

**San Diego County**  
**Plant Atlas Project:**  
a Partnership between Science  
and the Community



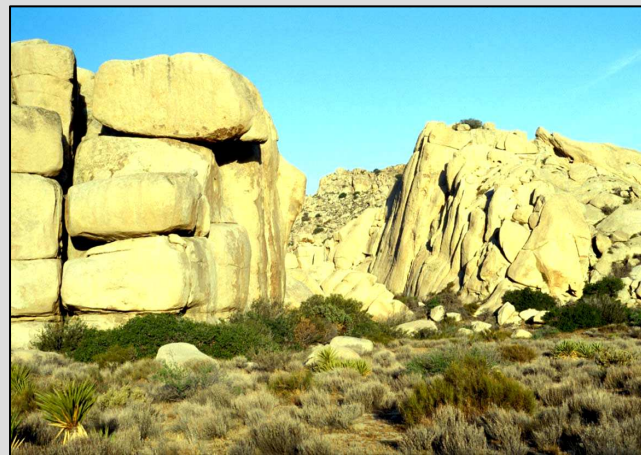
Jon P. Rebman, Ph.D.  
Curator of Botany  
San Diego Natural History Museum

# Mountain



*Foothill*

*Transition*



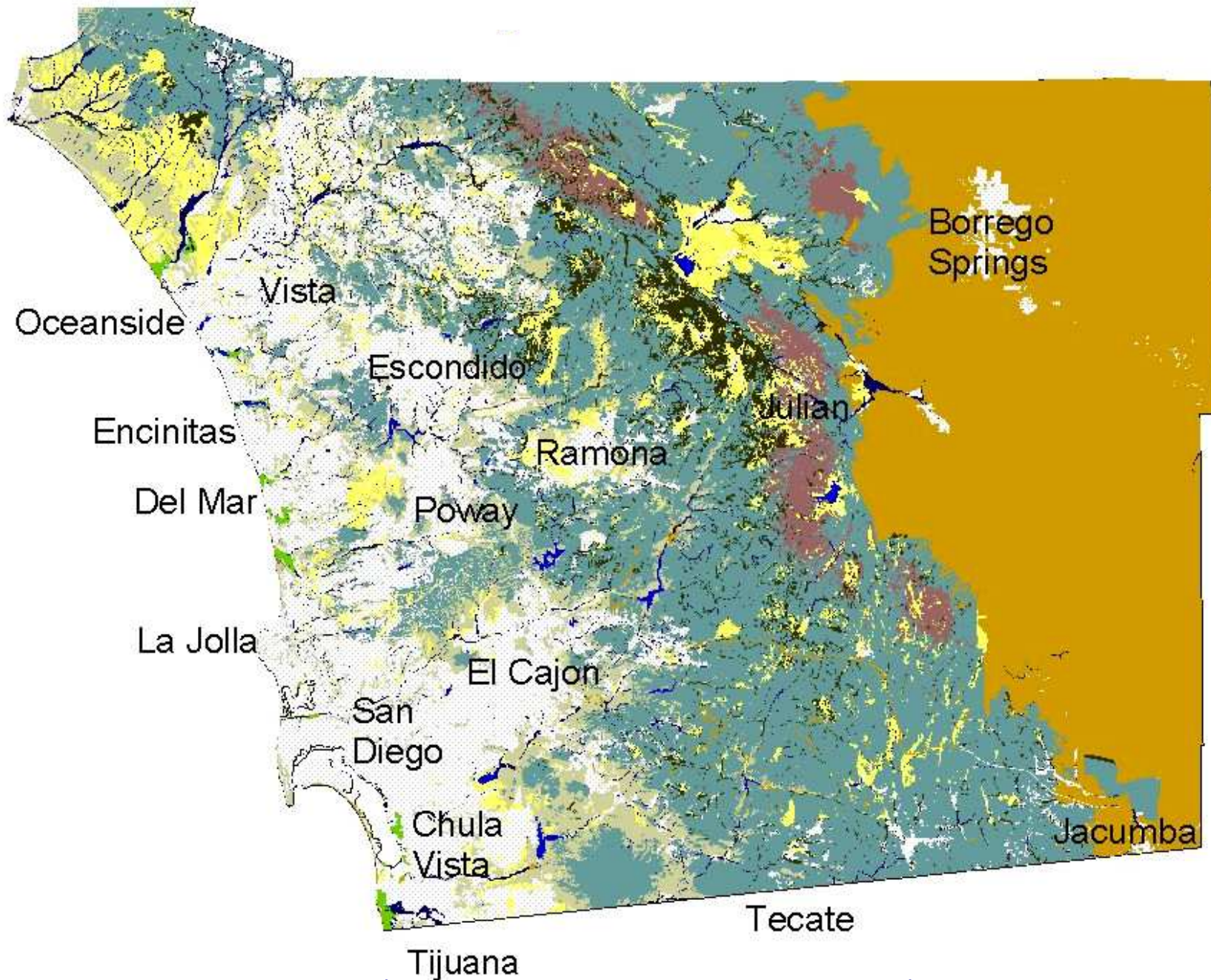
*Coast*

*Desert*



## Habitat Diversity





San Diego County Vegetation Types

**Plant  
Distributions  
from  
Mexico**



*Bahiopsis laciniata*



*Acanthomintha  
ilicifolia*



*Ornithostaphylos oppositifolia*

*Viguiera purissimae*



**Plant  
Distributions  
from the  
North**



*Pinus lambertiana*



*Boschniakia strobilacea*



*Nolina cismontana*

*Pilostyles thurberi*



*Carex obispoensis*

*Sibaropsis hammittii*



*Herissantia crisper*

**Strange Plant  
Distributions  
in  
San Diego County**

**Plants Endemic  
to  
San Diego Co.**



*Pogogyne abramsii*



*Pinus torreyana ssp. torreyana*



*Cylindropuntia wolfii*



*Bloomeria (Muilla) clevelandii*

# How diverse is San Diego County?







In respect to floristic richness (no. of species), San Diego County is the most diverse county in the contiguous United States!

# San Diego County's Flora

- 2,314 documented plant taxa (including subspp. & vars.)
- 2,143 plant species (1,573 [73.4%] native spp.)
- 579 [25%] non-native and naturalized taxa
- 26 endemics, plus many near-endemics
- Over 220 sensitive plant taxa
- More present, need to be vouchered!!



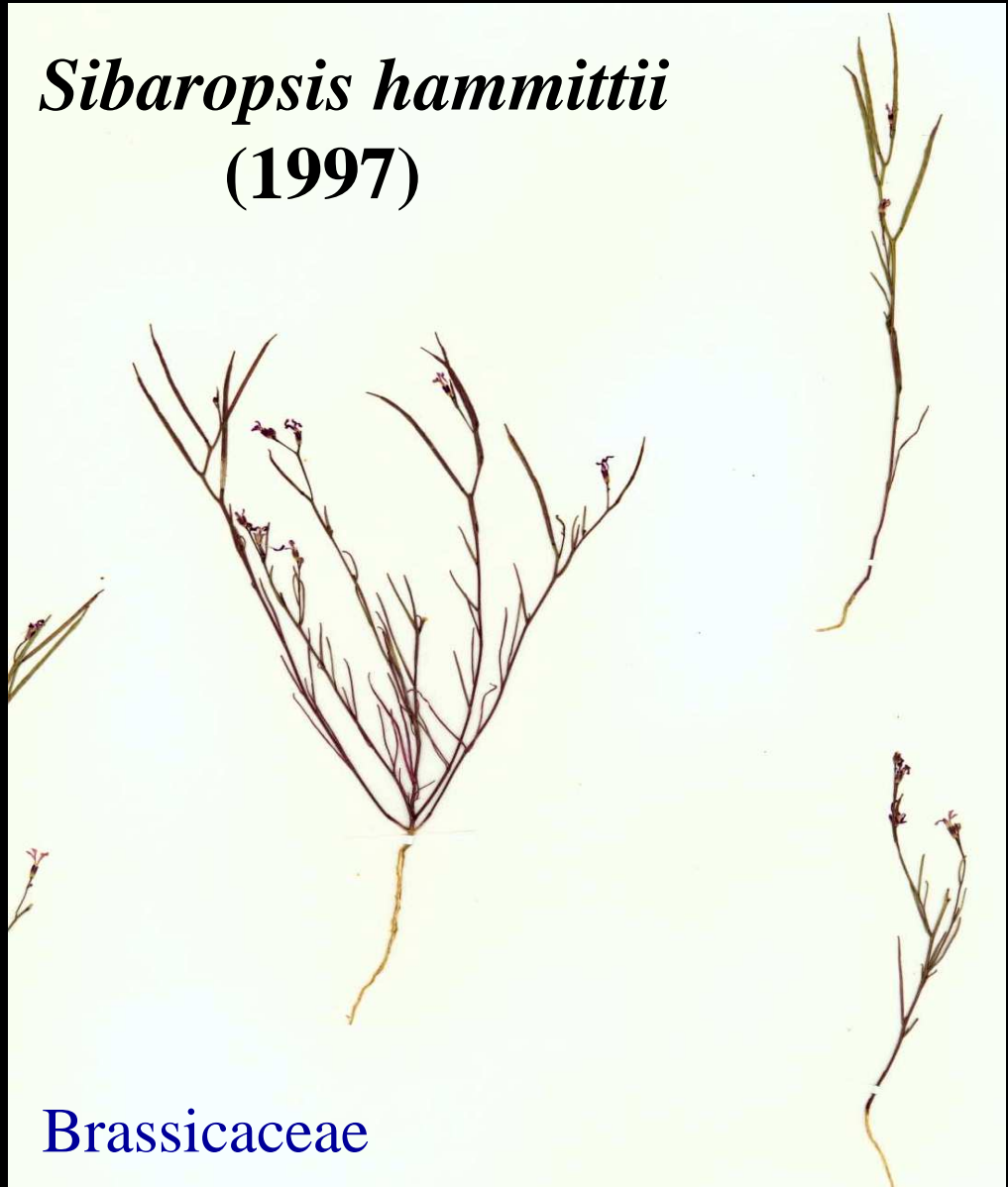
Based on Rebman & Simpson 2006

*Downingia concolor* var. *brevior*

# What new plant species are yet to be discovered in our region?



*Sibaropsis hammittii*  
(1997)



