The Elkhorn Slough
Coastal Training Program
&
The California Invasive Plant Council

- Present -

Control of Blue Gum Eucalyptus in Coastal California

Welcome, Review, and Introduction

Grey Hayes, PhD
Coordinator
Elkhorn Slough Coastal Training Program

History of Eucalyptus in California

Blue Gum Eucalyptus in the Elkhorn Slough Watershed

By Eric Van Dyke

Eucalyptus Globulus.
Ellwood Cooper, 1876

Out West, 1909

FOREST CULTURE
AND
Eucalyptus Trees.
BY
ELLWOOD COOPER.

The only Complete and Reliable Work on the Eucalypti Published in the United States.

SAN FRANCISCO:
Cubery & Company, Steam Book and Ornamental Job Printers,
No. 414 Market Street, below Sansome.
1876.

We have, perhaps, the most healthful, most equable, the best climate on this globe, and the only objections that can be urged are the prevailing high wind, and an uncertain, as well as an insufficient, quantity of rain-fall. Moderate the winds, increase the rain, and we have perfection. This result is so easily and so quickly to be obtained that it ought to have the attention and serious consideration of every land-owner in the State. How is this to be done? How are we to obtain this result? By planting forest trees. I would recommend belts from 100 to 150 feet in width, each quarter of a mile, planted at right angles with the prevailing direction of the winds, and to line all the highways, parallel with or to the general currents, with belts of two or three rows, closely planted. This planting would occupy about one eighth of the land.

No one disputes the importance of planting on the plan suggested; neither can the feasibility be questioned. Contemplate the beauty, the grandeur, the productiveness of the great valleys of the Sacramento, the San Joaquin, the Salinas plain, and of every strip of arable land in the State, with belts of *Eucalyptus-trees* planted as I have recommended. With such shelter California would become the paradise of the world.

How is this to be brought about? By convincing owners of land that financially it will be a great success. Individual effort alone must accomplish the work. We cannot look to the State for either aid or protection, as, in this *independent, free Republic*, the Government or the State is powerless in the execution of any measure that would compel land-owners to plant trees, no matter how urgent the necessity or how important the duty. What we have therefore to do, as individuals, is to begin at once to plant.

EUCALYPTUS TIMBER SEASONING

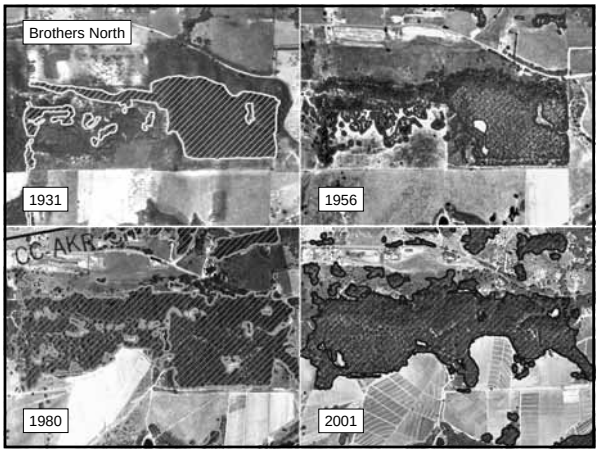
Out West, 1909

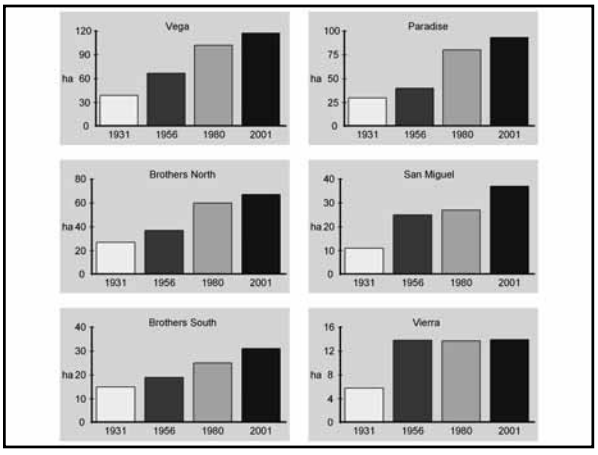
MADE OF E. GLOBULUS, LIGHT MAHOGANY FINISH

Out West, 1909

Does Blue Gum Spread??

