Welcome to the Conservation Lecture Series

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CDFW Conservation Lectur... × +

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CDFW Conservation Lecture Series

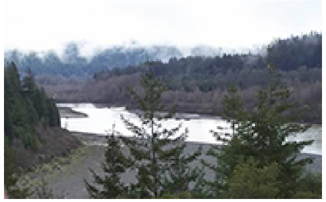
The Conservation Lecture Series is organized by CDFW's Habitat Conservation Planning Branch. The lecture series is designed to deliver the most current scientific information about species that are of conservation concern.

Below is a list of lectures and speakers for the Conservation Lecture Series. Lectures are open to anyone who is interested in participating. Participants may attend in-person or remotely via webinar. Please be sure to register for each class. Lectures are recorded and posted for those unable to attend the day of the event. Visit the archive page to see recordings of past lectures.

Subscribe to receive email updates and invitations to upcoming lectures.

Upcoming Lectures

Development of multi-threaded wetland channels and the implications for salmonids and ecosystem rehabilitation - November 19, 1:00-3:00 pm. Presented by Dr. Brian Cluer and Lauren Hammack



The land clearing and draining industriousness of the early European settlers largely erased riparian wetlands and multi-threaded channels from the California landscape, as well as from our collective consciousness. Incised, simplified channels are the result of those efforts and what we tend to manage our waterways to be. The importance of multi-threaded channels for ecosystem function and biotic productivity is beginning to be understood and taken into account

The Wildlife Society (TWS) Upcoming Ever

Videos and Past Lectures

- Process Based Stream Restoration (Dr. Pollo
- San Joaquin Kit Fox (Dr. Cypher)
- Metrics for Quantifying Ecosystem Impacts an Restoration Success (Dr. Rubin)
- American Badgers (Dr. Jessie Quinn)
- Design Validation Monitoring Klamath Watershed (D.J. Bandrowski, Aaron Marin, an Rocco Fior)
- Dogs Moving Conservation Forward (Dr. Deborah (Smith) Woollett and Aimee Hurt)
- Black Swans, Brown River (Dr. Viers)
- White-Nose Syndrome in Bats (Wyatt)
- Invasive Watersnakes (Dr. Todd)
- Tricolored Blackbird (Dr. Meese)

Habitat conservation in a brave new environment: climate change, nitrogen deposition, and the Bay checkerspot butterfly

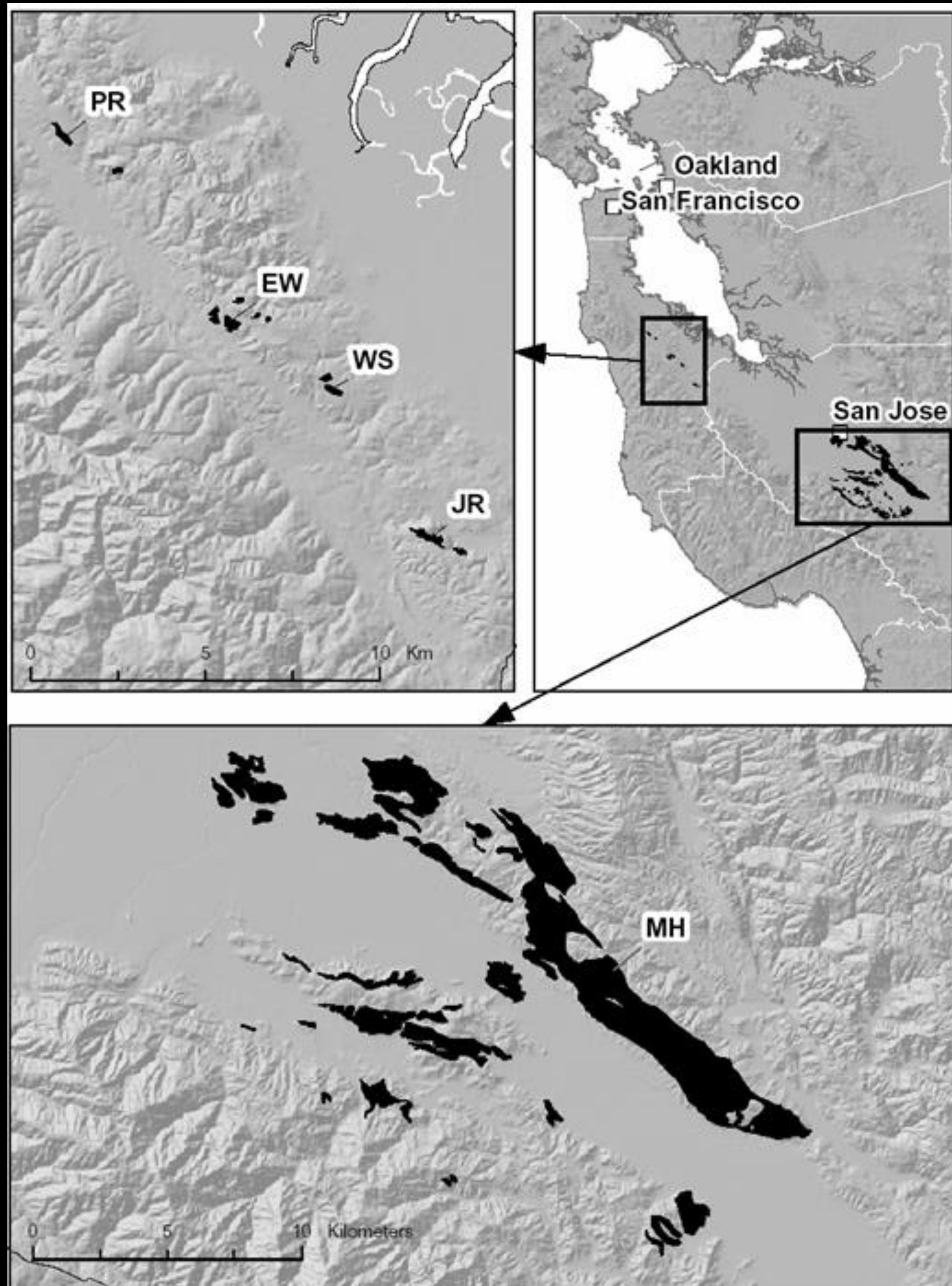
Stuart B. Weiss

Creekside Center for Earth Observations

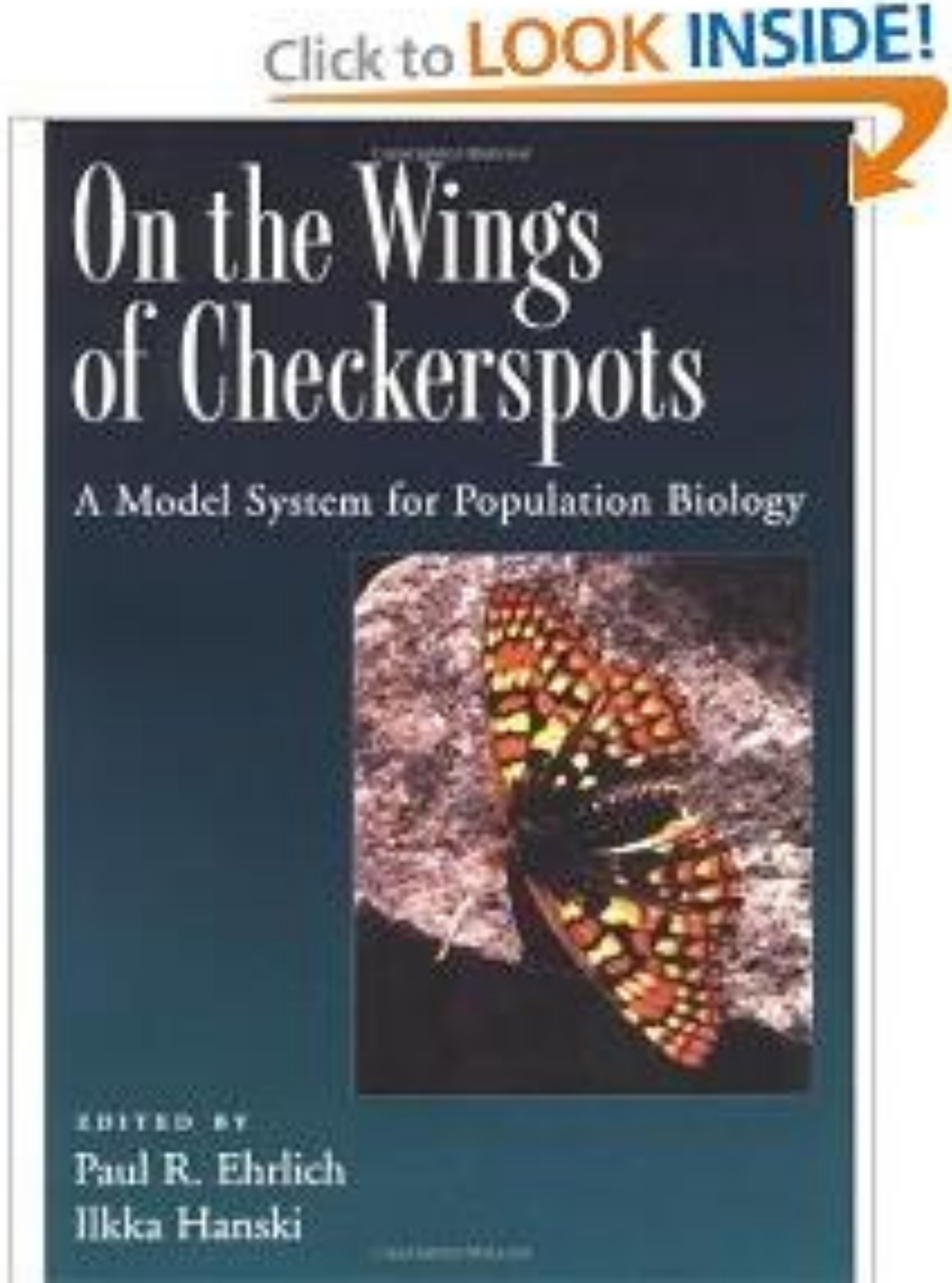
Charismatic meso-invertebrate

Hostplants and Nectar Sources

Serpentinite forms discrete patches of habitat


PR
EW
WS
JR
0 5 10 Km
Oakland
San Francisco
San Jose
MH
0 5 10 Kilometers

Charismatic micro-flora



- 53 years of research
- Hundreds of scientific papers
- In textbooks
- Dozens of Ph.D.s
- Heritage of ALL of humanity

Serpentine Grassland as a Model System

Rare Endemic Flora





The Climate Near the Ground

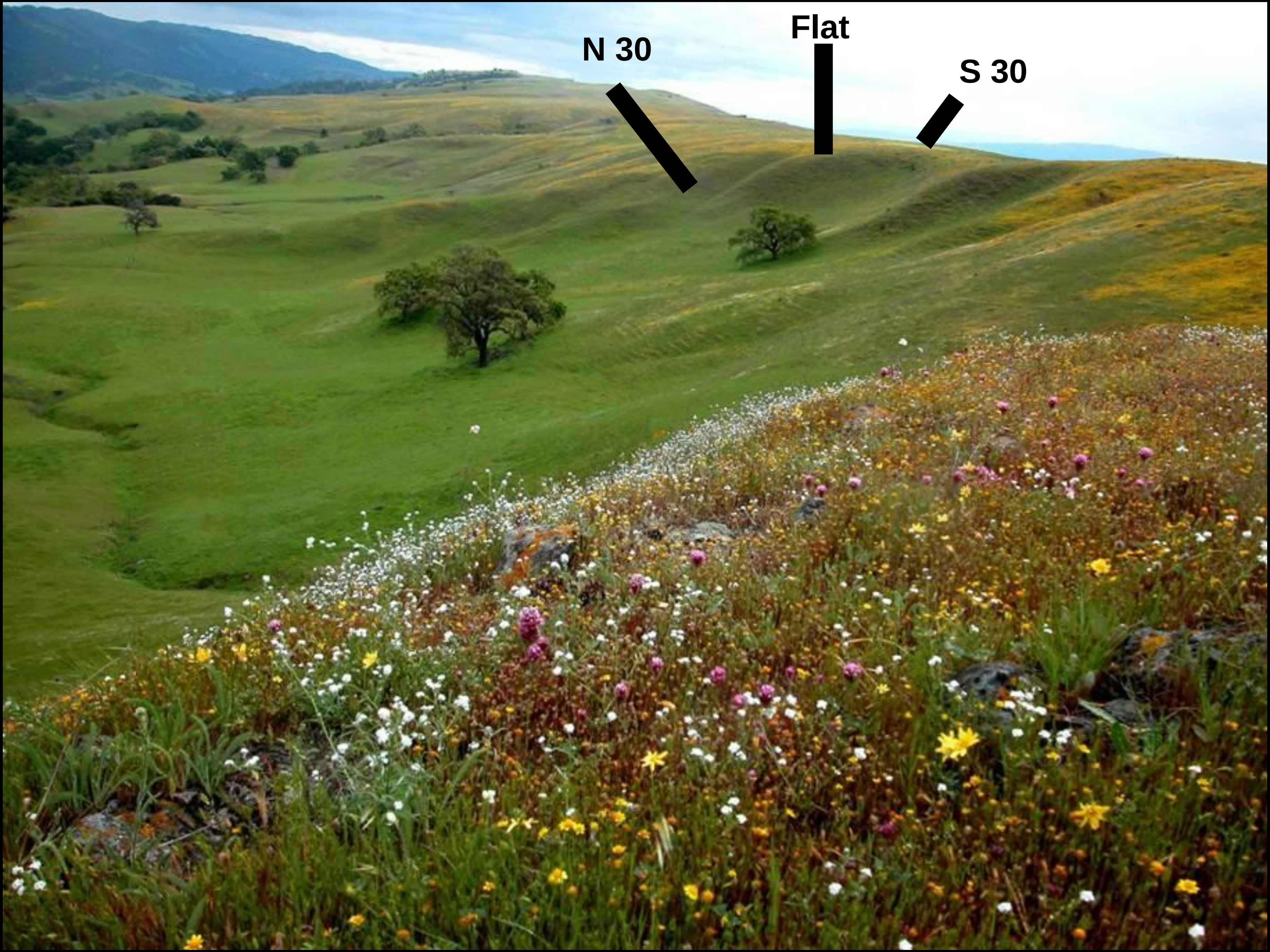
Macroclimate: 1000 - 20 km
Global Circulation, Synoptic Meteorology

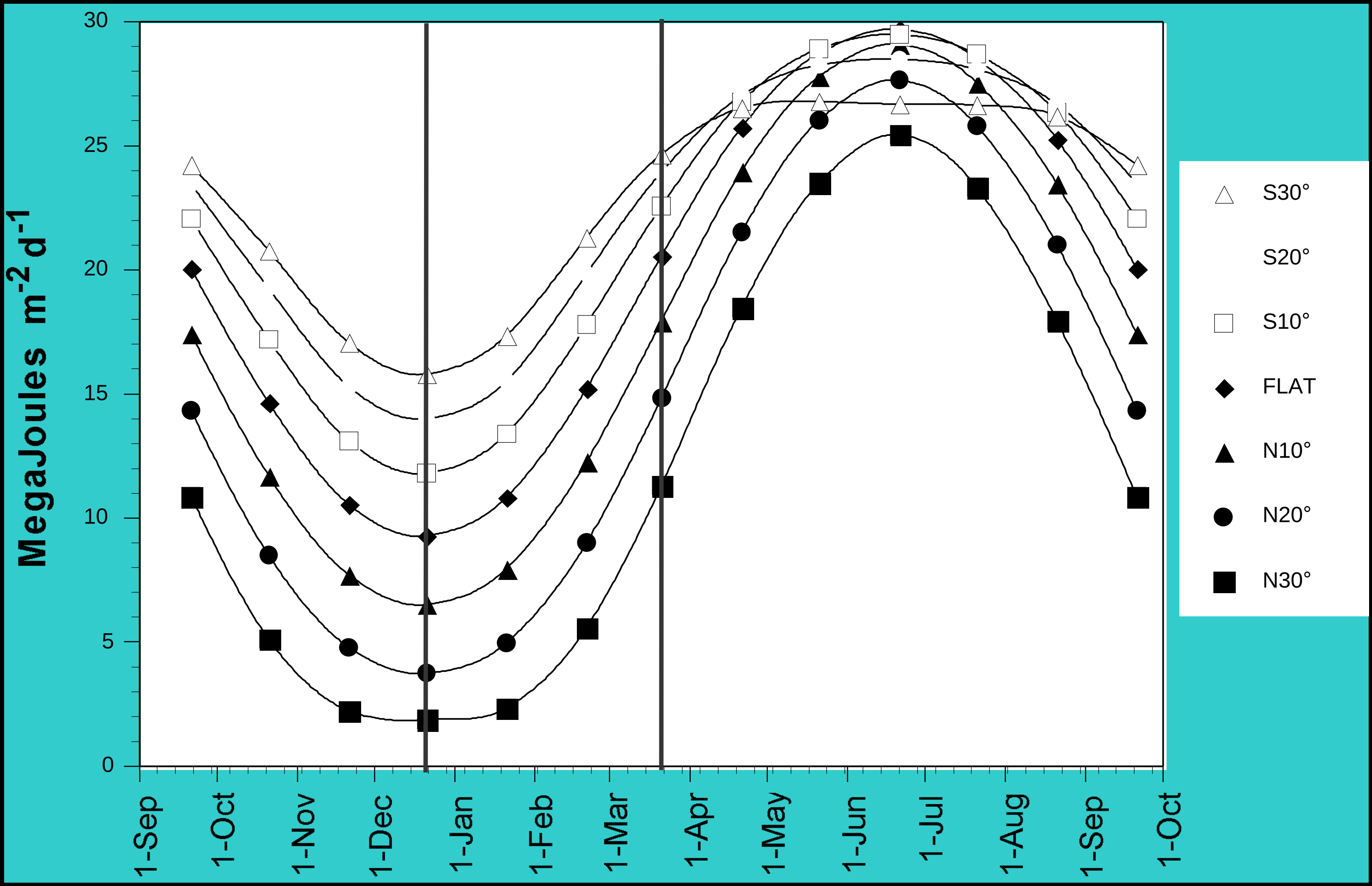
Mesoclimate: 20 – 0.5 km
Coastal-Inland, elevation
Santa Cruz – San Jose

Topoclimate: 0.5 km - 10 m
solar radiation relative elevation
N-S slopes, frost pockets

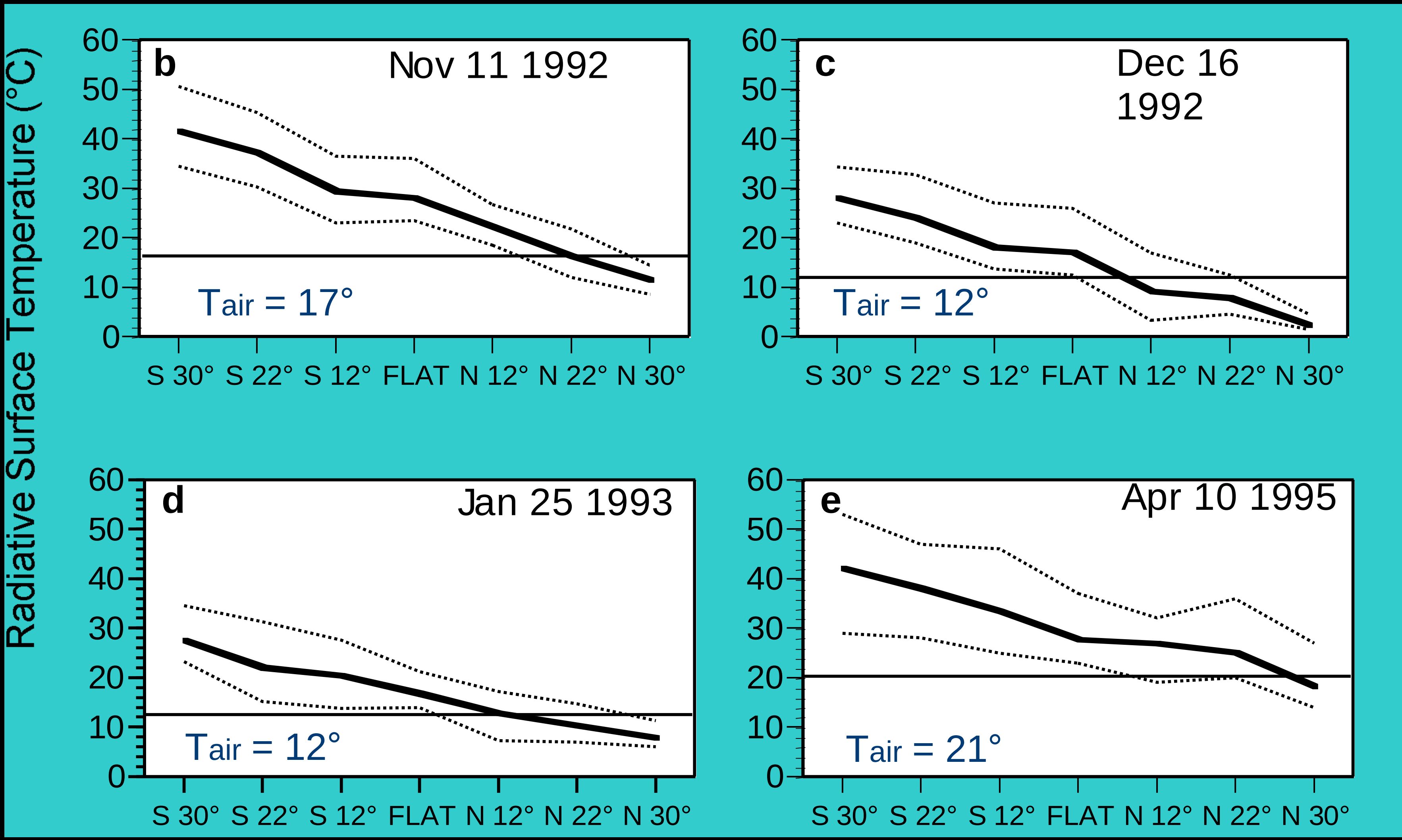
Microclimate: 100 m – 1 cm
vegetation canopies

Organism:
physiology, behavior


N 30
Flat
S 30



Clear-sky insolation is determined by latitude, day of year, aspect, slope, and horizon shading.