Brassicaceae

*Boechera (Arabis) hirshbergiae*  
(1998)



Brassicaceae



*Eryngium pendletonense*  
(1999)



Apiaceae

*Monardella stoneana*  
(2004)

Lamiaceae



# Where are the new species?

- 1968-1986: 219 new plants described from California (avg. = 11 new taxa/year in CA) \*
- At least 300 new plants are still undiscovered for the state of California \*
- 4844 native spp. in CA and 1534 spp. in San Diego County = 32%
- Possibly 96 new spp. in San Diego County

\* Reference: Ertter, B. 2000. Floristic surprises in North America North of Mexico. *Ann. Missouri Bot. Gard.* 87: 81-109.

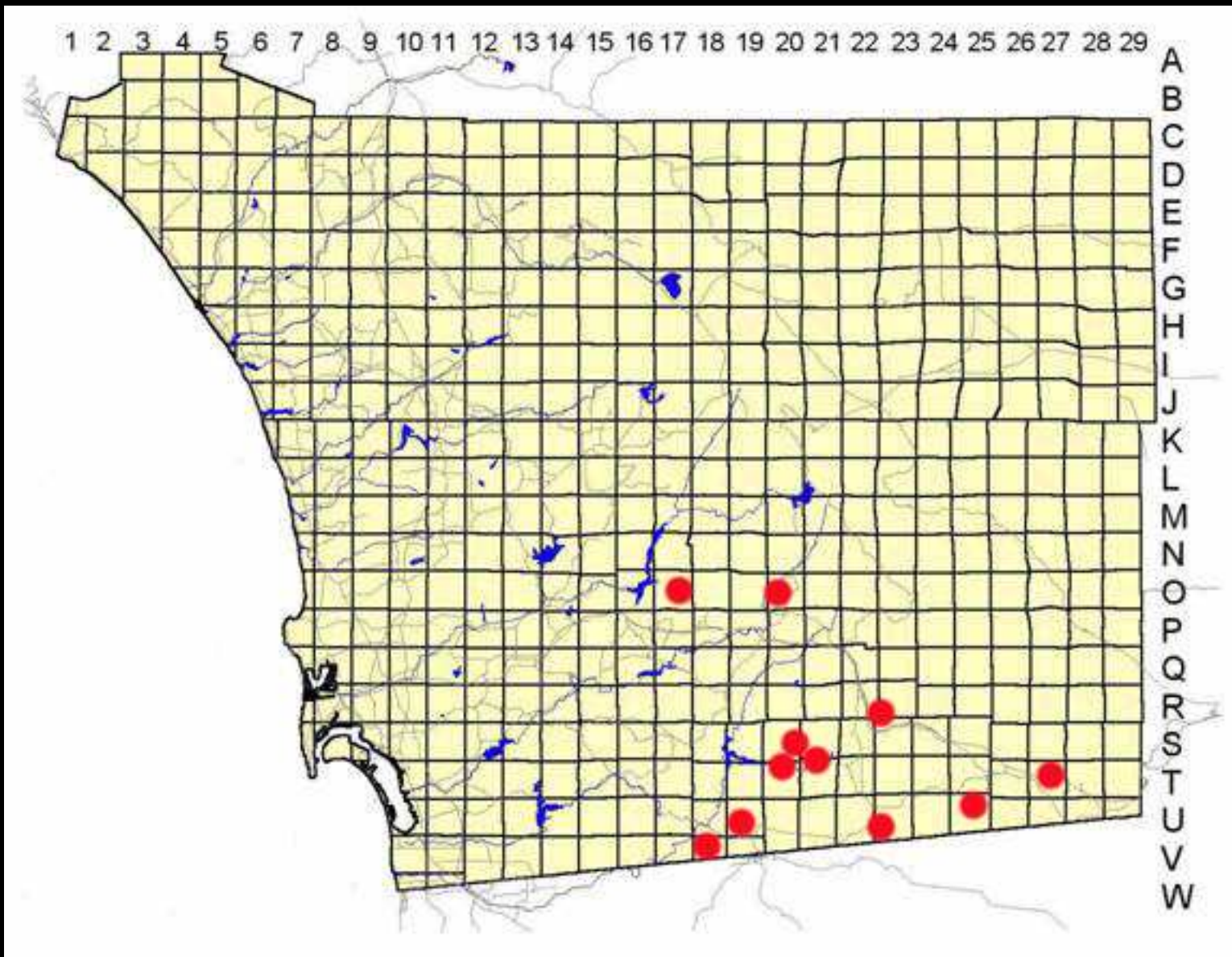


*Pentagramma*  
*triangularis*  
subsp. nov.

Pteridaceae



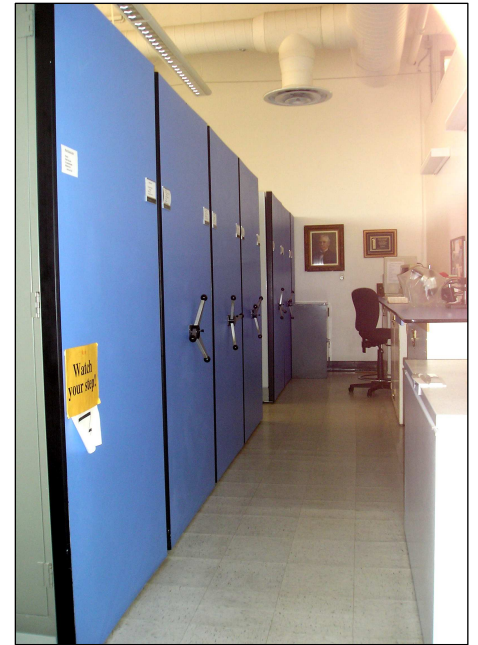




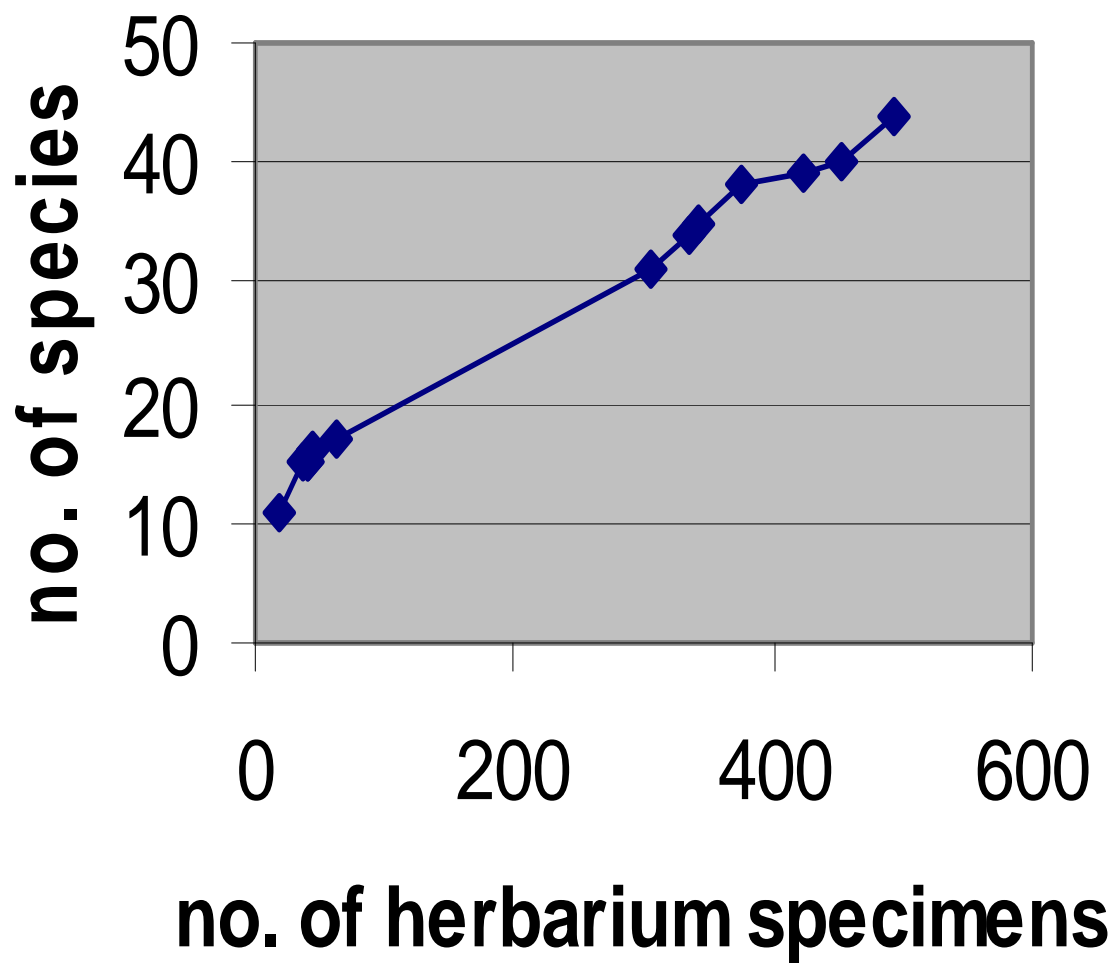
*Pentagramma triangularis* subsp. nov.

