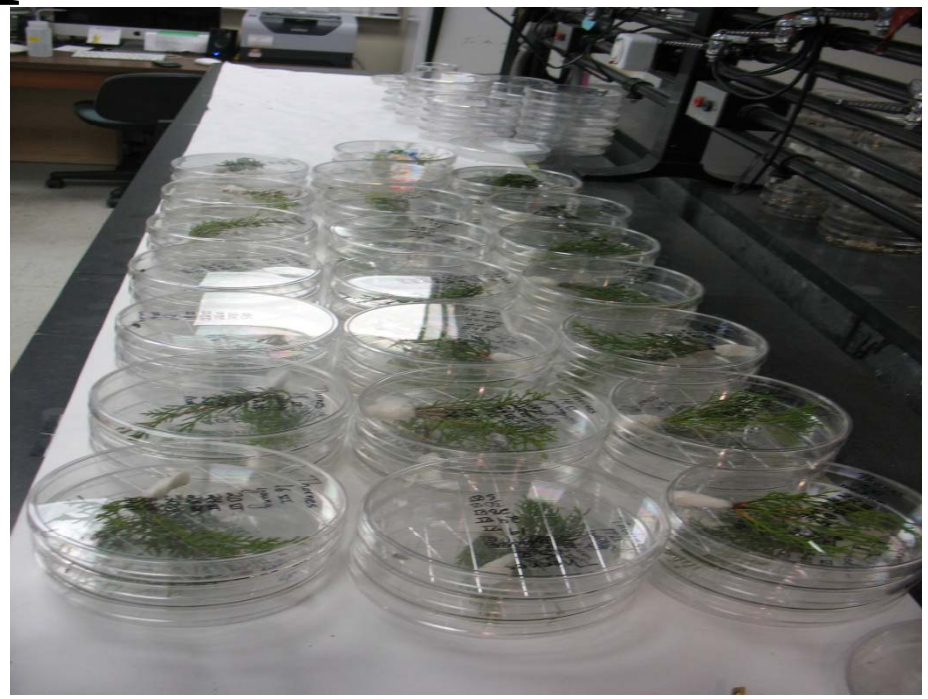
