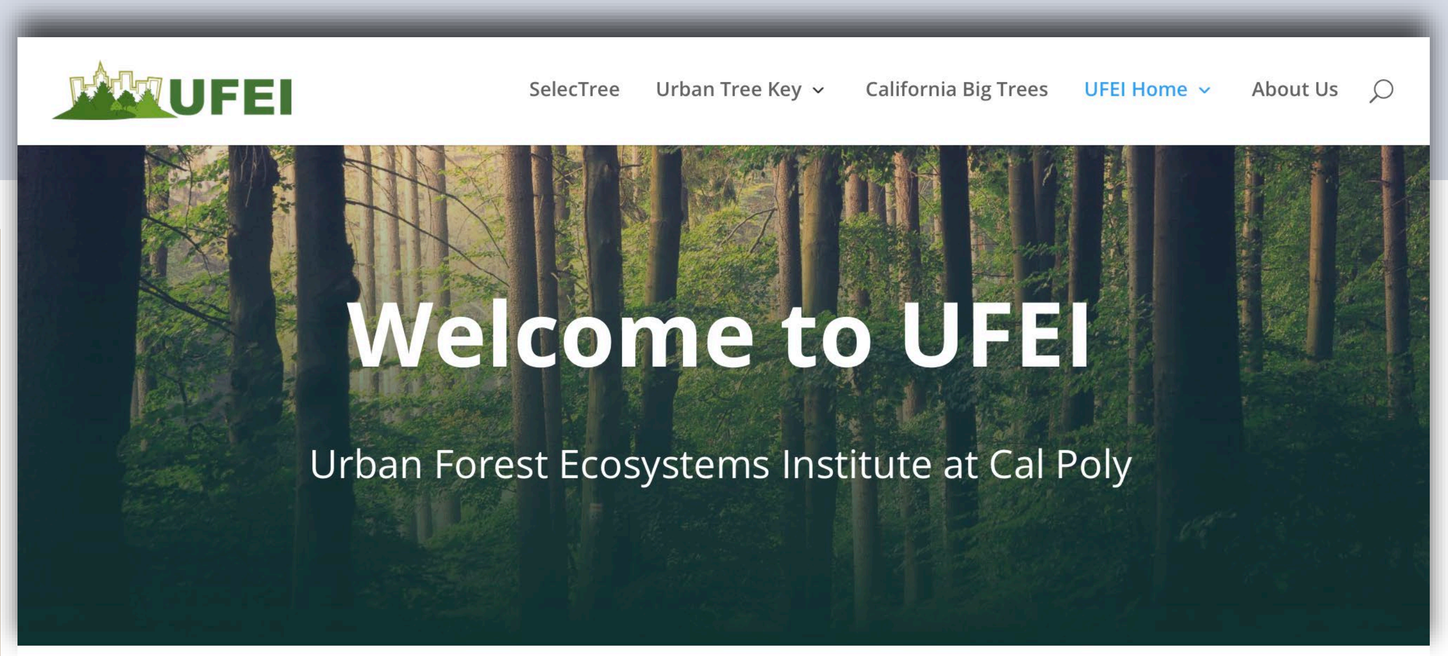
New tools from the Urban Forest Ecosystem Institute

Dr. Jenn Yost, Camille Pawlak
And Dr. Natalie Love,
Moderator: Dr. Matt Ritter
Urban Forest Ecosystems Institute
Cal Poly, San Luis Obispo
California ReLeaf
May 11th, 2023



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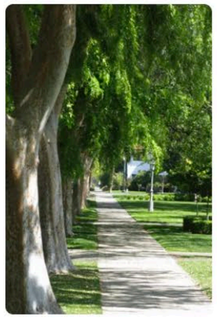
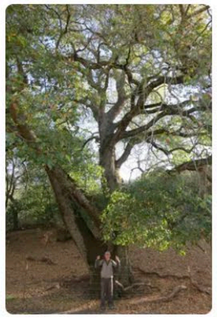
Tree Information & Resources



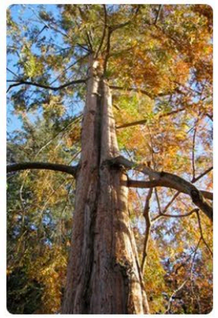
SelecTree

A tree selection guide. Find the tree you want.



California Big Trees

See the champions our state has to offer.



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Identify a tree. Listing over 350 trees.

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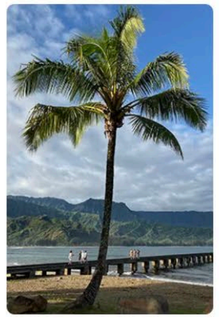
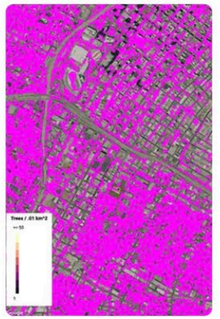
A spacial analysis of California's urban trees.



Pacific Island Trees

Tree listings and identification



Urban Tree Detector

Urban Forest Tree Detector for California

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SELECTREE URBAN TREE KEY CALIFORNIA BIG TREES

SelecTree

A TREE SELECTION GUIDE

Enter a tree name...

SEARCH PACIFIC ISLANDS
Click here to search trees in the Pacific Islands

SEARCH CHARACTERISTICS
Search by height, flower color, and more.

SEARCH HELP
Find more information to help with your search.

SEARCH BY CHARACTERISTICS

TREE CHARACTERISTICS

MAXIMUM TREE HEIGHT

0ft 100ft

0 25 50 75 100+

IS CA NATIVE?

☐ Yes

HAS FALL COLOR?

☐ Yes

POWERLINE FRIENDLY?

☐ Yes

OVERVIEW

Common Name	Scientific Name	Synonym
African Fern Pine	*Afrocarpus falcatus*	*Podocarpus gracilior*
Floss Silk Tree	*Ceiba speciosa*	*Chorisia speciosa*
Lemon Scented Gum	*Corymbia citriodora*	*Eucalyptus citriodora*
Red Flowering Gum	*Corymbia ficifolia*	*Eucalyptus ficifolia*
Trumpet Trees	*Handroanthus* spp.	*Tabebuia* spp.
Monterey Cypress	*Hesperocyparis macrocarpa*	*Cupressus macrocarpa*
Brisbane Box	*Lophostemon confertus*	*Tristania conferta*
London Plane Tree	*Platanus × hispanica*	*Platanus × acerifolia*
African Sumac	*Searsia lancea*	*Rhus lancea*
Japanese Pagoda Tree	*Styphnolobium japonicum*	*Sophora japonica*
Chinese Tallow Tree	*Triadica sebifera*	*Sapium sebiferum*
Water Gum	*Tristaniopsis laurina*	*Tristania laurina*

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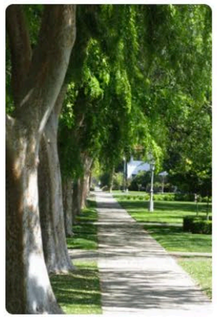

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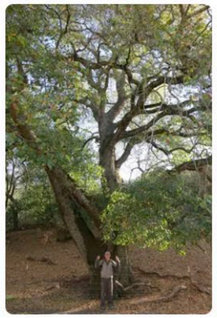

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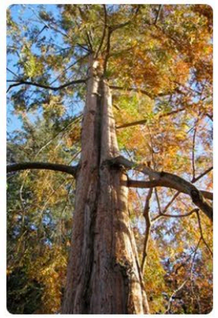

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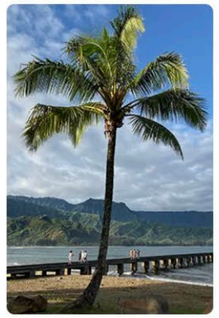

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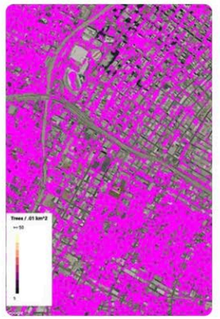

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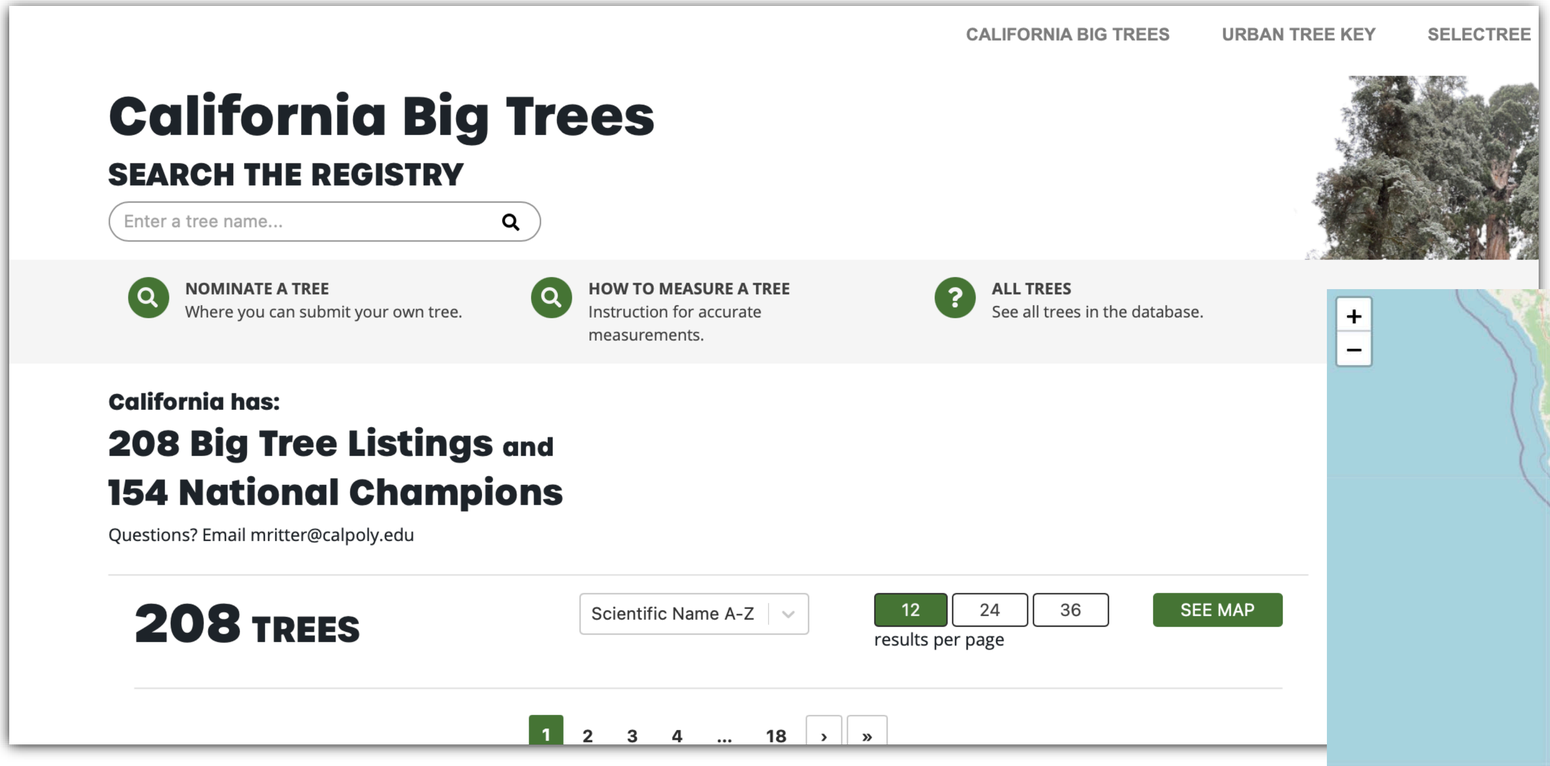
CALIFORNIA BIG TREES
URBAN TREE KEY
SELECTREE
California Big Trees
SEARCH THE REGISTRY
Enter a tree name...
NOMINATE A TREE
Where you can submit your own tree.
HOW TO MEASURE A TREE
Instruction for accurate measurements.
ALL TREES
See all trees in the database.
California has:
208 Big Tree Listings and
154 National Champions
Questions? Email mritter@calpoly.edu
208 TREES
Scientific Name A-Z
12
24
36
results per page
SEE MAP
1
2
3
4
...
18
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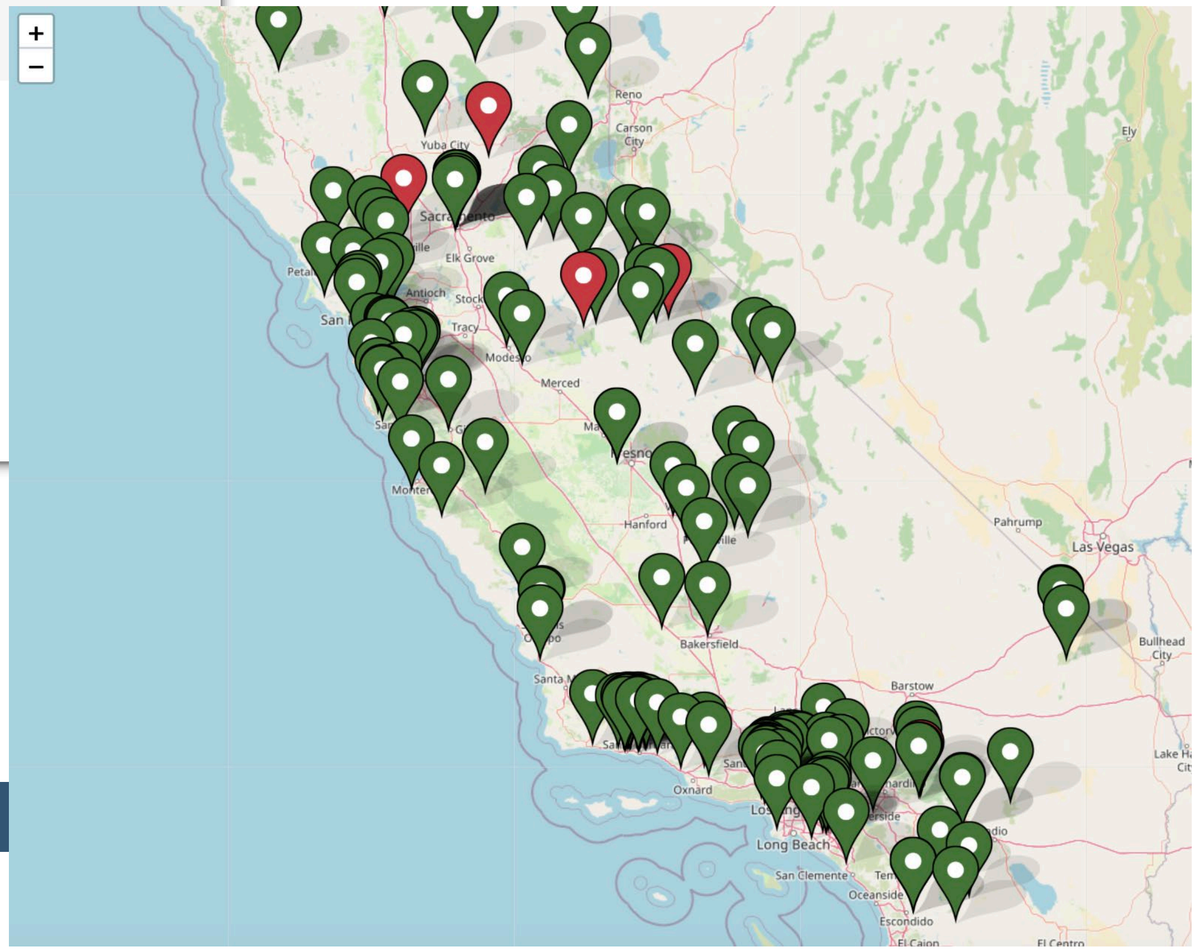
Reno
Carson City
Yuba City
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Elk Grove
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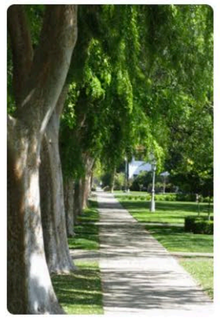

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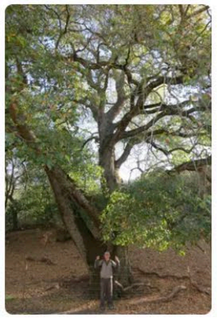

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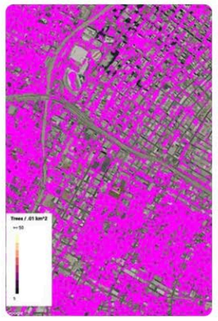

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The California Urban Forest Inventory and the Urban Tree Detector: Tree locations for every urban tree in California

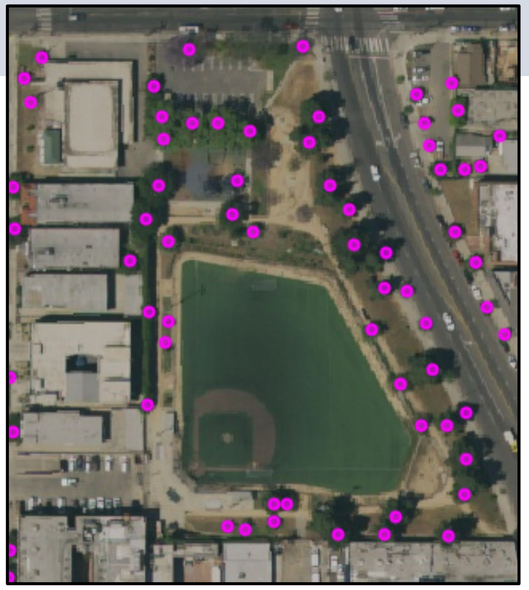
Jenn Yost, Ph.D.