## SD Herbarium

- **Approx. 170,210 accessioned specimens**
- **Estimated holdings include over 70,000 vascular plants from CA (35,000 in San Diego Co.) and 50,000 from Mexico (mostly Lower CA)**
- **Many specimens date to 1870's**
- **~5,000 algae, 1,000 lichens, 100 fungi, 100 bryophytes**
- **383 types & searchable online**
- **61% of collection is databased**



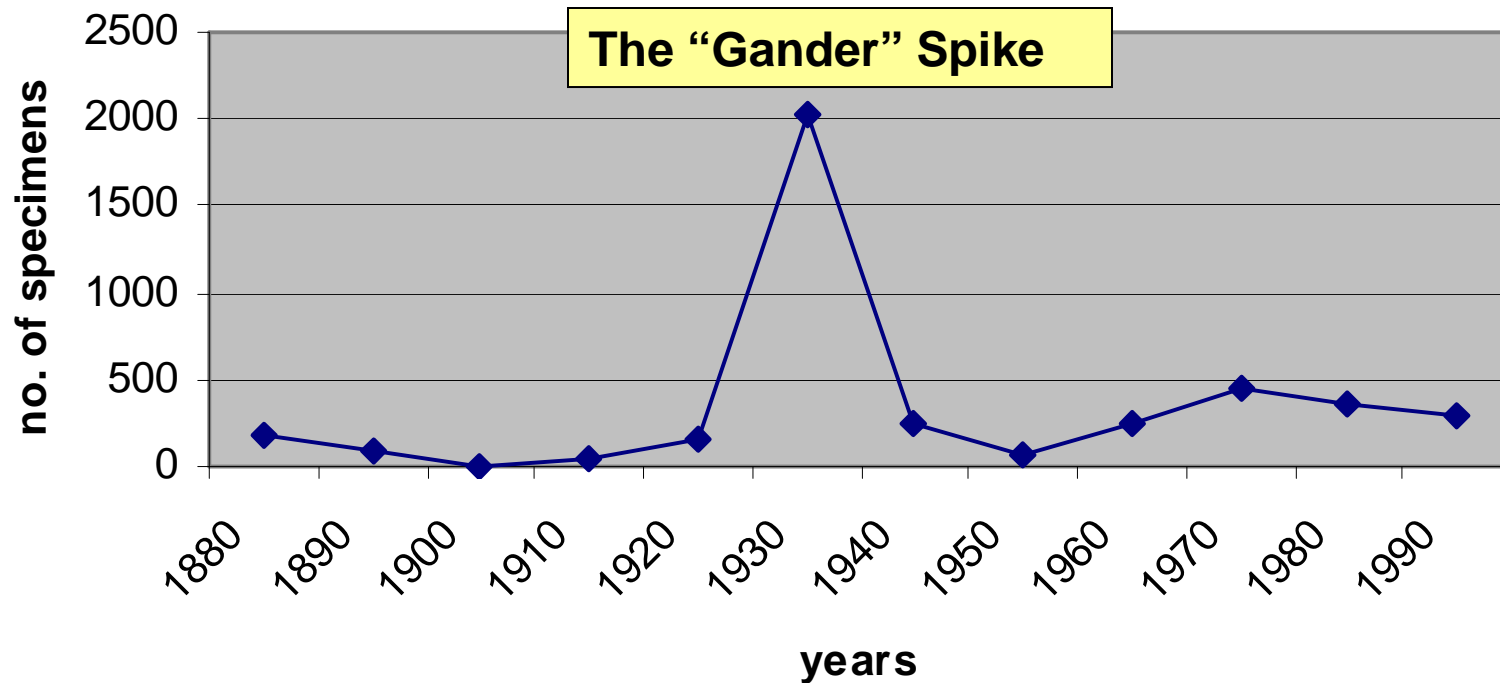
## Apiaceae collections



Data from SD Herbarium electronic database

It has been over 70 years since the last major collection effort

### Herbarium collections of Asteraceae and Brassicaceae added each decade



Data from SD Herbarium electronic database

## **How does the lack of voucher specimens affect our scientific knowledge of plants?**

- **Plant distributions are poorly known (biogeography)**
- **High diversity areas are not identified**
- **Morphological variation between populations not well understood (plasticity/taxonomic boundaries)**
- **Field observations can be wrong (misidentifications)**
- **No way to correct lists that are not vouchered (e.g., changes in taxonomic schemes)**
- **Checklists can not be used for other studies (anatomy, reproductive biology, DNA studies)**

# Threats to the native flora

- **Habitat loss** (urbanization, agricultural development)
- **Habitat degradation** (pollution & disturbance to native ecosystems)
- **Competition with invasive plant species** (displacement by exotics)
- **Fragmentation effects to natural communities** (reproductive isolation)
- **Changes in fire regimes** (intensity & frequency)
- **Lack of floristic knowledge or understanding** (ignorance of regional diversity and plant natural history)



Rare habitats impacted by land type conversion  
e.g. vernal pools

Most located on military lands (Miramar, Pendleton)

Many rare species such as: *Pogogyne*,  
*Navarettia*, *Ophioglossum*



*Ceanothus verrucosus*

# Urban Canyons

*Cylindropuntia  
californica  
var. californica*





# Fire Effects



# **What can be done to increase our botanical knowledge of the flora?**

- **Stimulate more interest in the entire flora, not just sensitive species (plant diversity surveys)**
- **Promote botanical studies that require voucher methods**
- **Document exotics, lower plants, and fungi**
- **Support/Participate in the Plant Atlas Project!**

**San Diego County**



**Plant Atlas Project**

## San Diego County Plant Atlas

# What is the San Diego County Plant Atlas?

■ A project to document the floristic diversity of the County through the collection of plant specimens/vouchers that will be housed in the SD Herbarium.



A banner for the San Diego County Plant Atlas. It features a yellow background with a white star on the left and a blue and white pattern on the right.

## San Diego County Plant Atlas

### What makes this project unique:

- 🌱 Focus is on an international *hotspot* of biodiversity
- 🌱 Based upon *voucher specimens*
- 🌱 Initiates *new collections*
- 🌱 Incorporates *historic* collections
- 🌱 Develops a new *training* program
- 🌱 *Results* available online immediately
- 🌱 *Links* with County Bird & Mammal Atlases
- 🌱 Engages the *community* in their regional natural science

# Parabotanist Program

**GOAL:** to improve our scientific knowledge and documentation of the flora of San Diego County by training members of the public how to survey, inventory, and voucher plants in natural areas throughout the region.

**OBJECTIVES:** to foster the public's awareness of local natural history; to increase our scientific collections of the regional flora; to gain a better understanding of the distribution, variation, and diversity of the plants in San Diego County.