Noon surface T° vary by 30+°C along N-S slope gradient, measured with IR thermometer, very different than air temperature. Linear function of insolation.

Black, Basking Caterpillars

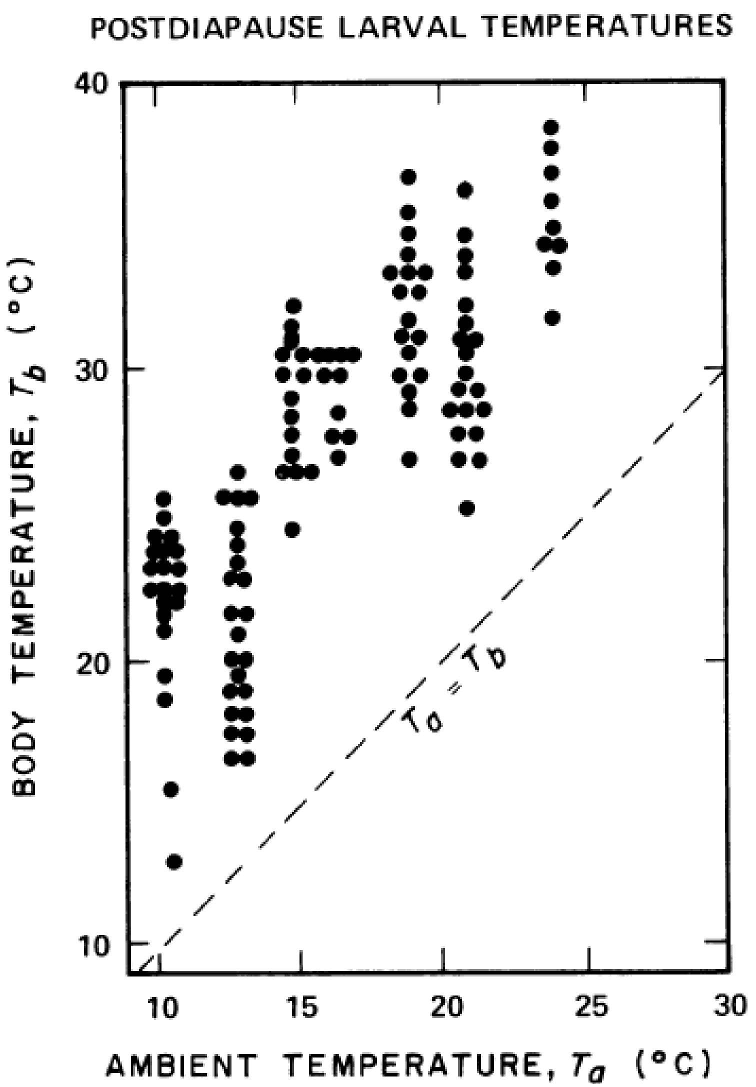


FIG. 4. Postdiapause larval body temperatures. T_a is ambient temperature measured at ground level adjacent to larvae, T_b is body temperature. This figure is a composite of all temperature measurements taken on various slopes at different times of the growing season.

Larvae achieve body temperatures well above (10-12°C) ambient when basking

Weiss et al. 1988 Ecology 69:1486-1496

486-1496

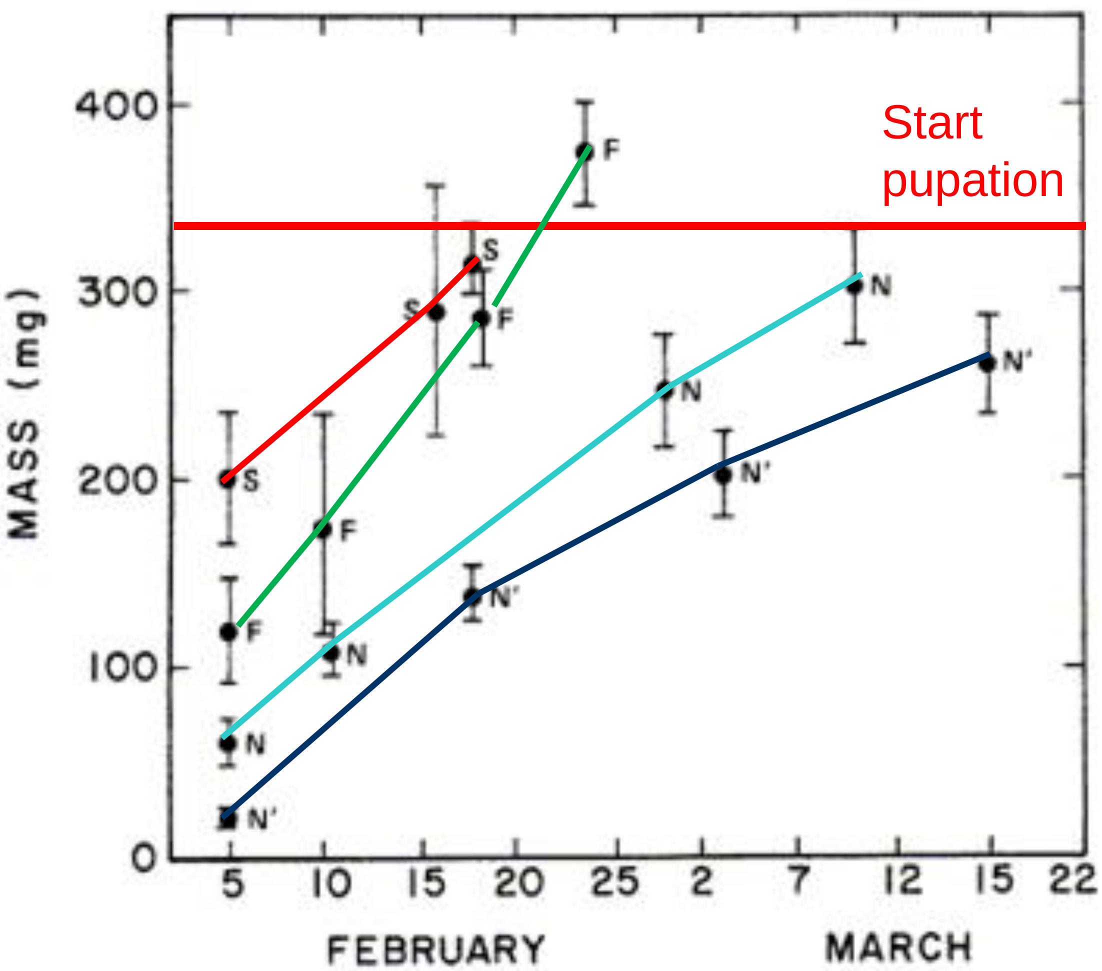


FIG. 3. Mean postdiapause larval mass in the field on different slope exposures. Error bars are 95% confidence intervals (*t* test). S = south-facing 6–11°, F = flat, N = north-facing 11–17°, N′ = north-facing 22–30°.

Weiss et al. 1988 Ecology Vol. 69:1486-1496

Larvae grow faster on warmer slopes, up to a 5 week difference in emergence as an adult butterfly

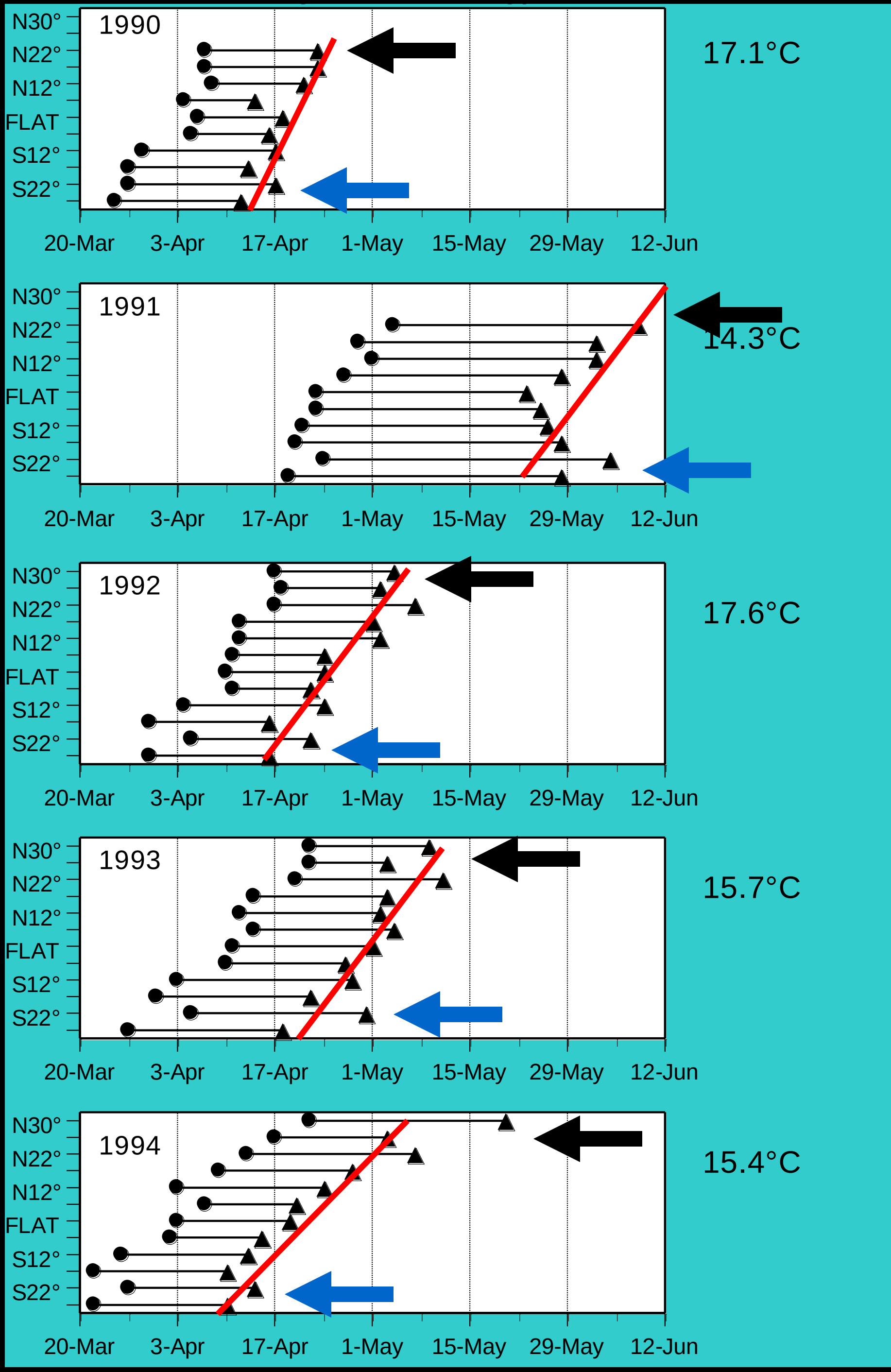
~21-25 days from egg laying to diapause

Phenology:

timing of seasonal biological events

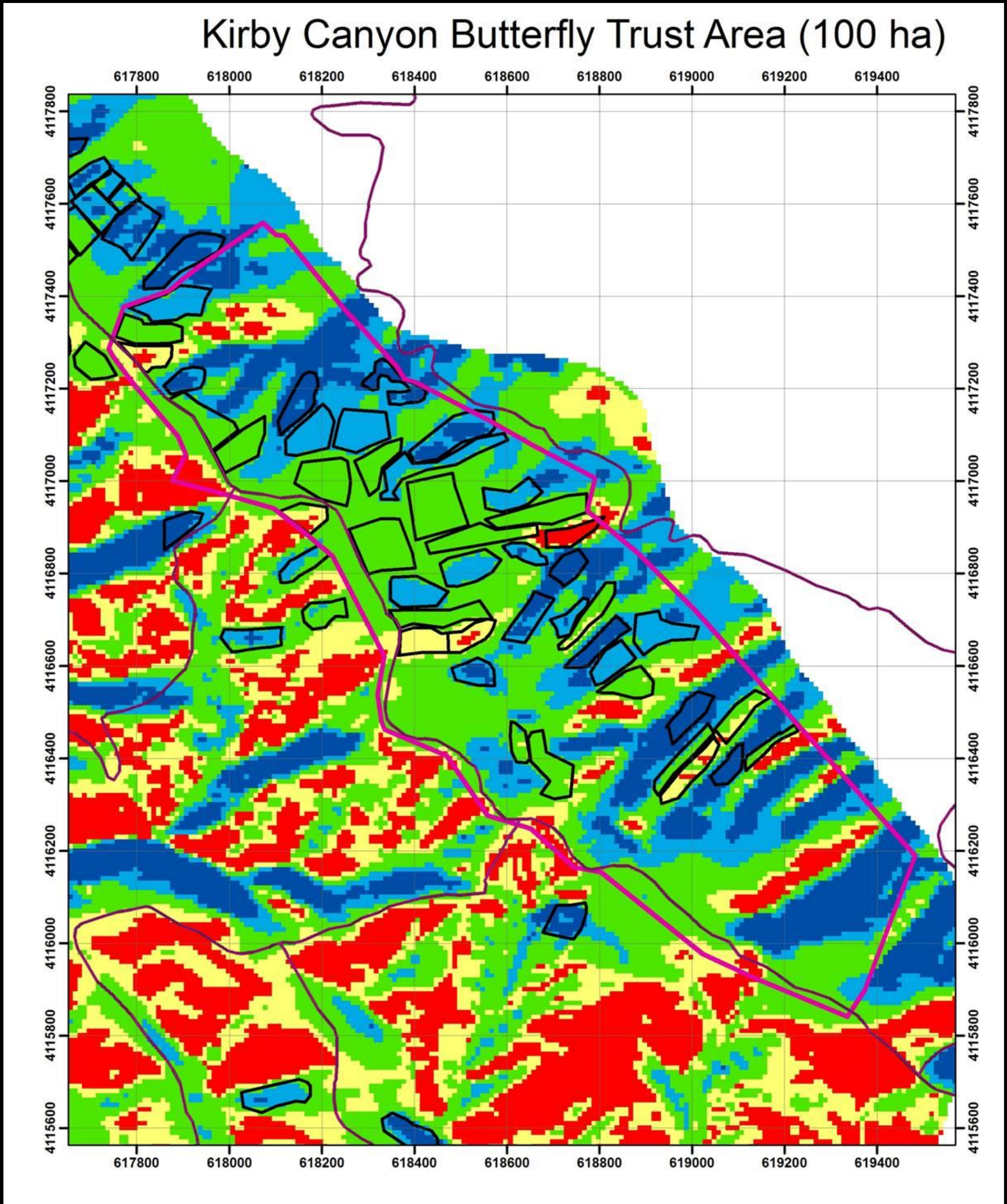
Plant phenology follows topoclimatic gradients

S-slope N-slope



High mortality is the rule!

- Females lay ~400 eggs on average
- Most mortality prediapause starvation 98-99+%
- ~50% in diapause
- ~10-20% as postdiapause larvae
- ~50% as pupae
- On average, 2 survive to adulthood; 99.5% mortality total
- if mortality lower = population boom, higher = population crash
- **Insect, not a grizzly bear!**



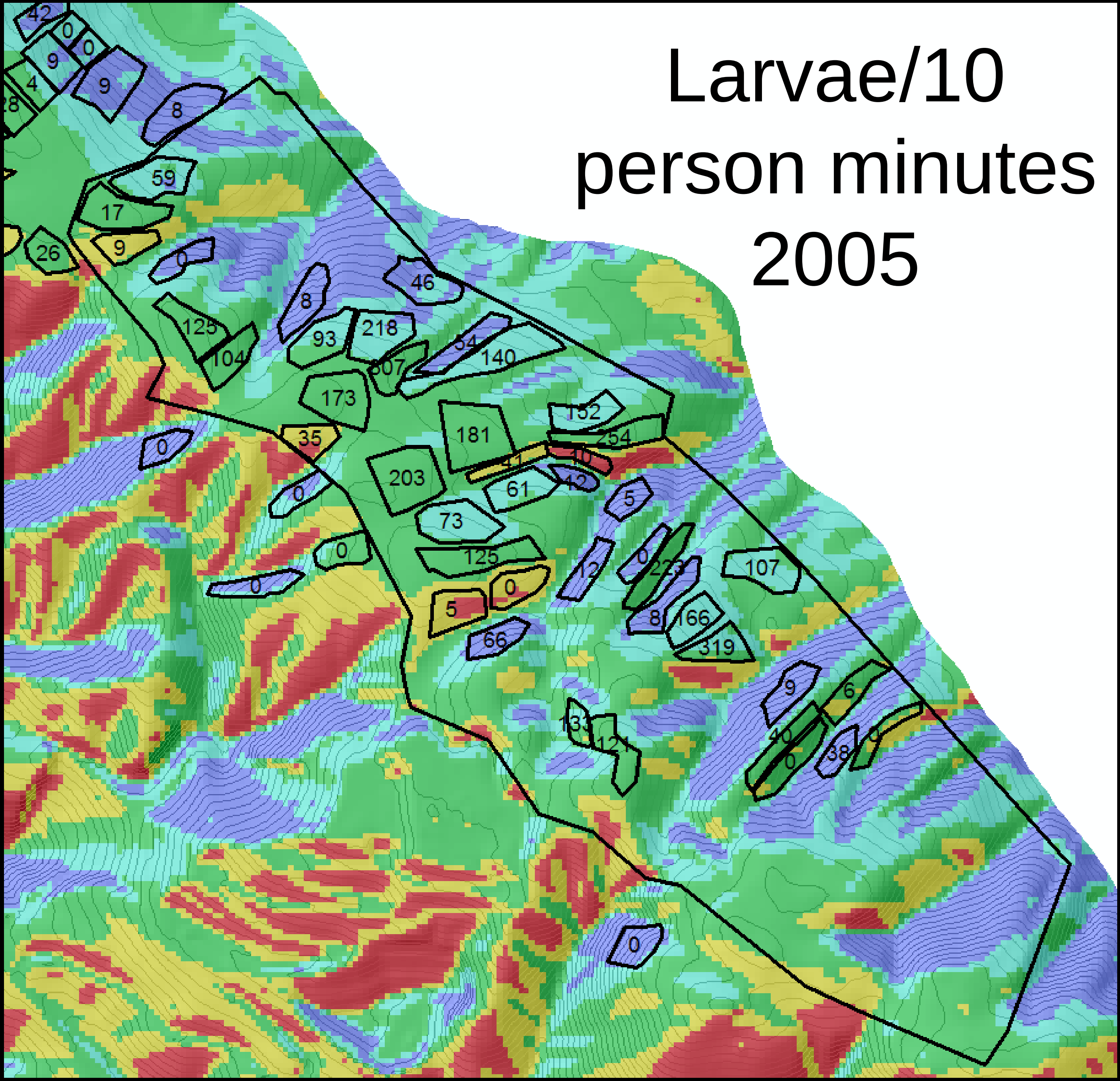
Stratified sampling across insolation gradients

