## Finding optimism for effective conservation in weedinvaded southern California





#### California Invasive Plant Council Mini-Symposium

June 13, 2022

Justin Valliere





# Finding optimism for effective conservation in weedinvaded southern California

- A very brief and incomplete history of invasion in southern California
- Invasion and environmental change
- Challenges of weed management in southern California
- Sources of optimism in the face of weed invasion



## What did Los Angeles look like pre-colonization?

#### An Environmental History of Metropolitan Los Angeles

# LAND OF SUNSHINE

EDITED BY William Deverell and Greg Hise





#### Historical Ecology of the Los Angeles River Watershed and Environs

Philip J. Ethington, Beau MacDonald, Gary Stein, William Deverell, and Travis Longcore

#### Legend

Chaparral
California Grasslands and Flowerfields
Coastal Dune and Bluff Scrub
Coastal Sage Scrub
Desert Wash Woodland and Scrub
Foothill and Coastal Rock Outcrops
Foothill and Valley Forests and Woodlands
Mixed Evergreen and Montane Conifer Forest
Freshwater Marsh
Lakes
Montane Riparian Forest and Woodland
Riparian Forest
Riverwash
Salt Marsh
Salt Marsh Meadows
Vernal Pools
Wet Meadow

#### The lost prairies of Los Angeles

Ronald L. Williams





## Black mustard Brassica nigra

Al Seib, Los Angeles Time







#### El Camino Real, 1906



## The Plant Content of Adobe Bricks

George W. Hendry, Margaret P. Kelly California Historical Society Quarterly (1925)





#### Old Plaza Church - 1869

#### Ranchos in Los Angeles County



<sup>8</sup>Catalina Island

indid tree!" The fascing-ion of the island is over not botanical n hurs. Trash ; albeit artly so, it is far are the fascination solitude. So she vas the other islands , will ! San hicolaus here there is great tare of Indian craft: ork; Santa Rosa; Remente. She says of an clemente that eike he other slands it drying up and that Misenbergantheman m take it-

July 1's

i.E. it is rapidly.

take the place of 20 else. Mrs. Track has l long in the open ( coast ) that in ap she does not su the woman she is brouged by the suns. a heavy he brown, slighty abour the ten featuris, a when she rome que

"She says of San Clemente that like the other islands it is drying up and that the *Mesembryanthemum* will soon take it – it is rapidly increasing and eventually it will take the place of everything else."

Excerpt from journal of Willis Jepson during 1908 visit to Catalina Island discussing the spread of the invasive ice plant throughout the Channel Islands as described to him by Blanche Trask

10 Catalina Island

-Xanthium spinosum

bigrining to come in just

## "Nicotiana glauca beginning to take over the deep canyons"

# - Mr. July 12, 1908 de litte

garden hiv Lavateras; Lassurgentiflora in fl: ; and L. \_ from San Clemente, the latter with larger lighter green leaves than the former. Mand only one on San Clemente Prumes intégri fo scare, the bar in squarish a blazes on some trim this due to nigury car rolling down hill but a man the where this cost a bund-blown trees end Cabalina say Mrs

- Bolanum Xanti Wal

the great plant ()

July 12, 190

- Cont. from p. 11. Speimen of Clemente Island shrub (6 yr was taken. See no. 14,050.

#### Downtown Los Angeles 1895



#### CCC Spreading mustard seed in post-fire chaparral - 1935



#### Mustard-fueled fire in Topanga Canyon 1943

#### Construction of 405 Freeway - 1957





## New invasives are emerging all the time

New introductions, or previously introduced plants finally making the move?

Euphorbia terracina



## Nonnative plant invasion in California



# Nonnative plant invasion in California

**Stages of Plant Invasion** 



How will invasion environmental change impact California's native plant communities?





How will environmental change impact California's native plant communities?



## Nitrogen deposition

Extreme drought

Nonnative plant invasion



# Nitrogen gas makes up about 78% of the Earth's atmosphere...



...yet bioavailable nitrogen is limiting in most ecosystems.