## San Diego County Plant Atlas

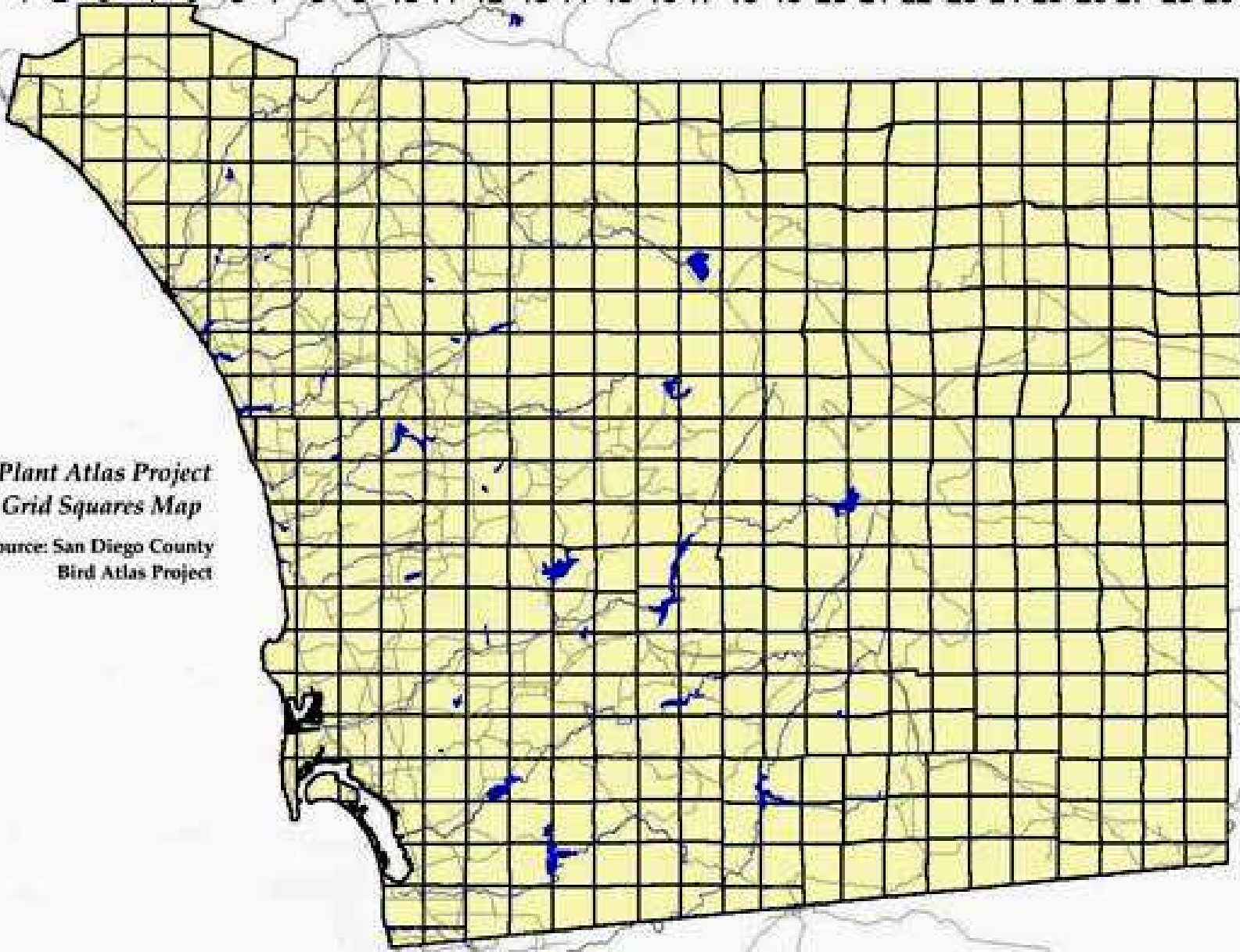
# Maps and the Grid System

- ▣ County divided up into 477 grid squares
- ▣ Each square is 3 miles on a side
- ▣ Each square is 9 Sections
- ▣ Parobotanists may adopt one or more squares
- ▣ Parobotanists may share squares with others

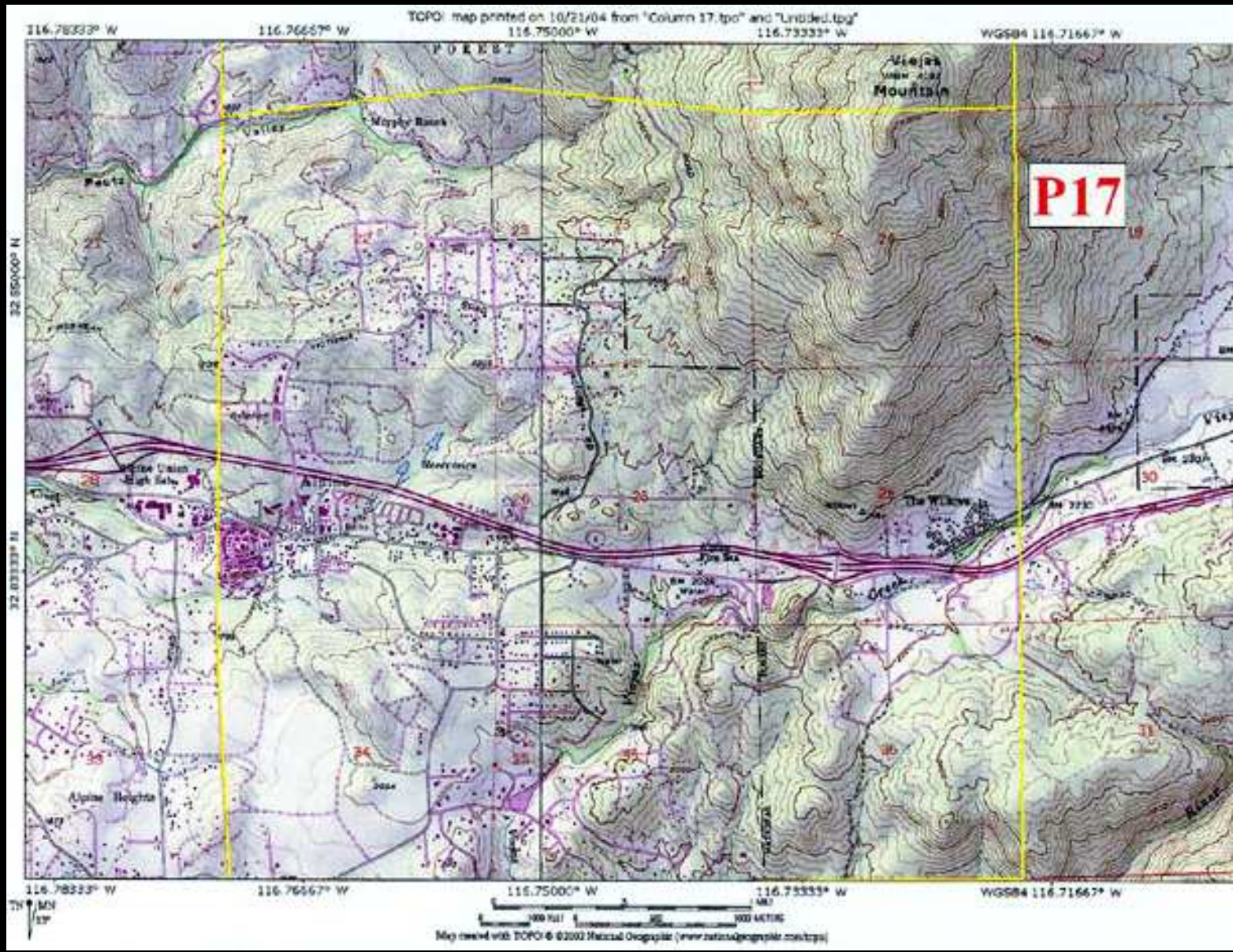
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

A  
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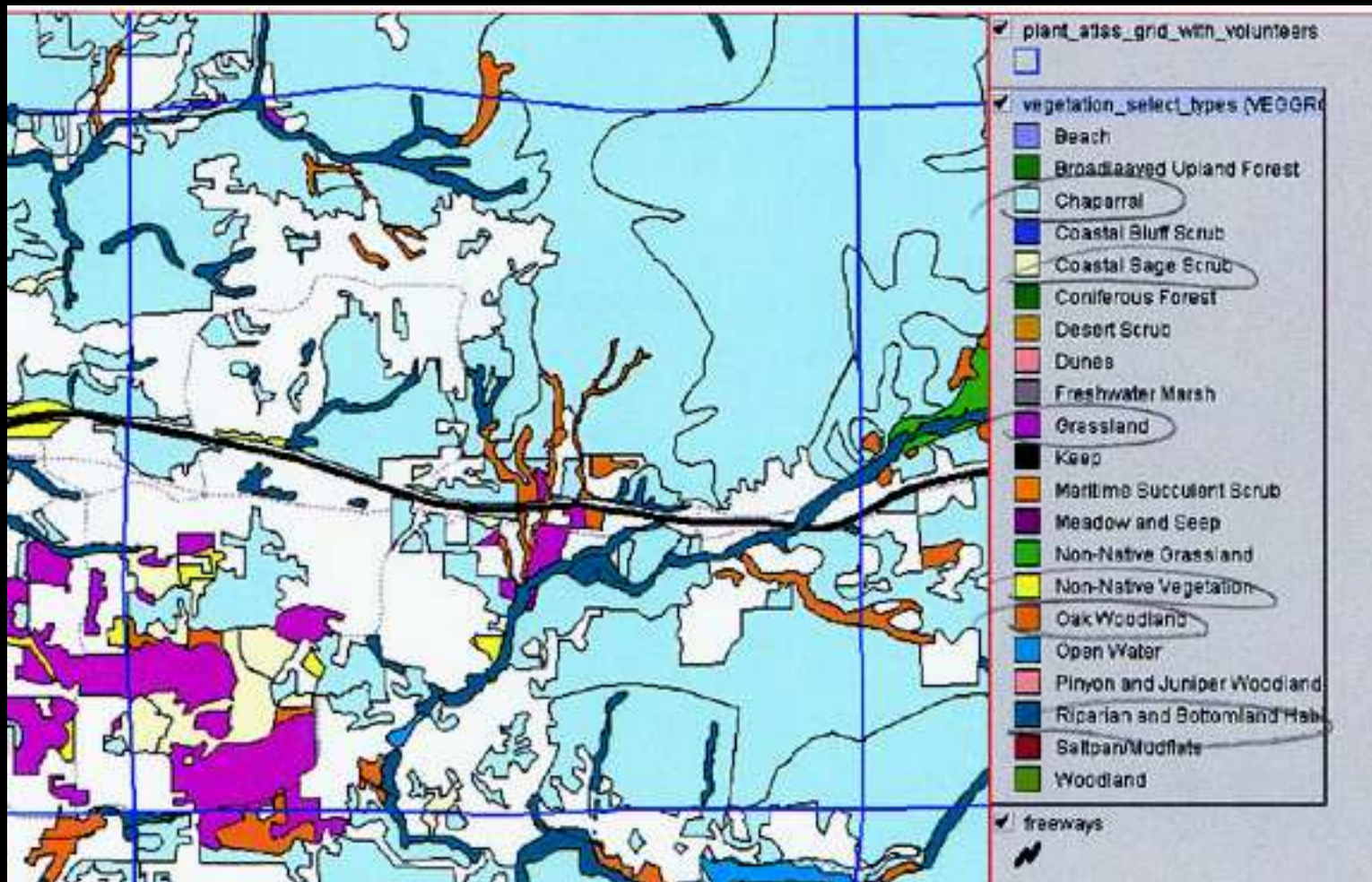
*Plant Atlas Project  
Grid Squares Map*  
Source: San Diego County  
Bird Atlas Project