Tracks both numbers and spatial distribution

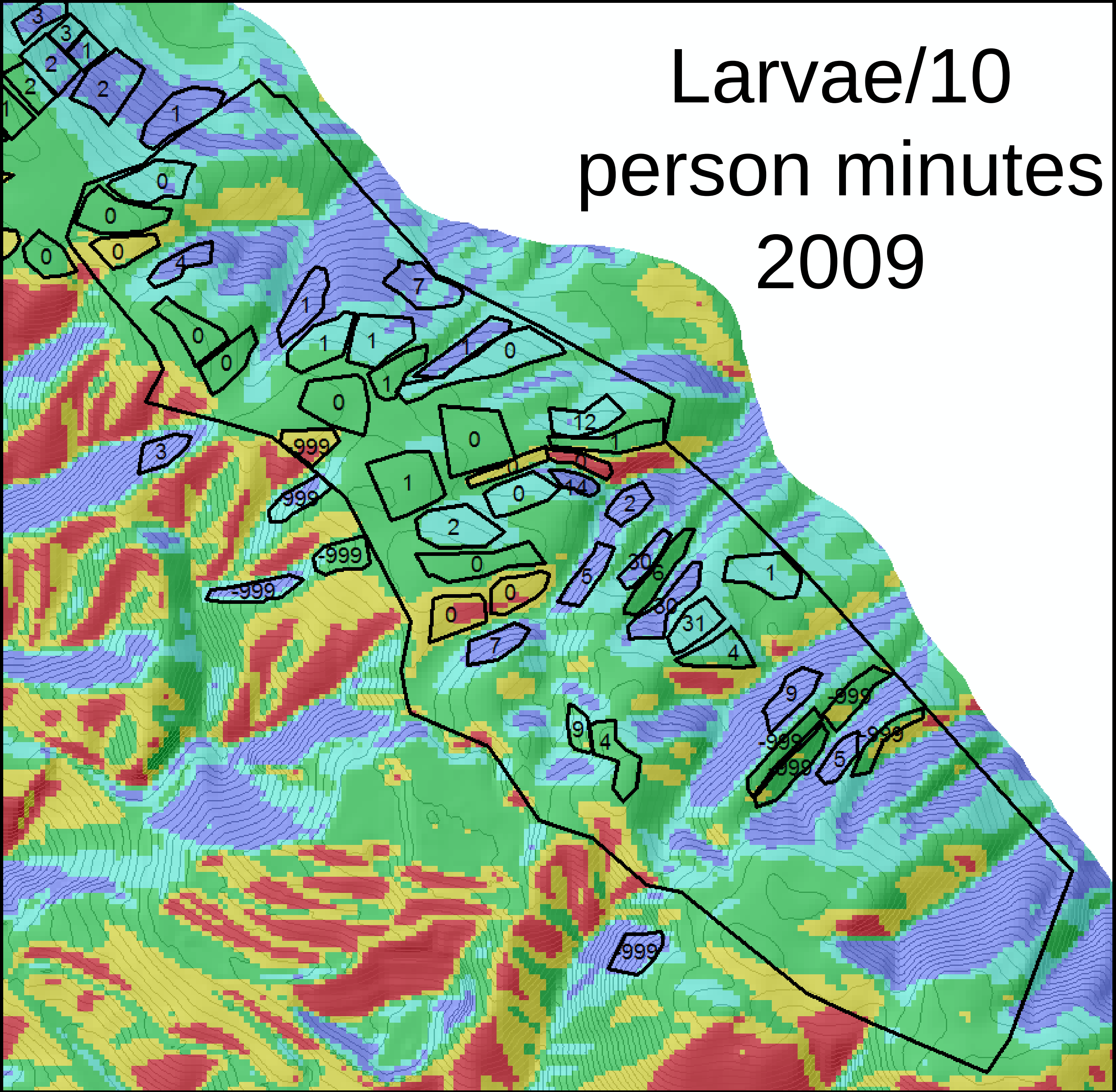
10 person-minute timed searches

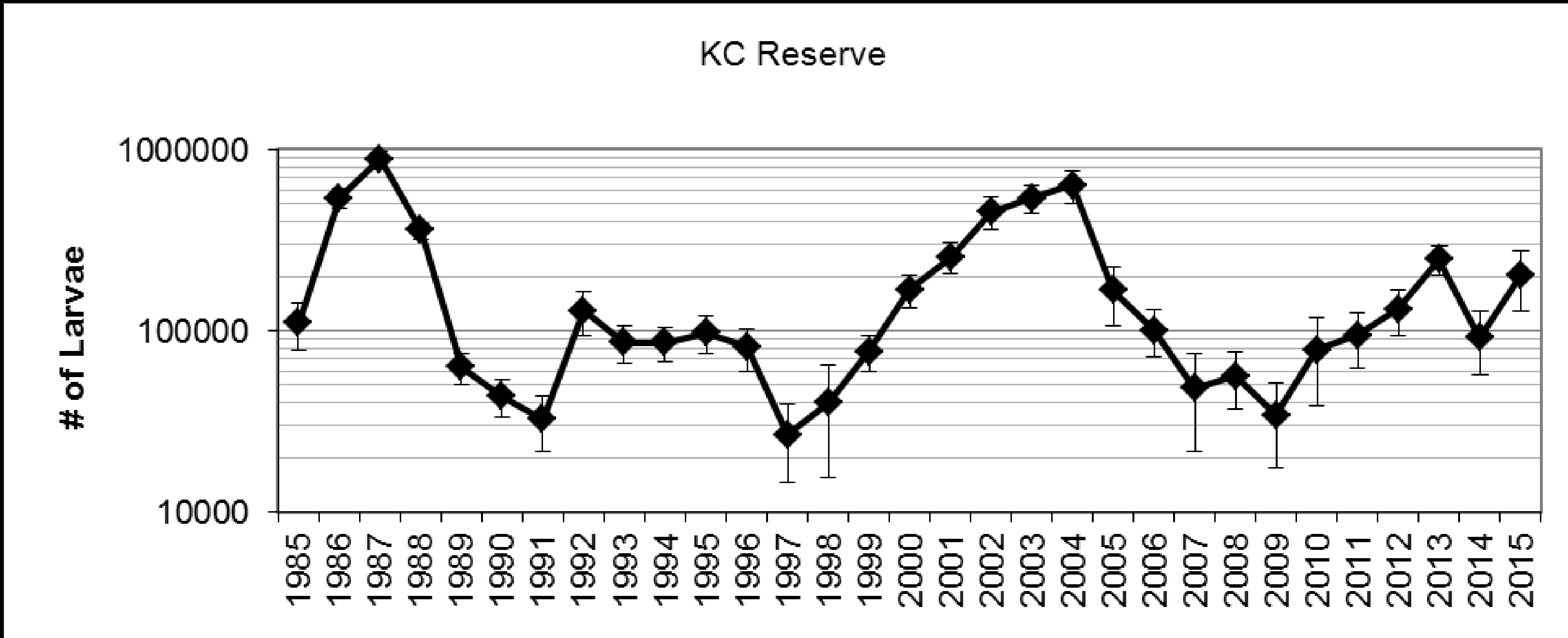
Cover hundreds of hectares

Larvae/10 person minutes 2005



Larvae/10 person minutes 2009




KC Reserve
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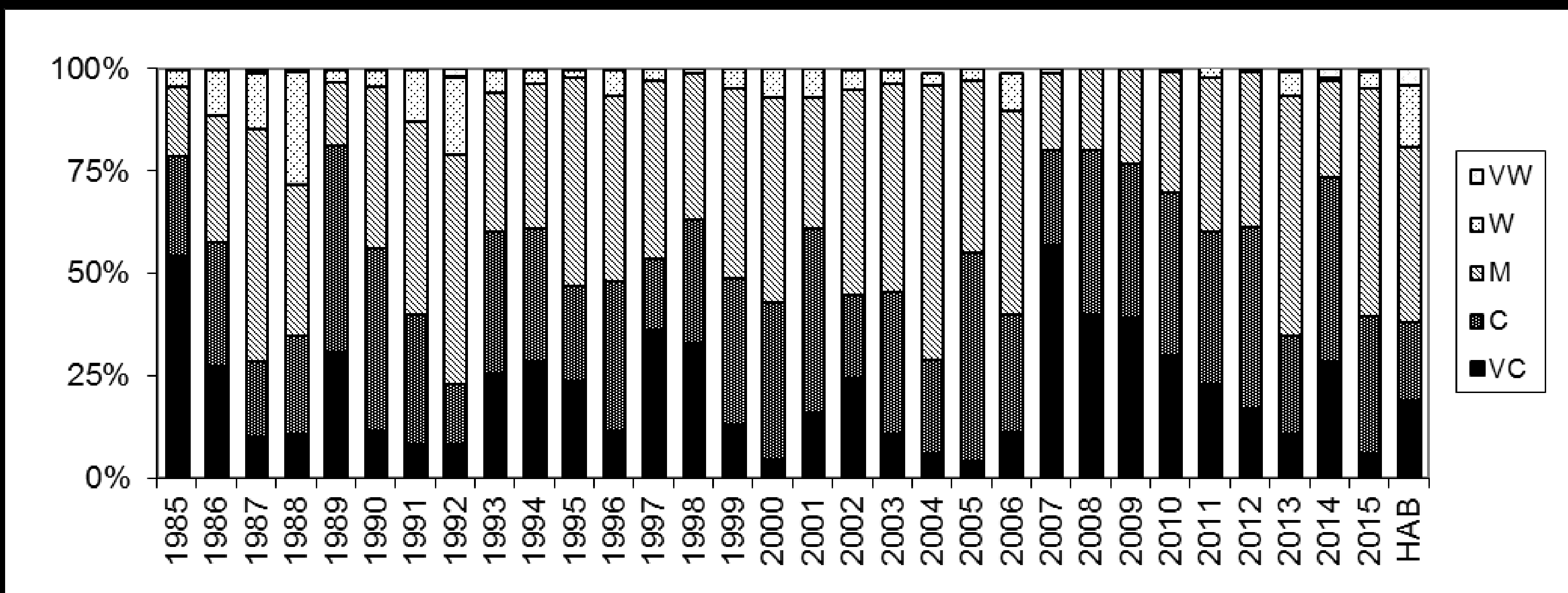
100%
75%
50%
25%
0%
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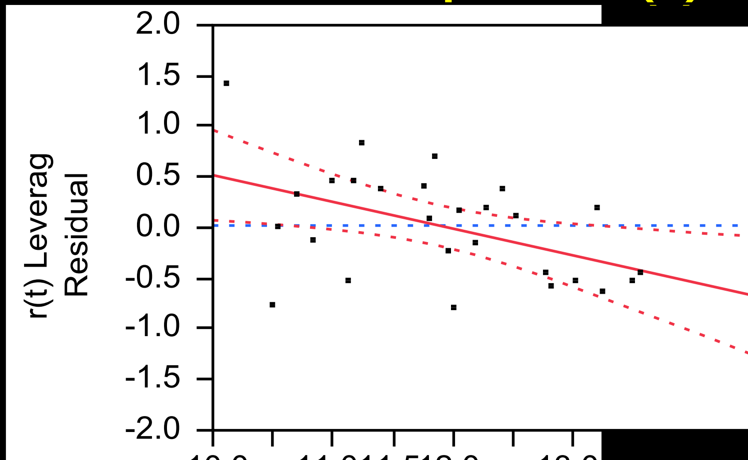
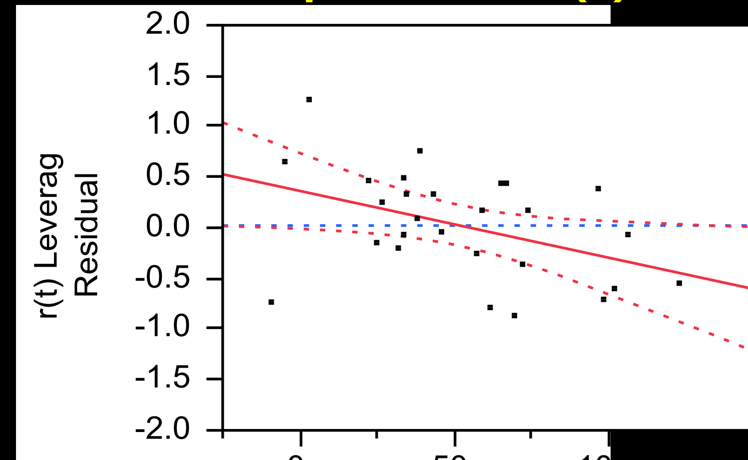
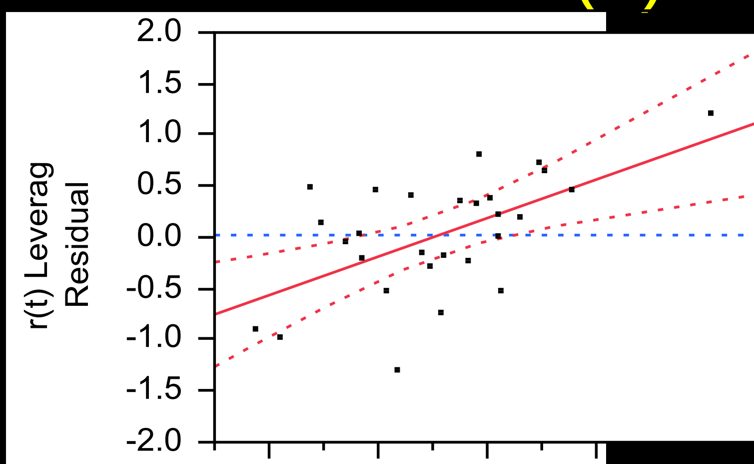
Mar-Apr °C (-)



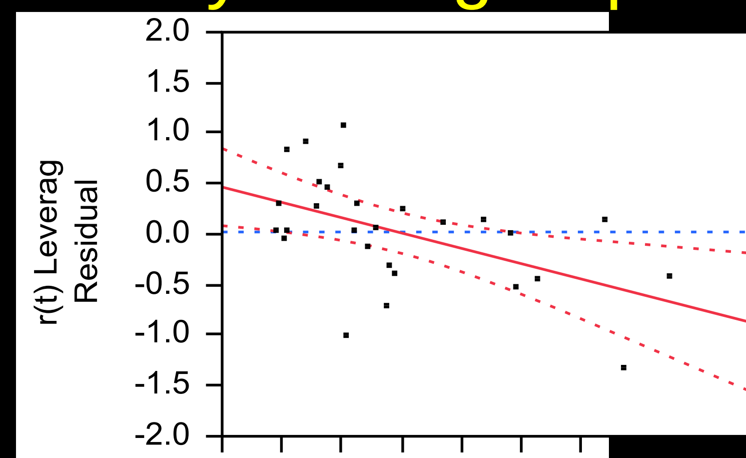
Apr Rain (-)



Oct-Nov Rain (+)

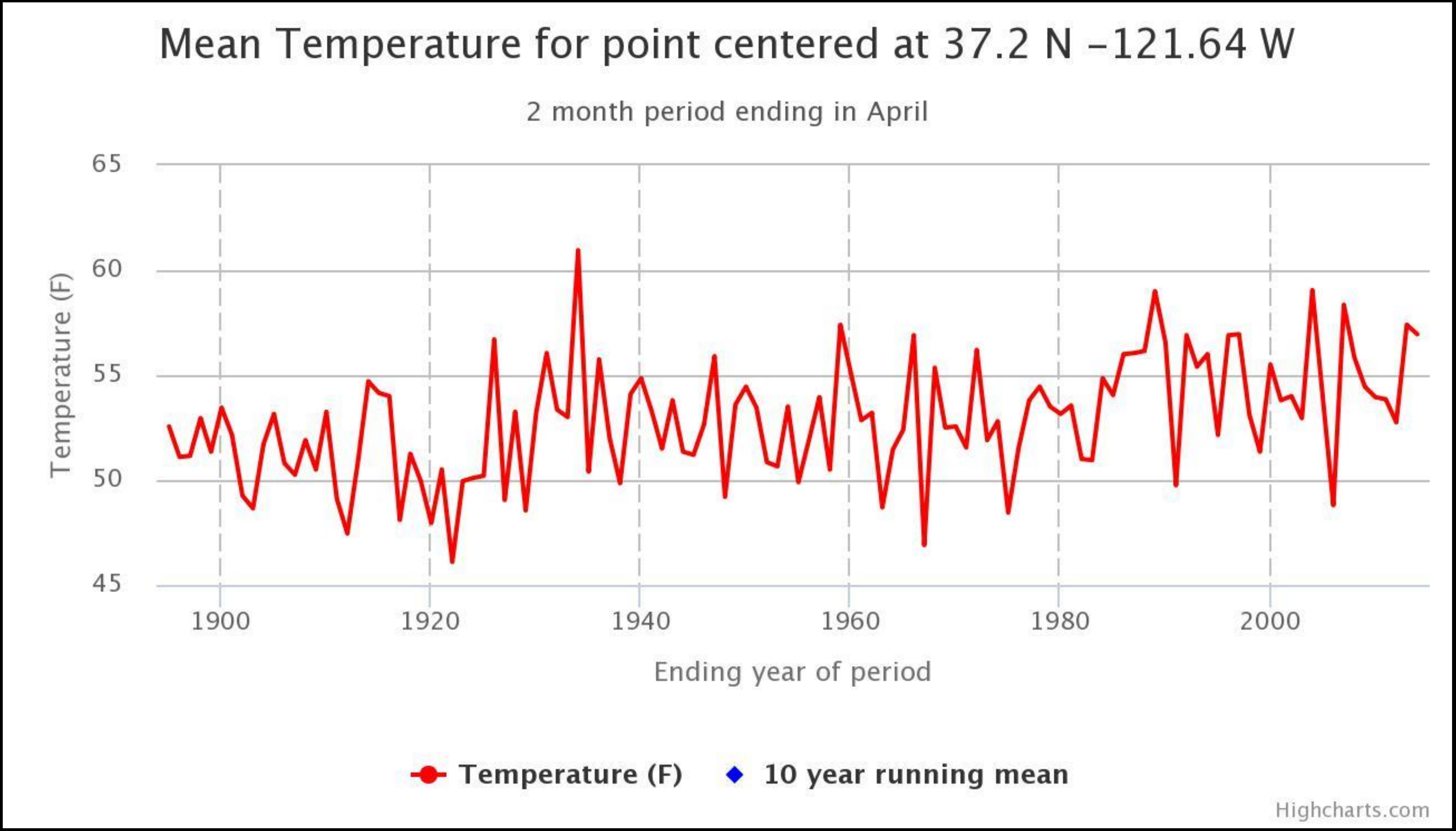


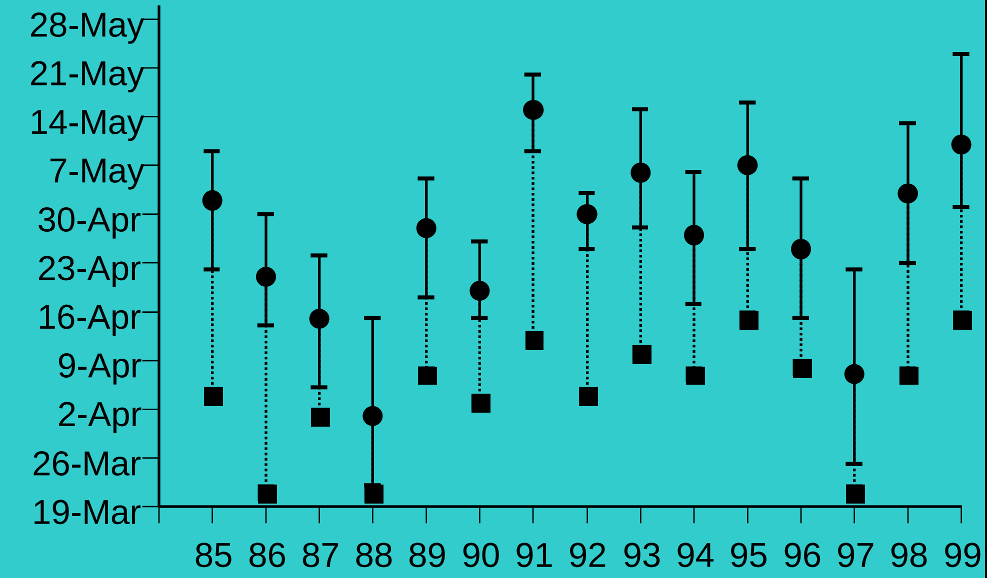
2-year avg Pop Size



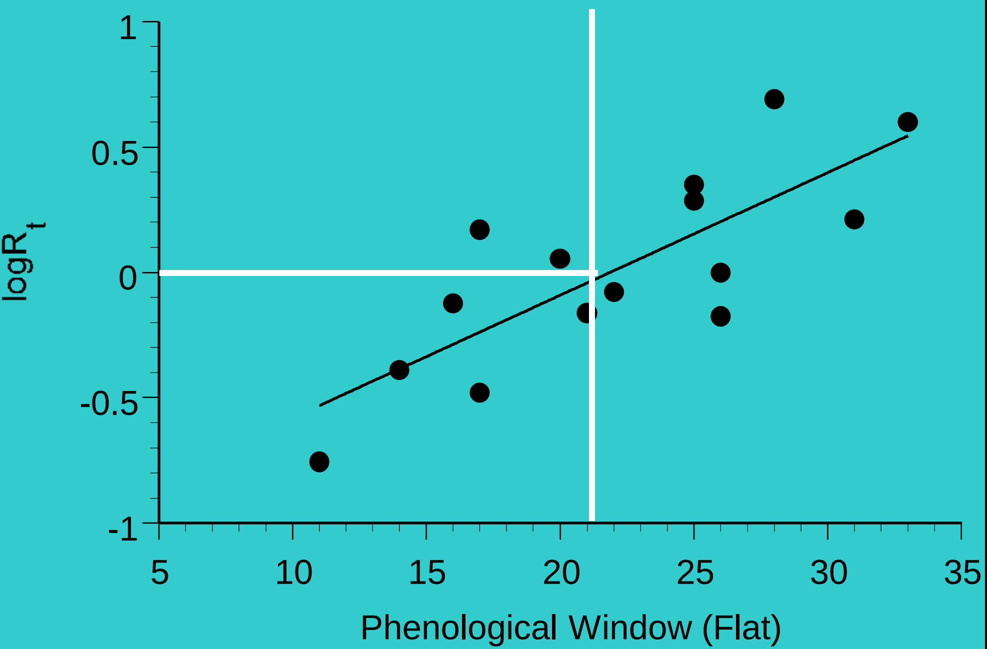
Trends in Mar-Apr Temperature?