An Elkhorn Case Study





Introduction

Birds and Eucalyptus on the Central California Coast: A Love – Hate Relationship

David L. Suddjian
Biological Consulting Services

For Birds, 2 Important Invaded Habitats in the Monterey Bay

- Oak Woodland
- Riparian

Affects on Birds Depends on:

- Canopy density
- Tree density
- Tree age
- Tree architecture
- Proximity of trees to water

On the "Up" Side

- 14% of Santa Cruz County's nesting birds nest regularly in blue gum (20 of the 148)
  - Most birds nesting in blue gum also nest in mixed conifer woodlands, while others nest otherwise in riparian or live oak woodland
- Great Blue Herons, Great Egrets, and Double-crested Cormorants currently nest in Santa Cruz County **only** in blue gum groves
- Red-shouldered and Red-tailed hawks and Great Horned Owls nest **preferentially** in blue gum
- Often the only significant tree groves in more urbanized areas

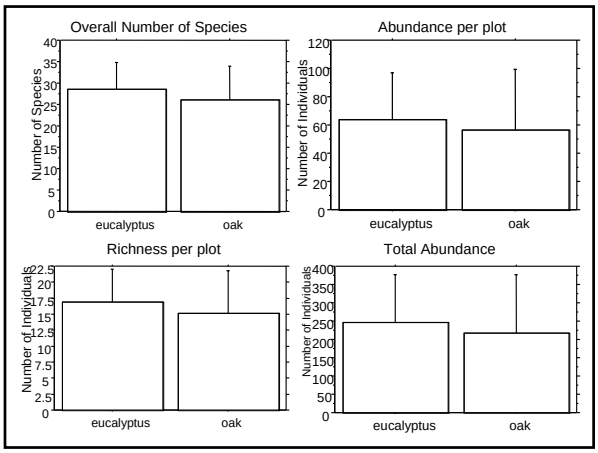
On the Down Side

- Blue gum is generally missing cavities
- Foliage gleaning birds are fewer in blue gum
- Riparian birds: Downy Woodpecker, Warbling Vireo, Tree Swallow, Violet-green Swallow, Swainson's Thrush, and Yellow, Orange-crowned, and Wilson's warblers
- Oak woodland birds: Western Screech-Owl, Acorn and Nuttall's woodpeckers, Ash-throated Flycatcher, Hutton's Vireo, Oak Titmouse, House Wren, Western Bluebird, Orange-crowned Warbler, and Lark and Chipping sparrows

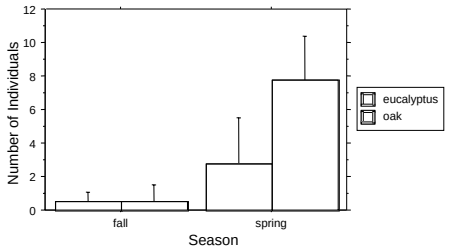
Oak, Eucalyptus, and Singing Birds

Or the effects of exotic versus native forest cover on abundance, composition, diversity, and evenness of avian species

Diana Kiyo Wakimoto, UC Santa Cruz

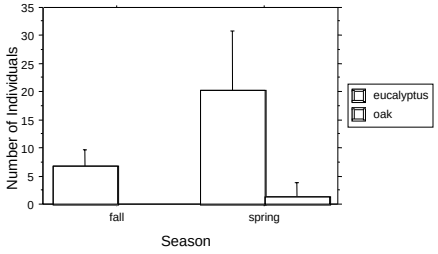


Bewick's Wren Effects of Woodlot and Season



P= 0.0273

European Starling Woodlot & Season effects



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Comparative Ecological Value of Coastal Live Oak and Australian Blue Gum Woodlands

Anna M. Kopitov
Resource Ecologist
June 2004

Nicholas School of the Environment
and Earth Sciences
Duke University

Bird Community

Describe breeding bird community for oak and eucalypt woodlands

Species richness and diversity indices

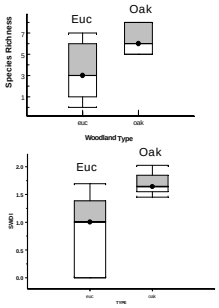
OBJECTIVE 1 / ANALYSIS

Breeding Birds

Species	28
Individuals	148

	Oak	Euc
Richness	22	12
Exclusivity	16	6
Individuals	85	63

❖Median values for species richness and Shannon Weiner Diversity Index are dissimilar.