Topographical Map



Vegetation Map



Field work! Collect the plant specimens, place in field press, record data about the plant and the location

## What to Collect?

- Native plant species
- Non-native, naturalized species
- Representative, museum-quality voucher specimens
- One specimen of each plant species found in each grid square



*Cylindropuntia ganderi*

## What NOT to Collect?

- ❗ **Special Status Species (over 200)!**
- ❗ Cultivated (irrigated) plants from lawns and gardens
- ❗ Anything on private property without permission to be there and to collect
- ❗ Anything from public land without a permit



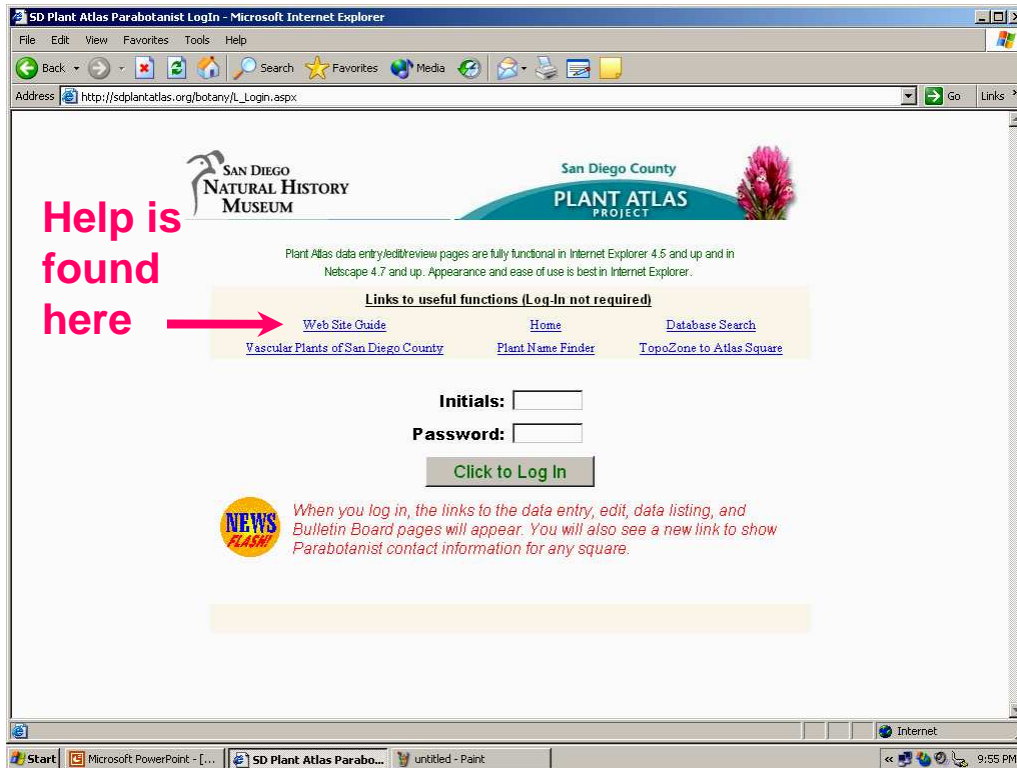
*Pogogyne  
nudiuscula*



Cleaning, clipping, and  
arranging specimens in the  
← plant press sandwiched  
between cardboard  
blotters

→  
Press is tightened and  
plants are pressed and  
dried for 1 to 2 weeks





Locality coordinates for point data are found on [topozone.com](http://topozone.com), Google Earth, or with a GPS unit

Parobotanist enters data using our online data entry system found on the website

Data entry needs to be done in a timely manner so that:

-information is not forgotten

-other people can query the database to find out what has already been collected so they don't duplicate your effort!



Plants in presses being dried in our dryer

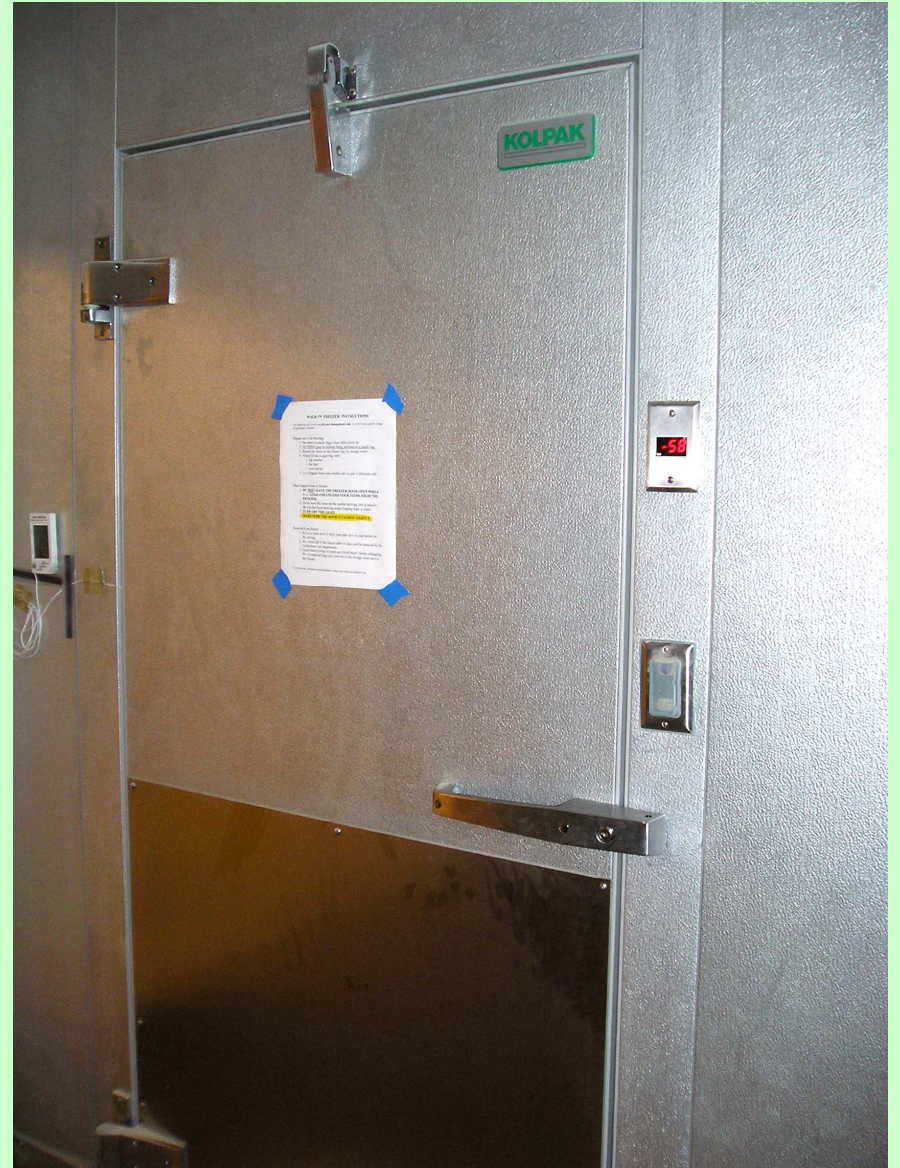


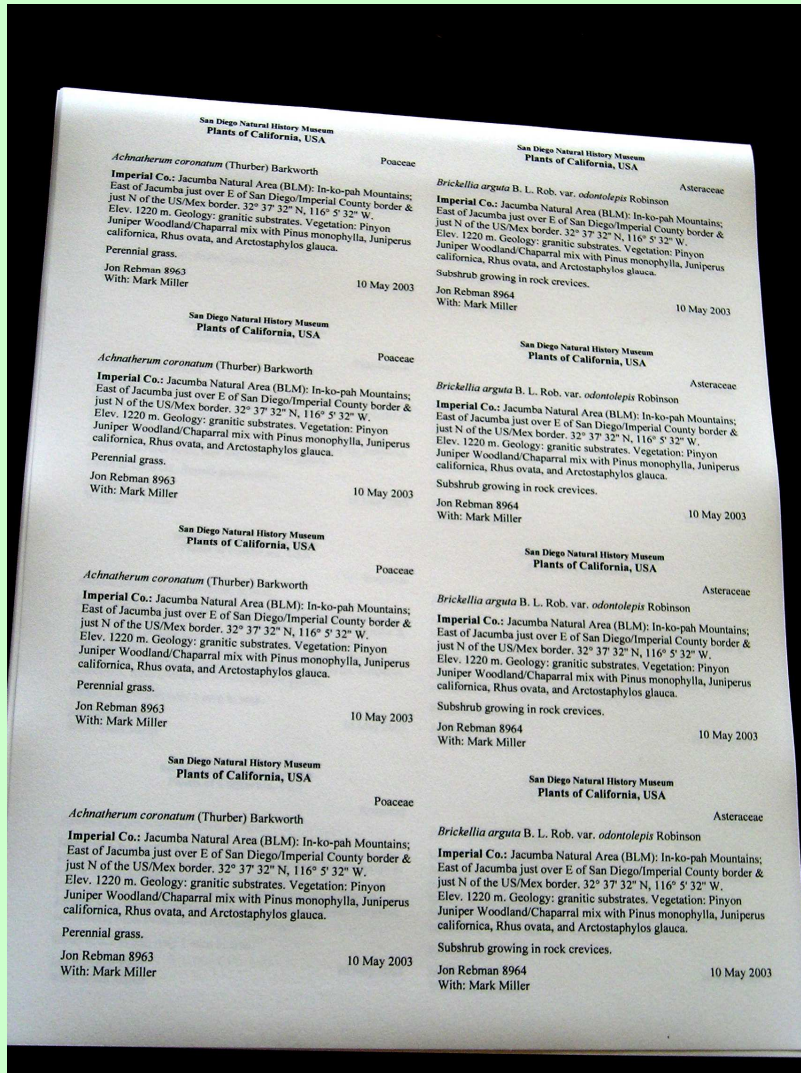
Plants submitted to SDNHM along with a completed form





Submitted specimens  
are frozen to kill pests





Labels (containing the field data that was entered online by the parobotanists) are printed and hand-cut.