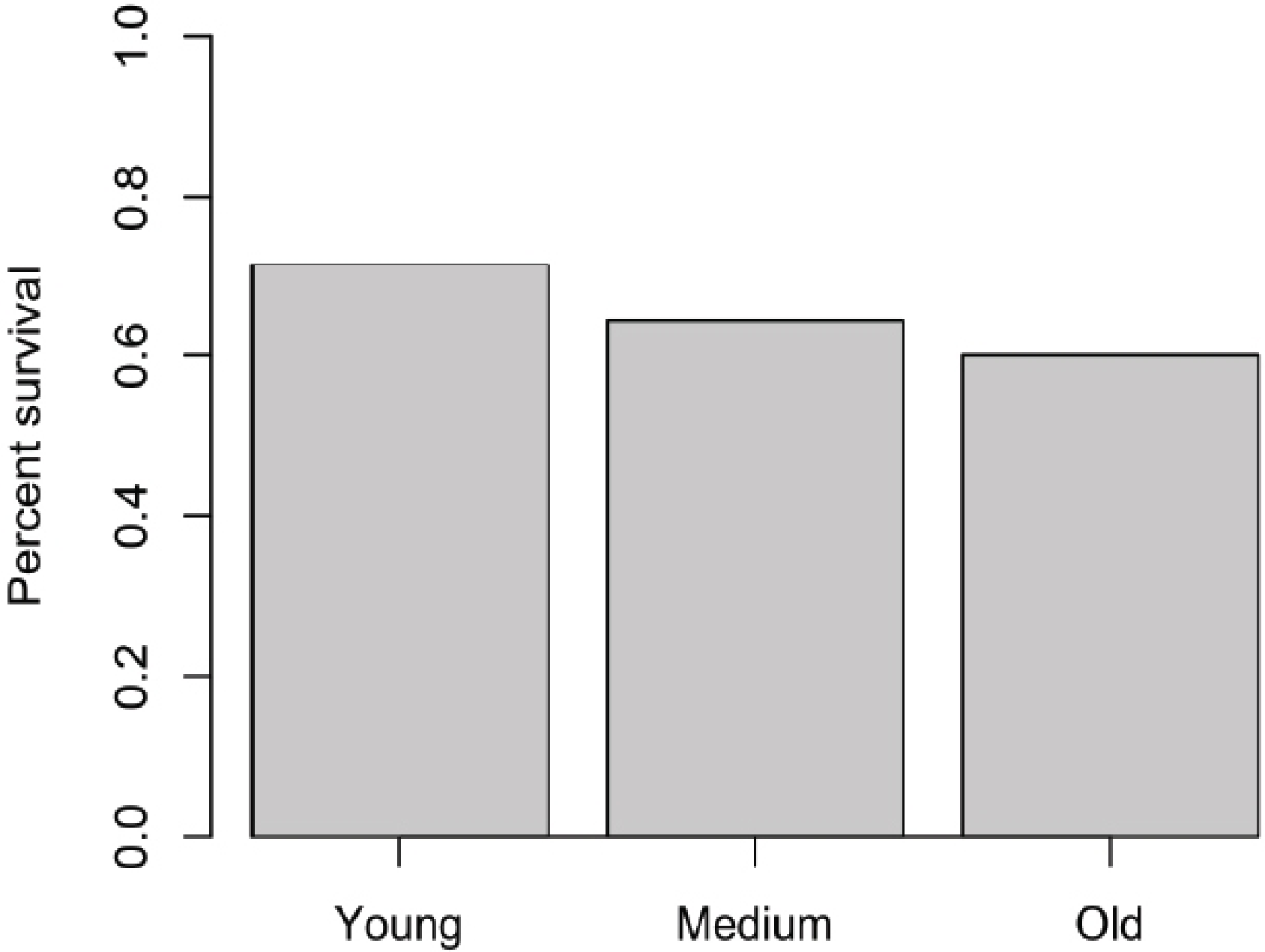
Larval experiments