Biology Professor

Urban Forest Ecosystems Institute

Cal Poly, San Luis Obispo

jyost@calpoly.edu

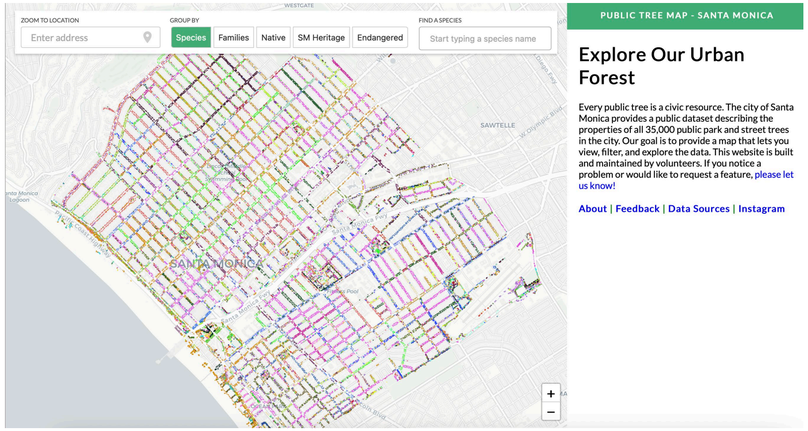


California Urban Forest Inventory assembly

Tree Inventories

=

Public Tree Data



+

Private Sector Tree Data

WCA

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PLANIT GEO™ mapping a greener future

California Urban Forest Inventory: Online data portal

- 7 million trees
  - mostly public trees
- 513 species
- 223 genera
- 753 cities in California

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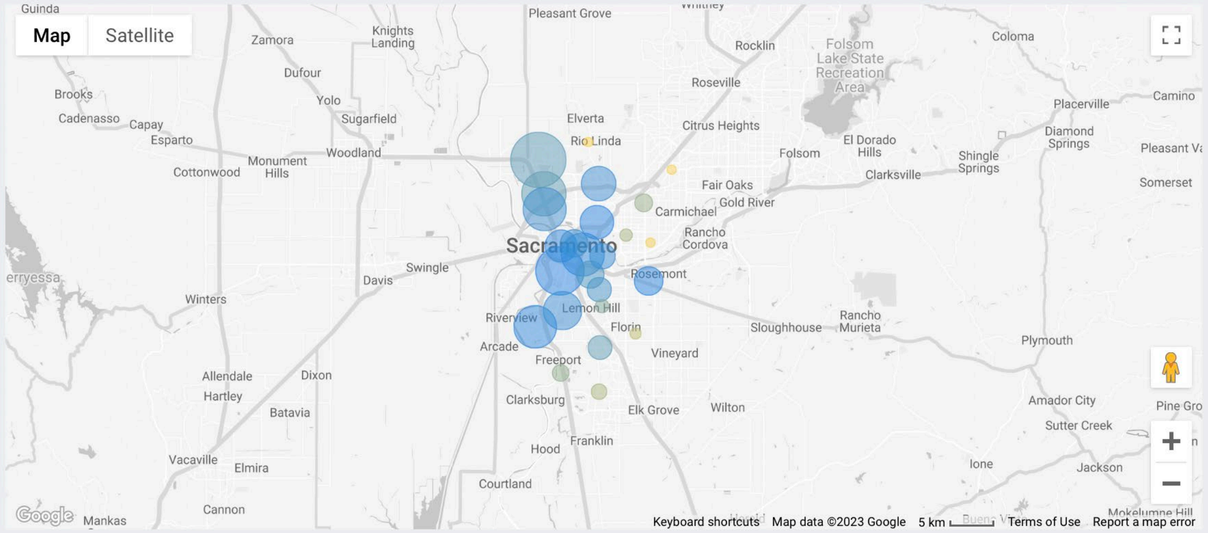
California Urban Forest Inventory: Sacramento

California Urban Forest Inventory

Number of trees in inventory	Number of genera in inventory	Number of species in inventory
119,790	132	269

Filter the inventory

County | Climate Zone | Family | Genus | Place: ...(1) | Species | Zip



Points are centered on the city jurisdiction and do not reflect specific locations. The size of the circle indicates the number of trees in the zip code boundary that are in the inventory, the color of the circle indicates the number of distinct species (blue regions have more species than yellow regions).

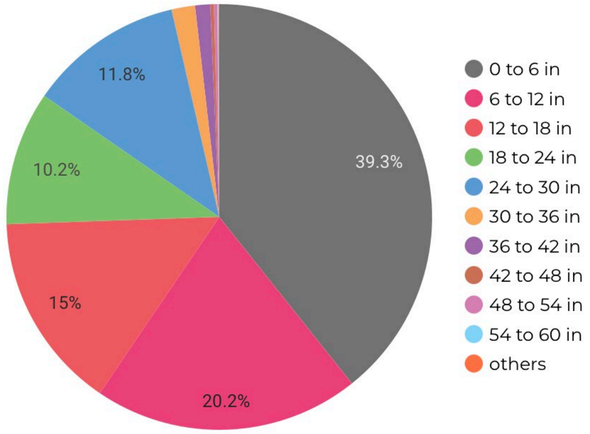
Count distribution of each species

	Species	Number of trees ▼	Proportion
1.	Platanus x hispanica	14,516	12.12%
2.	Lagerstroemia	6,450	5.38%
3.	Sequoia sempervirens	6,410	5.35%
4.	Pistacia chinensis	5,933	4.95%
5.	Zelkova serrata	5,094	4.25%
6.	Quercus lobata	4,790	4%
7.	Pyrus calleryana	4,499	3.76%
8.	Liquidambar styraciflua	3,039	2.54%

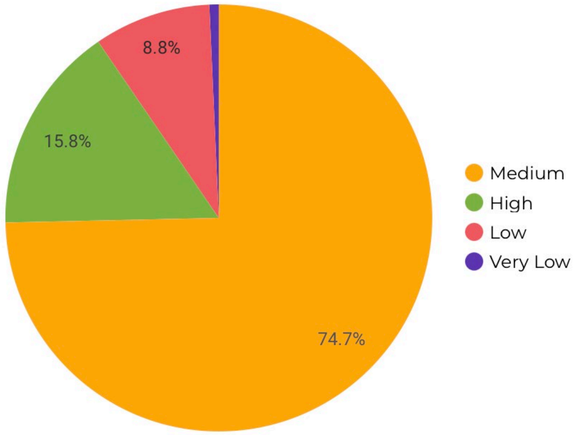
1 - 100 / 311

California Urban Forest Inventory: Sacramento

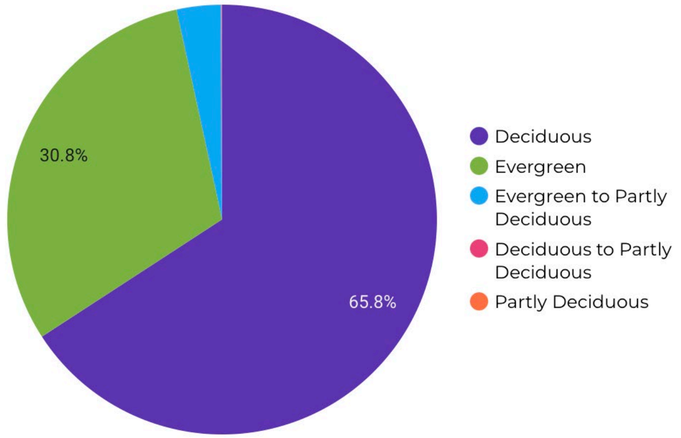
DBH Distribution



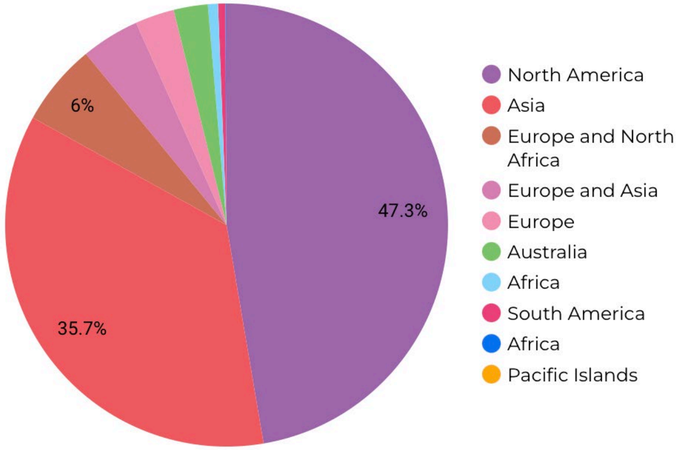
Water Use Distribution



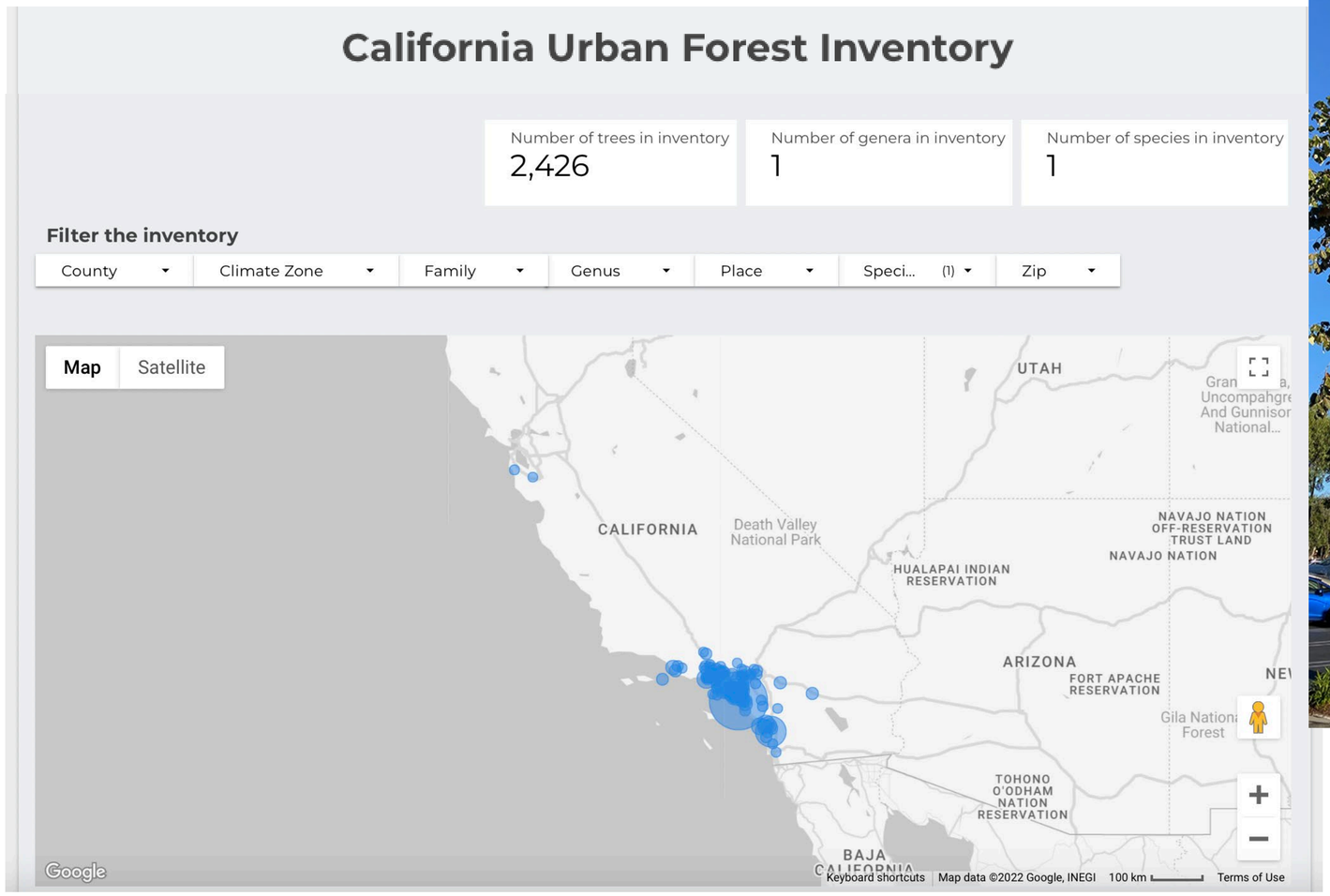
Foliage Type Distribution



Native Range Distribution



California Urban Forest Inventory: Online data portal



Mexican Sycamore

Platanus mexicana

URBAN TREE DETECTOR

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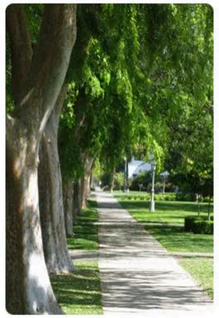
Tree Information & Resources



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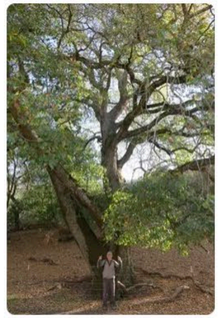

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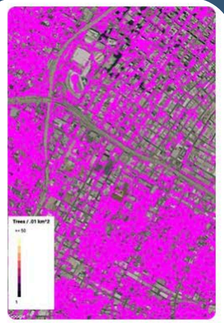

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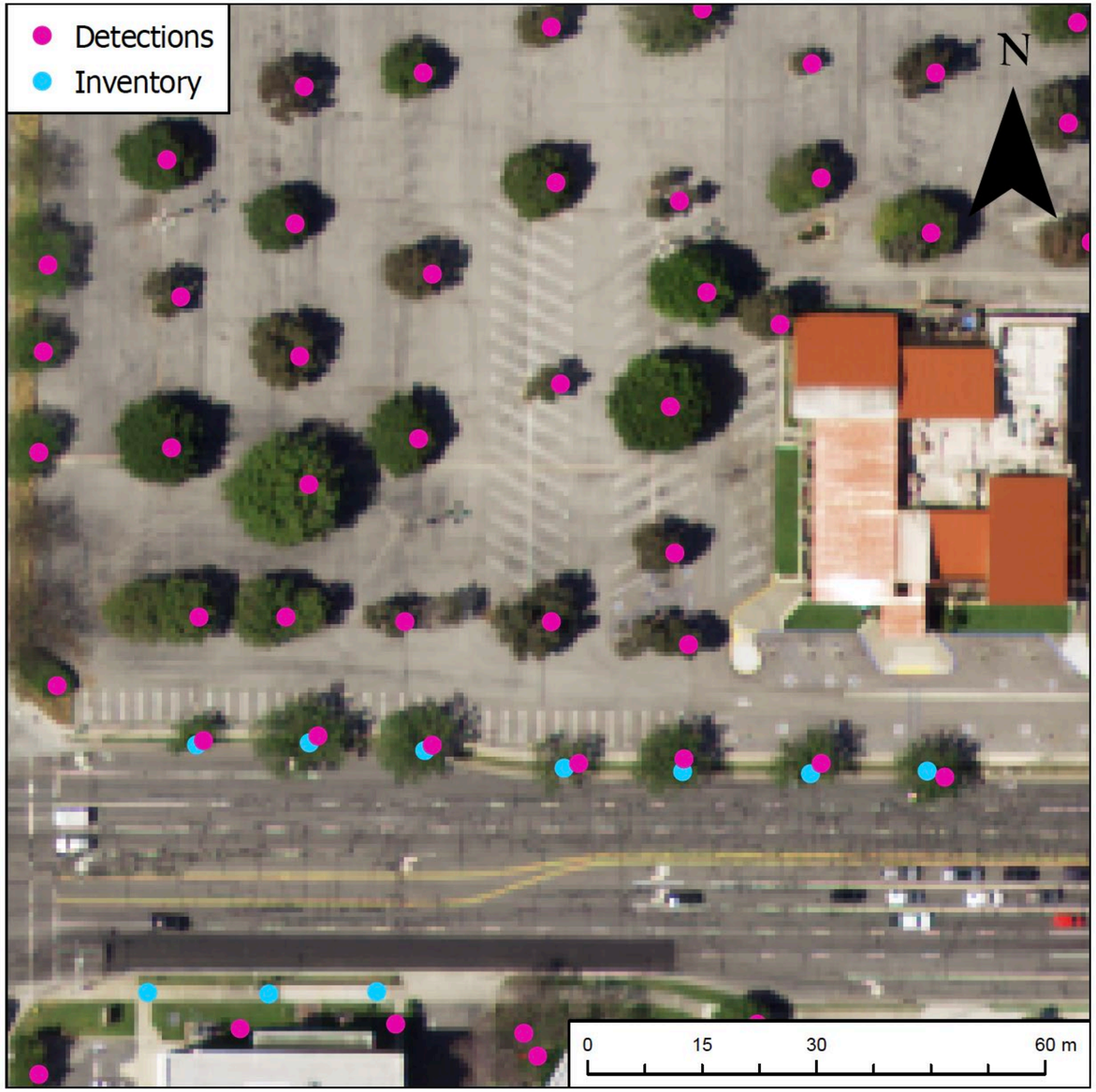
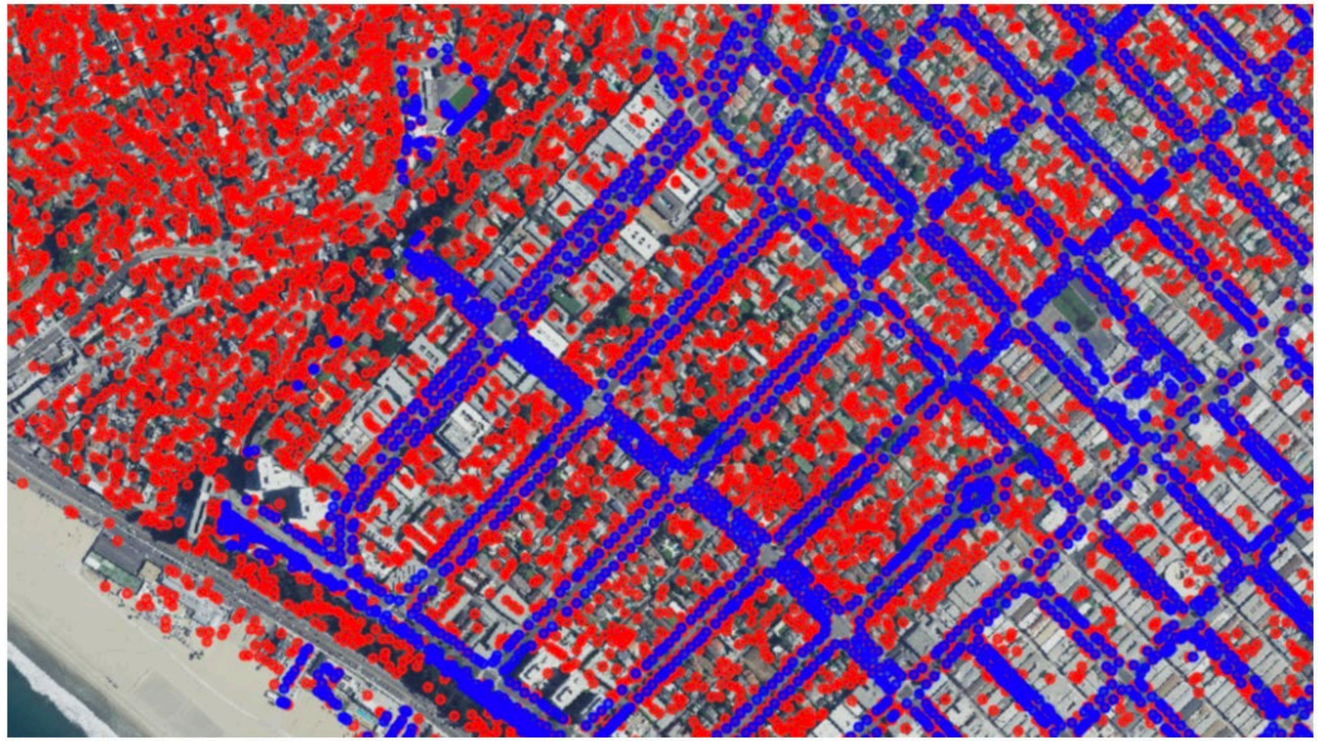


CNN Prediction

Arborist inventory



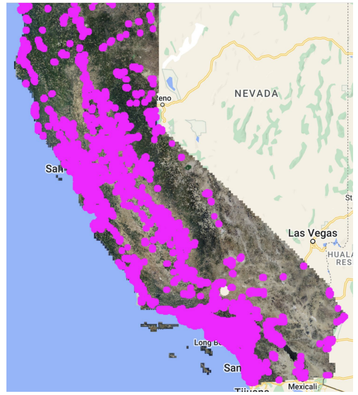
Santa Monica

Predicting Urban Trees

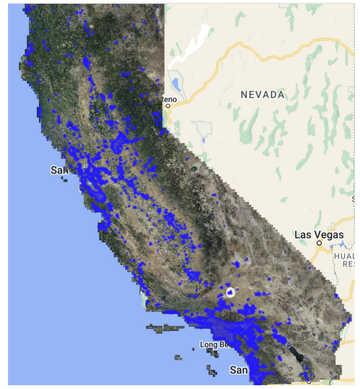
NAIP Imagery for California (2020)