Labels are added to each specimen, and they are then organized by plant family, awaiting verification



Each specimen is identified or verified by a botanist, and labels are annotated



Volunteers affix plants and labels onto the 11.5 in. by 16.5 in. sheets of acid free paper

# Challenges for the Atlas Project (both expected & unexpected)

- Recruiting enough volunteers
- Maintaining, organizing, supporting, and stimulating volunteers
- Increasing the efforts of plant specimen mounting to reduce voucher backlog
- Permit/Access problems for plant collecting activities
- Quality control measures for online data and label info.
- Development of procedures for submitting and processing vouchers
- Verification/Identification of specimens
- Staffing
- Storage and filing of new specimens

A decorative banner at the top of the slide. On the left, there is a stylized white flower with green leaves. The text "San Diego County Plant Atlas" is written in a black, serif font on a yellow background. To the right of the text, there is a faint, artistic illustration of a landscape with mountains and a body of water.

## San Diego County Plant Atlas

### Success to Date:

- New website, internet resources, and online database searches
- Database has over 23,300 entries based on voucher specimens only
- Verified ~ 19,800 specimens
- Discovered approx. 200 new County records (8% increase in the flora) & 1 new taxon
- Taught 30 training classes
- Trained over 540 parobotanists
- Secured various financial grants & contracts



San Diego County Plant Atlas Project

[Introduction](#) [Project News](#) [Public Resources](#) [Website Tools](#) [Parabotanist's Resources](#) [Forms](#) [Parabotanist's FAQ](#)

[Plant Name Finder](#)  
[TopoZone to Atlas Square](#)  
[SD Wildflower Identification](#)



*This project is sponsored by the  
San Diego Natural History Museum,  
Department of Botany  
Jon Rebman, Ph.D., Curator of Botany  
Mary Ann Hawke, Ph.D., Project Director  
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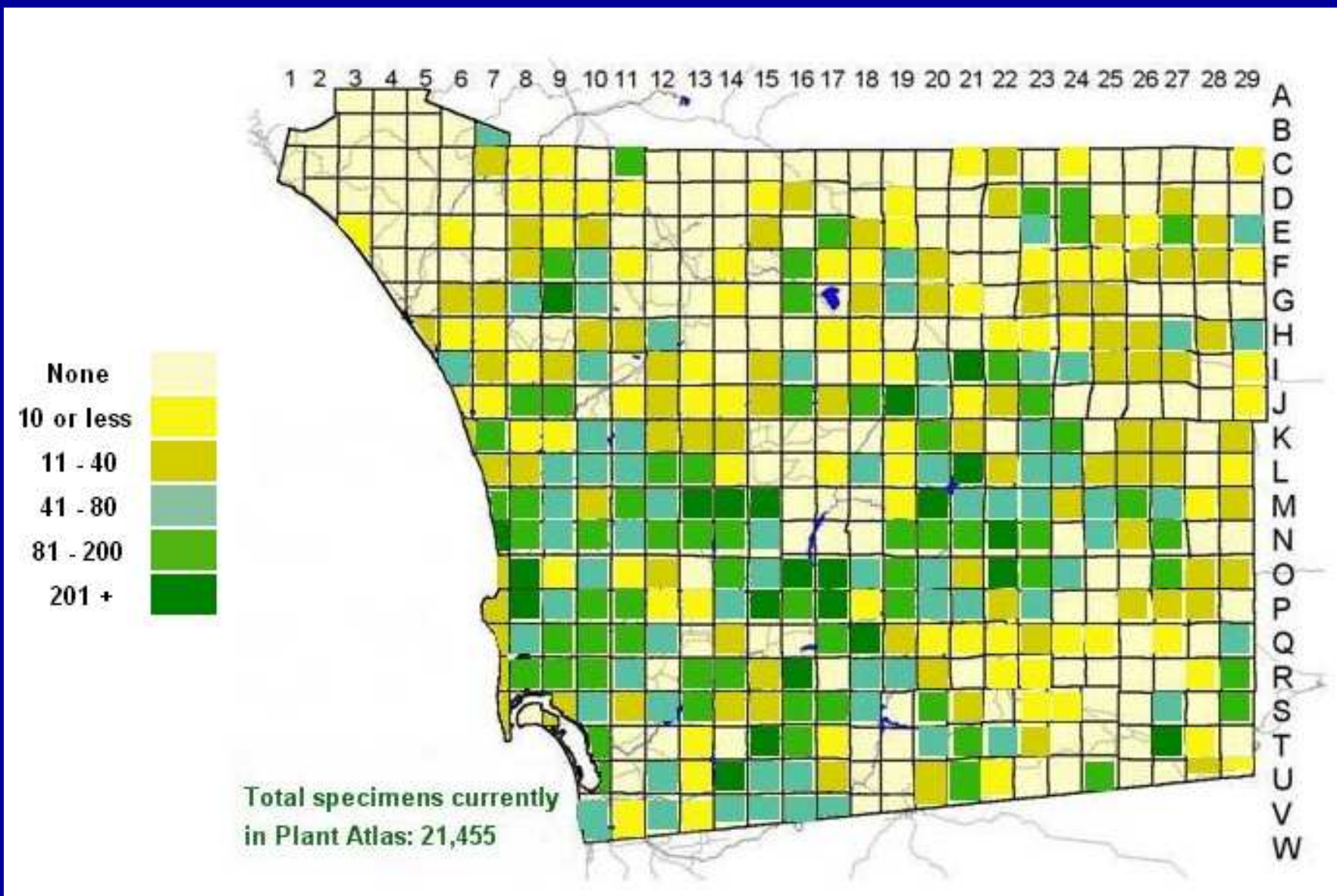
Wildflower photographs courtesy of [Ken Bowles](#)

[Parabotanist Log In](#)

[SDNHM Home](#) [SDNHM Botany](#) [A.R. Valentien Plant Portraits](#)