Two sample t-test statistically significant: *P* < 0.05

RESULTS

Bird Indicators

Do species occur preferentially in oak or eucalyptus habitat?

Indicator Species Analysis

- Uses relative abundance and relative frequency
- Assigns indicator values ranging from 0 to 100

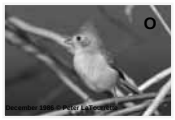
OBJECTIVE 3 / ANALYSIS

Bird Indicators in Oak Woodlands

Spotted Towhee
IV = 72
P = 0.04

Dark-eyed Junco
IV = 78
P = 0.03

Oak Titmouse
IV = 65
P = 0.05



California Quail
IV = 71
P = 0.01

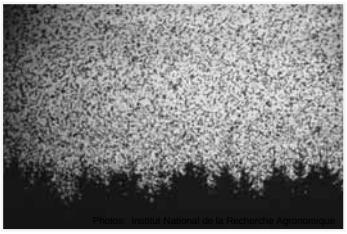
O = *Overall Community Indicators*, B = *Breeding Bird Indicators*

RESULTS

Bird Indicators in Eucalypt Woodlands

European Starling

IV = 71
P = 0.01



***No breeding bird indicators**

RESULTS

Understory Community

Describe understory vegetation community of oak and eucalypt woodlands

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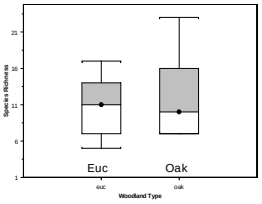
Species richness and diversity indices

Estimated Percent Cover, Strata, and Tree Diameter

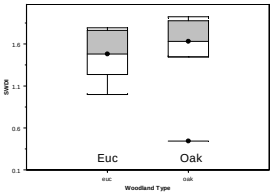
OBJECTIVE 1 / ANALYSES



Distribution and median values for understory plant species richness for oak and eucalypt sites (N = 7 for each type).

❖Median values for species richness and SWDI are nearly identical.

Distribution and median of understory Shannon Weiner Diversity Index (SWDI) for oak and eucalypt sites (N = 7 for each type).

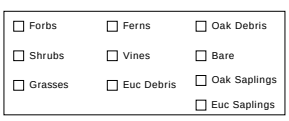


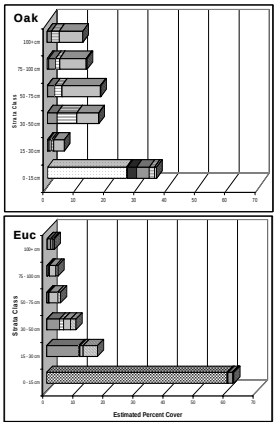
RESULTS

Percent Cover by Strata Class

❖Oak sites dominated by:
- Forbs and Shrubs
- 30 cm – 100 cm strata classes

❖Eucalypt sites dominated by:
- Eucalypt Debris (~56% cover)
- Forbs 15-30 cm strata class





RESULTS

Understory Indicators

Oak Sites

- **Bracken *** (*Pteridium aquilinum*)
- **Hedge Nettle*** (*Stachys ajugoides*)
- Italian Thistle* *(Carduus pycnocephalus)*
- Ripgut Grass* *(Bromus diandrus)*
- **California Blackberry*** (*Rubus ursinus*)
- **California Coffeeberry**** *(Rhamnus californica)*
- **Common Snowberry**** *(Symphoricarpos albus)*
- **Poison Oak*** *(Toxicodendron diversilobum)*

Eucalypt Sites

- Common Chickweed** (*Stellaria media)*
- **Miner's Lettuce*** (*Claytonia perfoliata*)
- **Stickey Monkeyflower*** *(Mimulus aurantiacus)*