Annotations

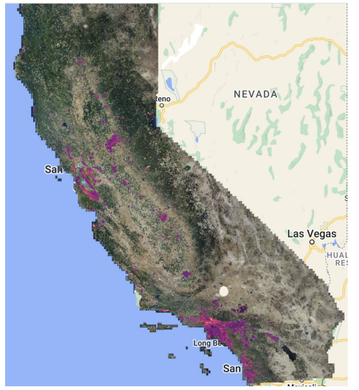
Neural Network Output



Clip to Urban Boundary

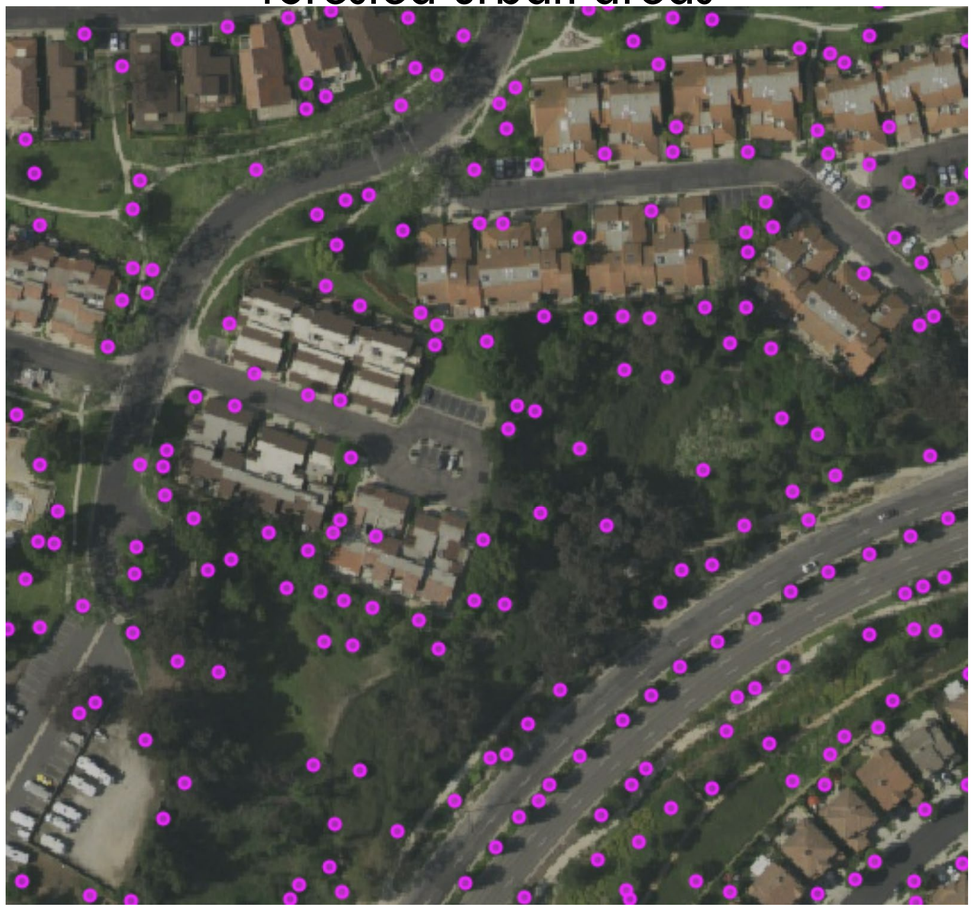


California Urban Tree Counts

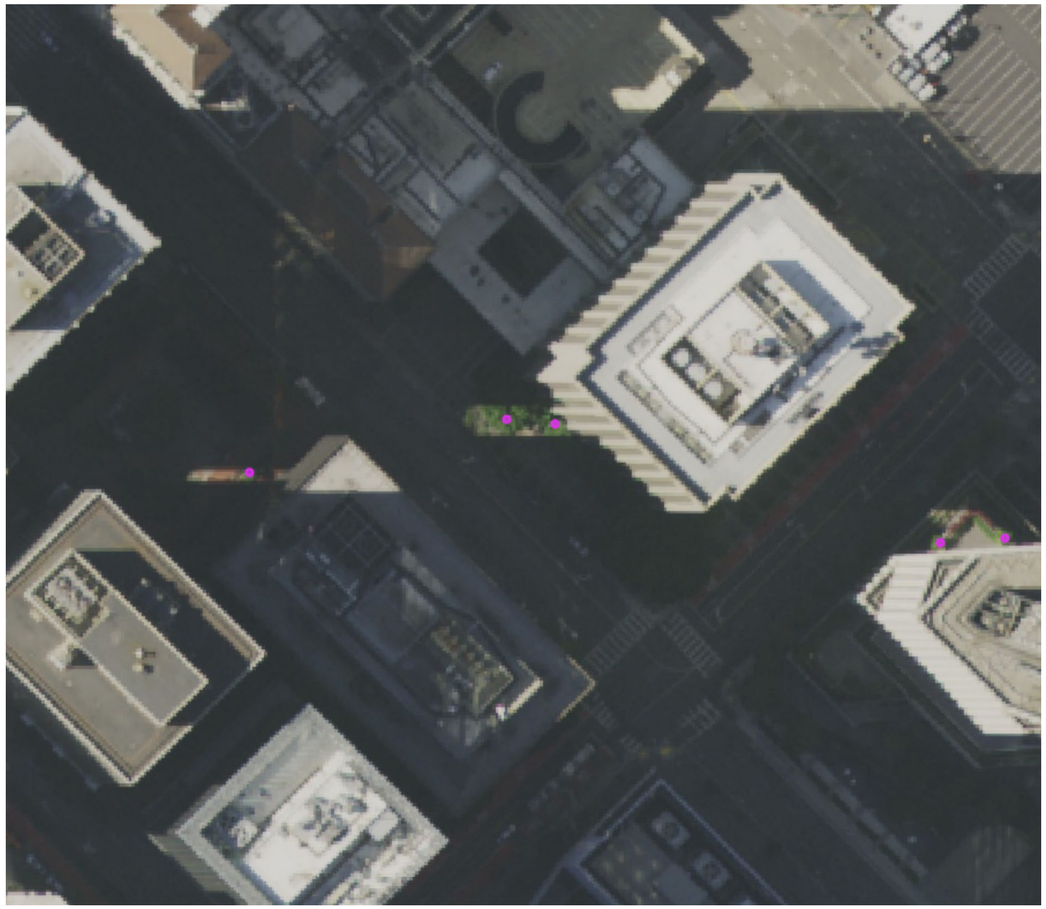


URBAN TREE DETECTOR: SOURCES OF UNCERTAINTY

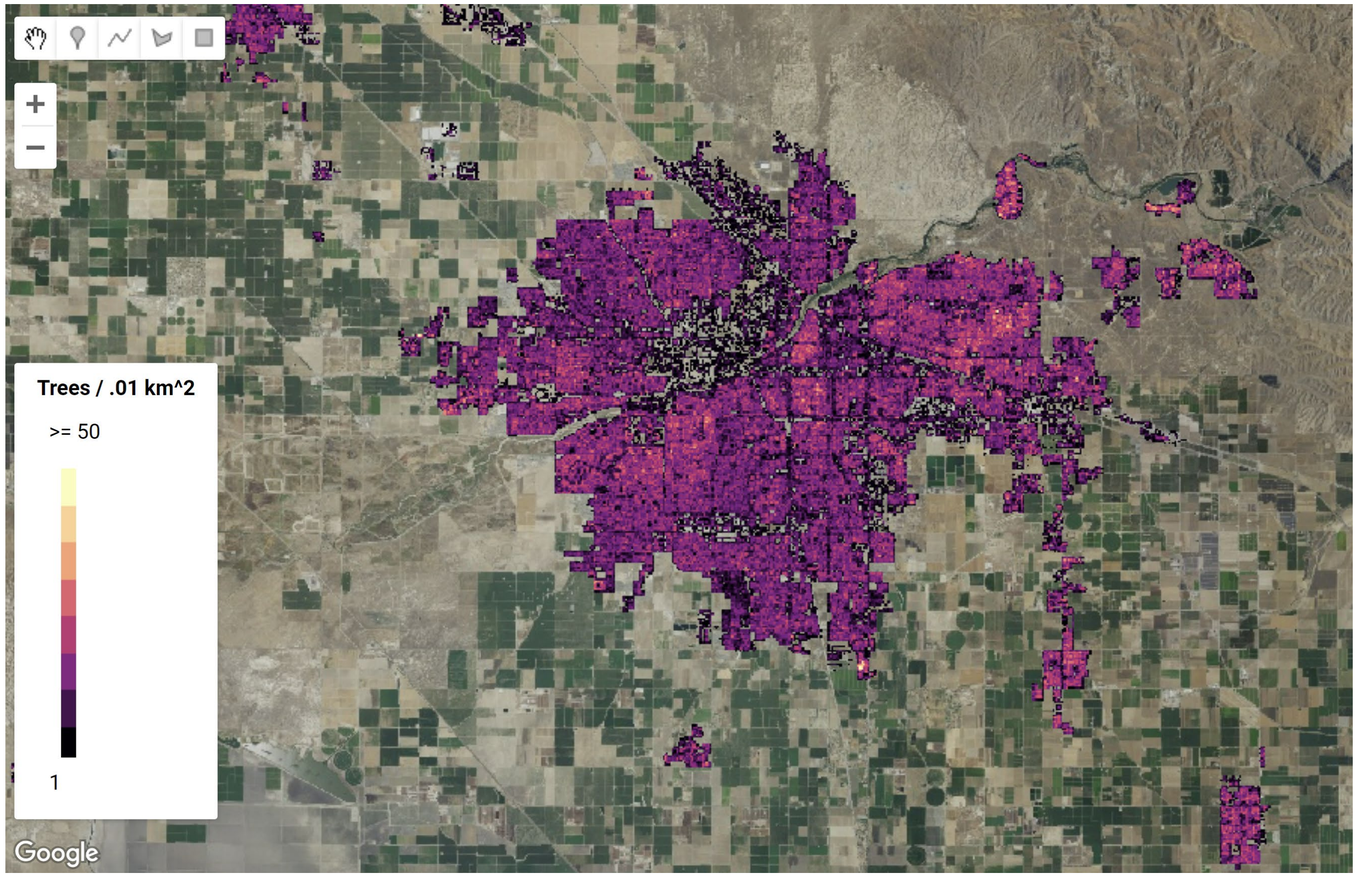
Under/overcounting in densely forested urban areas



Undercounting in shadowed areas



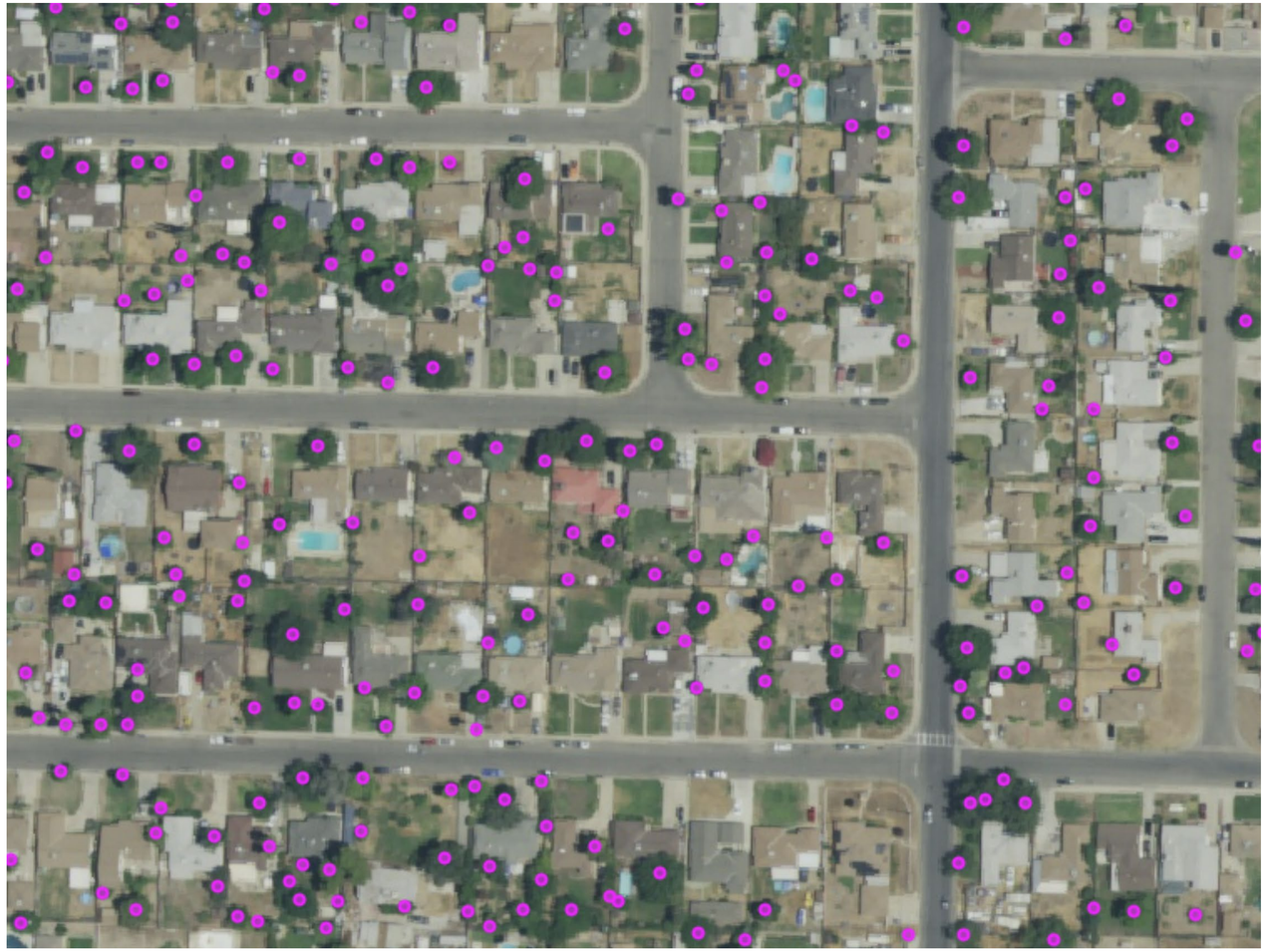
Data in new places: Bakersfield



Bakersfield: 340,921 Trees

Imagery

Detected trees



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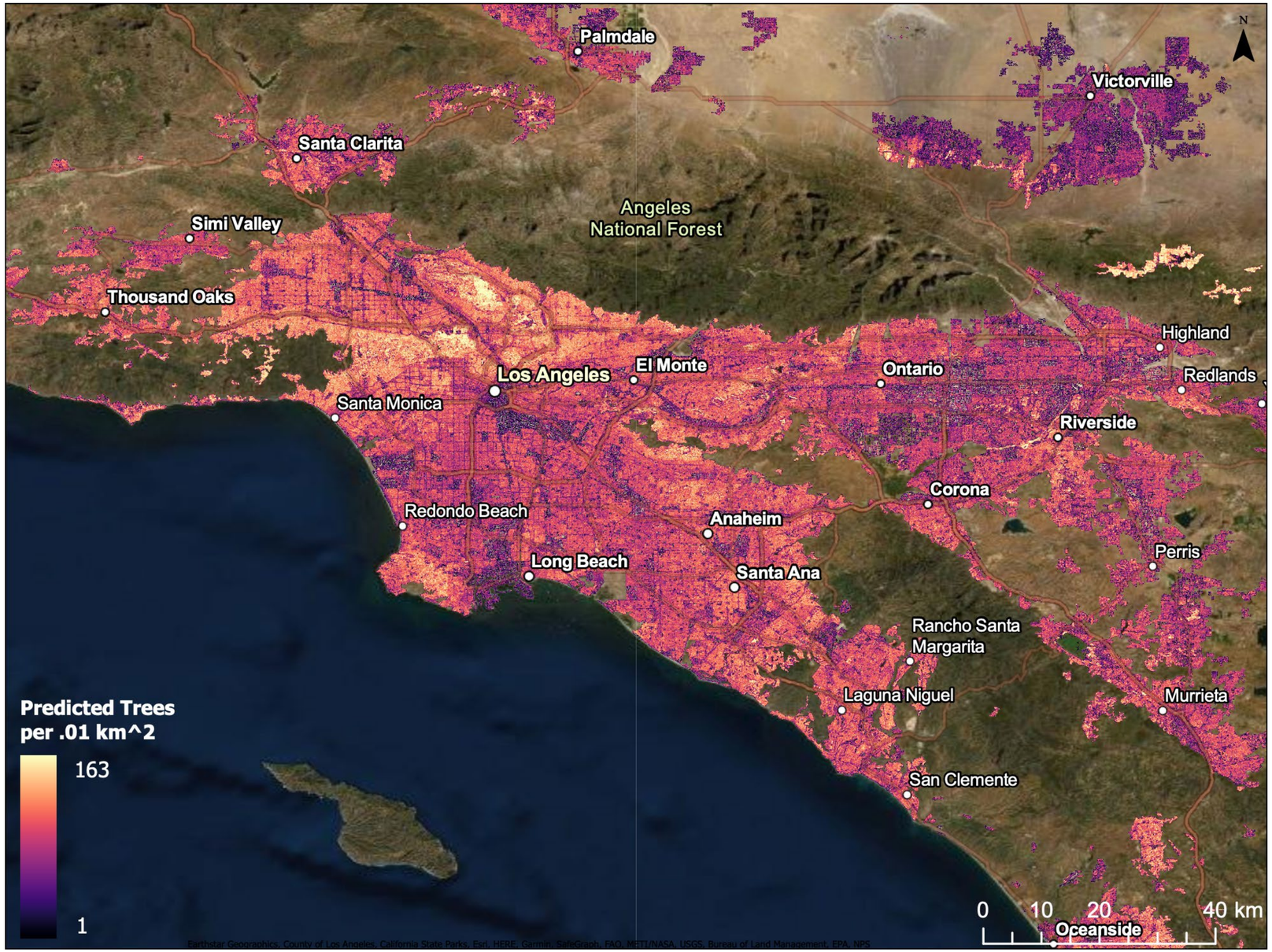
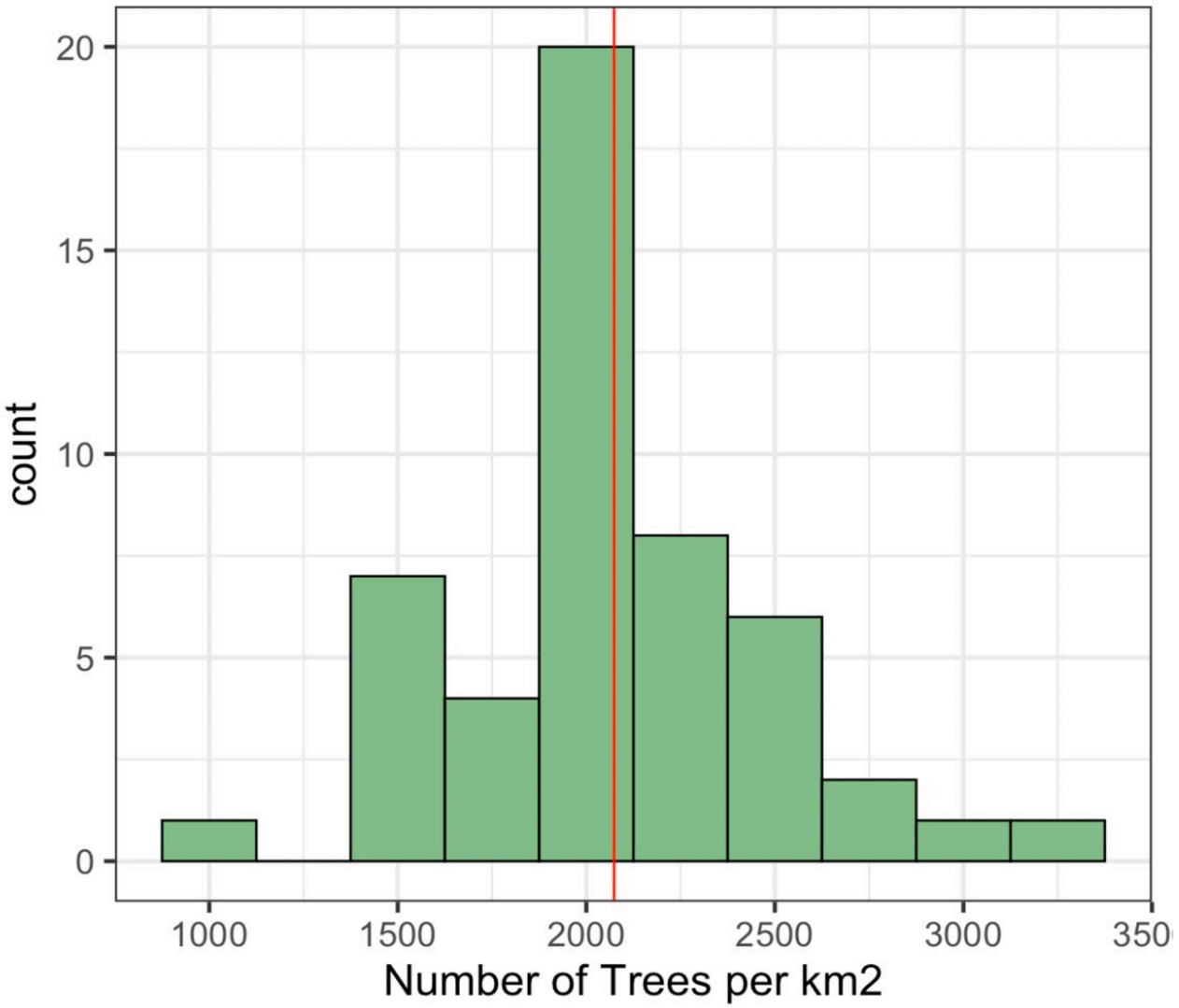