© San Diego Natural History Museum





**Current progress and coverage of Plant Atlas collections**



Natives

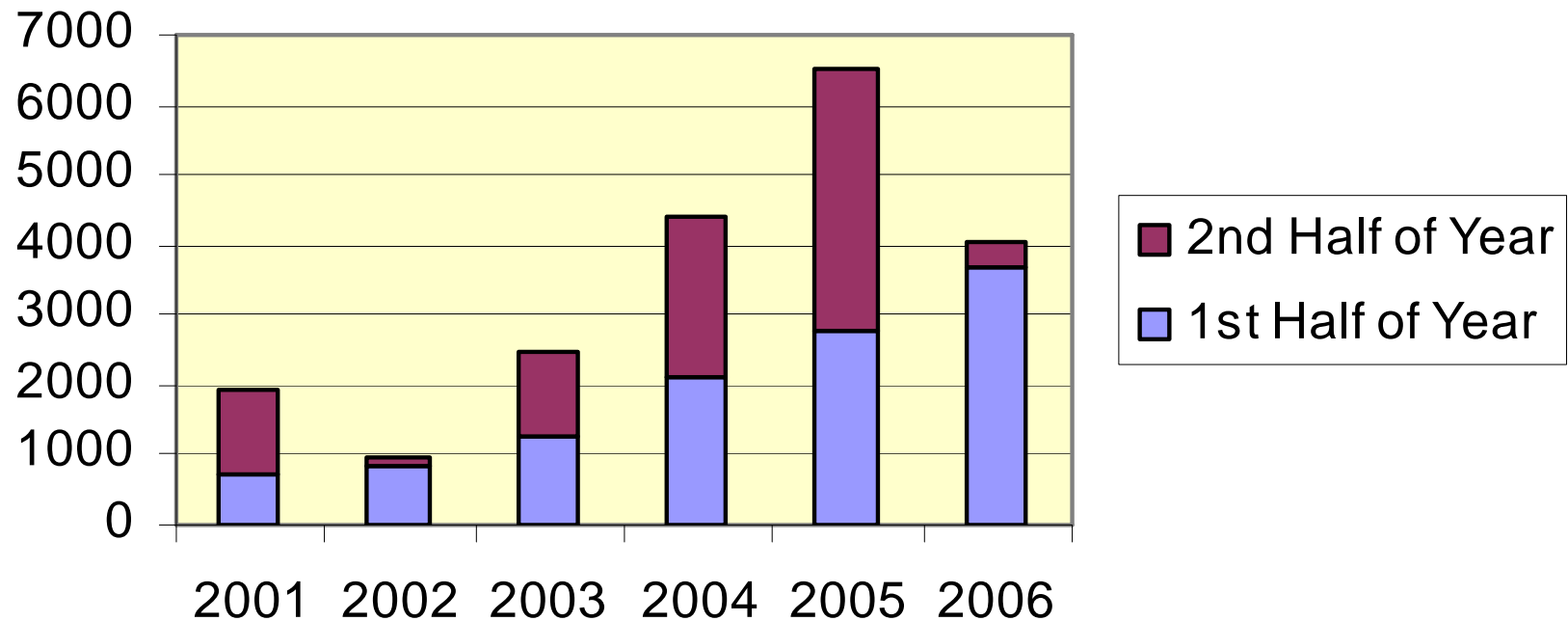


New  
San Diego County  
Plant Records

Exotics

# Specimen Mounting Challenges

## Specimens Added to SD Herbarium



**Note: 2006 through July 19 only**



## San Diego County Plant Atlas

# Plant Atlas E-Newsletter

- 🌿 Plant Atlas Happenings and Progress
- 🌿 Schedule of Events
- 🌿 Plant of the Month (common plants in flower)
- 🌿 New County Record of the Month
- 🌿 Wanted Plants (needs to be documented)

View/subscribe at [www.sdplantatlas.org](http://www.sdplantatlas.org)



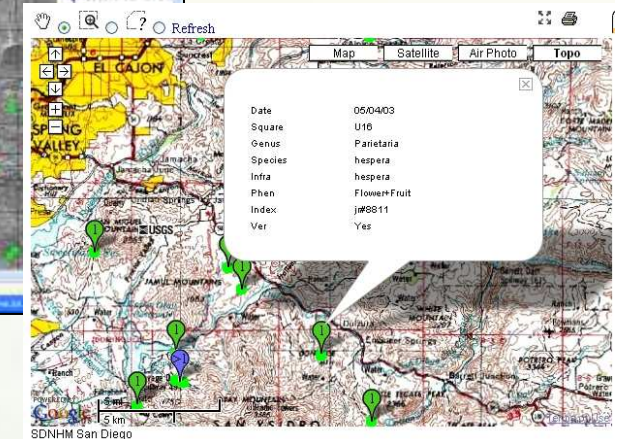
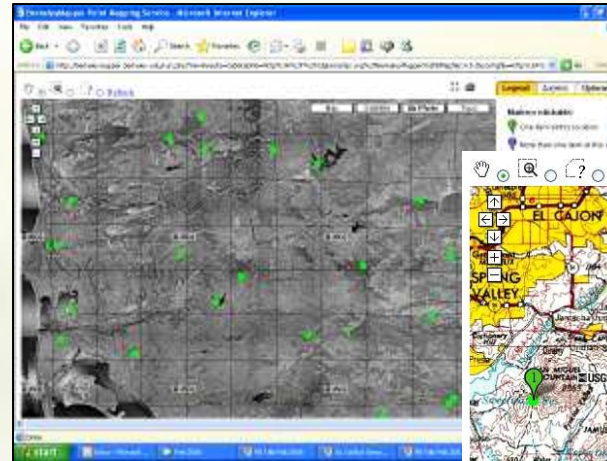
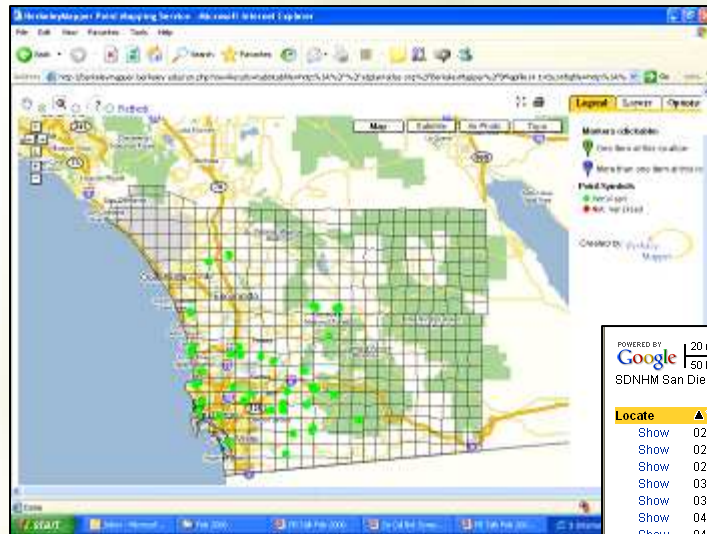
# More Successes of the Project

- Herbarium specimen vouchers for improved species' distributions and variability
- Growth of academic, research, and regional herbaria (USD, SDSU, ABDSP, DFG eco. reserves, UCR, UC, RSA, BCMEX)
- Contributions to the new *Checklist of Vascular Plants of San Diego County* by Rebman & Simpson (2006)
- Virtual access to the San Diego Synoptic Collection
- Specimen data for MSCP planning & other conserv. efforts
- Floristic resources for botanical consultants and land managers
- Better documentation of exotics/invasives
- Contributions to the ASLA/CNPS invasive plant field guide
- DNA/study/duplicate material for researchers (monographers, students, etc.)

# San Diego County Plant Atlas

## Mapping:

Interactive mapping capabilities for searching and viewing species' distributions online



All points represent actual specimens

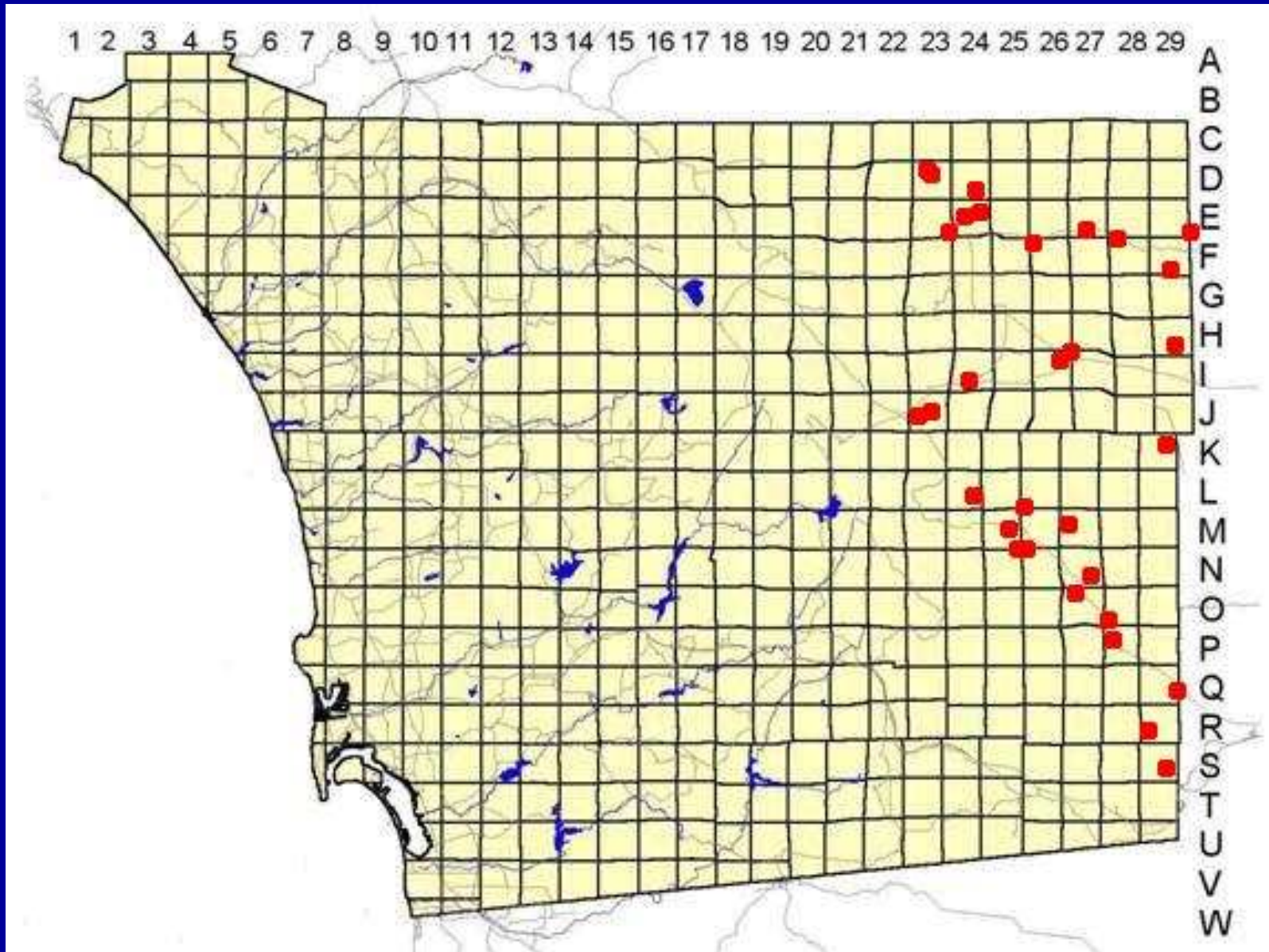
POWERED BY Google 20 mi 50 km SDNHM San Diego [Terms of Use](#)