WESTMAP PRISM 4 km



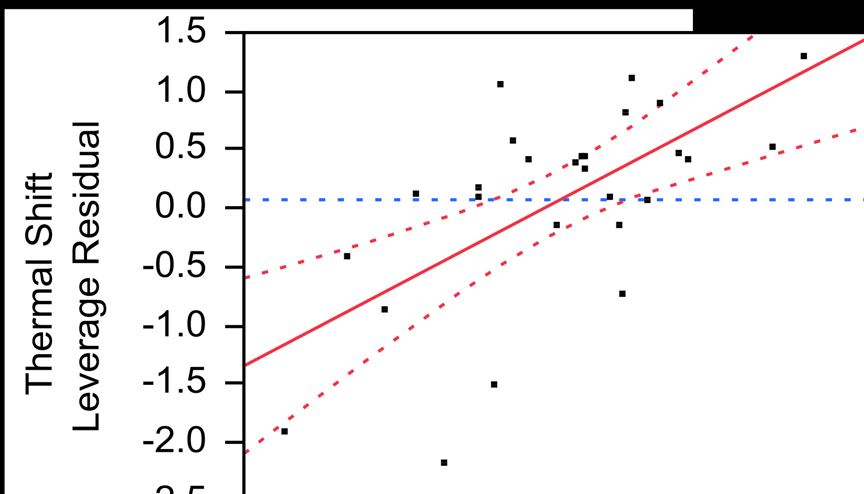


Phenological Window: Difference between peak emergence (square) and *Plantago* senescence on Flat (circle)



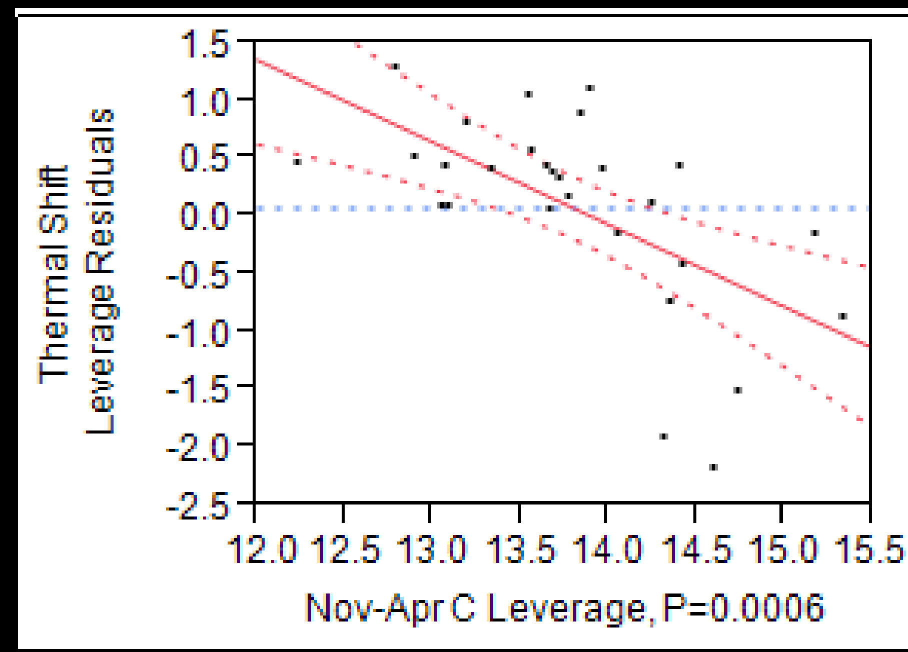
Timing may not be everything, but it is 63% of everything here.

Population increases = shift toward warmer slopes; Population decrease = shift toward cooler slopes



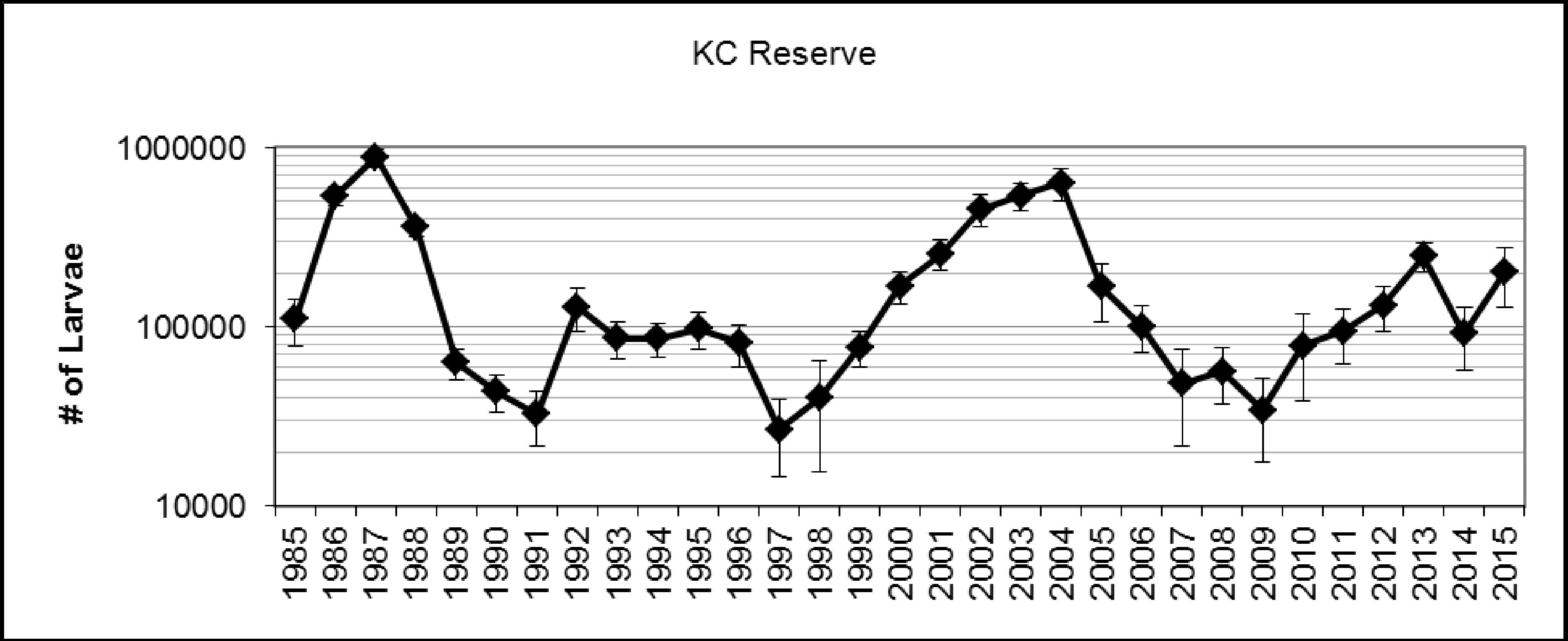
$r^2 = 0.40$,
P = 0.0003

Warmer growing season = shift toward cooler slopes

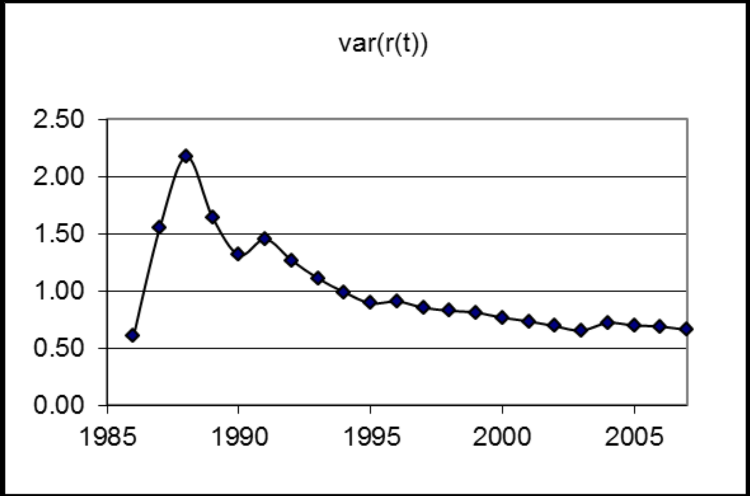


$r^2 = 0.37$,
P = 0.0006

Mean time to extinction analysis (Foley 1994)



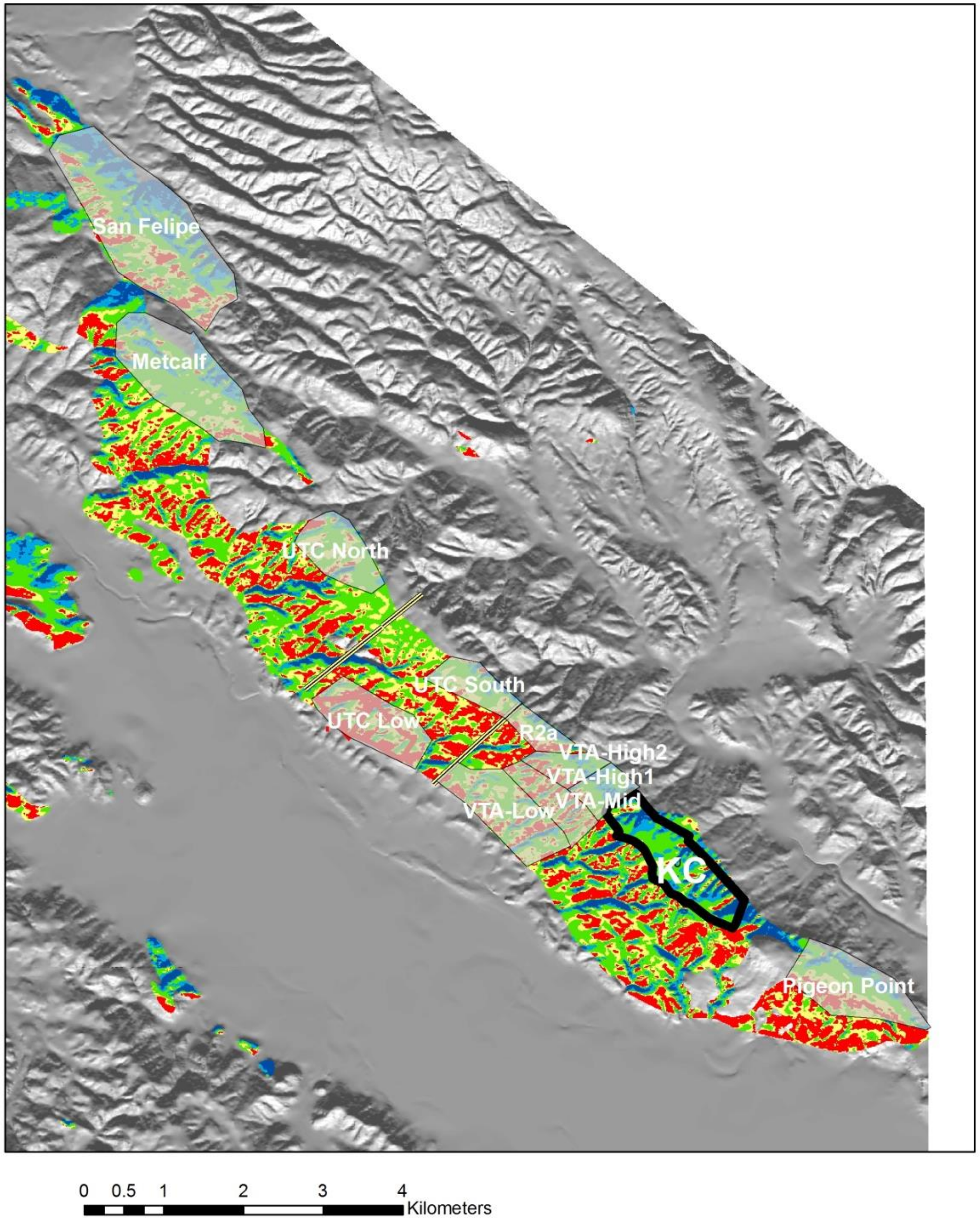
Diffusion approximation
Mean r(t)
Variance r(t)
Autocorrelation r(t)
Carrying Capacity K (cap)



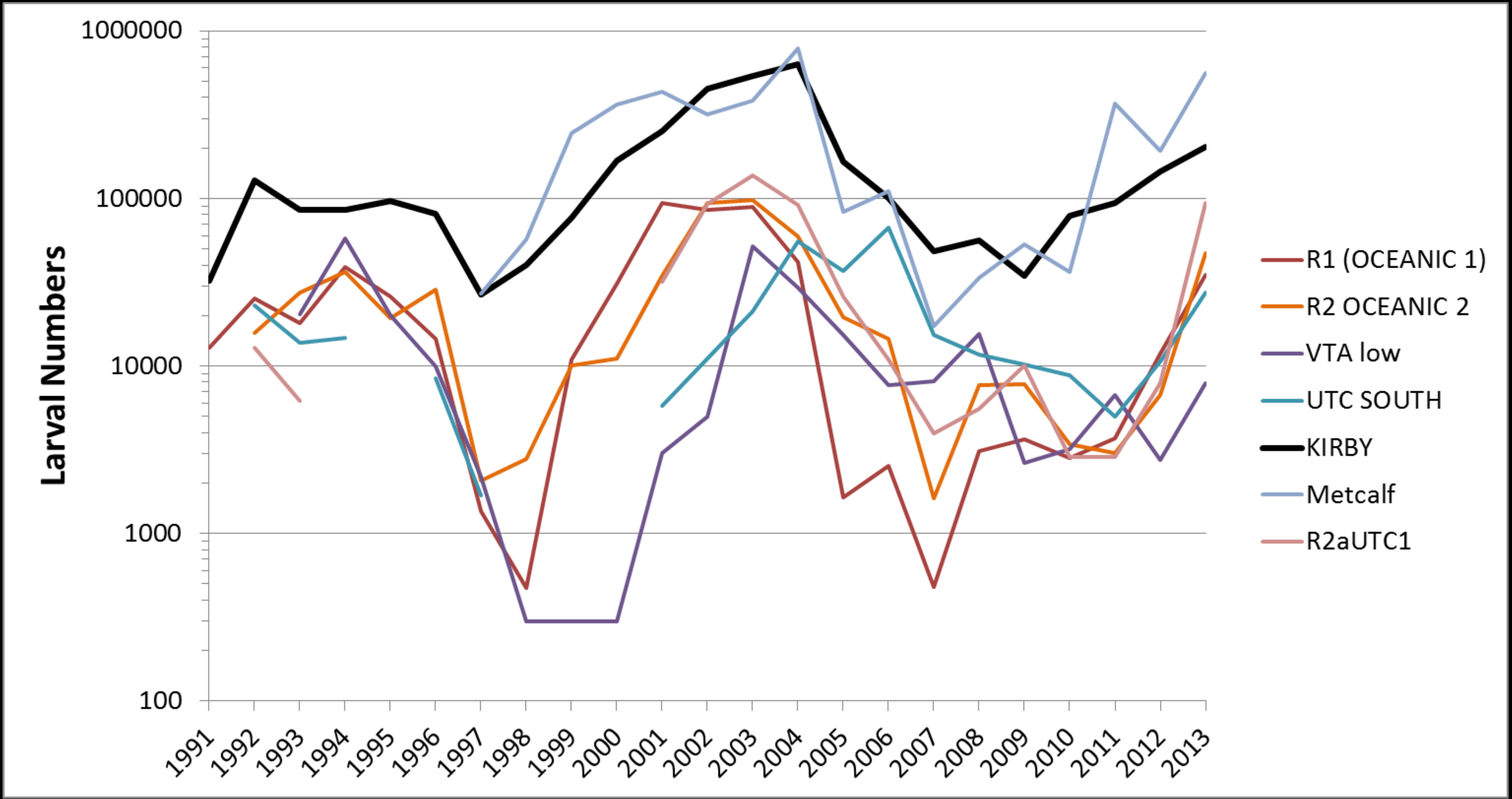
Mean r(t) = 0
Variance r(t) = 0.59
Autocorrelation r(t) = 0
Carrying Capacity K = 13.8 (10^6 larvae)
Mean time to extinction = 313 years

Mean r(t) = 0.1 (take out 2 population peaks where defoliation observed)
Variance r(t) = 0.59
Autocorrelation r(t) = 0
Carrying Capacity K = 13.8 (10^6 larvae)
Mean time to extinction = 2,970 years

Population Zones Coyote Ridge



“Subpopulation” behavior



Broad synchrony driven by weather
Local asynchrony driven by topography and population history

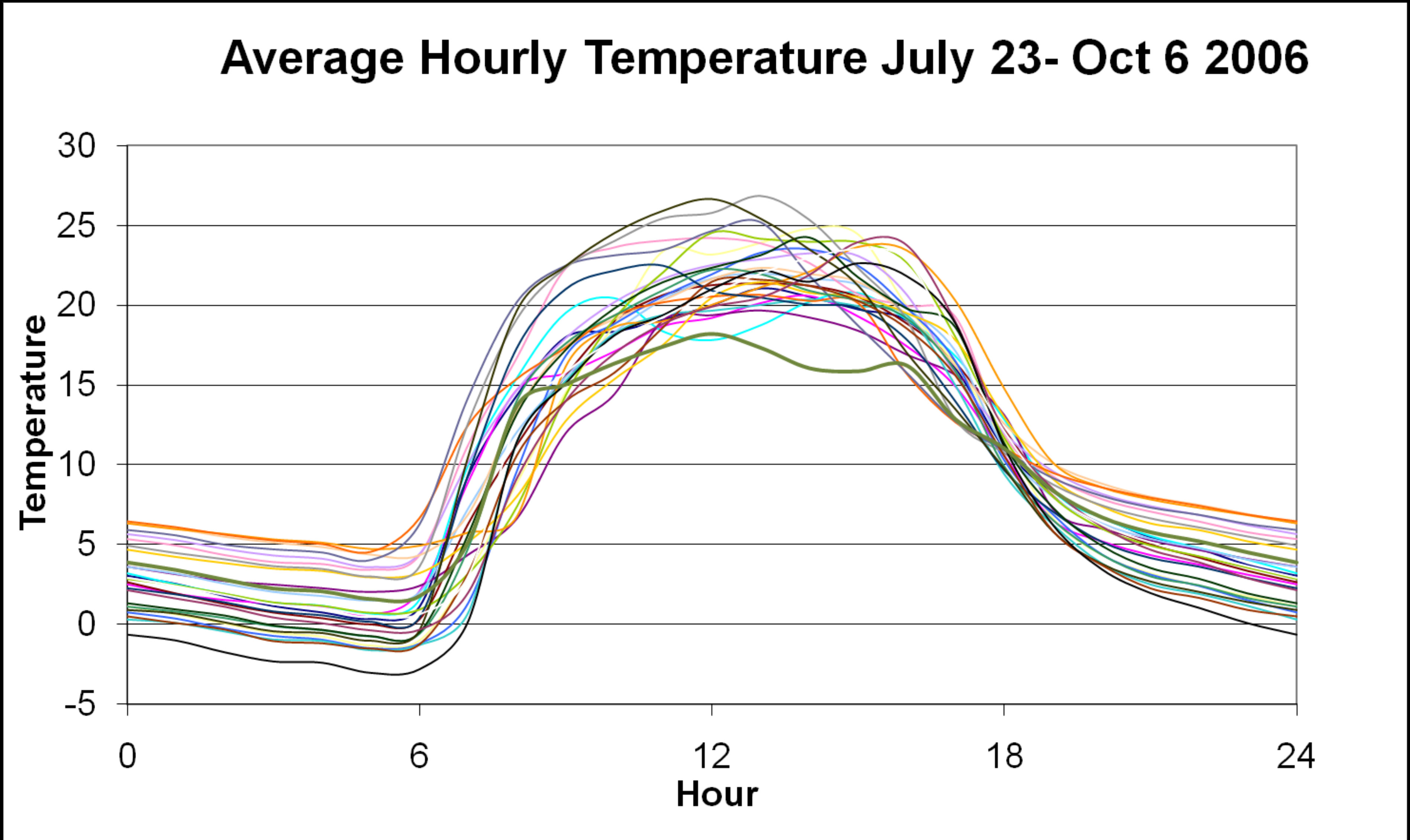
Checkerspot butterflies

- Population dynamics driven by phenology – timing of development of larvae and foodplants (very common among animals)
- Weather at beginning and end of growing season is most important
- Topoclimatic diversity: range of insolation = range of temperatures = range of phenology = **resilience**