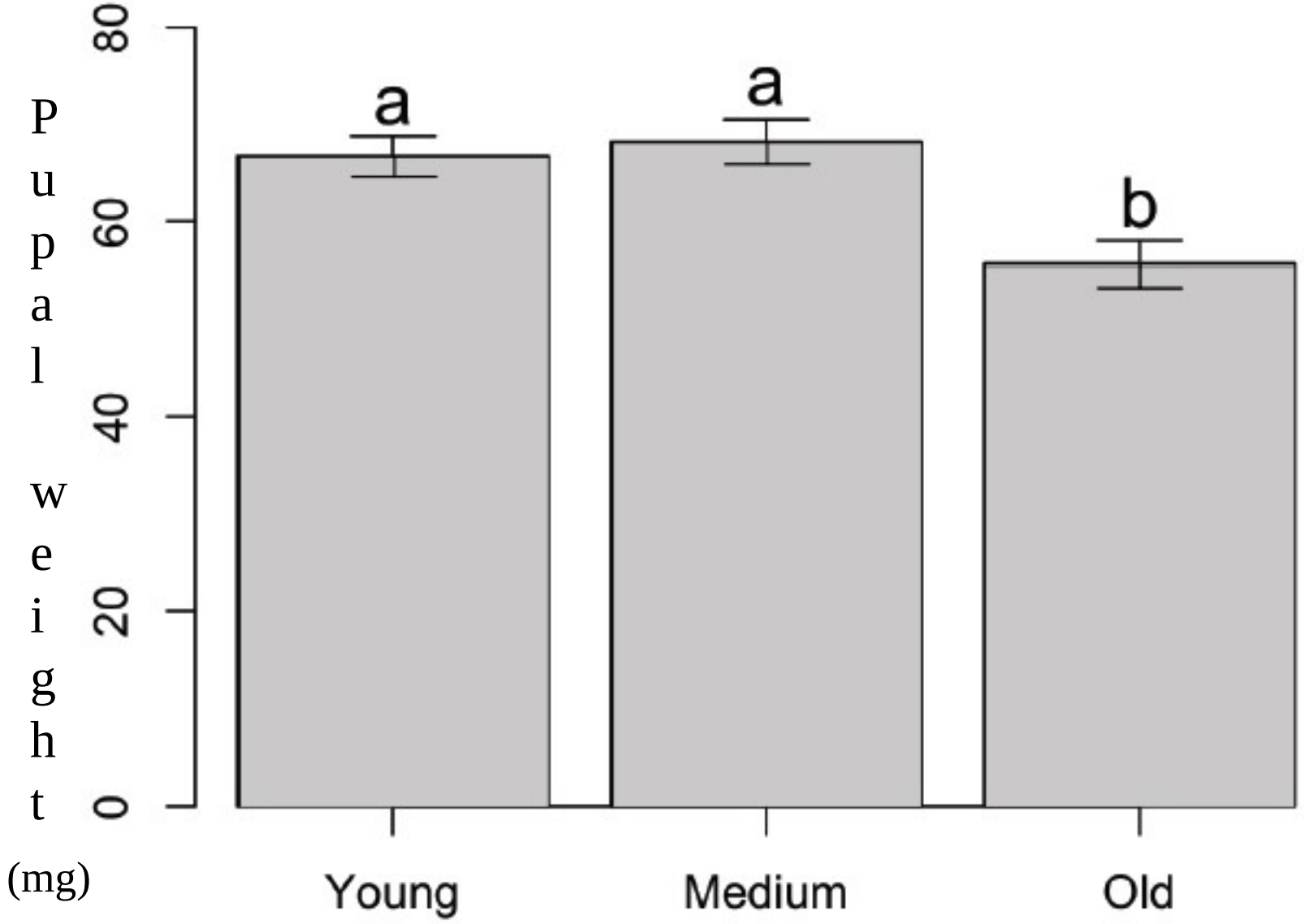


Methods

- Collected 86 larvae from 8 wild-caught *M. thornei* females
- Reared 56 larvae on foliage of three different ages of Tecate cypress