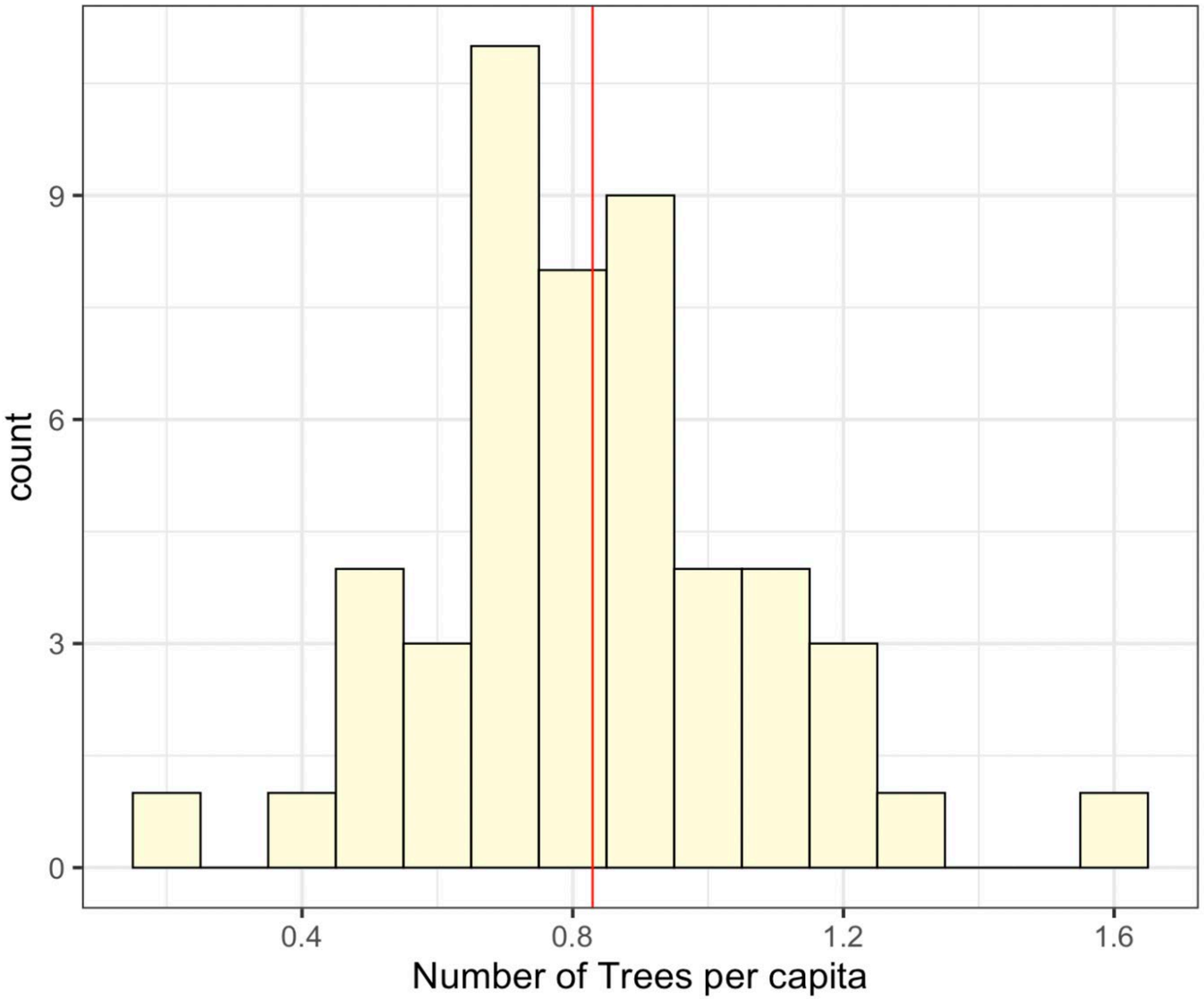
Data Uses

- Tree density for 50 most populous cities
- Mean = 2,073 trees/km²



Data Uses

- Trees per capita for 50 most populous cities
- Mean = 0.82 trees per person



Data Uses

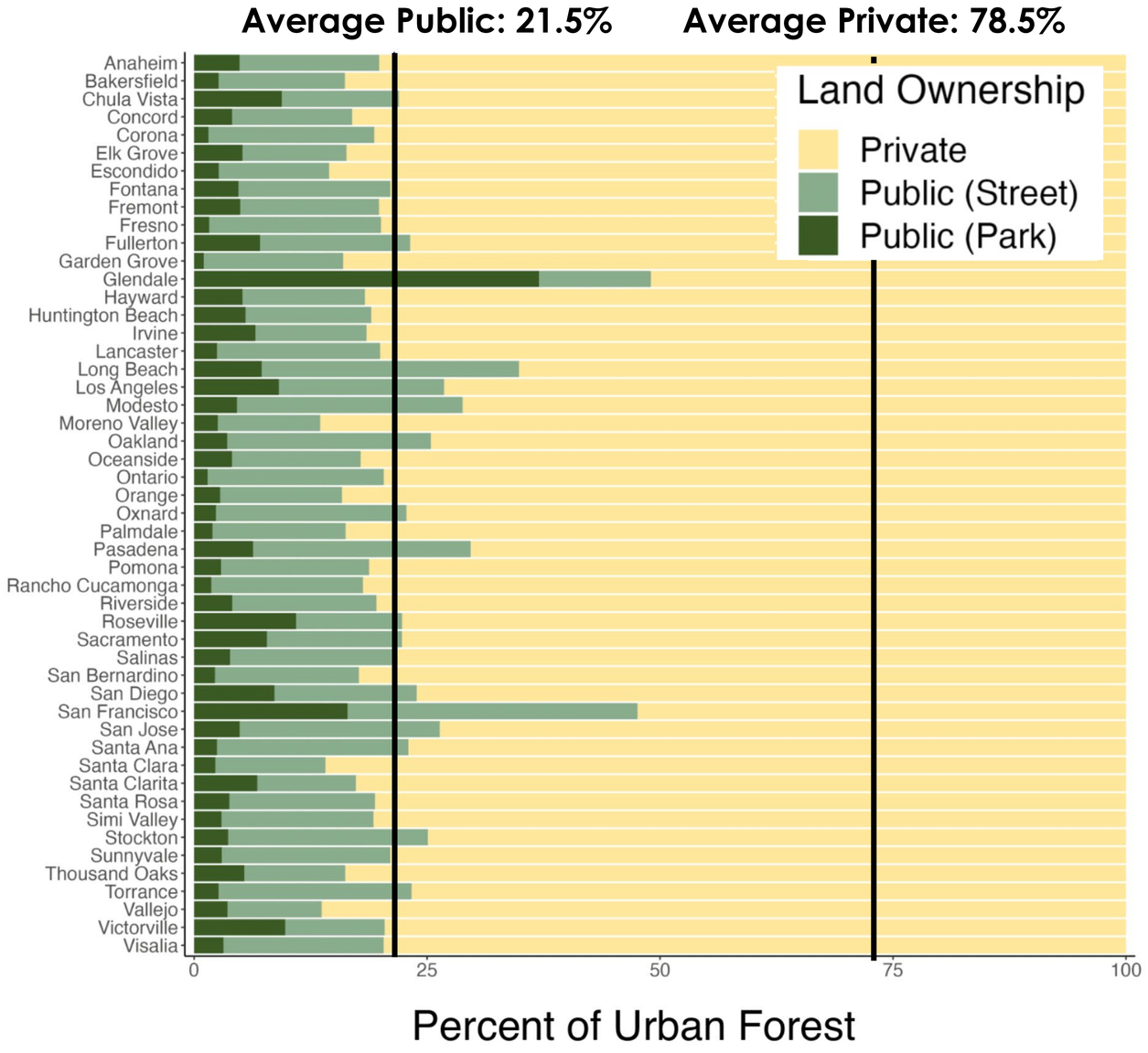
- Estimating the public and privately managed urban forest

○ Tree Detector Points

Public Land (Parks)
Street Buffers
● Public Trees
○ Private Trees

Data Uses

- Breakdown of urban trees by land ownership
- Glendale and San Francisco have the highest proportions of public trees



California's Native Trees in the Urban Environment

Camille Pawlak

Graduate Student

Urban Forest Ecosystems Institute

Cal Poly, San Luis Obispo

cpawlak@calpoly.edu

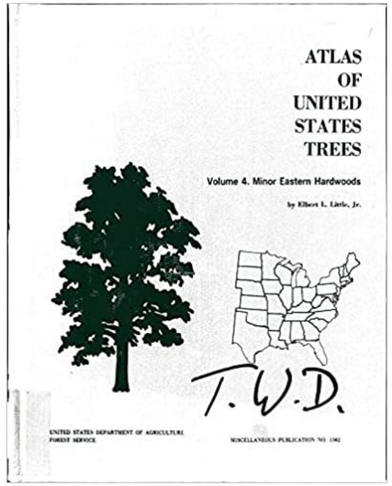
California's Native Trees

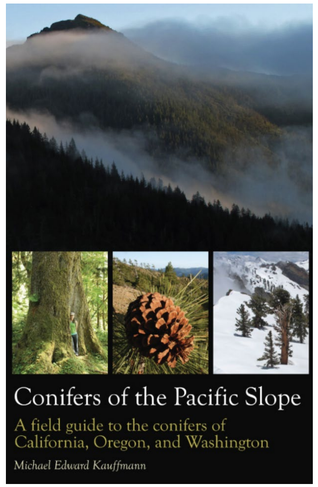
Coast Redwood in Arcadia, CA

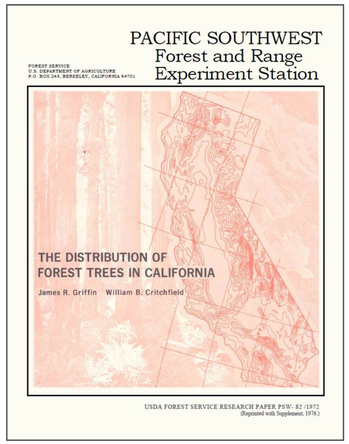
Coast Live Oak in Santa Cruz, CA

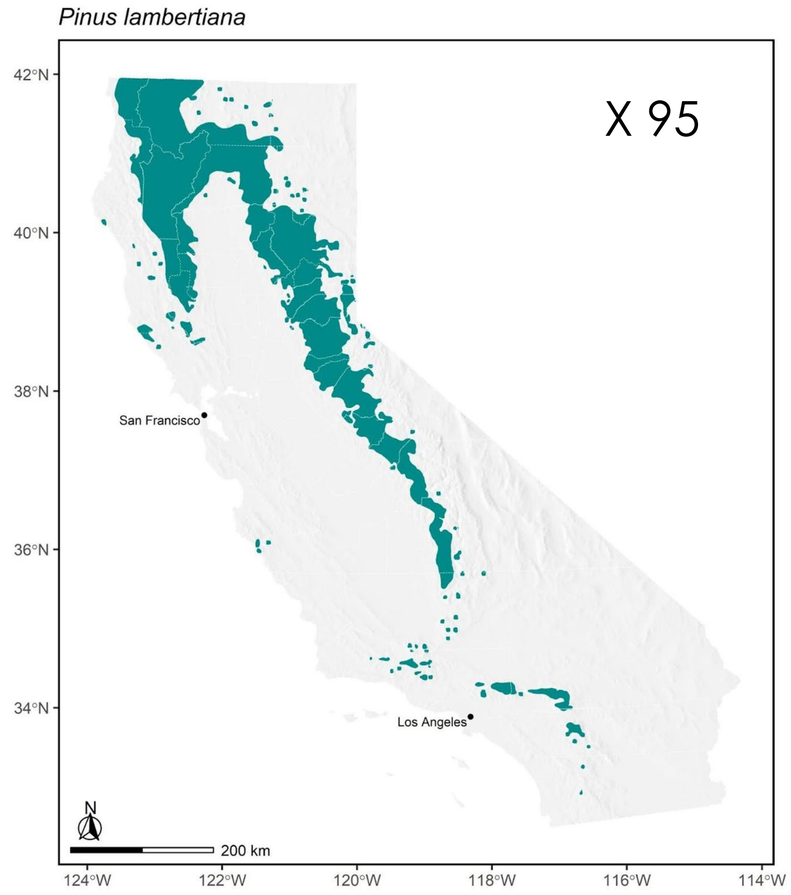
Monterey Cypress in Santa Barbara, CA

Where are California's Trees?