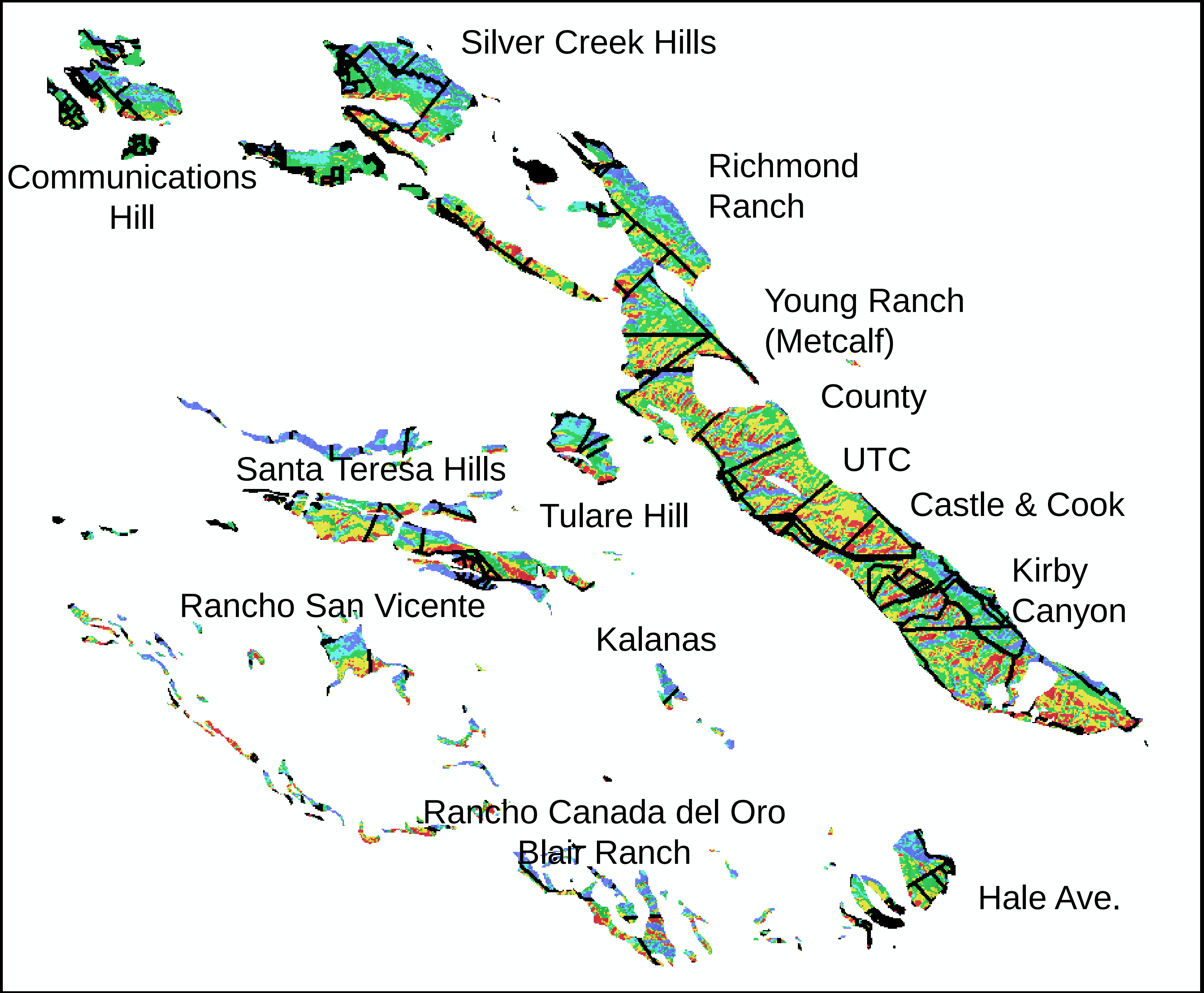
Charismatic Megaflora

Shifts across aspect

Topoclimatic variation is extreme: Nooks and Crannies




CATERPILLAR
627E


Silver Creek Hills
Communications Hill
Richmond Ranch
Young Ranch (Metcalf)
County
UTC
Castle & Cook
Kirby Canyon
Santa Teresa Hills
Tulare Hill
Rancho San Vicente
Kalanas
Rancho Canada del Oro
Blair Ranch
Hale Ave.

"The last of the Coast Range foothills were in near view all the way to Gilroy. Their union with the valley is by curves and slopes of inimitable beauty, and they were robed with the greenest grass and richest light I ever beheld, and colored and shaded with millions of flowers of every hue chiefly of purple and golden yellow; and hundreds of crystal rills joined songs with the larks, filling all the valley with music like a sea, making it an Eden from end to end…"

---John Muir, 1868 on his walk from San Francisco to Yosemite Valley.

In absence of cattle grazing in South Bay, introduced annual grasses overrun habitat within several years (repeatable - too many times).

“The goodness of the weather as I journeyed towards Pacheco was beyond all praise and description, fragrant and mellow and bright. The air was perfectly delicious, sweet enough for the breath of angels; every draught of it gave a separate and distinct piece of pleasure. I do not believe that Adam and Eve ever tasted better in their balmiest nook.

---John Muir, 1868 on his walk from San Francisco to Yosemite Valley along Coyote Ridge.


Dry Nitrogen Deposition
Smog is slow release N-fertilizer

What goes up……

Combustion

NO

O_3

hv

NO_2

PAN

[OH^*]

$HNO_3 + NH_3 \rightleftharpoons NO_3NH_4(p)$

Fertilizer, animal wastes, vehicles, vegetation,

Dry deposition

up to >50 lbs-N/acre/year, pre-industrial background is 0.5 lbs-N/acre/year

NO_2 and NH_3 gases are taken up through stomata

HNO_3 and NH_3 stick to surfaces, even “dry” surfaces

Particulates and other gases are relatively minor contributors

Dry deposition is >80-90% in polluted regions of California, wet deposition is of lesser importance most places

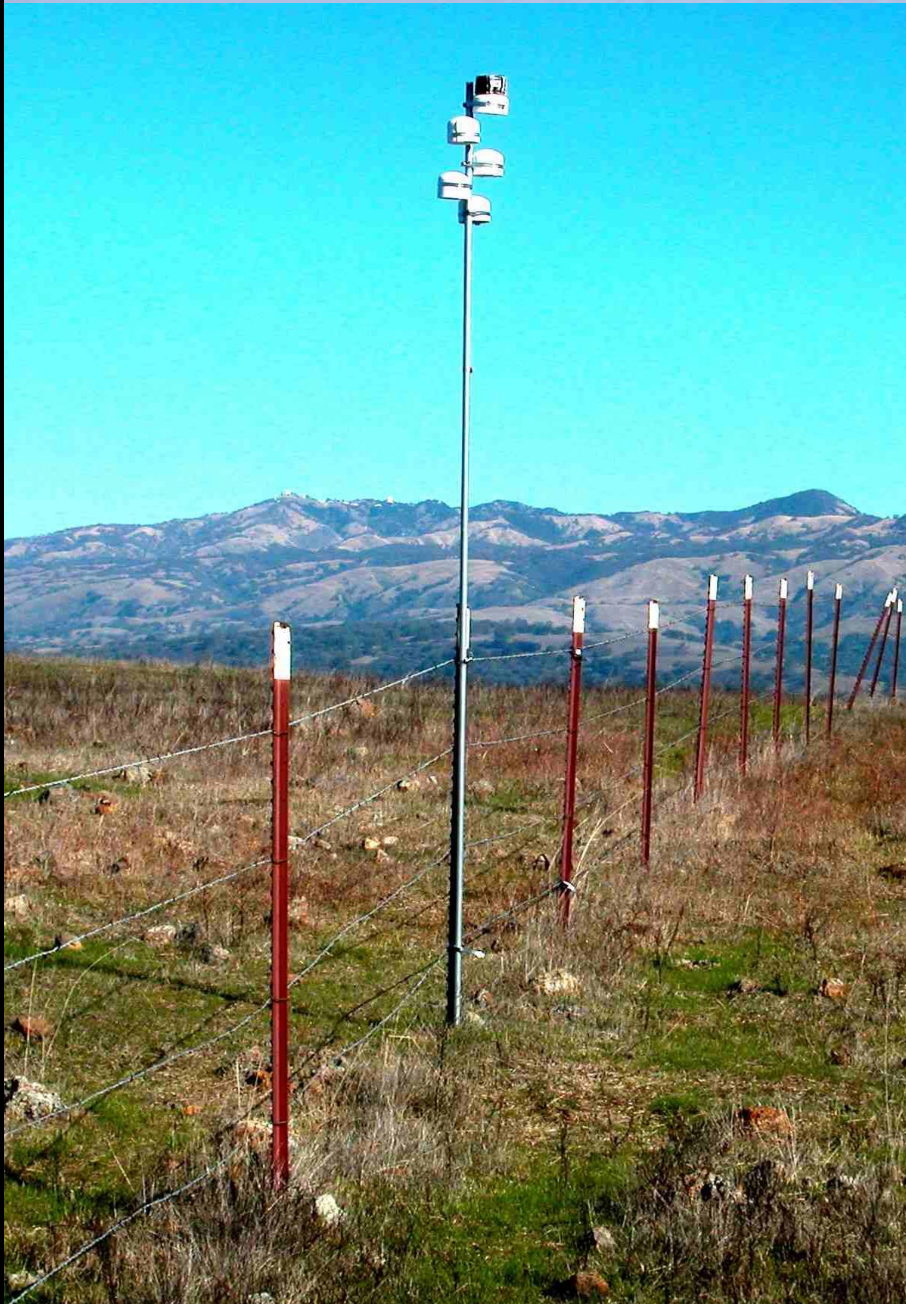
Weiss (1999) Conservation Biology 13(6):1476-1486

Cars, Cows, and Checkerspot Butterflies: Nitrogen Deposition and Management of Nutrient-Poor Grasslands for a Threatened Species

STUART B. WEISS

Center for Conservation Biology, Department of Biological Sciences, Stanford University, Stanford, CA 94305, U.S.A., email stu@bing.stanford.edu

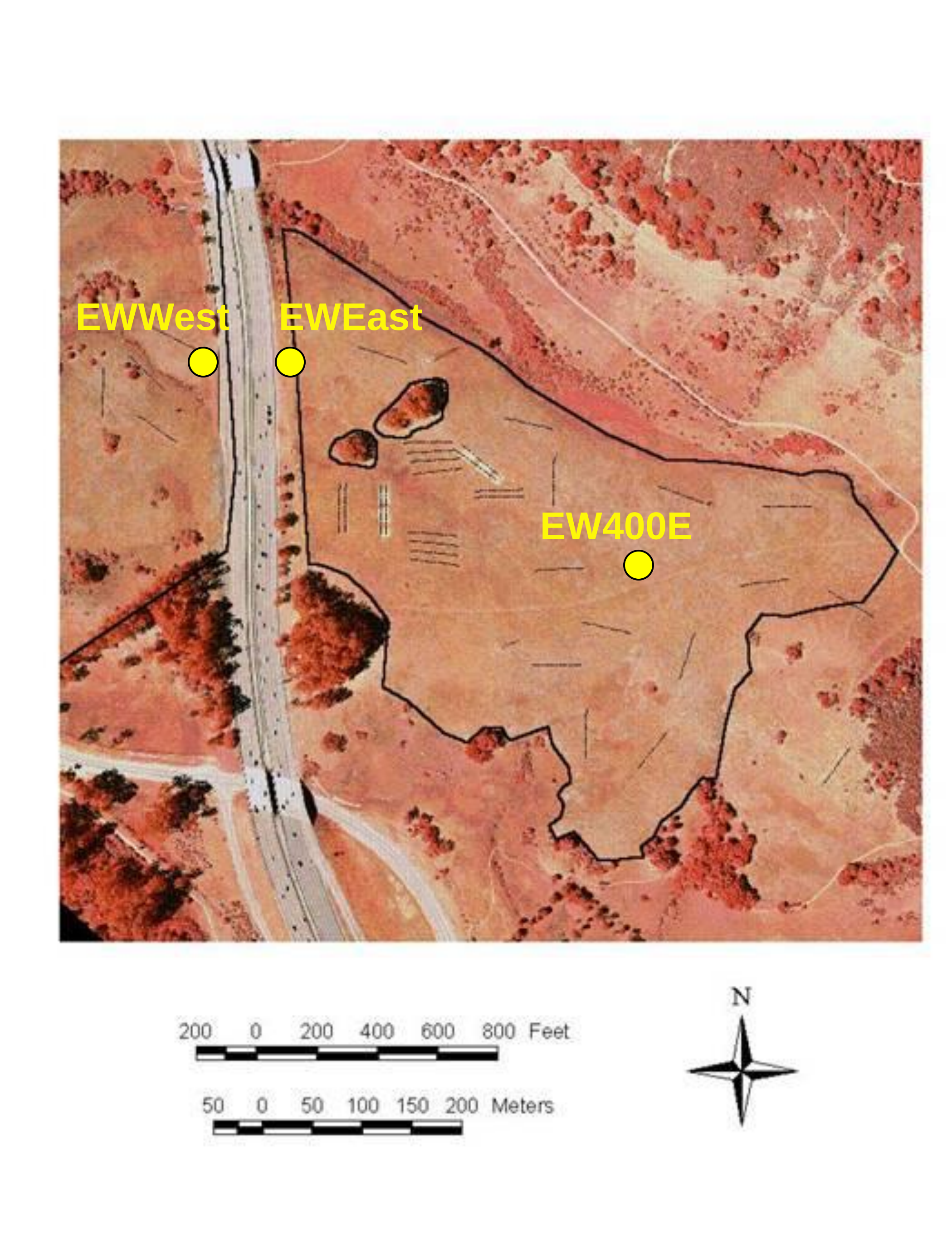
Abstract: *Nutrient-poor, serpentinitic soils in the San Francisco Bay area sustain a native grassland that supports many rare species, including the Bay checkerspot butterfly (*Euphydryas editha bayensis*). Nitrogen (N) deposition from air pollution threatens biodiversity in these grasslands because N is the primary limiting nutrient for plant growth on serpentinitic soils. I investigated the role of N deposition through surveys of butterfly and plant populations across different grazing regimes, by literature review, and with estimates of N deposition in the region. Several populations of the butterfly in south San Jose crashed following the cessation of cattle grazing. Nearby populations under continued grazing did not suffer similar declines. The immediate cause of the population crashes was rapid invasion by introduced annual grasses that crowded out the larval host plants of the butterfly. Ungrazed serpentinitic grasslands on the San Francisco Peninsula have largely resisted grass invasions for nearly four decades. Several lines of evidence indicate that dry N deposition from smog is responsible for the observed grass invasion. Fertilization experiments have shown that soil N limits grass invasion in serpentinitic soils. Estimated N deposition rates in south San Jose grasslands are 10–15 kg N/ha/year; Peninsula sites have lower deposition, 4–6 kg N/ha/year. Grazing cattle select grasses over forbs, and grazing leads to a net export of N as cattle are removed for slaughter. Although poorly managed cattle grazing can significantly disrupt native ecosystems, in this case moderate, well-managed grazing is essential for maintaining native biodiversity in the face of invasive species and exogenous inputs of N from nearby urban areas.*



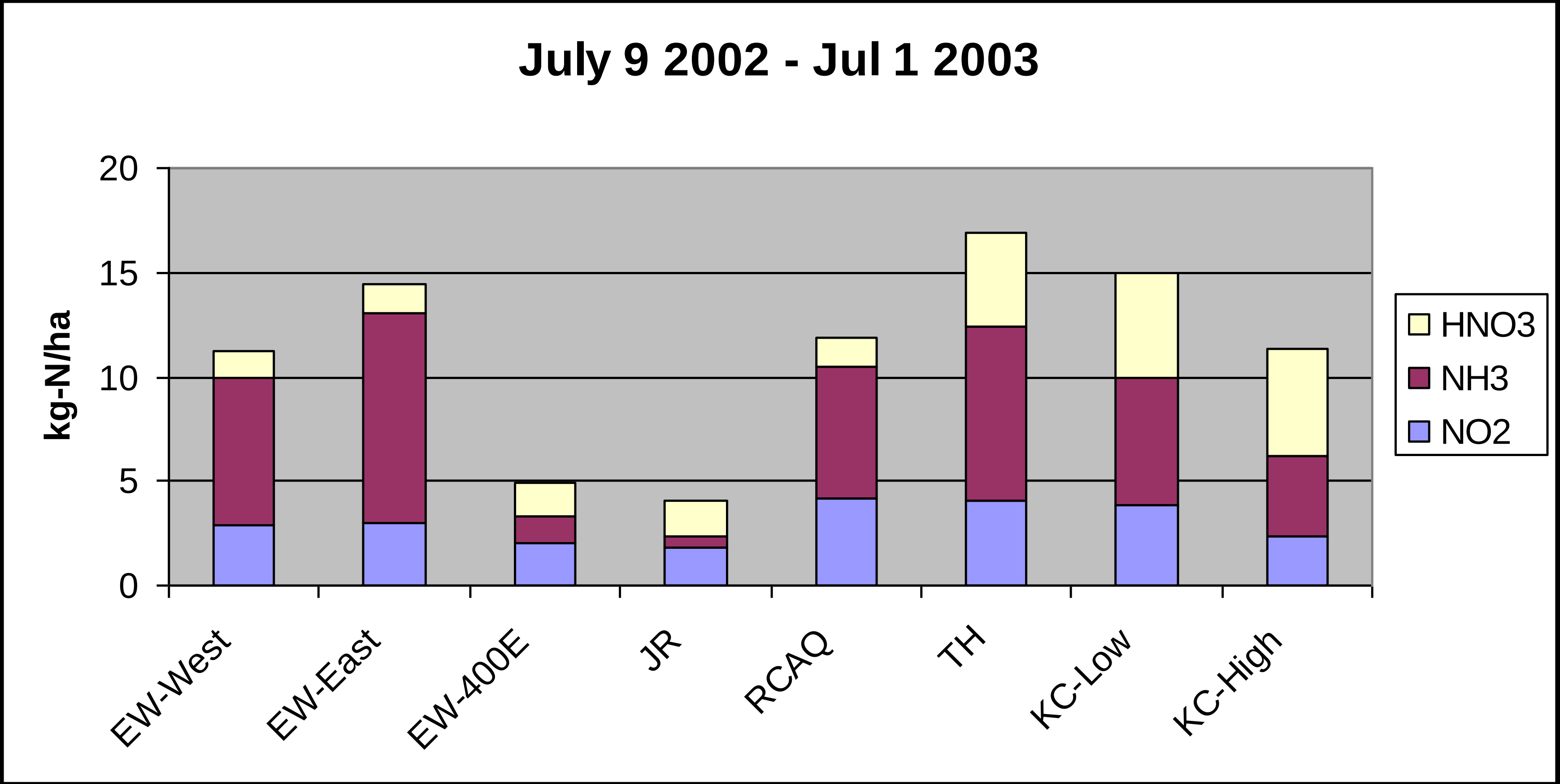
Dr. Andrzej Bytnerowicz

USDA FS Riverside, CA


5 RCAQ
1-3 EW
4 JR
SJAQ
6 Tulare
7-8 KC



Highway 280 carries 113,000 vehicles per day, often at capacity southbound in AM



Simple deposition model, monthly average deposition velocities for wet and dry season.