Percent survival
0.0
0.2
0.4
0.6
0.8
1.0
Young
Medium
Old

Older trees not better



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TH History

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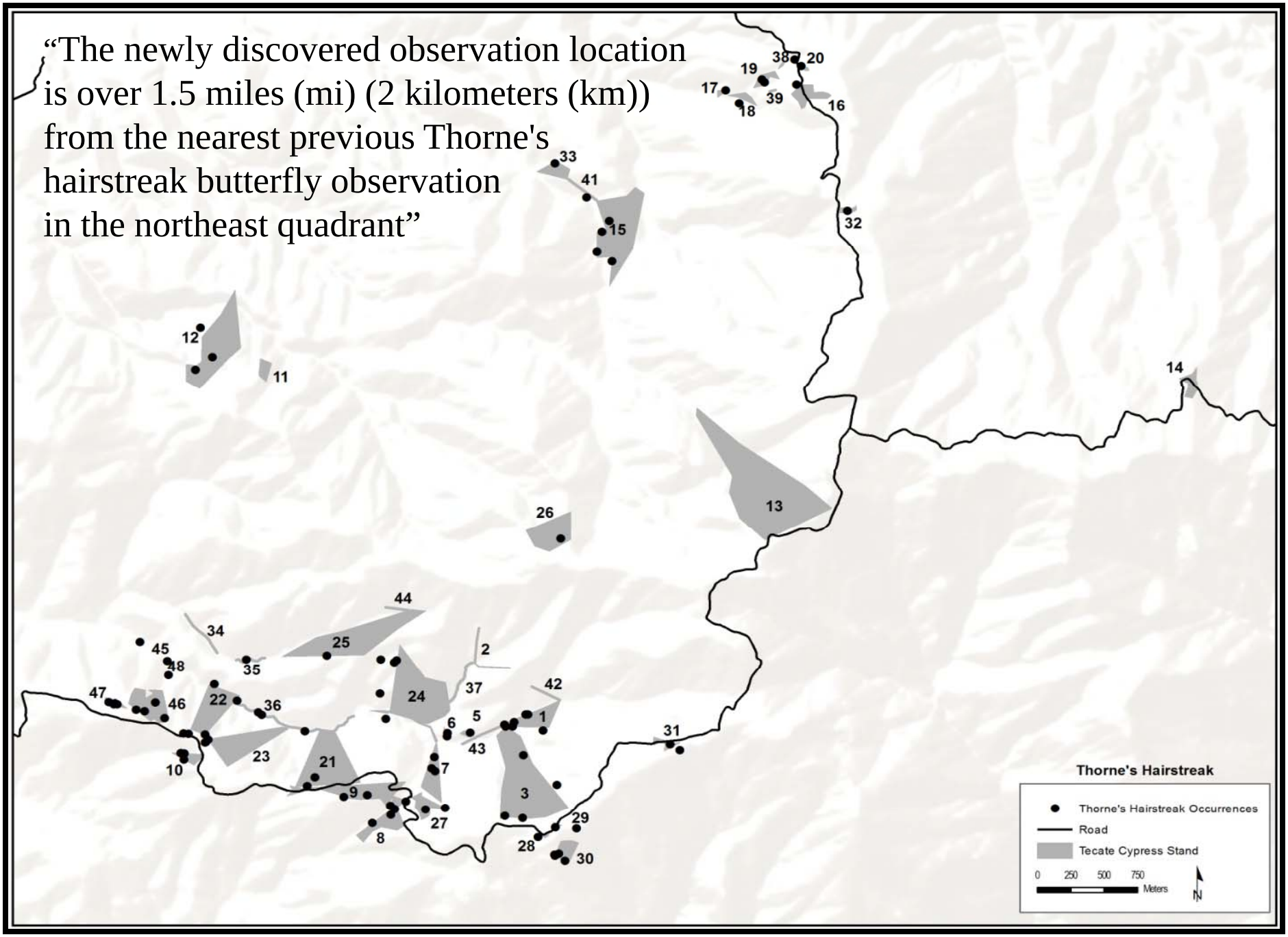
- 1991-2009 USFWS sued by various organizations
- 2012- ?????

U.S. Fish and Wildlife Service Finds Thorne's Hairstreak Butterfly Does Not Warrant Protection Under the Endangered Species Act

"Lucas also recorded a new Thorne's hairstreak butterfly occurrence location in an area within the northwest quadrant of Otay Mountain in 2010, thus expanding the pre-2007 fire known range"

https://www.federalregister.gov/articles/2010/04/05/2010-7547/endangered-and-threatened-wildlife-and-plants-90-day-finding-on-a-petition-to-list-thornes#h-55