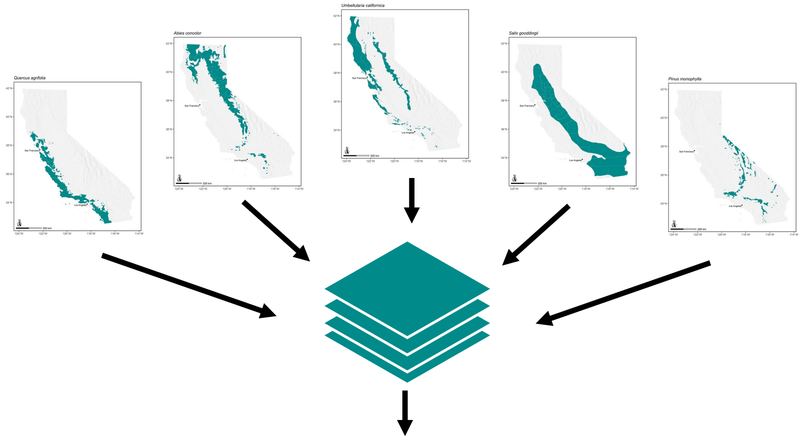


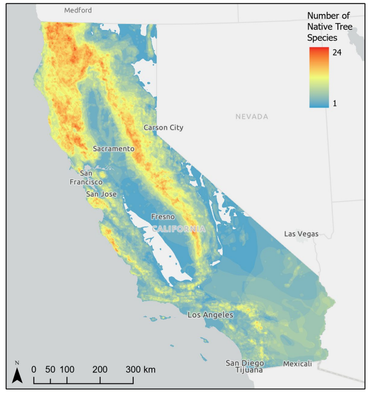






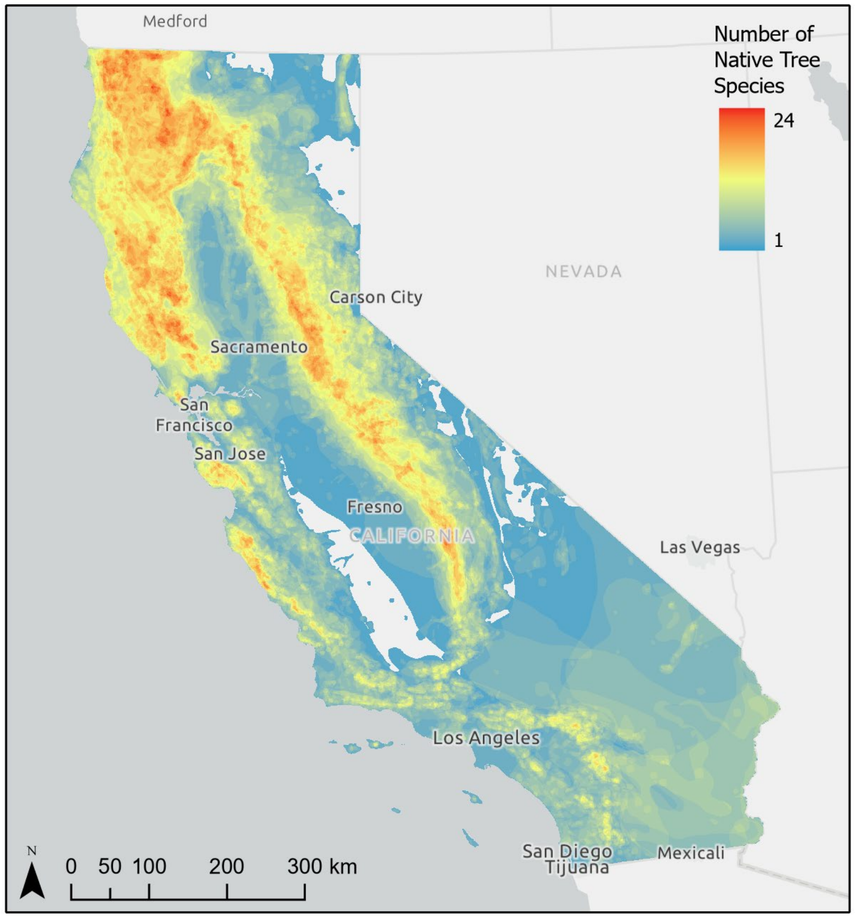
Heat Map of Native Tree Diversity





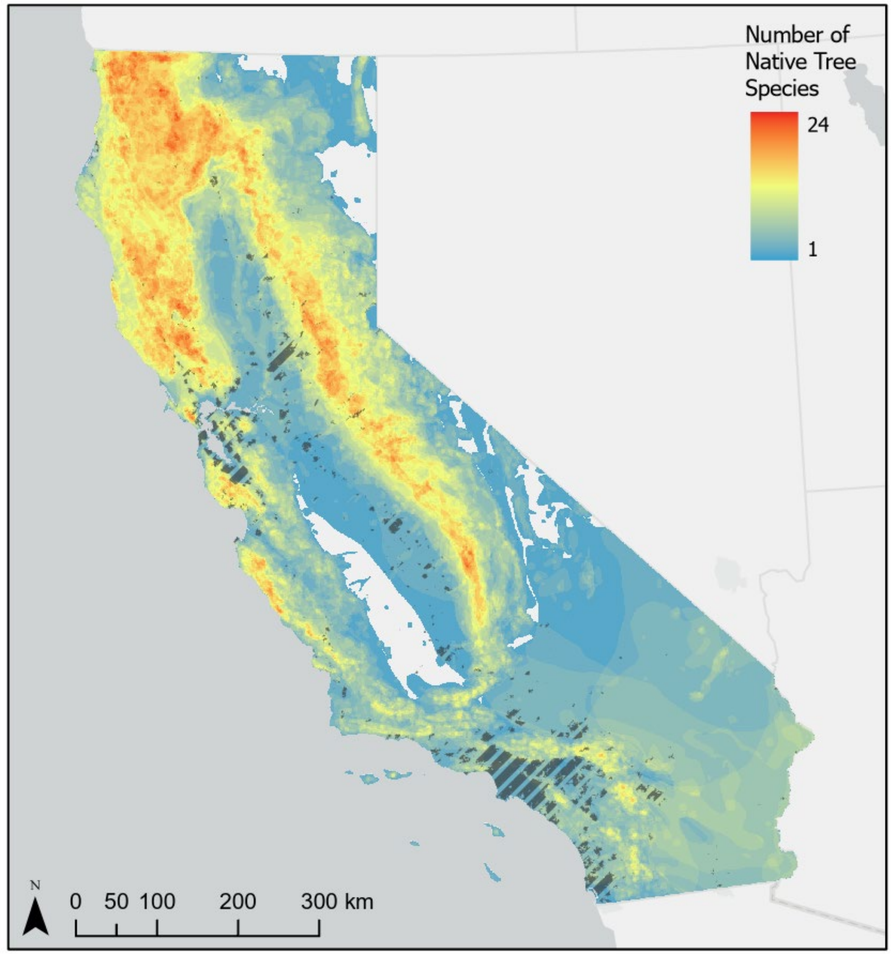
Native Tree Heat Map

- More species in the Sierras and Coast Ranges



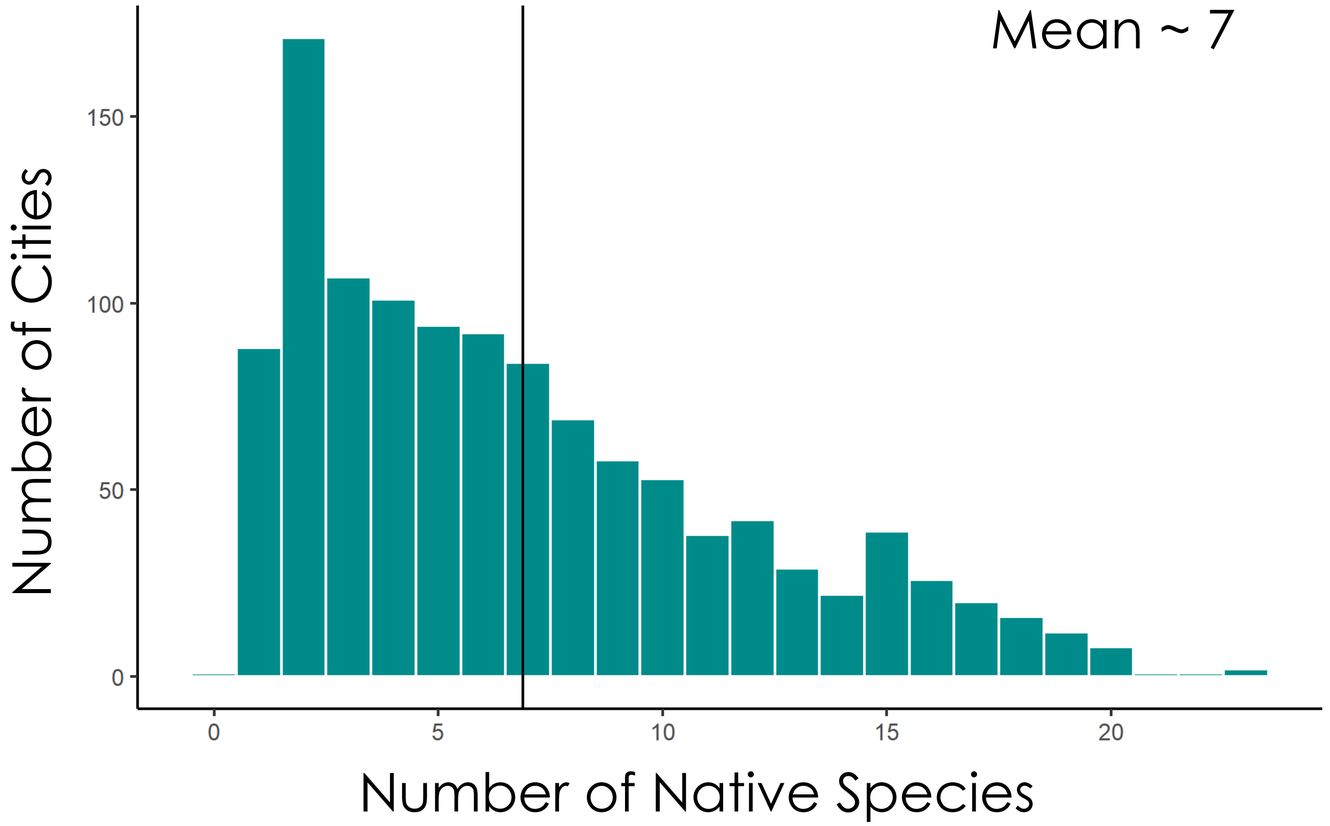
Native Tree Heat Map

- More species in the Sierras and Coast Ranges
- Major urban areas have few native species
- We created native species lists for each of California's urban areas



Urban Native Trees

- Relatively few species native to cities
- Rarely more than ten species of trees native to urban areas



Los Angeles: 15 Native Tree Species

California Bay Laurel, *Umbellularia californica*

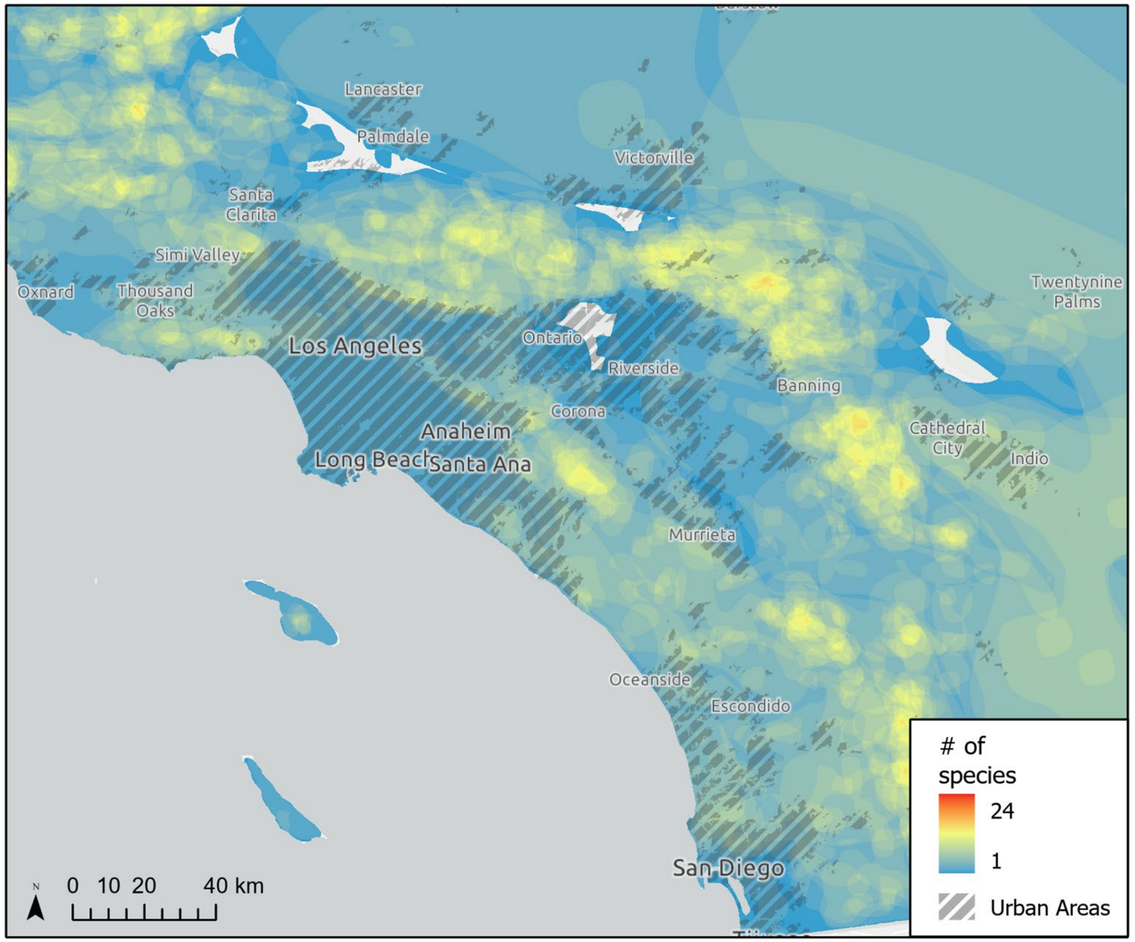
Western Sycamore, *Platanus racemosa*

Coast Live Oak, *Quercus agrifolia*

White Alder, *Alnus rhombifolia*

Los Angeles: Native Trees

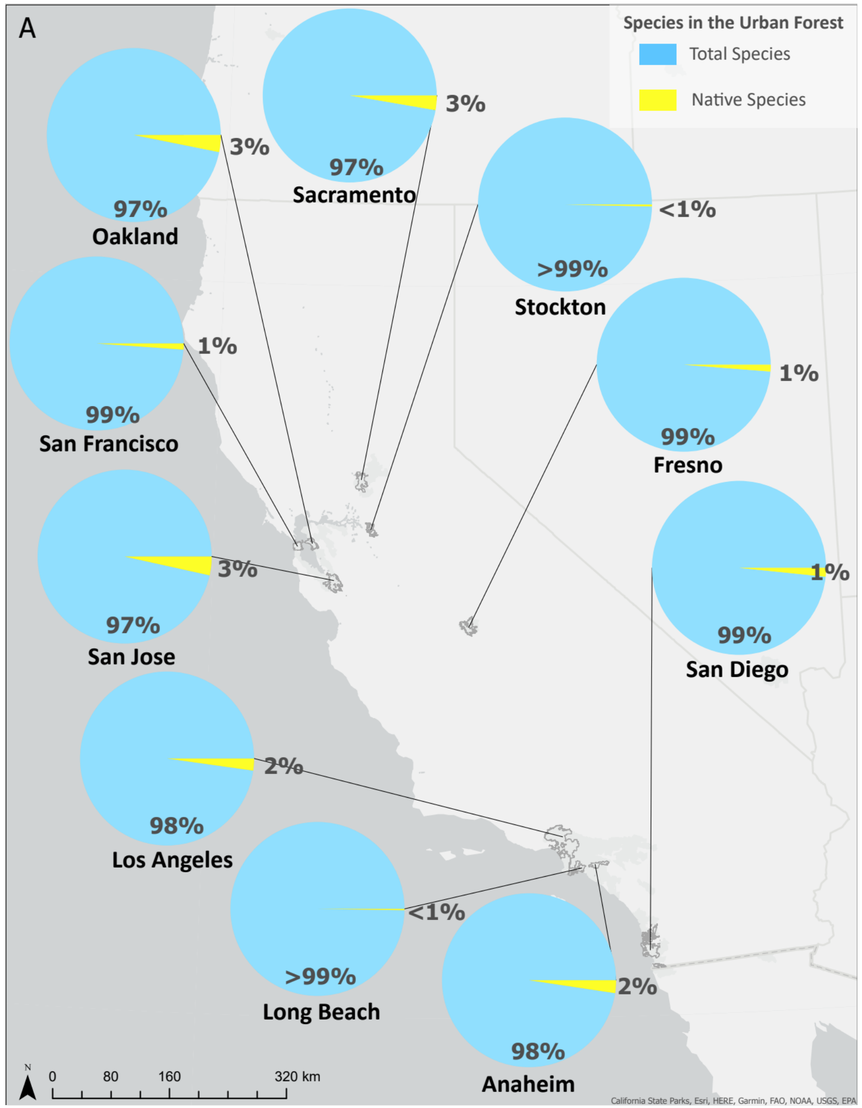
- Surrounding areas have higher numbers of native species than urban areas