$HNO_3 > NH_3 >> NO_2 >>> NO$

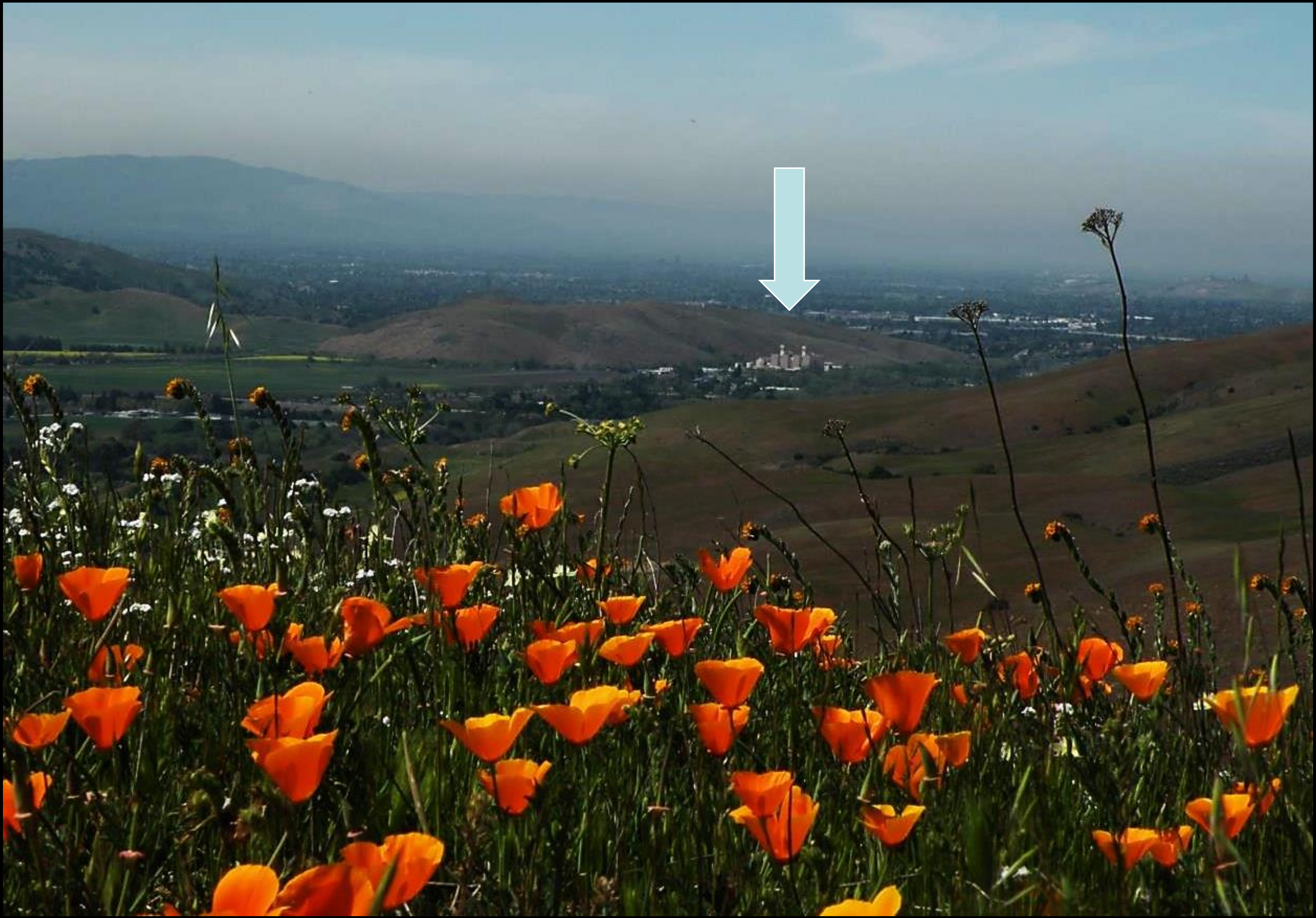
NH_3 deposition to Italian ryegrass canopy measured = 16.7 mm/s (Sommer, S. G. & Jensen, E. S. 1991. *Journal of Environmental Quality* **20,** 153-156.)

Metcalf Energy Center, Tulare Hill

Large point source, but incremental effects in an already polluted region

Precedent setting mitigation:

131 acres + $1.4 million endowment + 30-year operating expenses



Los Esteros Critical Energy Facility

40 acres + $400,000 endowment + 30-year operating expenses

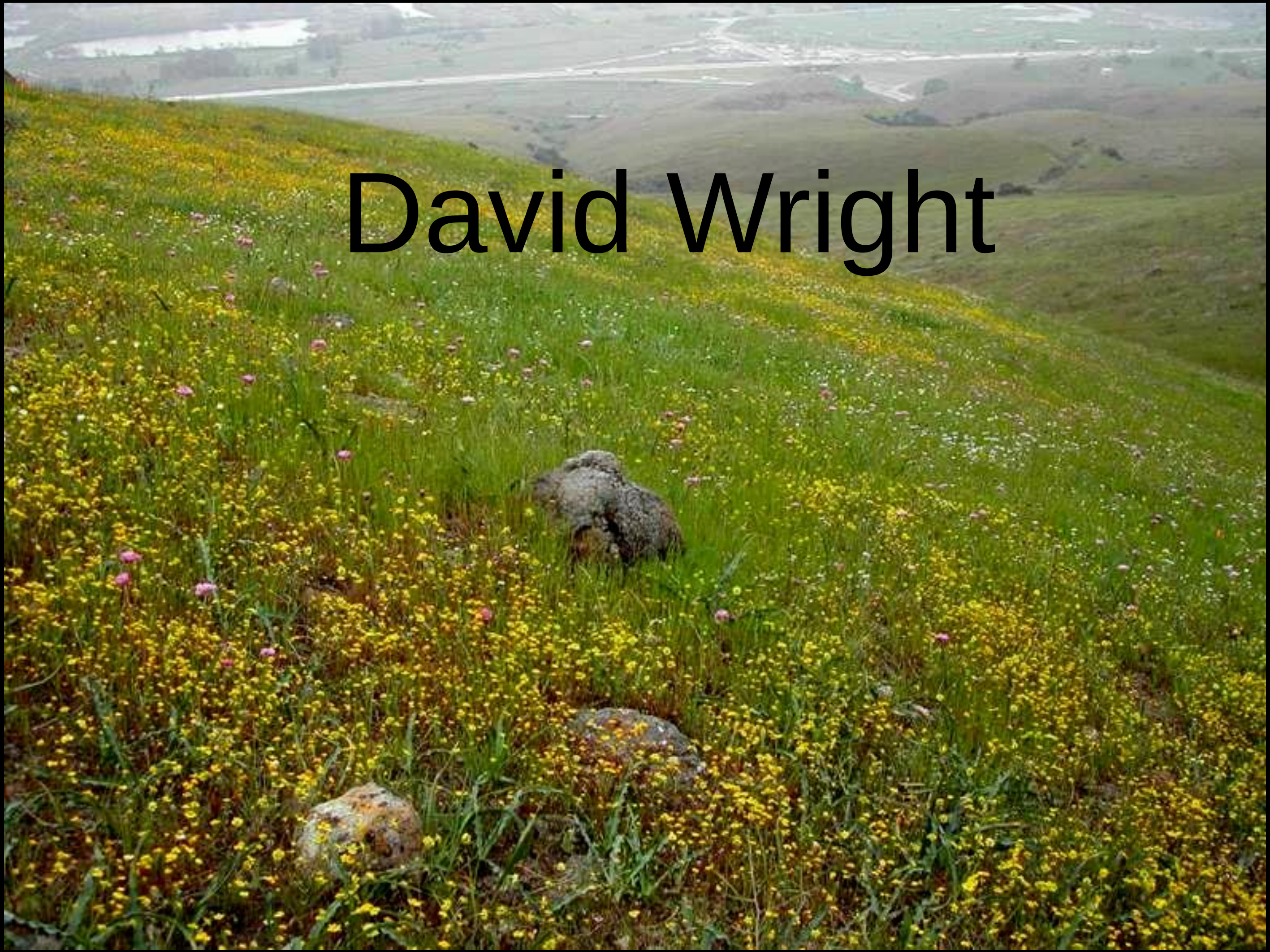
Silicon Valley Power (City of Santa Clara)

40 acres + $270,000 endowment + 30-year operating expenses

Far away (20 miles), small cumulative impacts

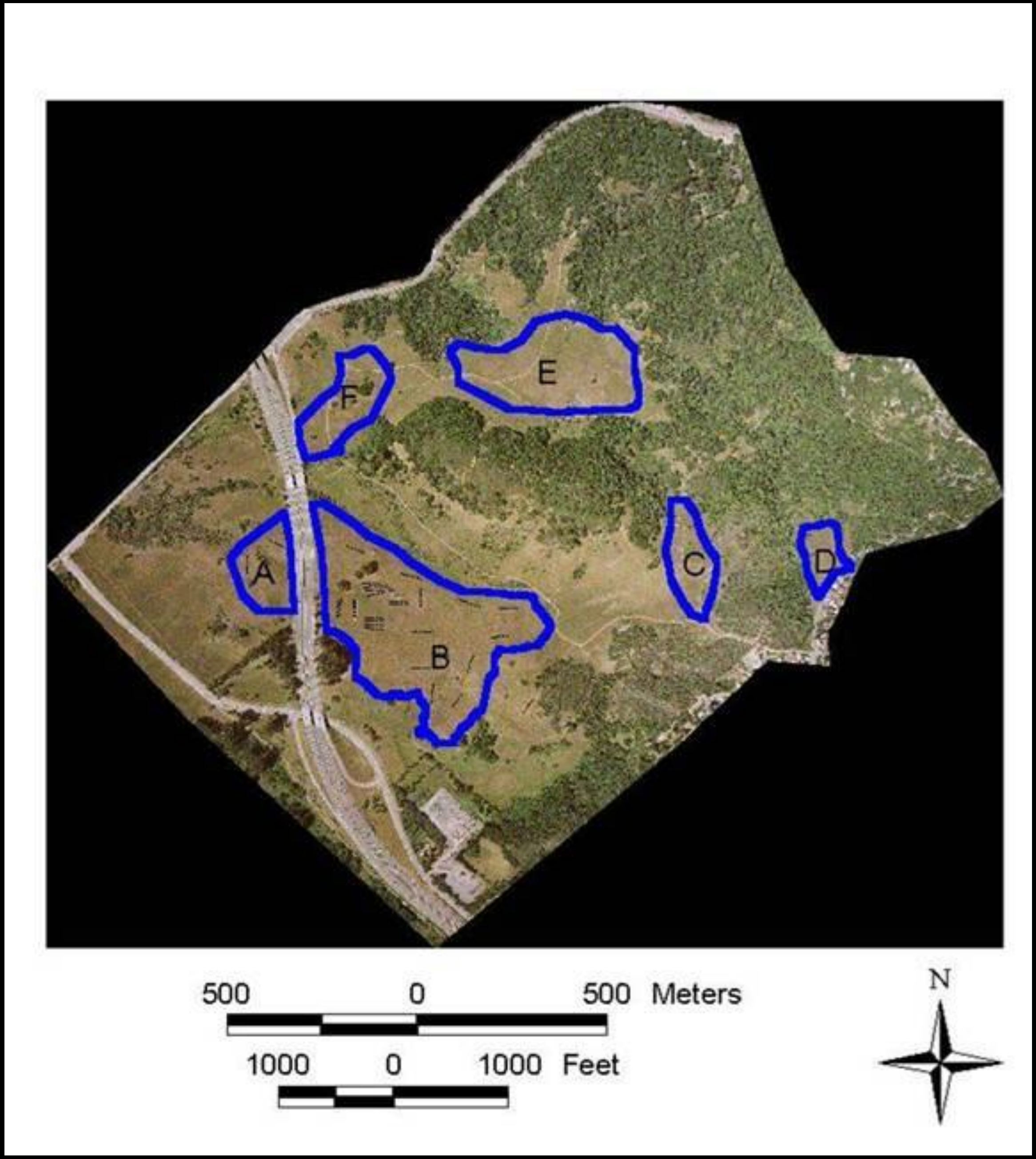
Two more powerplants in San Diego County, Quino Checkerspot

Widening Highway 101 in 2001 – 540 acres mitigation + commitment to Habitat Conservation Plan


David Wright

The Case of the Drive-by Extinction: Search for the Subtlety Smoking Tailpipe

Another episode of CSI Redwood City



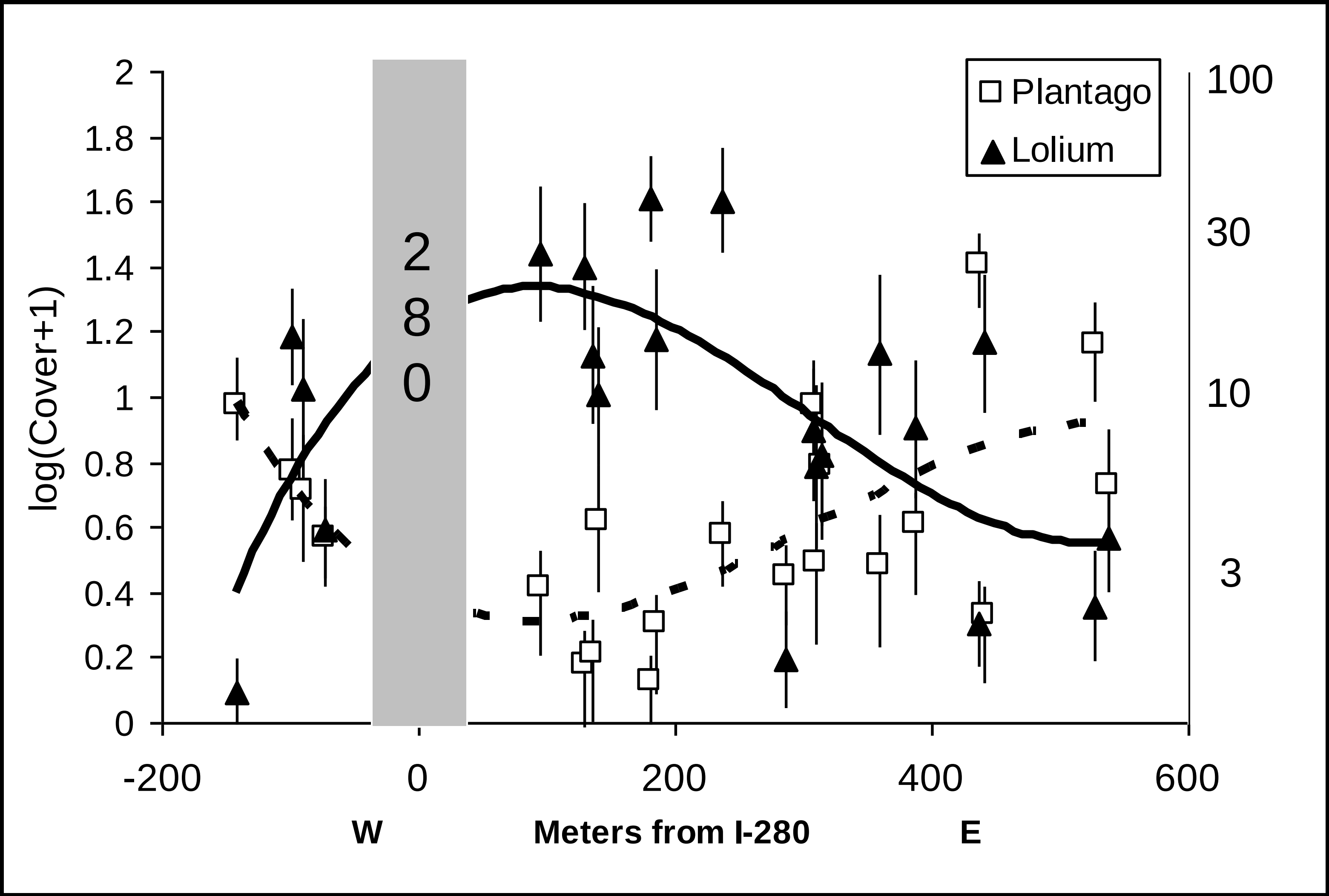
Bay checkerspot habitat (blue outlines) bisected by Highway 280

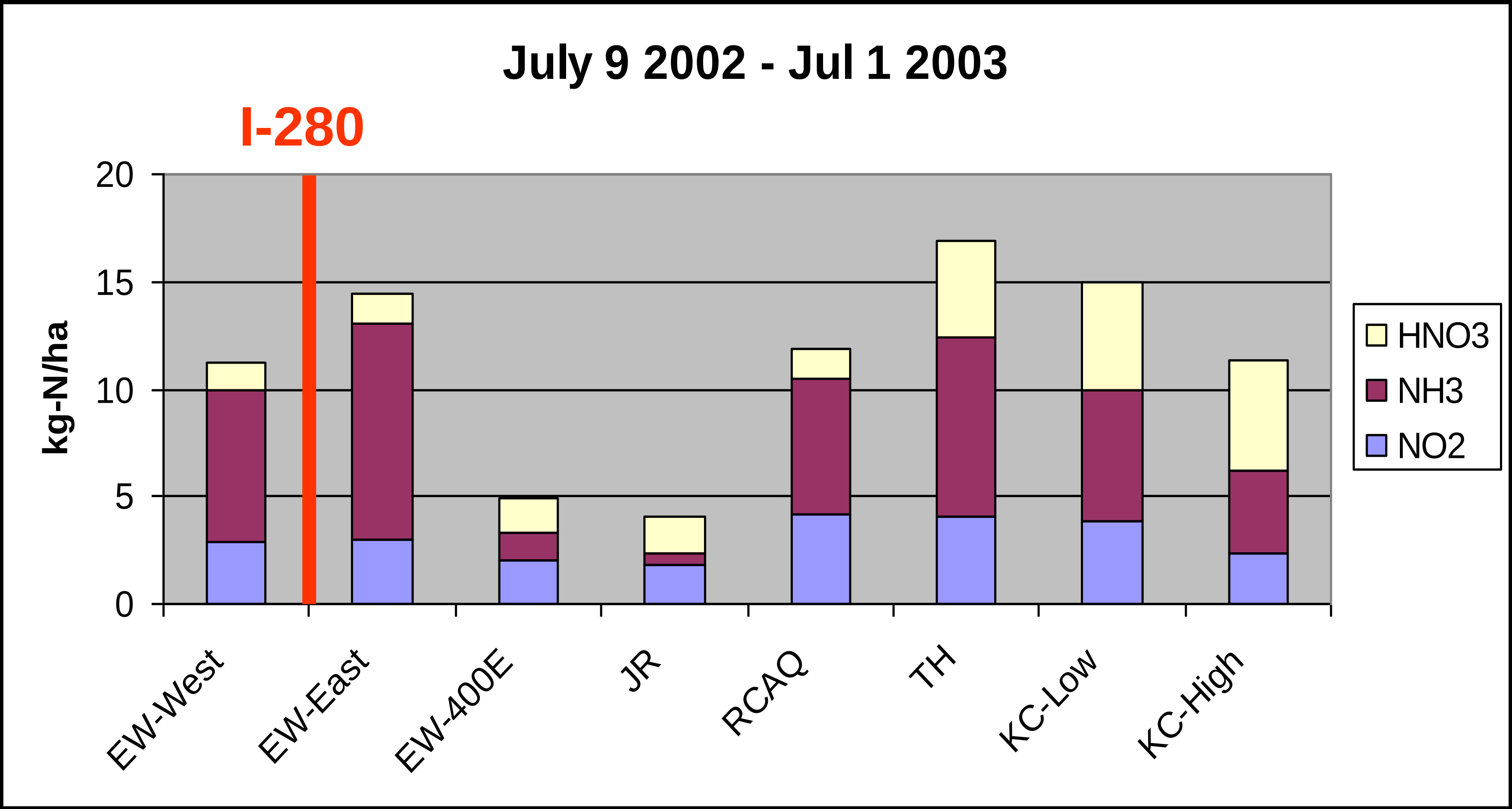
113,000 vehicles/day

35 acres in the main habitat area “B”

9,000 larvae in 1997
The last larva in 2002

Edgewood 2001





NH_3 from catalytic converters!