Displaying 1 to 10 of 40 records visible on map

Locate	▲▼Date	▲▼Square	▲▼Genus	▲▼Species	▲▼Infra	▲▼Index	▲▼Phen	▲▼Ver
Show	02/03/05	P14	Artemisia	californica	n/a	jr#10908	Fruiting	Yes
Show	02/18/04	R9	Artemisia	californica	n/a	jq#624	Flowering	Yes
Show	02/29/04	Q14	Artemisia	californica	n/a	cbc#14	Unknown	Yes
Show	03/01/04	P8	Artemisia	californica	n/a	mf#4	Fruiting	Yes
Show	03/04/05	Q11	Artemisia	californica	n/a	jr#11145	Fruiting	Yes
Show	04/08/05	U14	Artemisia	californica	n/a	jr#11496	Fruiting	Yes
Show	04/09/05	S20	Artemisia	californica	n/a	jr#11630	Fruiting	Yes
Show	04/12/05	M7	Artemisia	californica	n/a	de#23	Fruiting	Yes
Show	04/29/05	J18	Artemisia	californica	n/a	jh#1034	Vegetative	Yes
Show	05/04/05	T15	Artemisia	californica	n/a	jr#11859	Vegetative	Yes

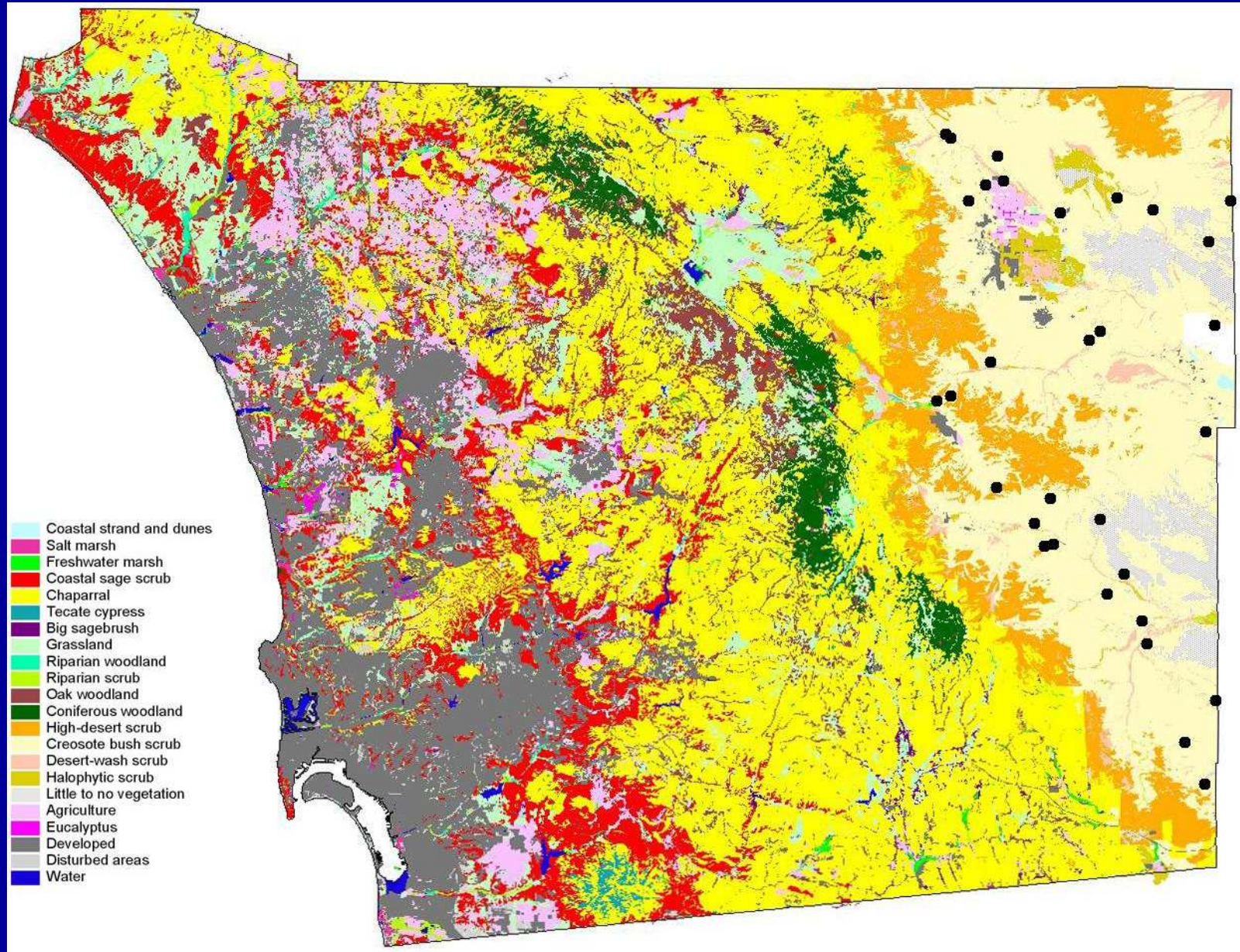


# Distribution Data



*Larrea tridentata* (Creosote Bush)

# Distribution Data



*Larrea tridentata* (Creosote Bush)



# Old & New Specimen Data Combined

- Online mapping resources integrate new Plant Atlas collections with historic specimens
- IMLS grant to database and georeference old San Diego County collections
  - Currently 29,300 in SD Herbarium db.
  - Adding 200 per week to db.
  - 16,000 specimens georeferenced



# San Diego County Plant Atlas

## Grid Square or Ecoregion Searches

📍 Lists all plants collected within a square or an ecoregion selected from a drop-down list

📍 Links to a photo from Google images

[www.sdplantatlas.org](http://www.sdplantatlas.org)

Map by S. Leininger, Source: SanGIS/County of San Diego

EcoRegion Selector  
Central Coast  
Save List to Excel

[What Grid Squares are in a Region?](#)

Listed plants have been verified.

Family	Plant Name	Google Image
Agavaceae	Hesperoyucca whipplei ssp. whipplei	<a href="#">Click Here</a>
Agavaceae	Yucca schidigera	<a href="#">Click Here</a>
Aizoaceae	Carpobrotus chilensis	<a href="#">Click Here</a>
Aizoaceae	Carpobrotus edulis	<a href="#">Click Here</a>
Aizoaceae	Malephora crocea	<a href="#">Click Here</a>
Aizoaceae	Malephora crocea var. crocea	<a href="#">Click Here</a>
Aizoaceae	Mesembryanthemum crystallinum	<a href="#">Click Here</a>
Aizoaceae	Mesembryanthemum nodiflorum	<a href="#">Click Here</a>
Alliaceae	Allium haematochiton	<a href="#">Click Here</a>
Amaranthaceae	Amaranthus albus	<a href="#">Click Here</a>
Amaranthaceae	Amaranthus hitoides	<a href="#">Click Here</a>

# Future Objectives for the Project

- Complete atlas project (~100,000 specimens)
- Increase grid gatherings and focus on unexplored areas
- Obtain access and collecting permits for difficult areas (tribal reservations, military lands, large private areas, etc.)
- Development of photographic resources from archives (Bajaflora.org) and parobotanist digital photo submission process
- Increase educational resources (i.e. Bowles lucid key)
- Compile a printed atlas
- Integration with bird and mammal atlas projects



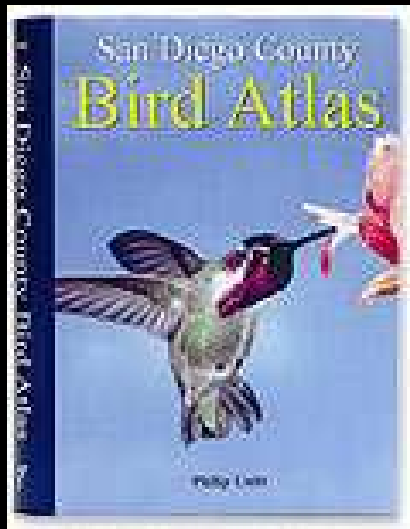
# Grid Gatherings



*Solanum parishii* (white form)



# Integration of San Diego County Atlas Projects



**Bird Atlas**



**Mammal Atlas**

# Plant Atlas & Botany Dept. Staff

- Dr. Mary Ann Hawke
- Jeannie Gregory
- John Sanborn
- Mary Alice Kessler
- Margie Mulligan
- Judy Gibson
- Karen Rich
- Dr. Ina Brown
- Layla Aerne
- SDNHM Botany Dept. Volunteers



*Cylindropuntia xfosbergii*

# Acknowledgements



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Division of Environmental Biology (DEB)



Museums for America  
Program



**The SDNHM thanks the following organizations for their support over the past 3 years:**

- ❖ The San Diego Foundation
- ❖ **Union Bank of California**
- ❖ California State Parks
- ❖ **The County of San Diego**
- ❖ California Native Plant Society
- ❖ **URS Corporation**
- ❖ AMEC Earth & Environmental
- ❖ **California Dept of Fish & Game**
- ❖ Private Donors



*Cylindropuntia  
ramosissima*