Nitrogen deposition: The input of reactive nitrogen from the atmosphere to the earth's surface



Human alteration of the global nitrogen cycle



Galloway et al. 2008

#### Nitrogen Deposition in Southern California



## Climate change and extreme drought

In addition to reactive N, air pollution also contains greenhouse gases...



Global change-type drought: when precipitation is below long-term averages under hotter temperatures

#### U.S. Drought Monitor California

#### May 24, 2022

(Released Thursday, May. 26, 2022) Valid 8 a.m. EDT

Drought Conditions (Percent Area)



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	99.86	97.56	59.81	11.59
Last Week 05-17-2022	0.00	100.00	99.86	95.14	59.81	0. 18
3 Month s Ago 02-22-2022	0.00	100.00	100.00	68.77	6.70	0.00
Start of Calendar Year 01-04-2022	0.00	100.00	99.30	67.62	16.60	0.84
Start of Water Year 09-28-2021	0.00	100.00	100.00	93.93	87.88	45.66
One Year Ago 05-25-2021	0.00	100.00	100.00	94.61	74.46	26.04

#### Intensity:







D3 Extreme Drought

D1 Moderate Drought

D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author: Richard Heim NCEI/NOAA



#### droughtmonitor.unl.edu
## Invasive annual grasses in California



Avena fatua

Bromus diandrus

Bromus rubens

## Invasive annual grasses in California



Avena fatua

Bromus diandrus

Bromus rubens

# Invasive annual grasses are linked to increased fire frequency in California



*Source*: CAL FIRE, frap.fire.ca.gov/data, Fire Perimeters 2013

How will multiple drivers of global change impact coastal sage scrub of the Santa Monica Mountains?

### Nitrogen deposition gradient of the Santa Monica Mountains



Valliere et al. In press: *Ecosphere*.

Nitrogen deposition gradient of the Santa Monica Mountains



Nitrogen deposition reduces forb richness of an already imperiled plant community



Nitrogen deposition is associated with reduced diversity & increased invasion



Nitrogen deposition is associated with reduced diversity & increased invasion





# Experimental N Addition Plots in the Santa Monica Mountains



Nitrogen deposition exacerbates native shrub loss and invasion during extreme drought



Valliere, J. M., I. C. Irvine, L. Santiago, and E. B. Allen. 2017. High N, dry: Experimental nitrogen deposition exacerbates native shrub loss and nonnative plant invasion during extreme drought. Global Change Biology.



Nitrogen deposition exacerbates native shrub loss and invasion during extreme drought





Nitrogen deposition exacerbates native shrub loss and invasion during extreme drought





Erodium cicutarium Centaurea melitensis



Bromus rubens

Hirschfeldia incana

# How do you find optimism in the face of such challenges?

# Successful weed management and restoration projects

### Italian thistle control in the Santa Monica Mountains Joey Algiers, NPS





#### 2009: Yellow star thistle infestation



## 2015: After years of control, native tarweed takes its place



#### 2017: Still native tarweed



# 2019: Post-fire, native California poppies appear early in the season



# 2019: Tarweed returns later in the growing season



### Non-chemical weed control and restoration of coastal sage scrub Sandy DeSimone, Audubon's Starr Ranch

### 2001: Prior to artichoke thistle control



### Following weed control and seed-based restoration

#### 2001: Prior to artichoke thistle control

Strip-seeding and passive recruitment following invasive control

Following weed control and seed-based restoration

and the second second

### Other sources of inspiration (for me)

#### Coastal sage scrub persistence despite extreme drought (and N deposition)





### Remnant natives in urban areas



## Native plants spared during roadside weed control



The next generation of applied ecologists and land managers Fruitful collaborations between researchers and land managers

Cal-IPC plays a critical role in facilitating such collaborations





# Greater public awareness of invasive plants
We cannot win this battle to save species and environments without forging an emotional bond between ourselves and nature as well - for we will not fight to save what we do not love

-Stephen Jay Gould

## Finding optimism for effective conservation in weedinvaded southern California





Thank you! jvalliere@csudh.edu