$^{*}P < 0.05$
$^{**}P < 0.10$

Bold text => Natives

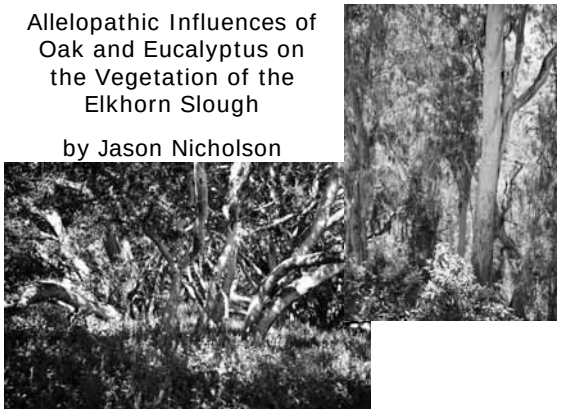
RESULTS

Sax, 2002

- Showed similar species richness and diversity for oak and eucalyptus understory plants
- Majority of species sampled did not occur in both woodland types, with only 39% in common between the two

Allelopathic Influences of Oak and Eucalyptus on the Vegetation of the Elkhorn Slough

by Jason Nicholson



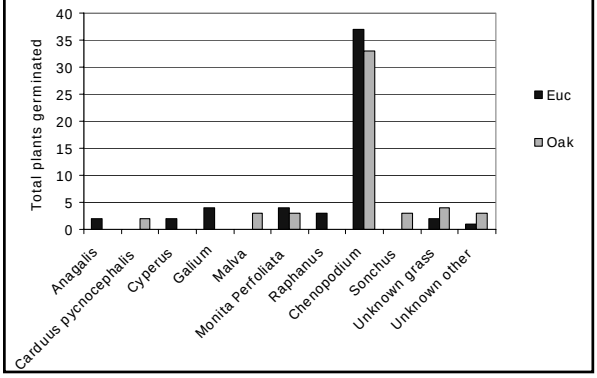
Jason's research:

- Investigated the direct effect of allelochemicals derived from the leaf litter of *Quercus agrifolia* and *Eucalyptus globulus* on native and non-native understory plants
- Carried out a series of germination experiments, in which seeds were exposed to varying light intensity, substrate composition, and concentrations of leaf litter leachate

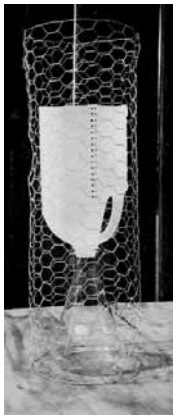
Allelopathic compounds

- Oaks produce mostly tannins, which are a sub-group of phenolics
- Eucalyptus produce several compounds, mostly terpenes and phenolics

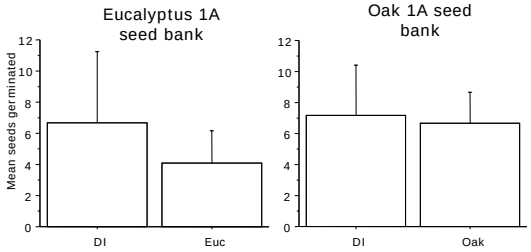
Seed bank composition



Drip method leachate extraction



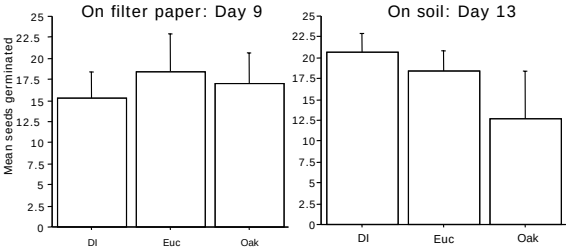
Seed bank results: Effect of same source leachate



