Welcome to the Conservation Lecture Series

https://www.wildlife.ca.gov/Conservation/Lectures

Questions? Contact Margaret.Mantor@wildlife.ca.gov
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...
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
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

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

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

Microclimat: 100 m – 1 cm
vegetation canopies

Organism:
physiology, behavior
Clear-sky insolation is determined by latitude, day of year, aspect, slope, and horizon shading.
Noon surface $T^\circ$ 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
Larvae achieve body temperatures well above (10-12°C) ambient when basking.

Weiss et al. 1988 Ecology 69:1486-1496

**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 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
Trends in Mar-Apr Temperature?
WESTMAP PRISM 4 km

Mean Temperature for point centered at 37.2 N – 121.64 W

2 month period ending in April

Temperature (F)
Timing may not be everything, but it is 63% of everything here.

Phenological Window:
Difference between peak emergence (square) and *Plantago* senescence on Flat (circle)
Population increases = shift toward warmer slopes; Population decrease = shift toward cooler slopes

Warmer growing season = shift toward cooler slopes

$r^2 = 0.40, P = 0.0003$

$r^2 = 0.37, P = 0.0006$
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 \( K = 13.8 \times 10^6 \) 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 \( K = 13.8 \times 10^6 \) larvae
**Mean time to extinction = 2,970 years**
“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

E-slope  N-slope
Topoclimatic variation is extreme: Nooks and Crannies

Average Hourly Temperature July 23- Oct 6 2006
“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

\[
\begin{align*}
\text{NO} & \xrightarrow{hv} \text{O}_3 \\
\text{NO}_2 & \xrightarrow{[\text{OH}^*]} \text{PAN} \\
\text{HNO}_3 + \text{NH}_3 & \leftrightarrow \text{NO}_3\text{NH}_4(p)
\end{align*}
\]

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
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, serpentine 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 serpentine 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 serpentine 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 serpentine soils. Estimated N deposition rates in south San Jose grasslands are 10–15 kg N/ba/year; Peninsula sites have lower deposition, 4–6 kg N/ba/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
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.

\[ \text{HNO}_3 > \text{NH}_3 > > \text{NO}_2 > > > \text{NO} \]

\( \text{NH}_3 \) 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
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
Reintroduction in 2007
“Navigating the Regulatory Ecosystem”
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
Drought year: luck of the draw

Monthly Mean Precipitation for point centered at 37.4796 N -122.312668 W

Precipitation (inches)

ENDING YEAR OF PERIOD

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)”
Checkerspotters

Bay Checkerspot Butterfly Walking Transects
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 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

Implementing Agreement

by and among the
United States Fish and Wildlife Service, California Department of Fish and Wildlife,
Santa Clara Valley Habitat Agency, County of Santa Clara, City of San Jose,
City of Gilroy, City of Morgan Hill, Santa Clara Valley Water District,
and Santa Clara Valley Transportation Authority regarding the
Santa Clara Valley Habitat Plan

This Implementing Agreement governs the implementation of the joint
habitat conservation and natural community conservation plan for the
Santa Clara Valley as of the Effective Date. The SCVHP is a plan to protect
and enhance ecological diversity and function in a substantial portion of
Santa Clara County, while allowing appropriate and compatible growth
and development to occur in accordance with certain environmental laws.

Signed on this day, Thursday, October 3, 2013.
Cars, Cows, and Checkerspot Butterflies: Nitrogen Deposition and Management of Nutrient-Poor Grasslands for a Threatened Species

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~$700,000,000 paper
UTC Acquisition Oct 2015
1800+ acres, primarily serpentine grassland
Air Quality Regulations Working (Thank you CARB + EPA) (No Thanks VW)
Further $\text{NO}_x$ decreases anticipated
No $\text{NH}_3$ decreases (CARB)
Chemical Climate of California
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
Lasthenia conjugens
+Fairy Shrimp, CTS, CLRF
The biggest global environmental change (almost) nobody has ever heard of