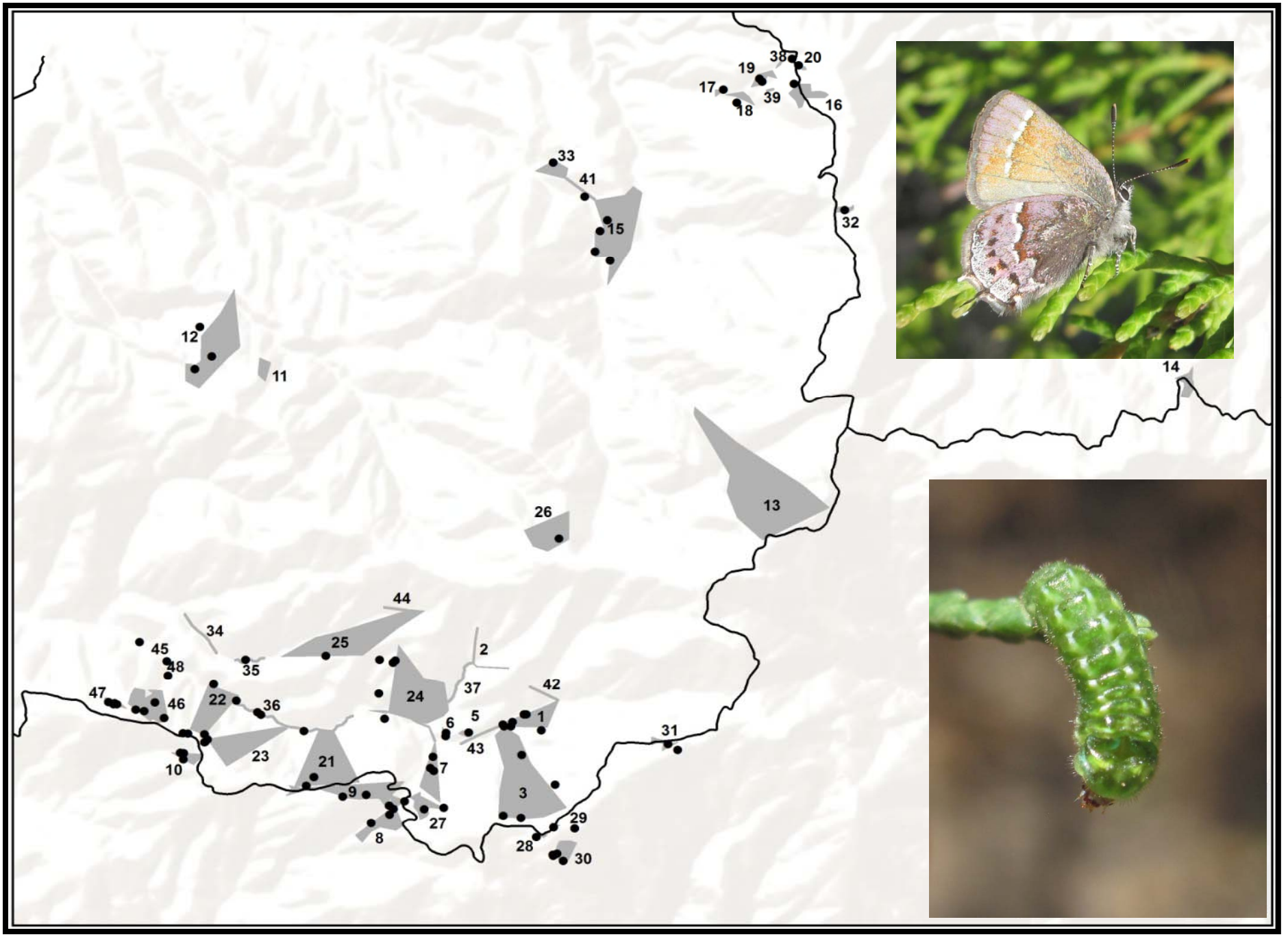

"The newly discovered observation location is over 1.5 miles (mi) (2 kilometers (km)) from the nearest previous Thorne's hairstreak butterfly observation in the northeast quadrant"
Thorne's Hairstreak
Thorne's Hairstreak Occurrences
Road
Tecate Cypress Stand
0 250 500 750
Meters
N

U.S. Fish and Wildlife Service Finds Thorne's Hairstreak Butterfly Does Not Warrant Protection Under the Endangered Species Act

- "Surveys by Lucas on Otay Mountain in 2010 revealed the presence of Thorne's hairstreak butterfly throughout the majority of *H. forbesii* that burned in the 2003 fire, the 2007 fire, and in areas burned by both fires"

Summary

- Thorne’s hairstreak occurs more broadly than previously recognized
- Abiotic/biotic variables explain very little variation where Thorne’s hairstreak is found
- Thorne’s hairstreak utilizes perimeters
- Older trees are not better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