Somewhat significant for Euc
p = 0.091

Two-way ANOVA

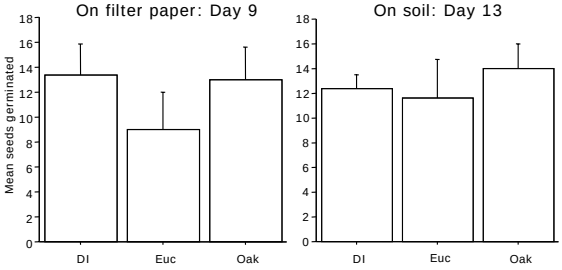
Germination of Bromus carinatus



Significant for Oak
p = 0.043

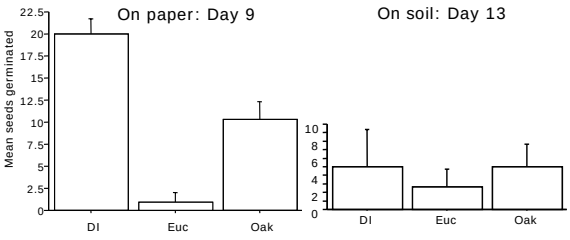
Two-way ANOVA

Germination of Baccharis



Two-way ANOVA

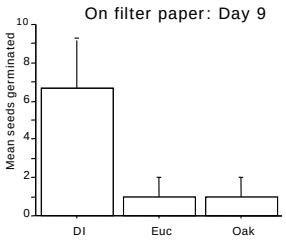
Germination of Achillea millefolium



Significant for
Oak p = 0.0040
Euc p = <0.0001

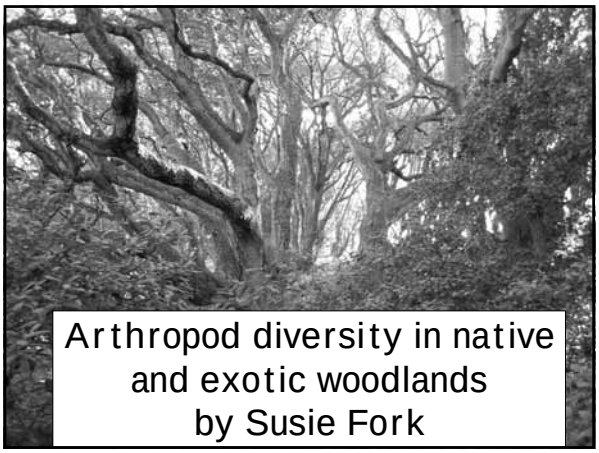
Two-way ANOVA

Germination of Mimulus aurantiacus



Significant for
Oak p = 0.0059
Euc p = 0.0059

Two-way ANOVA



Field methods - Pitfall traps

Captures surface-active, larger terrestrial arthropods (e.g. beetles, spiders, ants, isopods)

Field methods - Sticky traps

Samples aerial insects and those associated with foliage

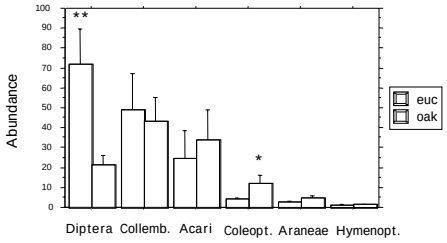
Field methods – Winkler (litter) traps

Captures slower-moving, arthropods hidden within litter layer (ants, springtails, mites), some of which are not caught in pitfall traps.

Sorting and identification

Arthropods keyed to level of order

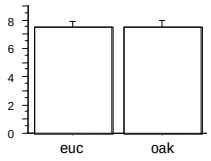
Average abundance of top orders



ANOVA, *P< .05; **P < .02)

Overall habitat comparisons

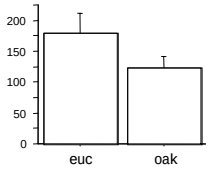
Order richness
average per sample



No significant different between woodland types (ANOVA, P>.05).

Overall habitat comparisons

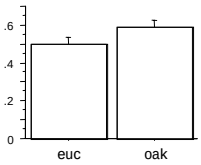
Total abundance
average per sample



Abundance greater in eucalyptus groves than in oak woodlands (ANOVA, P>.05).

Overall habitat comparisons

Diversity (Shannon-Weaver)
average per sample



Diversity is greater in oaks- i.e. same number of orders but more evenly spread in oaks than eucs (ANOVA, P>.05).