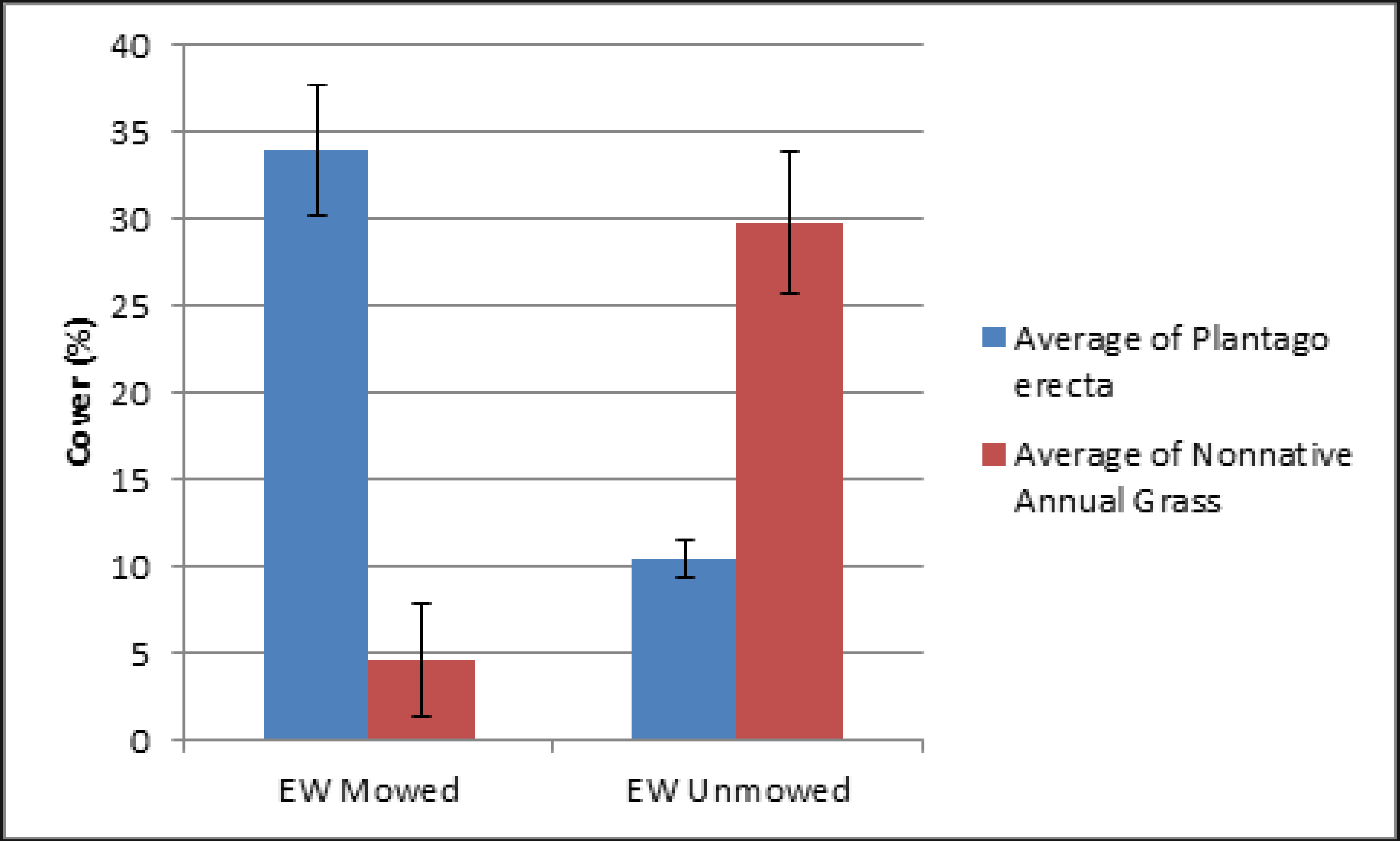
“The subtlety smoking tailpipe”

Mowing

Early May Timing

Mowing passes the "O-test"

Mowing passes the F-test



County staff managing habitat by mowing

Photo: Christal Niederer


2006
2007
2005
2003
2007
280
N
W
E
S
© 2005 TeleAtlas
Google
Pointer 37°27'46.24" N 122°17'15.61" W elev 623 ft
Streaming |||||||||| 100%
Eye alt 3422 ft

Reintroduction in 2007
"Navigating the Regulatory Ecosystem"


COUNTY OF SAN MATEO
Welcome home to Edgewood!
Checkerspot Butterfly
AREA CLOSED
FRAGILE WILDFLOWER
& BUTTERFLY HABITAT
DO NOT ENTER
Oaks

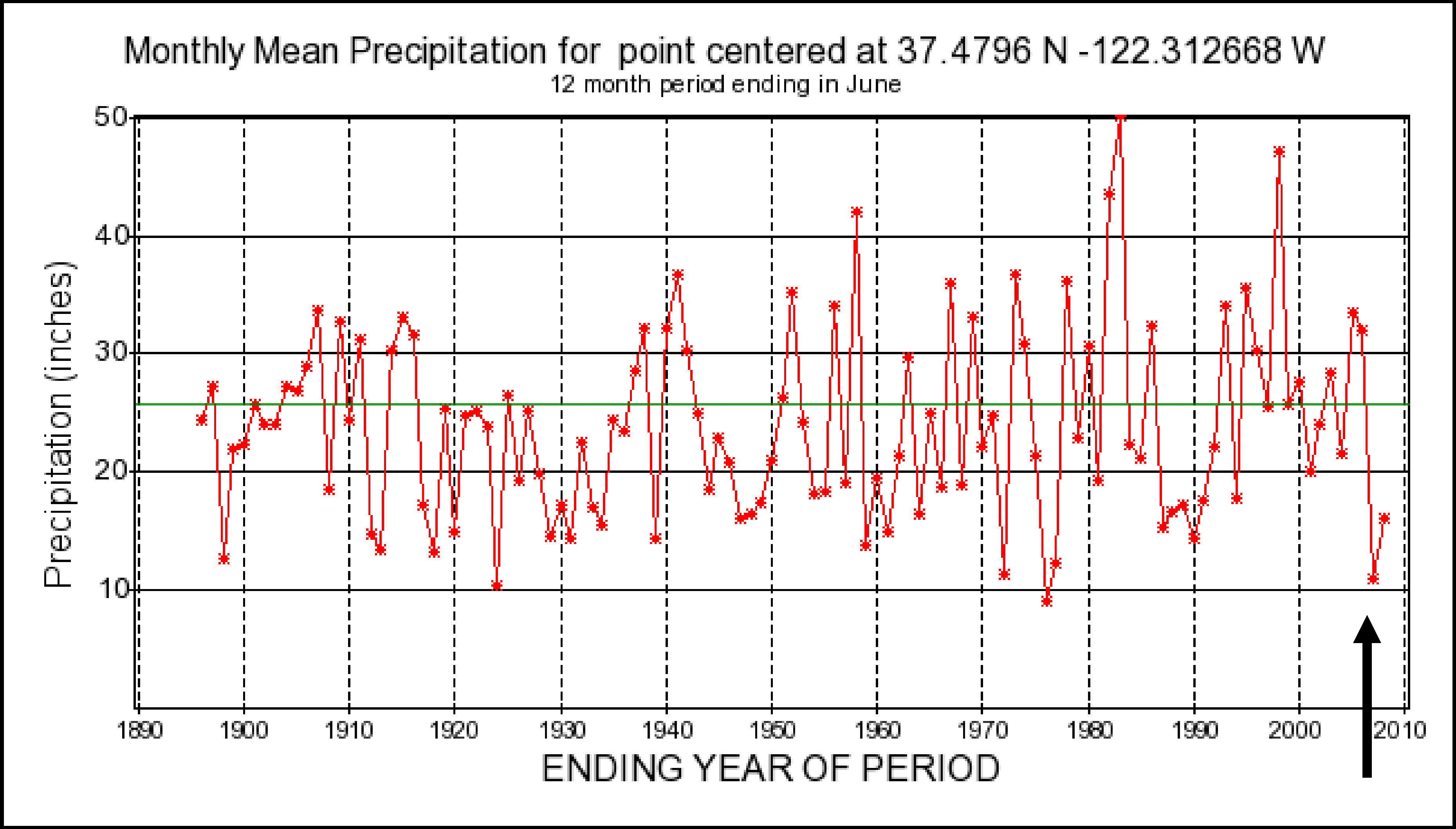

Sulfate
21-0-0
Ammonium Sulfate 21-0-0

What Happened in 2007 and 2008

- We saw adult butterflies in 2007: not as many as hoped
- We found 1 larva in 2008
- No adults seen
- Not a “total failure” but disappointing

Edward I of Edgewood

Drought year: luck of the draw



Hypotheses

- Drought: timing looked OK, not great, but little Owl's clover
- Butterflies leave habitat: source area is thousands of acres, recipient area is dozens, recognition of edges, hilltops
- Not high enough density of adults to indicate high quality habitat
- Second diapause – wait out a year Feb 2009 (nope….)
- Try again (and again?) – higher numbers, add adults, hope for good weather year

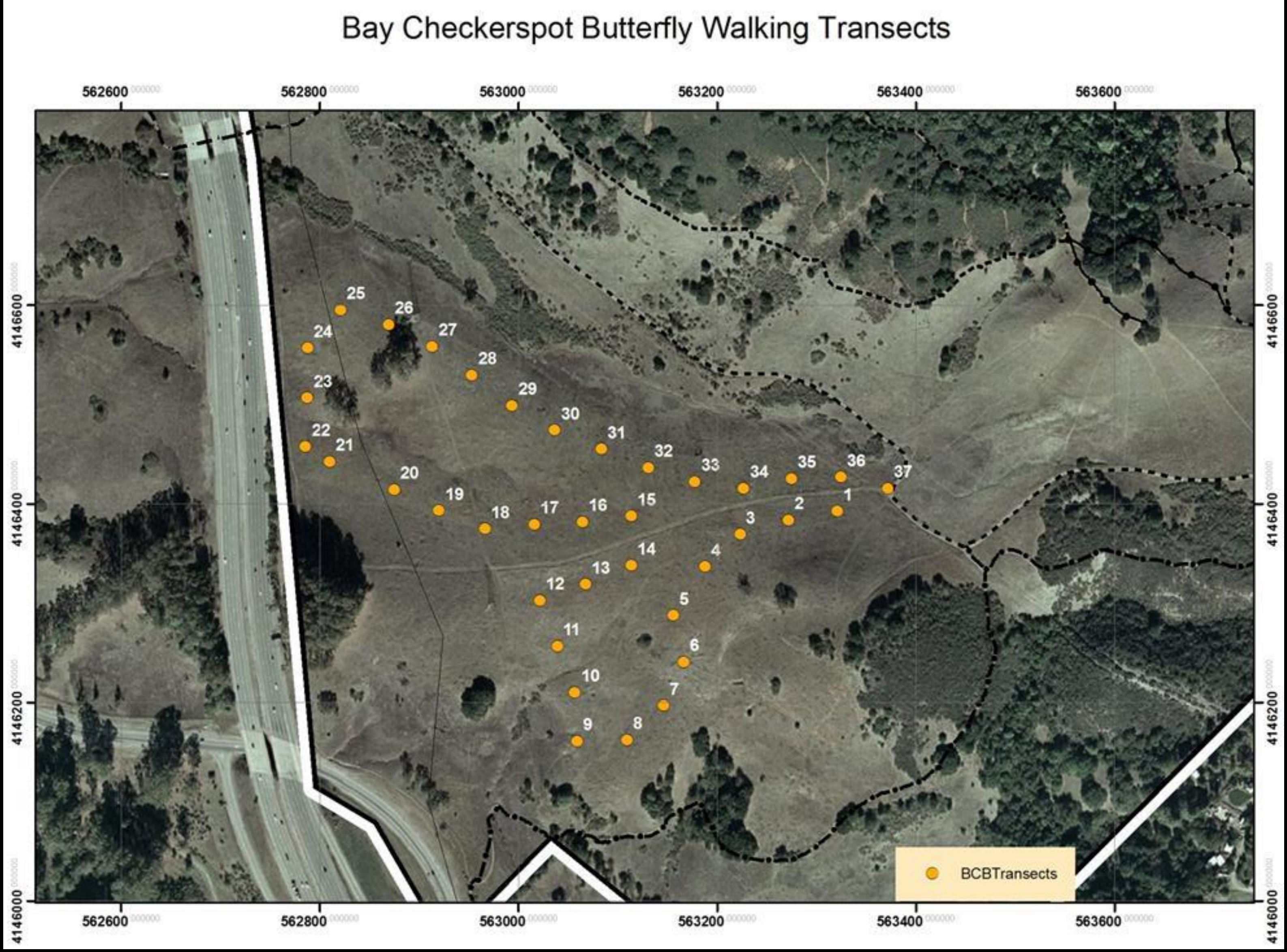
Failure in 2007, Re-reintroduction in 2011-2015
"bigger hammer, better year(s)"

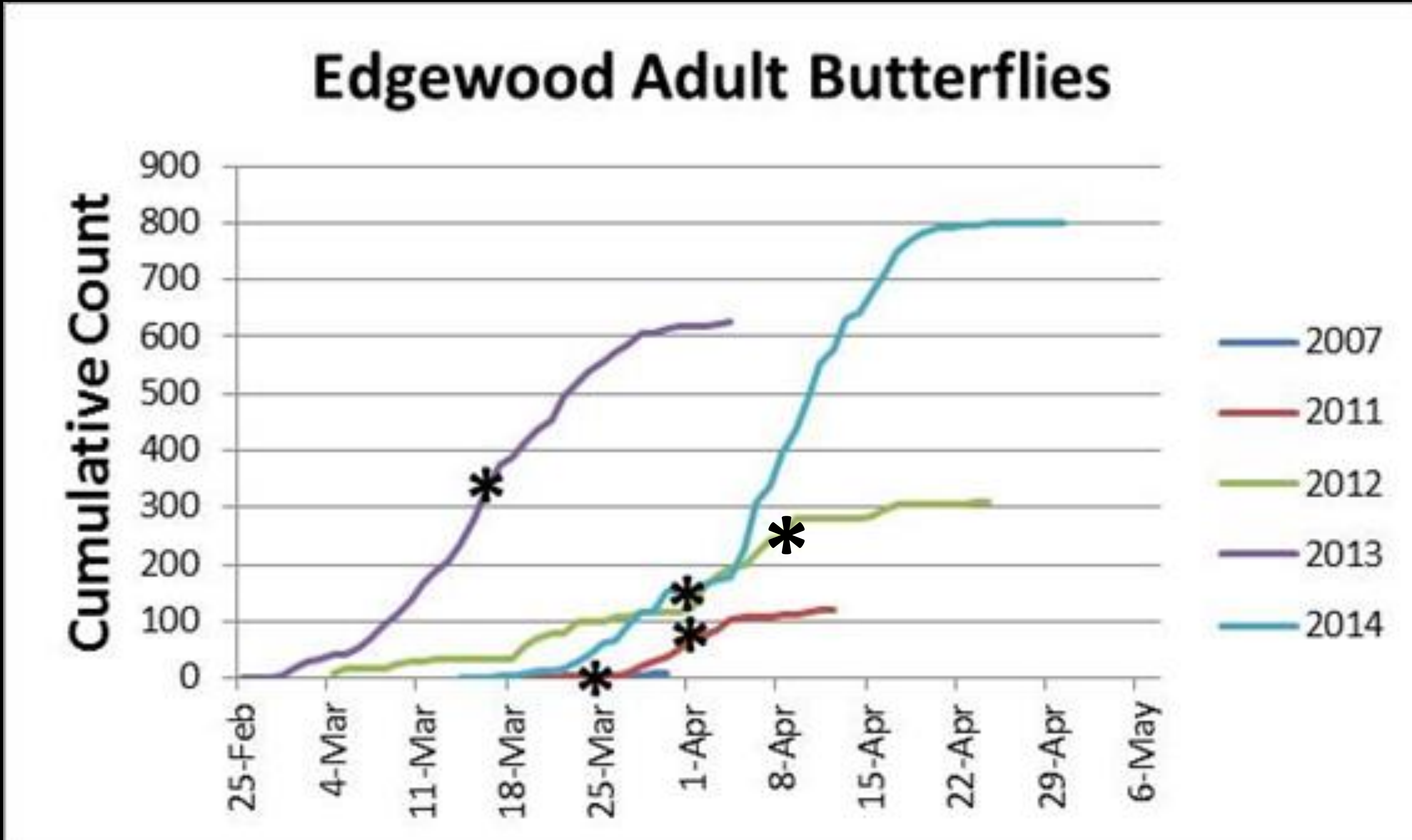
X 4000, 5000, 5000, 5000, 5000

2010

2012-2014

Checkerspotters





Edgewood Adult Butterflies
Cumulative Count
900
800
700
600
500
400
300
200
100
0
25-Feb
4-Mar
11-Mar
18-Mar
25-Mar
1-Apr
8-Apr
15-Apr
22-Apr
29-Apr
6-May
2007
2011
2012
2013
2014

498 in 2015

Back to the South Bay

Santa Clara County HCP/NCCP

- Systematic planning 50-year permit
- Partners: Santa Clara County, San Jose, Morgan Hill, Gilroy, Santa Clara Valley Water District, Valley Transportation Authority
- 6-year planning process, start 2005
- Serpentine, red-legged frog, tiger salamander
- $665,000,000 over 50 years ($13 million/year) – development fees + grants + ongoing efforts
- Acquire and ***manage*** ~46,000 acres for covered species

Keystone Species: Justin Fields

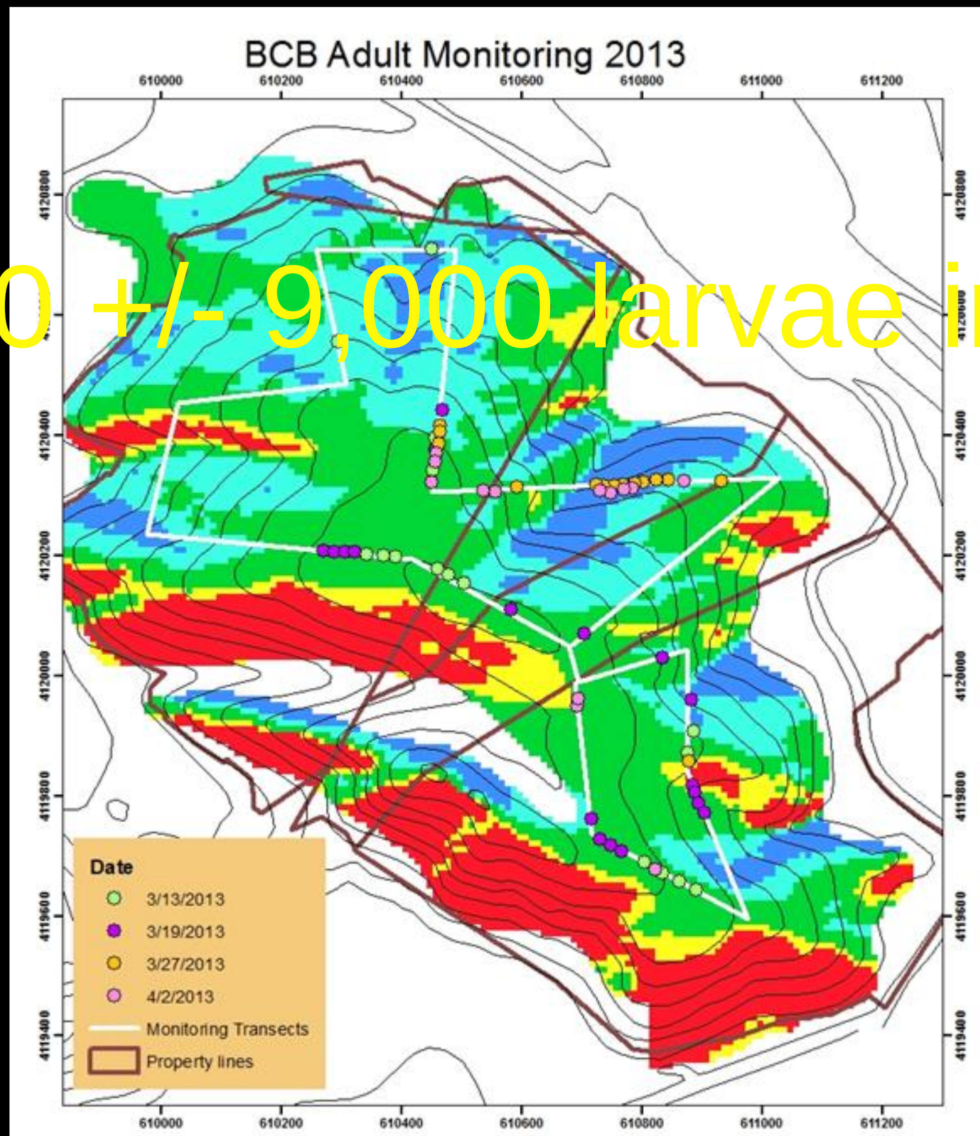
N-side Tulare Hill 2002

N-side Tulare Hill 2007

N-side Tulare Hill 2014


Reintroduction Tulare Hill

5,000 larvae in 2013, 3,450 in 2014



20,000 +/- 9,000 larvae in 2015

Operation Flower Power: Grassroots Lobbying

Docents led 2000+ people on tours 2001-2012

Habitat Conservation Now

- Need for organized presence in front of decision-making bodies
- $45,000 grant from Moore Foundation 2011-13
- Hired grassroots organizers
- CNPS, Greenbelt Alliance, CGF, Sierra Club, Audubon, others (real pros)
- Generate letters, comments, speakers
- Deeply appreciated by planners and wildlife agencies