RESULTS

Species

- Fewer native species than introduced

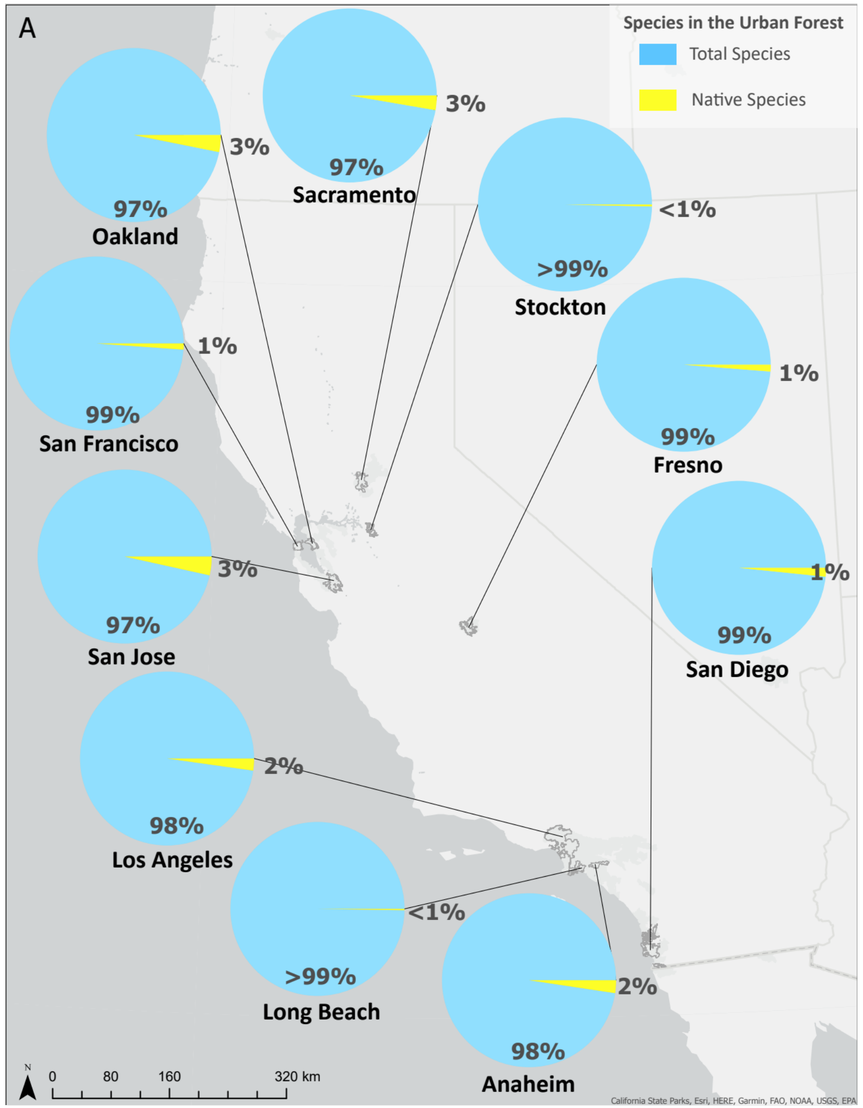


RESULTS

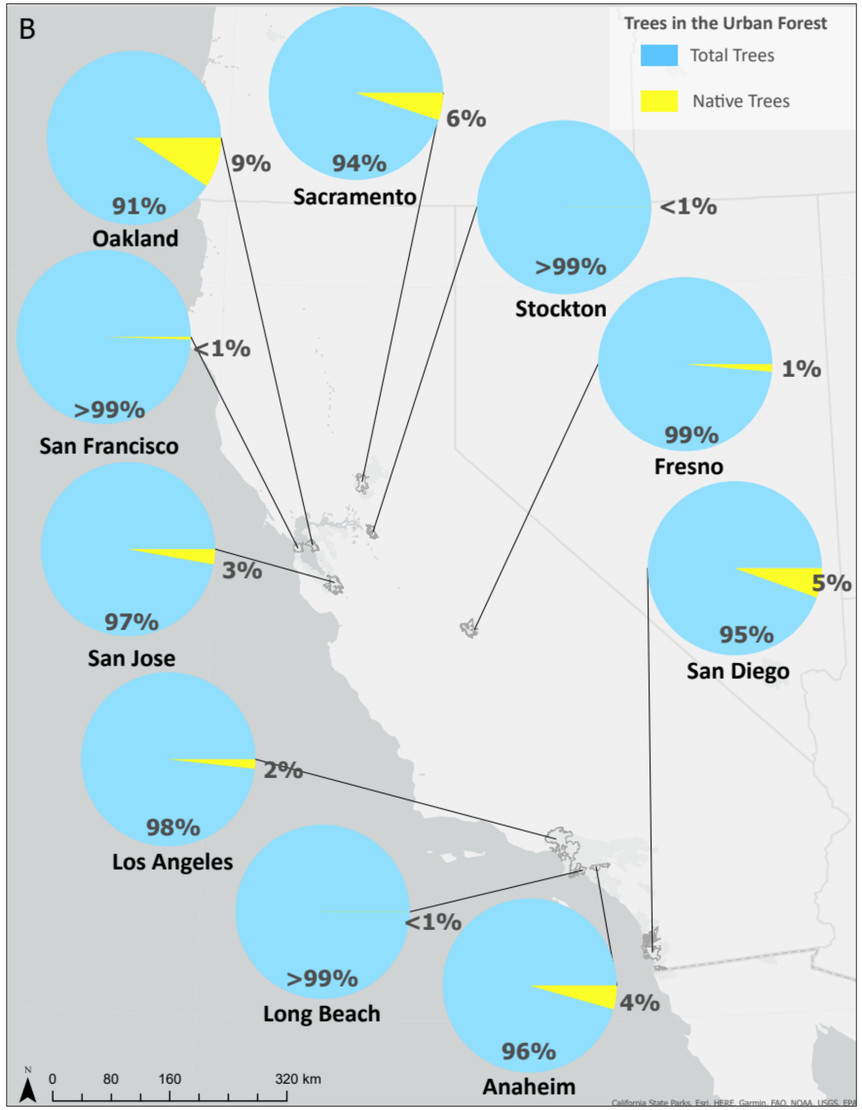
- Fewer native species than introduced

- Fewer native individual trees than introduced

Species

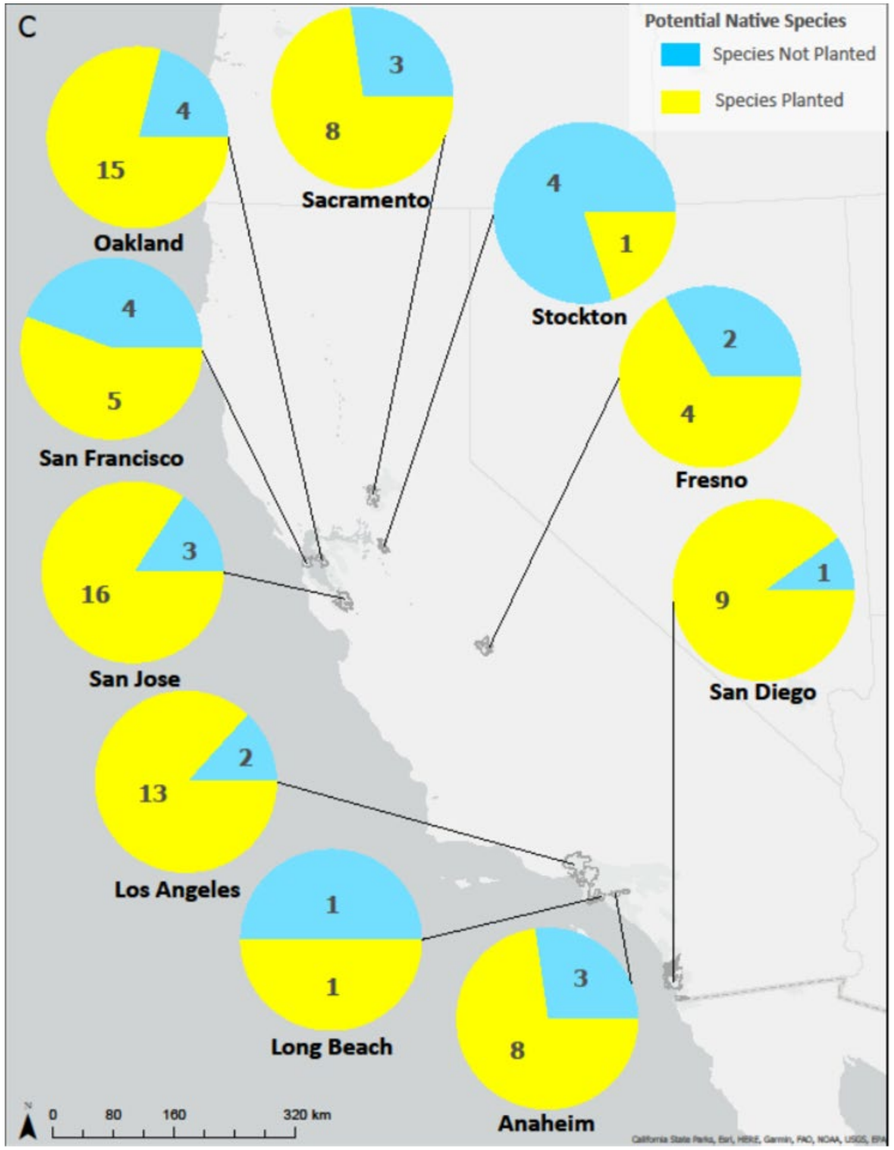


Individual Trees

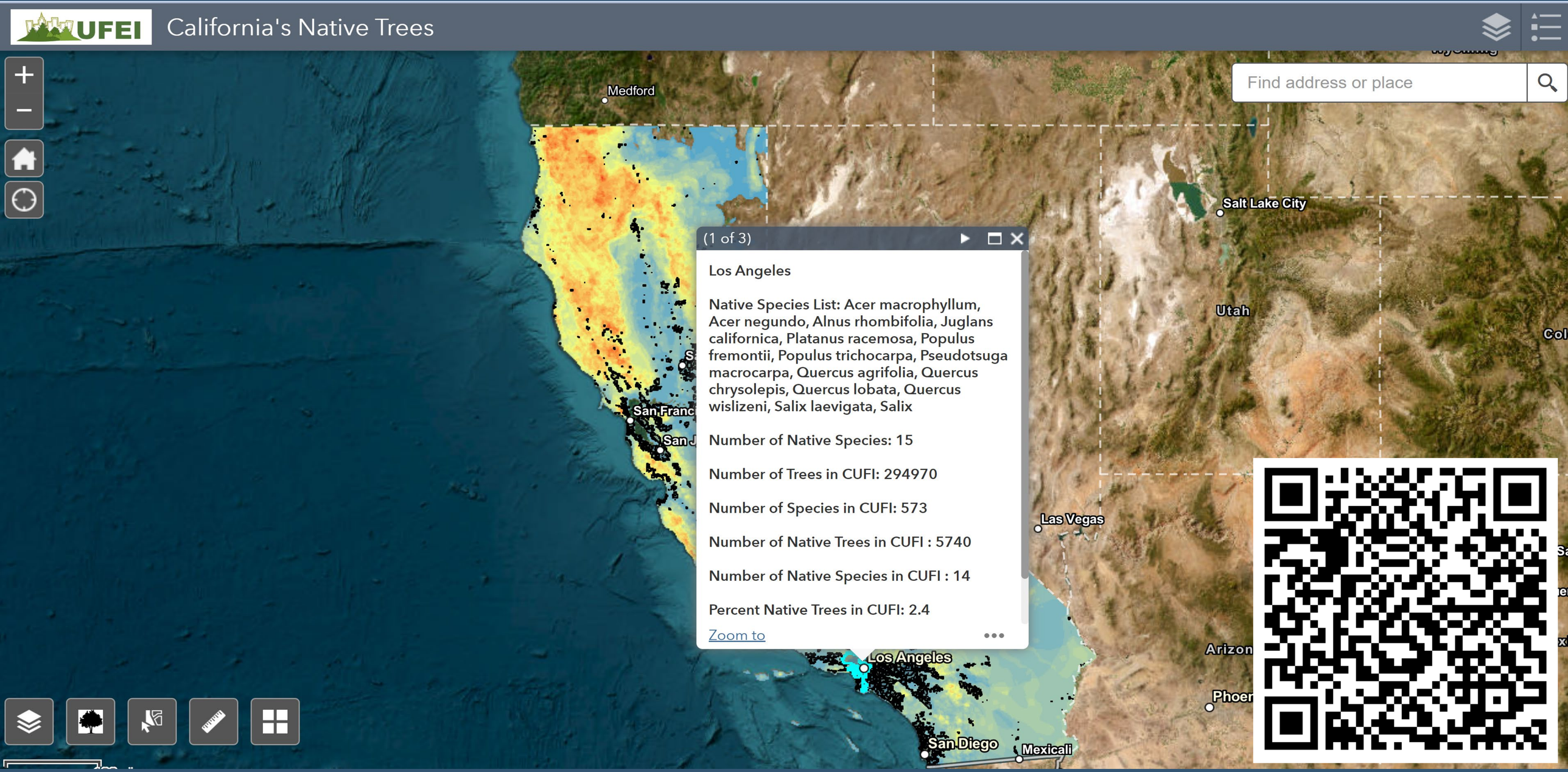


RESULTS

- Few native trees that are not currently planted in urban environments



ACCESS


UFEI
California's Native Trees
Find address or place
Medford
Salt Lake City
Utah
San Franc
San J
Las Vegas
Los Angeles
San Diego
Mexicali
Arizon
Phoer
(1 of 3)
Los Angeles
Native Species List: Acer macrophyllum, Acer negundo, Alnus rhombifolia, Juglans californica, Platanus racemosa, Populus fremontii, Populus trichocarpa, Pseudotsuga macrocarpa, Quercus agrifolia, Quercus chrysolepis, Quercus lobata, Quercus wislizeni, Salix laevigata, Salix
Number of Native Species: 15
Number of Trees in CUFI: 294970
Number of Species in CUFI: 573
Number of Native Trees in CUFI : 5740
Number of Native Species in CUFI : 14
Percent Native Trees in CUFI: 2.4
Zoom to

Planning for resilient urban forests: A data-driven approach to assessing urban tree species suitability in California

Natalie Love, Ph.D.

Frost Postdoctoral Fellow

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May 11th, 2023

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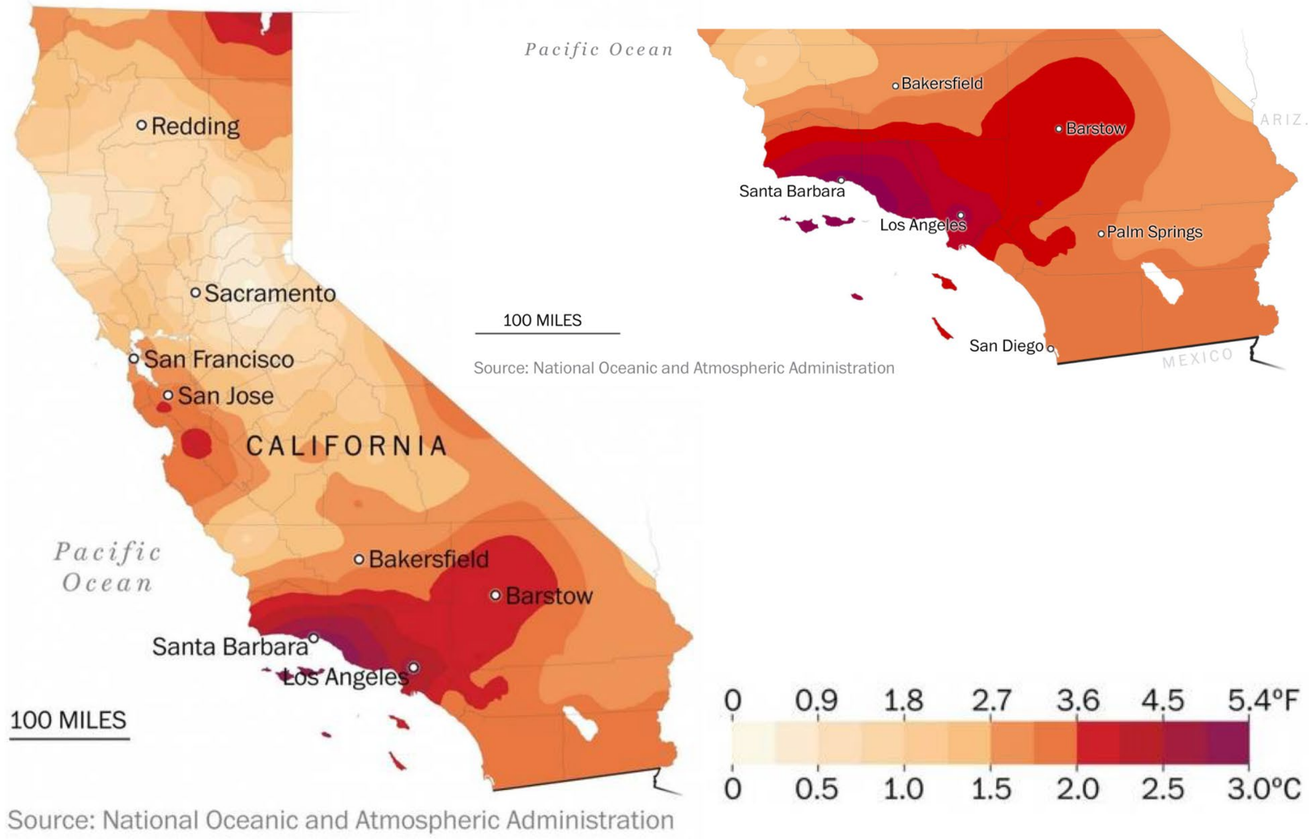
Urban forests and climate change

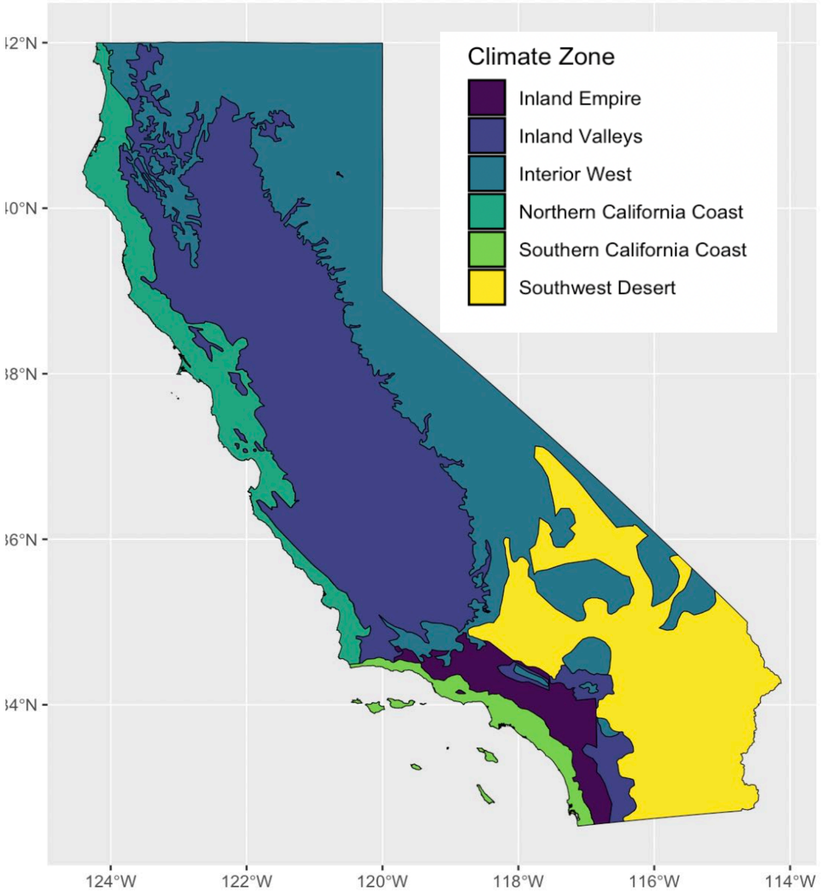
- To maintain canopy cover, we need to plant trees that will tolerate future climate
- **Can we use a data-based approach to predict which tree species will do well as the climate changes?**



Temperature change in California since 1895

Urban forests and climate change

- To maintain canopy cover, we need to plant trees that will tolerate future climate
- **Can we use a data-based approach to predict which tree species will do well as the climate changes?**
- **Can we make location-specific recommendations?**

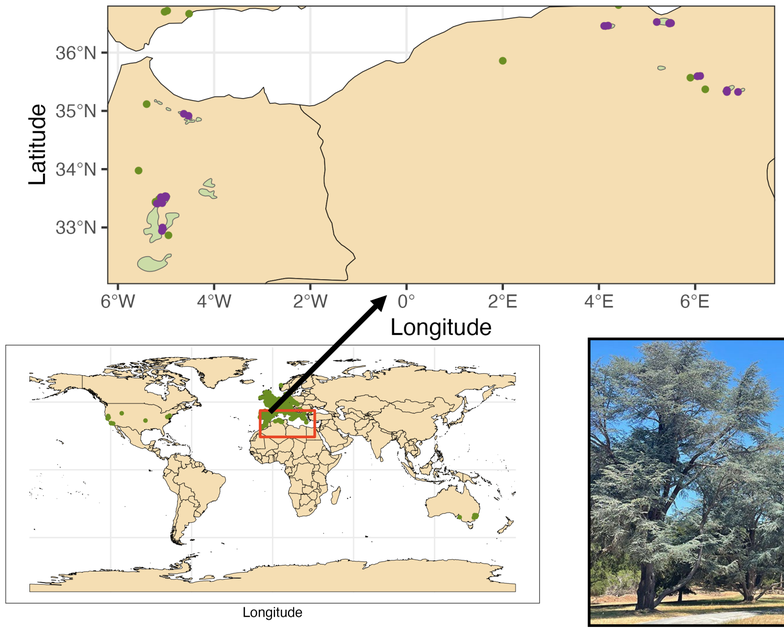


Climate zones delineated by McPherson et al. 2010

Modeling climate suitability of California's urban tree species

- 114 most common urban tree species

Occurrence data in native range



Atlas cedar
Cedrus atlantica

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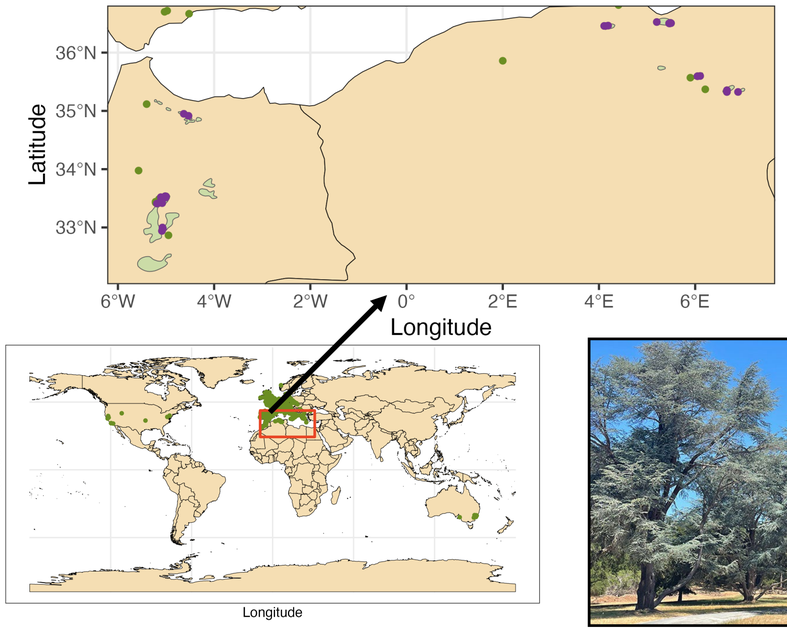
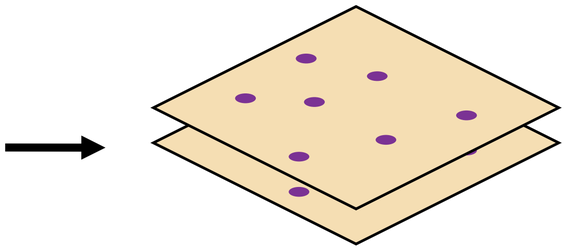


Climate data layers



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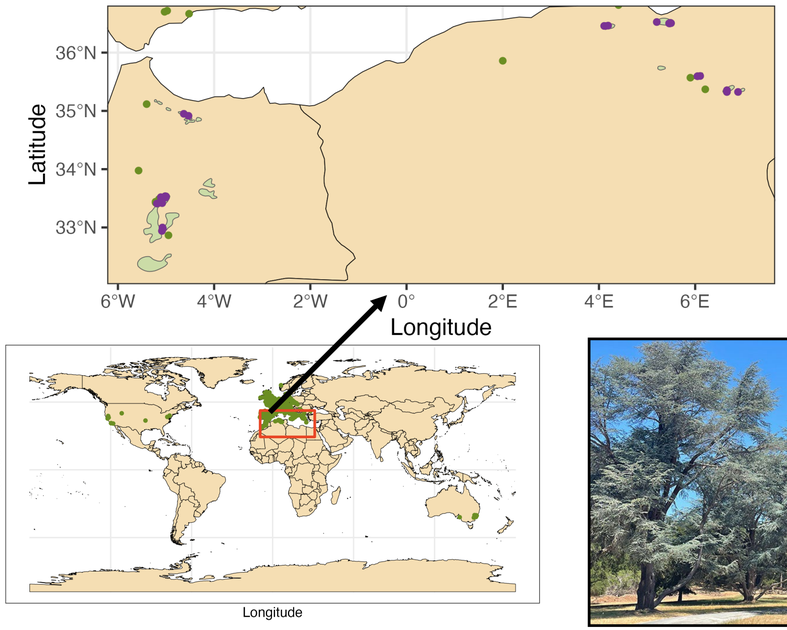