Previous research on native and eucalyptus woodlands

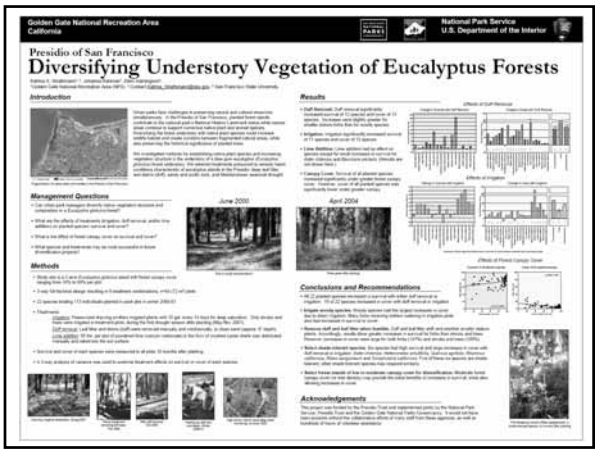
- Sax (2002) surveyed arthropod diversity of native (oak and bay) and eucalyptus woodlands.
  - equal species richness (approximately 40 sp. in each habitat).
  - About half of species were shared by both woodland types.
  - Species composition was different between woodland types.
  - Eucs had higher invertebrate diversity than native woodlands (spring only).

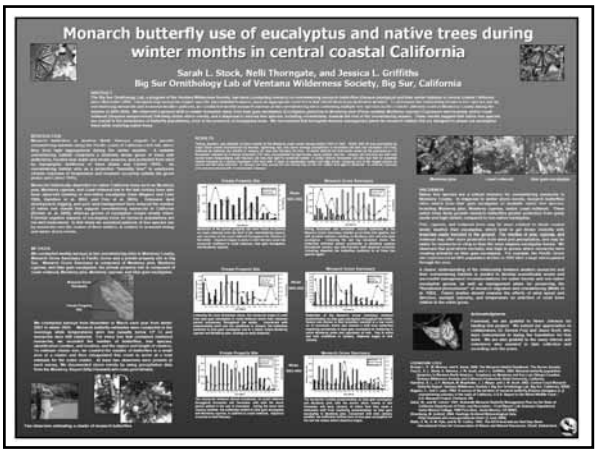
Comparison of two studies

- Taxa richness equal in eucs and native woodlands
  - Order richness (present study) and species richness (Sax study)
- Diversity results differ
  - oaks have higher diversity than eucs (present study) while Sax detected higher diversity in eucs

Stuart Weiss & Monarchs

- Blue gum used because of
  - Proximity to ocean (no frost)
  - Light
  - Wind
- It is necessary to manage blue gum groves to continue to be useful as habitat





Summary of 2004 Workshop

- Blue gum is significantly spreading from existing stands
- Some blue gum groves may support important birds (especially by the water or in urban areas)
- Riparian and cavity-nesting birds are likely to be the most affected by blue gum invasion
- Blue gum may affect oak-associated birds, especially breeding birds

More 2004 Workshop Summary

- The plant community associated with blue gum is different in structure and composition than coast live oak woodland
- These differences may not be well described by allelopathy
- Blue gum vs. live oak insect abundance – jury out – may have species specific effects

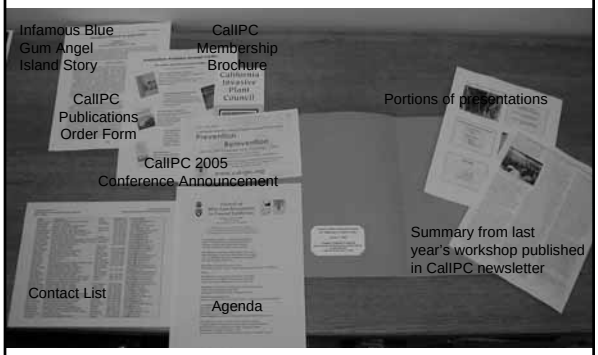
And, now onto today….

But first, a word of caution…

Assumption:
Blue Gum Needs Eradicating

Evidence:
Appropriate Biological Review

In Your Packet:



Take Home Messages

- A little review on what we know about the ecology and impacts of blue gum
- How to minimize public outcry against control measures
- What to do with blue gum after it falls
- Methods for restoration and monitoring after control
- How others have approached this issue