October 3, 2013 Signing Ceremony

Weiss (1999) Conservation Biology 13(6):1476-1486

Cars, Cows, and Checkerspot Butterflies: Nitrogen Deposition and Management of Nutrient-Poor Grasslands for a Threatened Species

STUART B. WEISS

Center for Conservation Biology, Department of Biological Sciences, Stanford University, Stanford, CA 94305, U.S.A., email stu@bing.stanford.edu

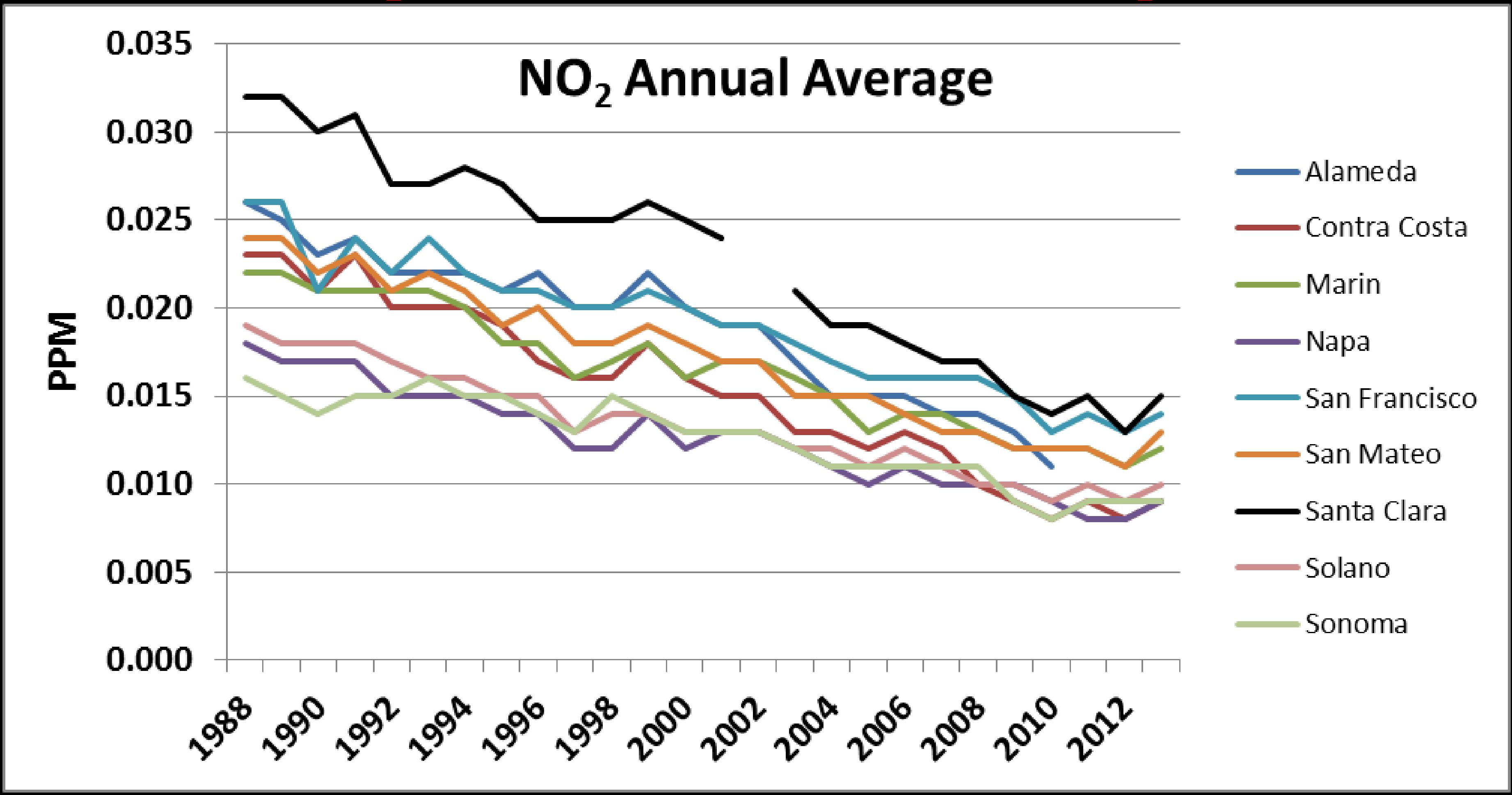
~$700,000,000 paper

osition in the region. Several populations of the butterfly in south San Jose crashed following the cessation of cattle grazing. Nearby populations under continued grazing did not suffer similar declines. The immediate cause of the population crashes was rapid invasion by introduced annual grasses that crowded out the larval host plants of the butterfly. Ungrazed serpentinitic grasslands on the San Francisco Peninsula have largely resisted grass invasions for nearly four decades. Several lines of evidence indicate that dry N deposition from smog is responsible for the observed grass invasion. Fertilization experiments have shown that soil N limits grass invasion in serpentinitic soils. Estimated N deposition rates in south San Jose grasslands are 10–15 kg N/ha/year; Peninsula sites have lower deposition, 4–6 kg N/ha/year. Grazing cattle select grasses over forbs, and grazing leads to a net export of N as cattle are removed for slaughter. Although poorly managed cattle grazing can significantly disrupt native ecosystems, in this case moderate, well-managed grazing is essential for maintaining native biodiversity in the face of invasive species and exogenous inputs of N from nearby urban areas.

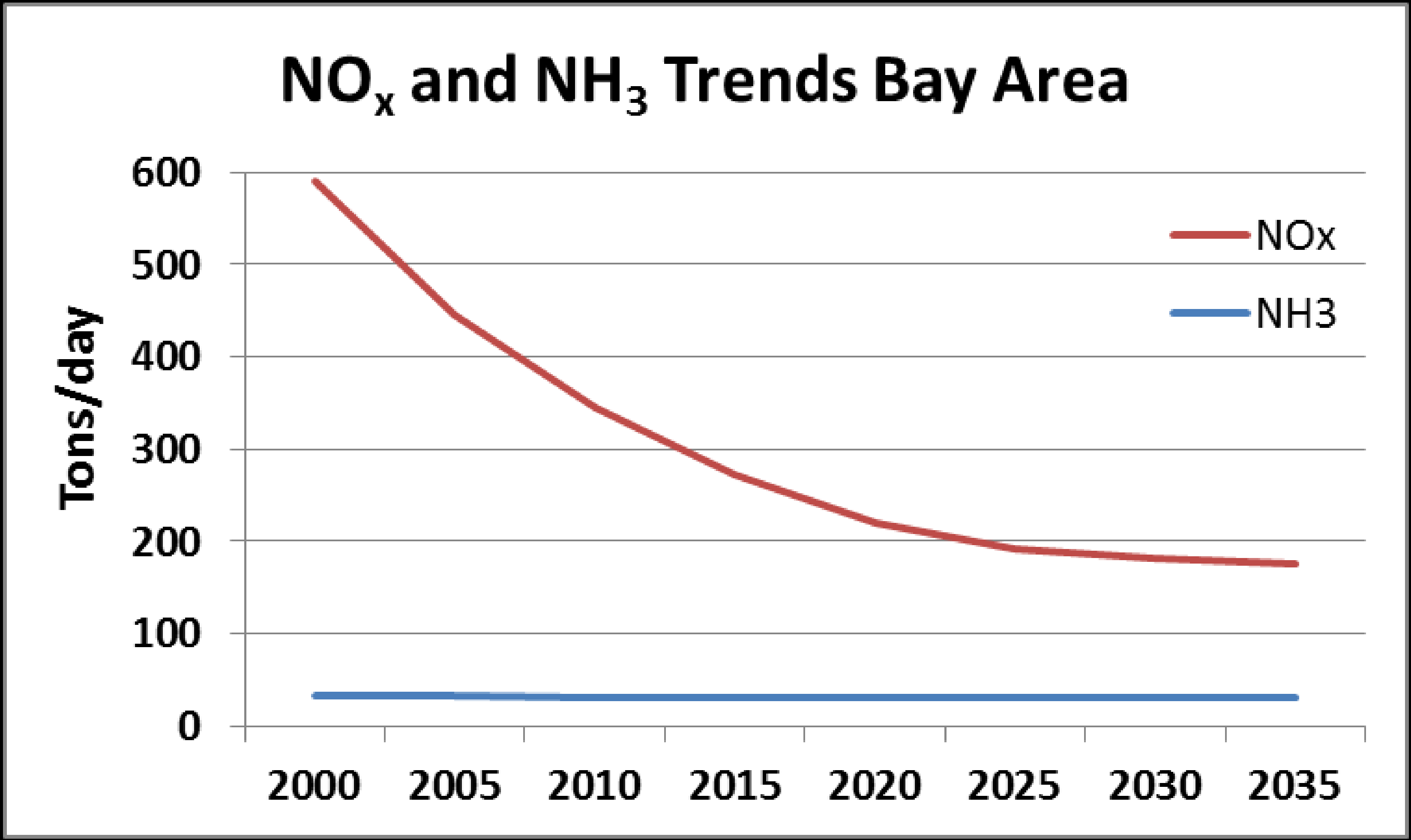
UTC Acquisition Oct 2015
1800+ acres, primarily serpentine grassland

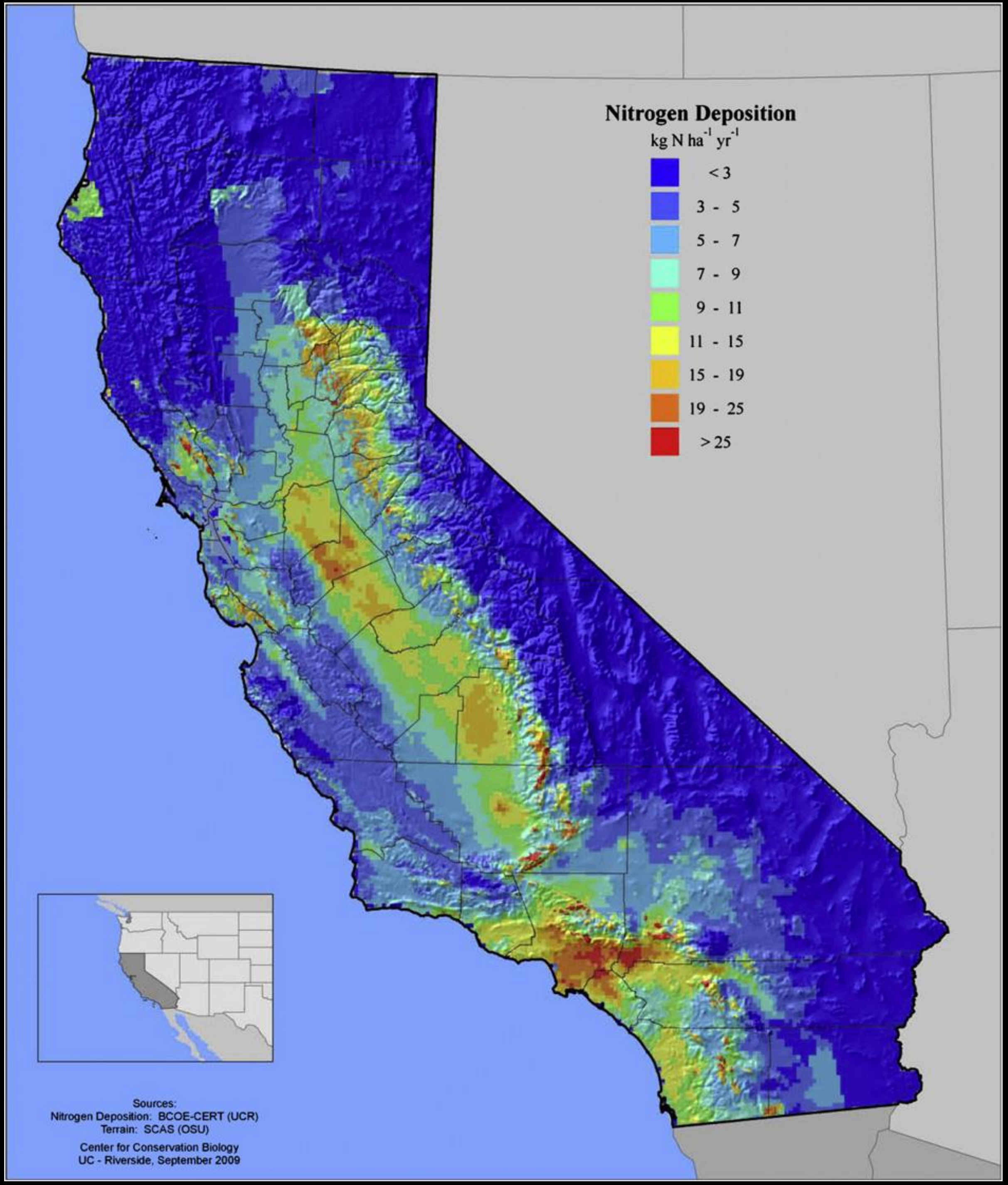
Air Quality Regulations Working (Thank you CARB + EPA)

(No Thanks VW)



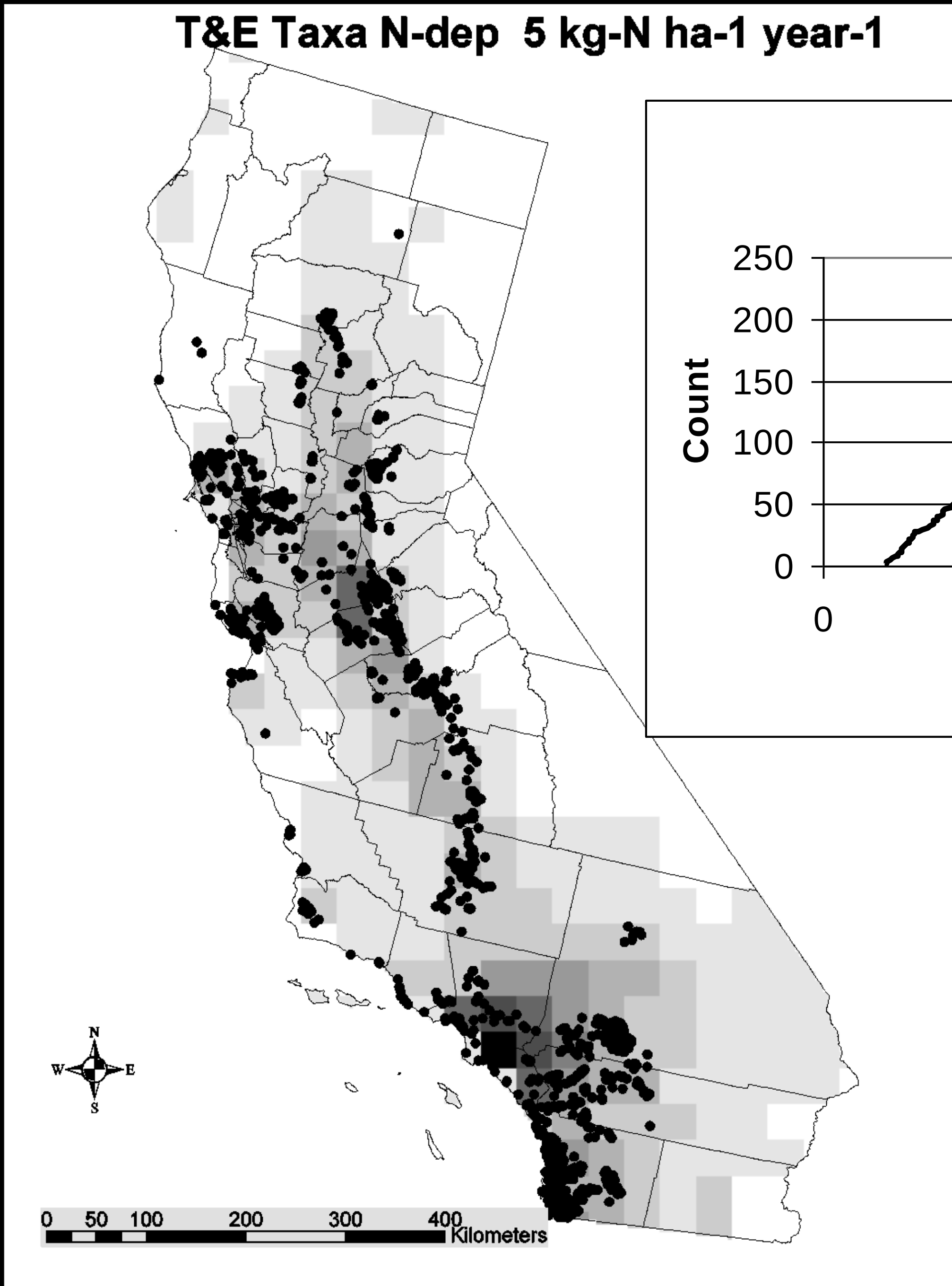
Further NO_x decreases anticipated
No NH_3 decreases (CARB)

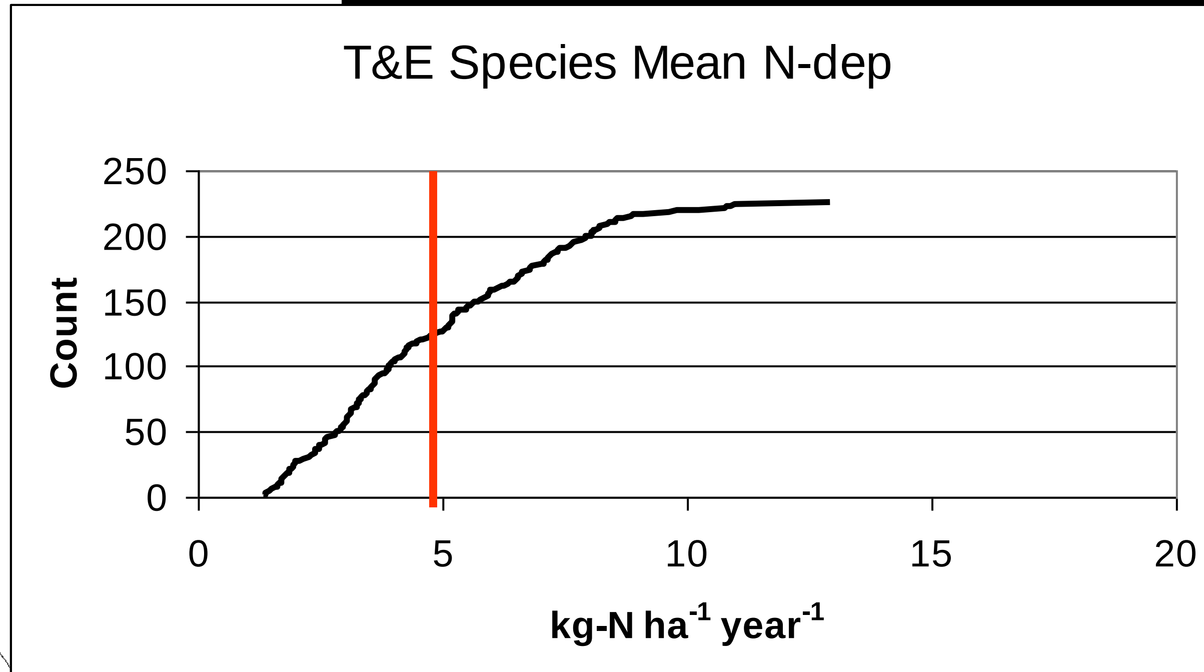




Chemical Climate of California

Plants





99/225 listed T&E plants exposed to > 5 kg-N ha^{-1} yr^{-1}

Table in CEC 2006 report

Vernal Pools: grass invasion in absence of grazing (Jaymee Marty TNC) 10 kg-N/ha/yr

23 T&E, 22 Rare in Vernal Pools

Blennosperma bakeri

Orcuttia pilosa

Pogogyne abramsii

Limnanthes vinculans

Limnanthes gracilis parishii

+Fairy Shrimp, CTS, CLRF

Lasthenia conjugens

N_r

The biggest global environmental change (almost) nobody has ever heard of

Success?

Photo: Lech Naumovich