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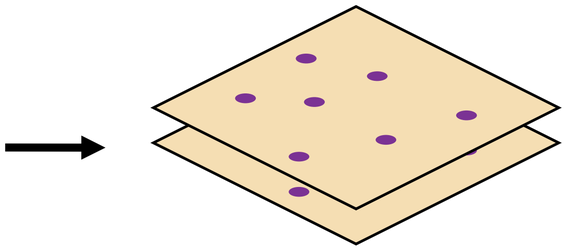
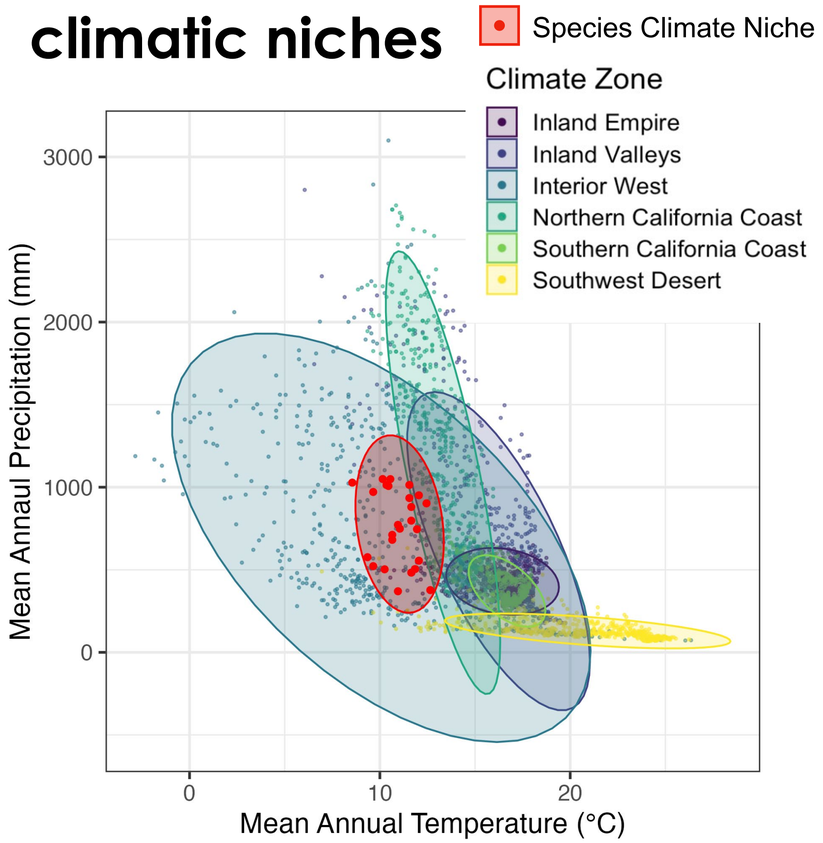


Atlas cedar
Cedrus atlantica

Construct climatic niches



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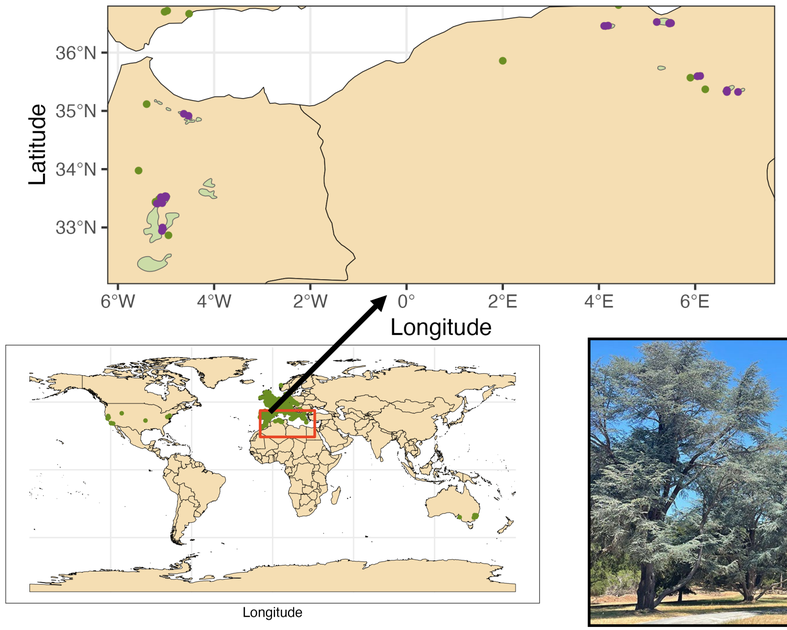
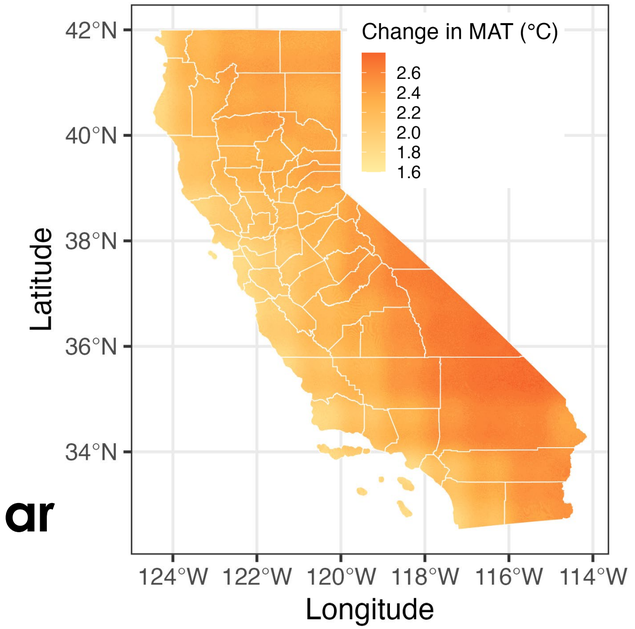


Atlas cedar
Cedrus atlantica

Predicted California Climate 2041-2070

Change in Temperature



Data from the CMIP6 GFDL-ESM4 SSP585 model available via CHELSA

Modeling climate suitability of California's urban tree species

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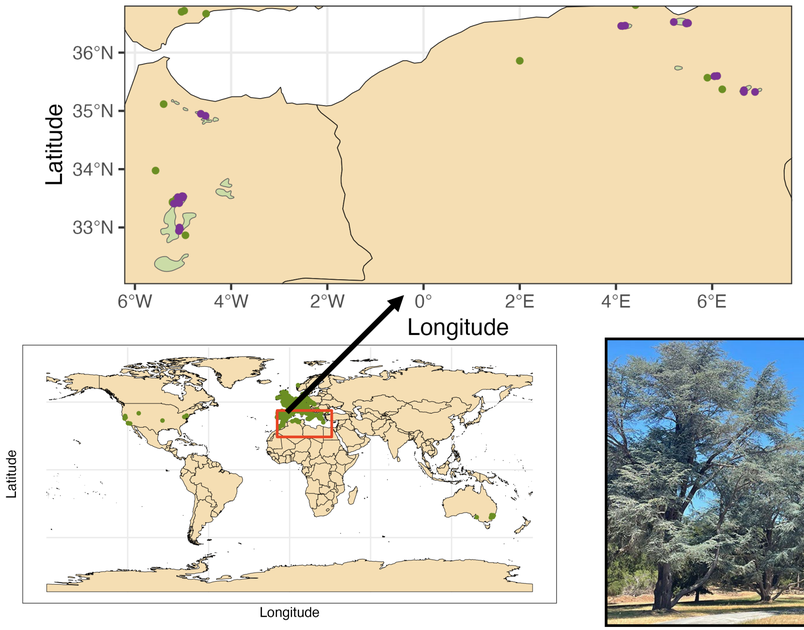
Occurrence data in native range



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Cedrus atlantica

Predicted California Climate 2041-2070

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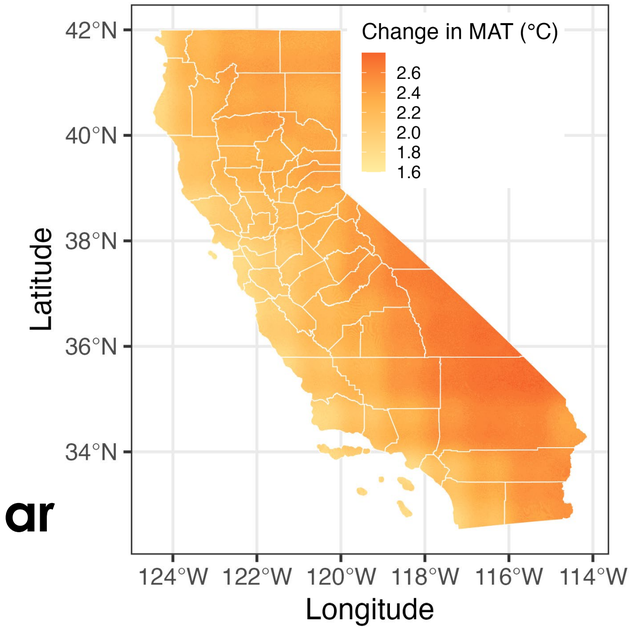
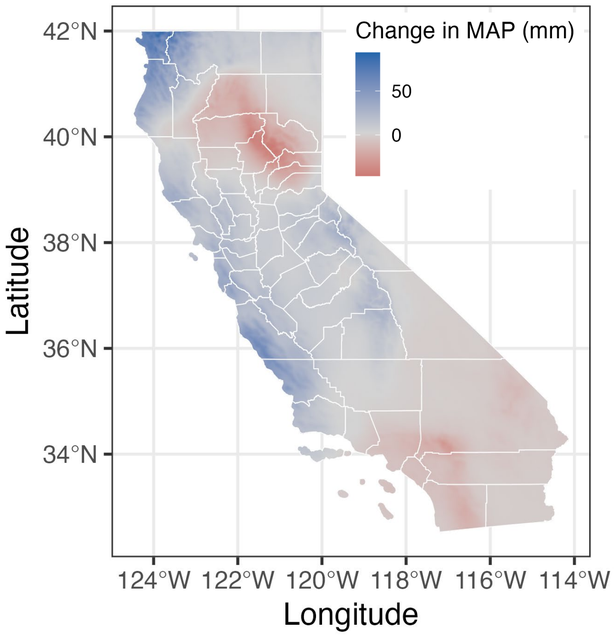


Change in Precipitation



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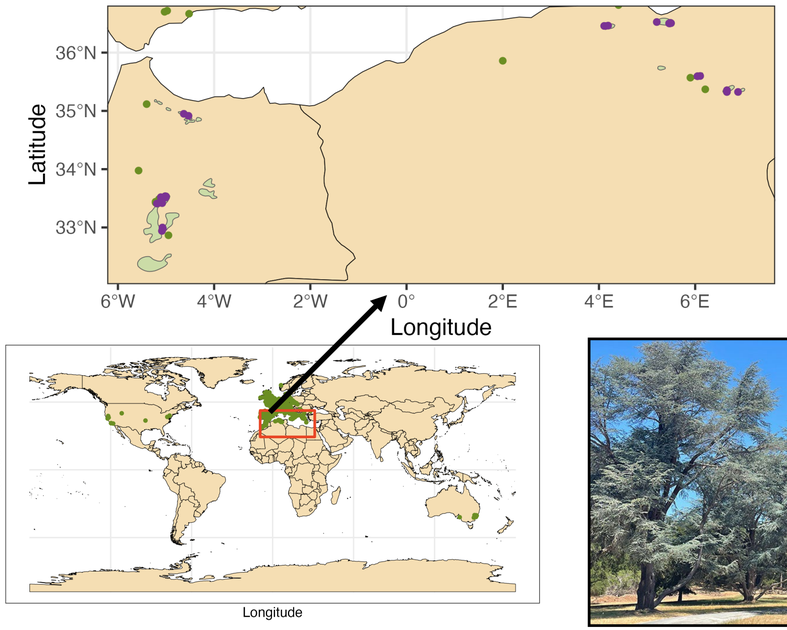
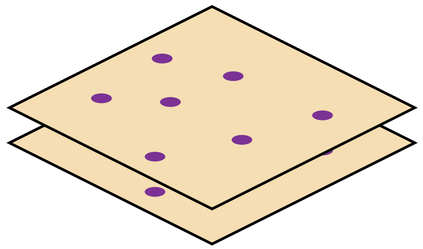


Future data layers



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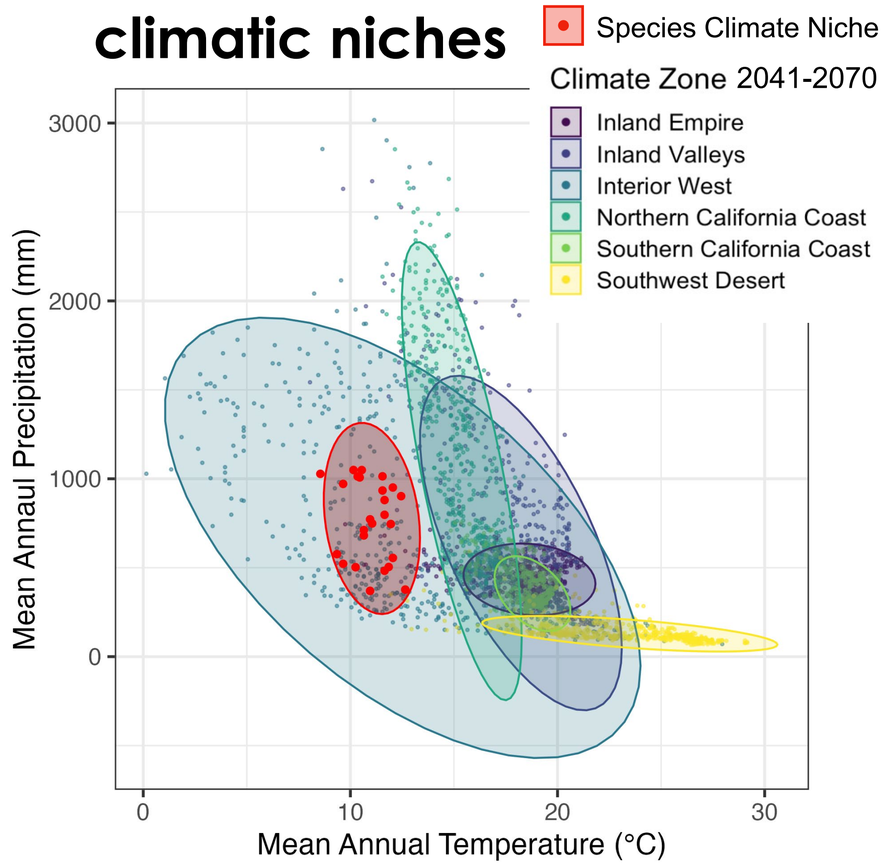

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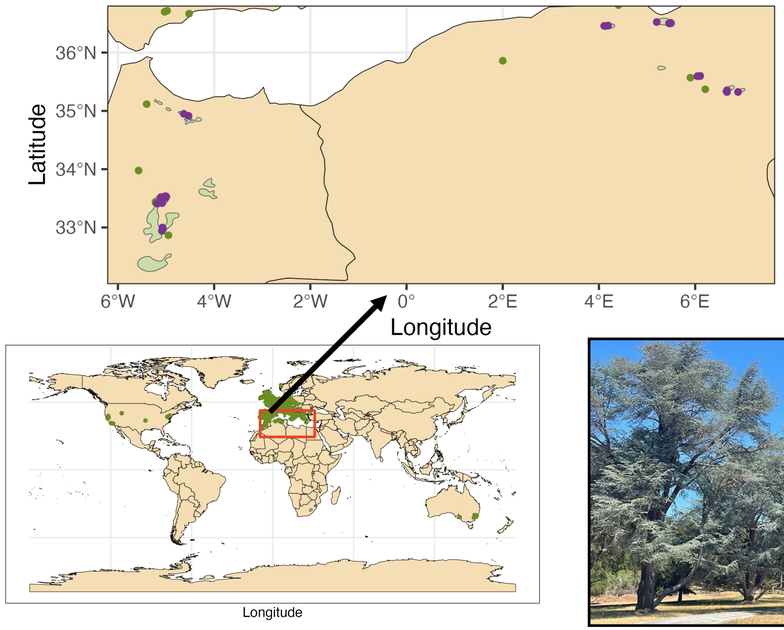
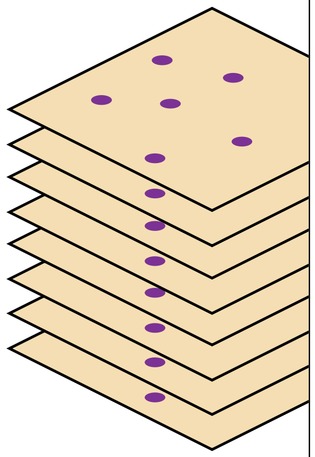


Climate data

8 variable



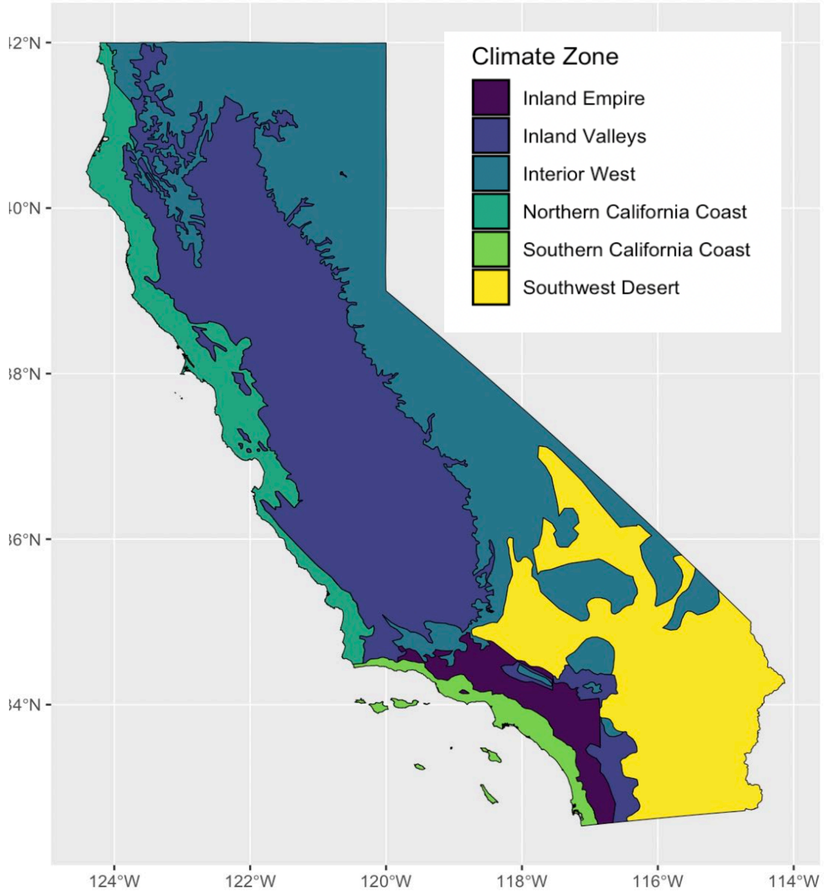
Atlas cedar

Cedrus atlantica

Atlas cedar is climatically well-suited for Inland Valleys and Interior West under current climate conditions

Current Suitability

Climate Zone	Percent Overlap
Inland Empire	3%
Inland Valleys	81%
Interior West	93%
Northern California	27%
Southern California Coast	<1%
Southwest Desert	15%



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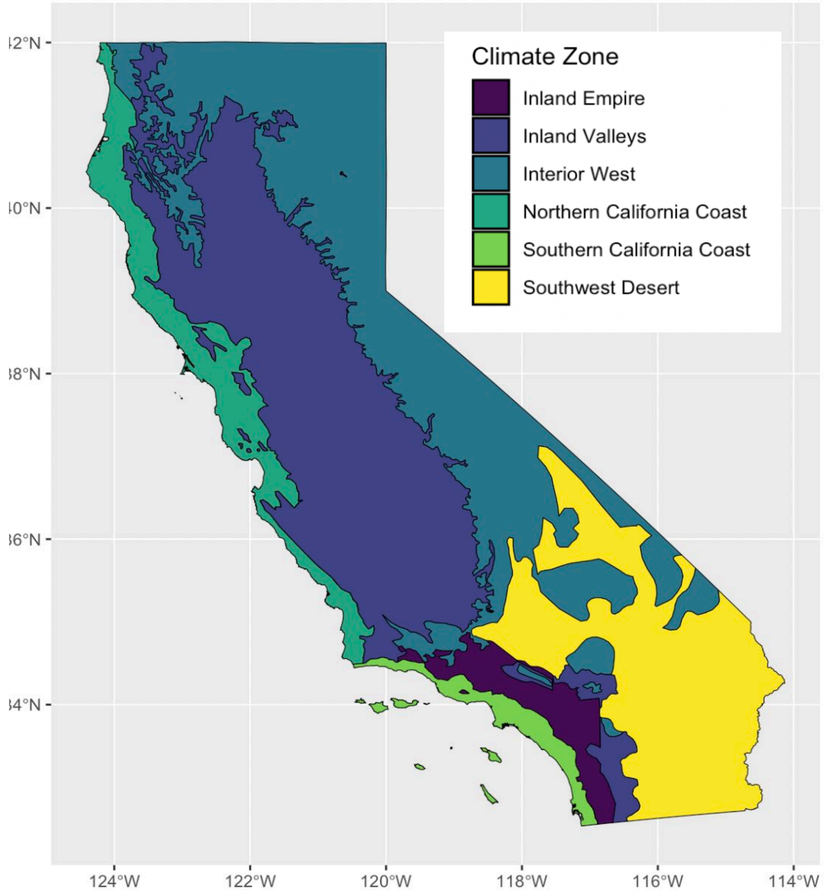
Southwest Desert	15%

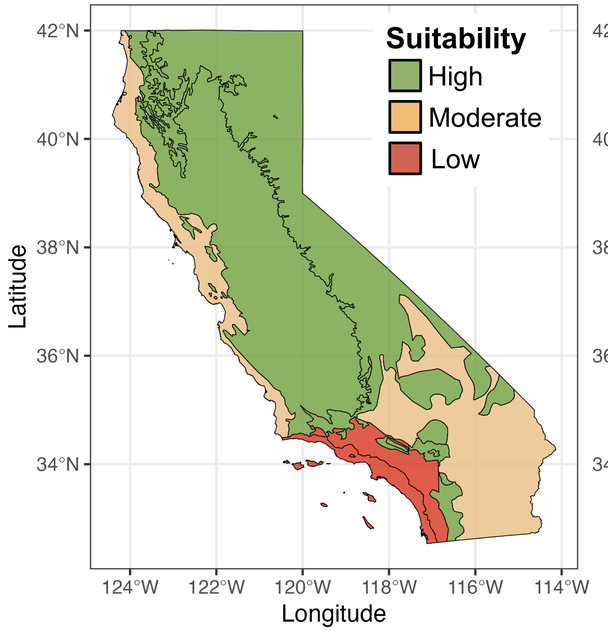
2041-2070 Suitability

Climate Zone	Percent Overlap
Inland Empire	<1%
Inland Valleys	20%
Interior West	28%
Northern California	51%
Southern California Coast	<1%
Southwest Desert	<1%

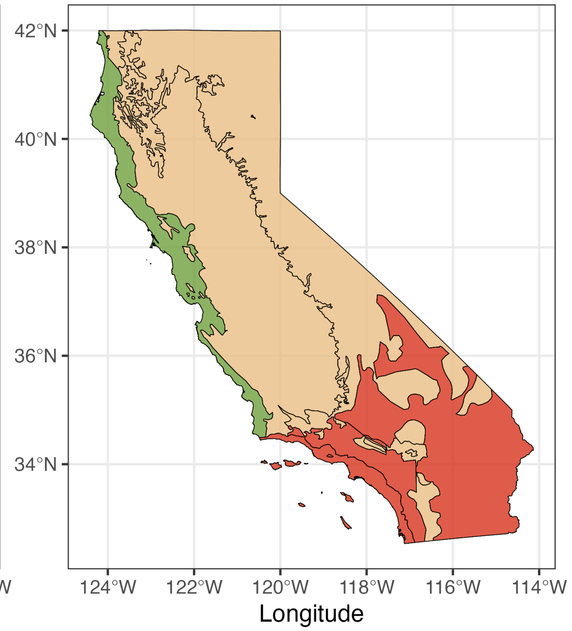


Atlas Cedar (*Cedrus atlantica*)

Current



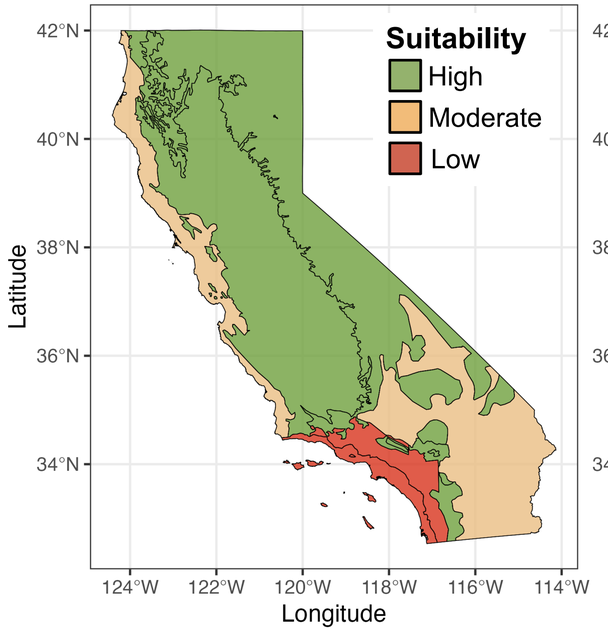
2041-2070



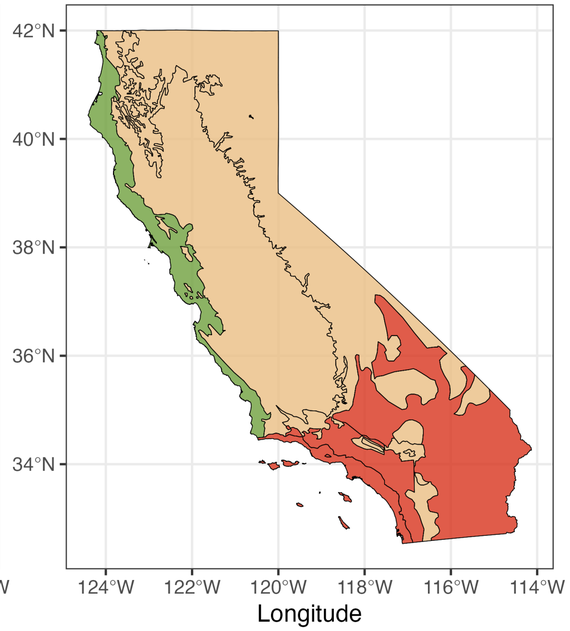
RESULTS

Atlas Cedar (*Cedrus atlantica*)

Current



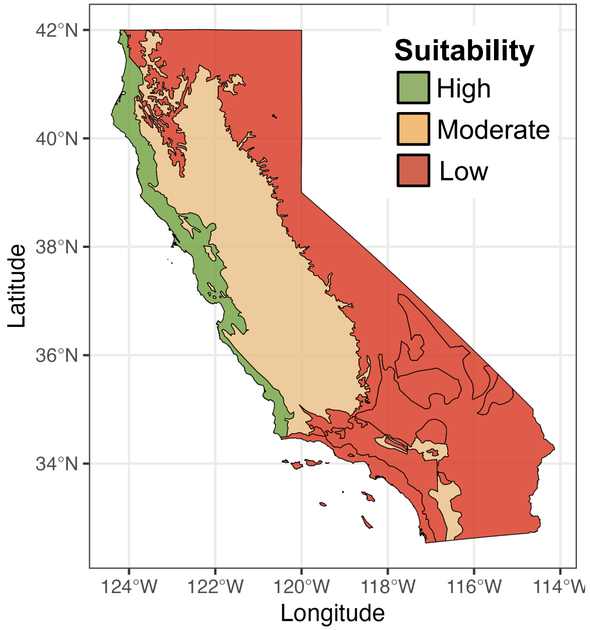
2041-2070



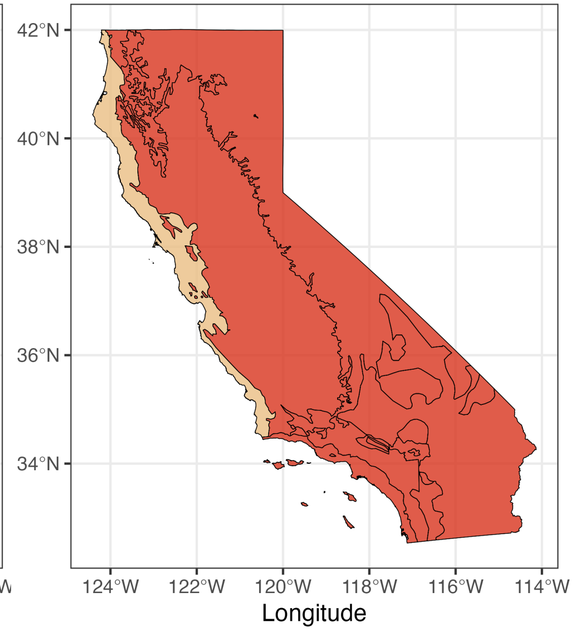
Coast Redwood (*Sequoia sempervirens*)

- Low suitability in the future
- 5th most common tree in Inland Valleys (61,000)

Current



2041-2070



Three suitable species for California's future climate

Interior Live Oak
(*Quercus wislizeni*)

- Suitable for Northern CA, Interior West, Inland Valleys
- CA native

Three suitable species for California's future climate

Interior Live Oak
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Blue Palo Verde
(*Parkinsonia florida*)

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Three suitable species for California's future climate

Interior Live Oak
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Blue Palo Verde
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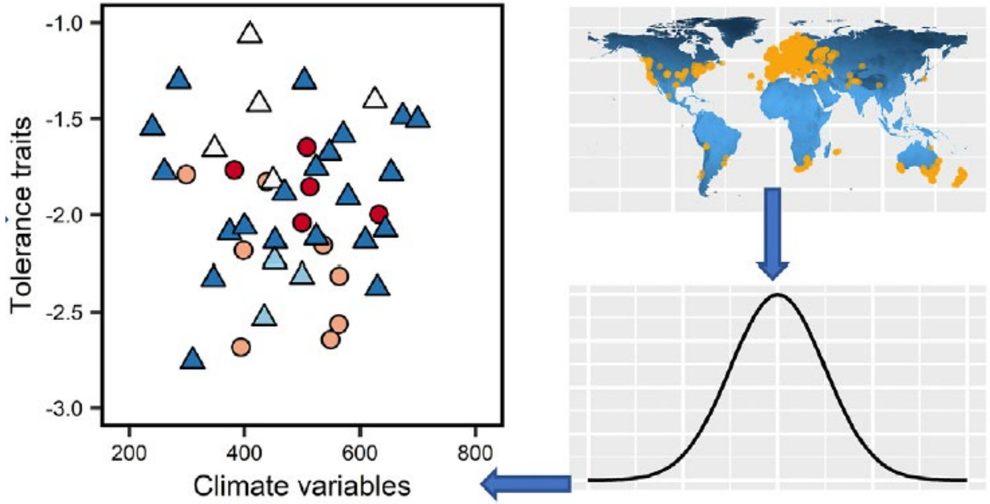
Manna Gum
(*Eucalyptus viminalis*)

- Suitable in Northern and Southern CA
- Native to SE Australia and Tasmania

Considerations for data-driven species selection

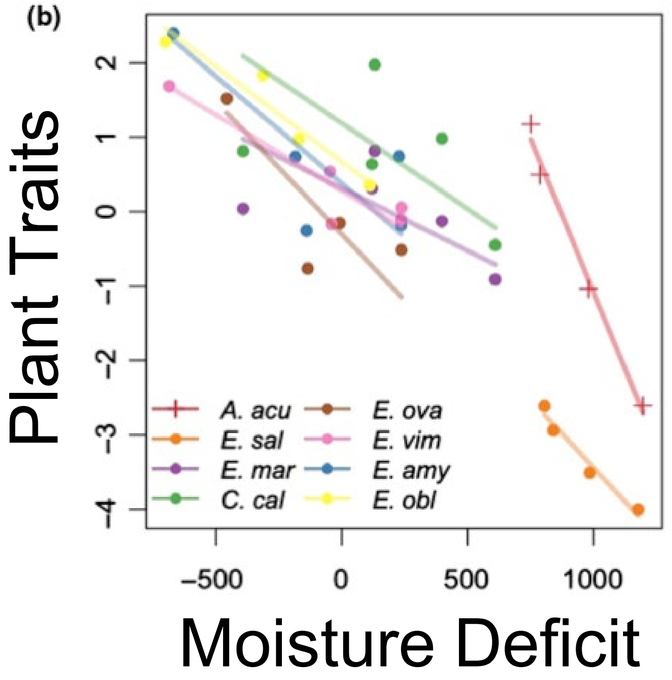
- Is tree physiology predicted by climate?



Global distribution of a tree speices does not predict drought or thermal tolerance traits (Hanley et al., 2021)

Considerations for data-driven species selection

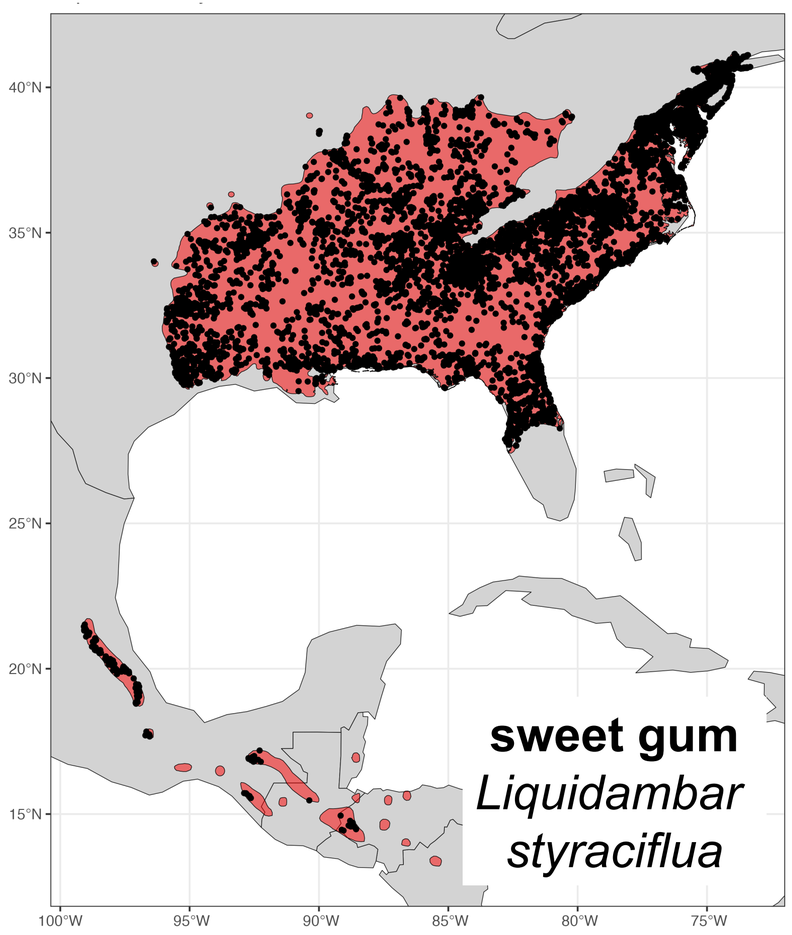
- Is tree physiology predicted by climate?



Moisture deficit predicts plant traits in wild populations (Anderegg et al. 2021)

Considerations for data-driven species selection

- Is tree physiology predicted by climate?
- Local population adaptation



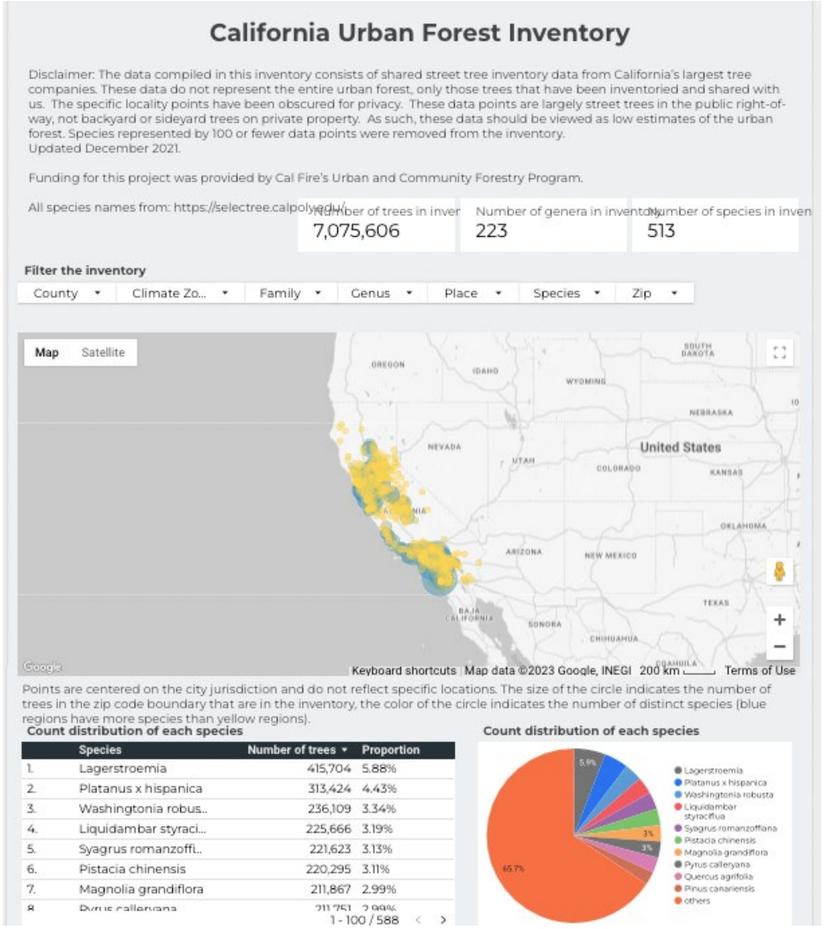
Considerations for data-driven species selection

- Is tree physiology predicted by climate?
- Local population adaptation
- Microregion considerations

Fremont Cottonwood
Populus fremontii

Considerations for data-driven species selection

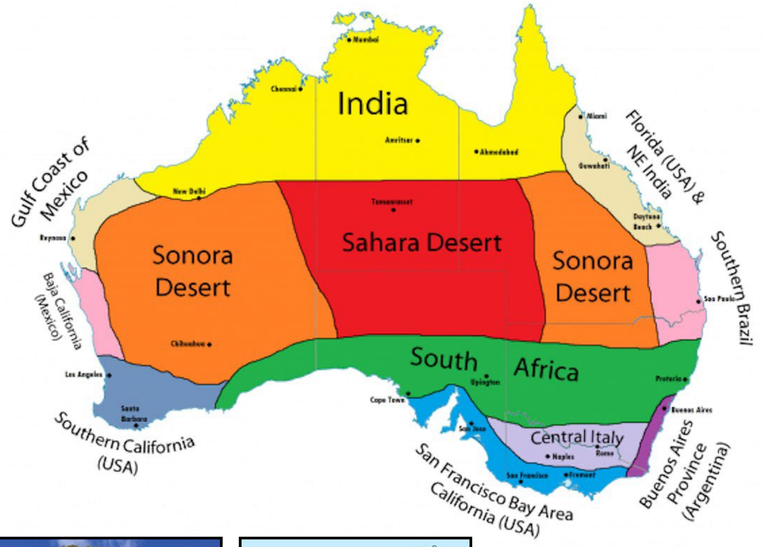
- Is tree physiology predicted by climate?
- Local population adaptation
- Microregion considerations
- Novel species for California's urban forest
  - Cities with similar climate (McBride and Laćan, 2018)



Considerations for data-driven species selection

- Is tree physiology predicted by climate?
- Local population adaptation
- Microregion considerations
- Novel species for California's urban forest
  - Cities with similar climate (McBride and Laćan, 2018)
  - Species' native range

Temperature Analogues in Australia



Salmon gum
Eucalyptus salmonophloia

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