Innovation in California Herbaria and Specimen Records Use

Dr. Jenn Yost
CCH Co-Chair with Staci Markos
Symbiota Support Hub, Community Lead
Director, Robert F. Hoover Herbarium (OBI)
Lead PI on the California Phenology TCN
• All herbaria in California
• Nearby herbaria with significant California collections
NSF Funded: California Phenology (CAP) TCN 2018 - 2023

Goal: 904,200 specimens

- 780,000 imaged
- 1.1 million transcribed
- 1.4 million scored for phenology
- 500,000 new georeferences
California Phenology Herbarium
Digitization Project

(BSCA) Colorado Desert District, California
(Chio) Dept. of Parks and Recreation
(CHSC) CSU, Chico
(CSLA) CSU, Los Angeles
(CSUSB) CSU, San Bernardino
(DAV) UC, Davis
(FSC) CSU, Fresno
(HSC) CSU, Humboldt
(IRVC) UC, Irvine
(LA) UC, Los Angeles
(LOB) CSU, Long Beach
(MACF) CSU, Fullerton

(OBI) California Polytechnic State University,
San Luis Obispo
(RSA) Rancho Santa Ana Botanic Garden
(SBBG) Santa Barbara Botanic Garden
(SD) San Diego Natural History Museum
(SDSU) San Diego State University
(SFV) CSU, Northridge
(SJSU) CSU, San Jose
(UC/JEPS) UC, Berkeley
(UCSB) UC, Santa Barbara
(UCSC) UC, Santa Cruz
(UCR) UC, Riverside
2020: Our first PEN: Expanding to the CA Floristic Province

• Aaron Liston (OSU)
• Jon Rebman & Layla Hains (SD)
• Jason Cantley (SFSU)
• Andy Gardner (SHTC)
• Lloyd Stark (UNLV)
• Genevieve Walden (CDA)
• Aimee Wyrick (PUC)
Monthly Meetings on Zoom
First Tuesday of the Month

- Rare species redactions, if any
- Collections in danger of fire
- Image storage solutions
- New proposals
- MOUs for data sharing

Consortium of California Herbaria (CCH)
Major technological advances in the last 5 years...

<table>
<thead>
<tr>
<th>Collection</th>
<th>Collection ID</th>
<th>Additional Attributes</th>
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<th>Author(s)</th>
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<th>Infrastructural epithet</th>
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Welcome to the Consortium of California Herbaria Portal (CCH2)

CCH2

Welcome to the Consortium of California Herbaria Portal (CCH2)

CCH2 offers data from specimens housed in CCH2 member herbaria. The data included in this database represents all specimen records from partner institutions. The data served through this portal are currently growing due to the work of the California Phenology Thematic Cooperator Network (CAPTC). This collaboration of 22 California university, research stations, natural history collections, and botanical gardens aims to capture images, label data, and phenological data in a user-friendly, climate-smart data stream. By 2022, data contained in the CCH2 portal will continue to grow even after this time through the activities of the CCH2 member institutions.

For more information about the California Phenology TCN, visit the project website:
https://cclp.ucmp.berkeley.edu/phenology.html

For more information about the Consortium of California Herbaria (CCH2) visit:
http://cch2.lbl.gov/about.html

The California Phenology TCN is made possible by the National Science Foundation Award 1202232. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Special thanks to the National Park Service who provided funds for the initial setup of the CCH2 website and database, November 2018.
The power of a portal in a virtual world...

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For more information about the California Phenology TCN, visit the project website:
https://www.capturingcaliforniasflowers.org

For more information about the California Consortium of Herbaria (CCH) see:
http://ucjeps.berkeley.edu/consortium/about.html

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Special thanks to the National Park Service who provided funds for the initial setup of the CCH2 website and database (November 2016).
What is Symbiota?

Open Source Software
https://github.com/BioKIC/Symbiota
What is Symbiota?

- Themed “portals” containing data from multiple sources
- Community-managed
- Data “snapshots” and live-managed data

Open Source Software
https://github.com/BioKIC/Symbiota
What is Symbiota?

Biodiversity data aggregator + Content Management System

Open Source Software
https://github.com/BioKIC/Symbiota

- Web-based data entry and editing interface
- Data cleaning and curation tools
- Supports multiple, remote users
What is Symbiota?
California Biodiversity

Consortium of Small Vertebrate Collections

The Consortium of Small Vertebrate Collections is a growing network of research, academic, and museum institutions focused on the study of birds, mammals, fish, amphibians, and reptiles. It is a collaborative venture of Caltech and Arizona State University and provides a mechanism for network members to manage and share biodiversity data to scientists and the general public. Participating institutions are afforded sophisticated online data management tools without the need for costly IT support.

Consortium of North American Bryophyte Herbaria

The Consortium of North American Bryophyte Herbaria (CNABH) was created to serve as a gateway to distributed data resources of interest to the taxonomic and environmental research community in North America. Through a common web interface, users can access and work with a variety of data. As a regular visitor, we invite you to specific resources, want to get feedback please do not hesitate.

News and Events

- April 2021 - The GLC Network, funded by the new project websites.

Extending Anthropology Research Through Image and Trait Digitization

The Anthro Library is an online repository of bee image, trait, and specimen data. The portal has a worldwide scope and may include other taxa that are not bees but intend with bees (i.e., bee parasites). The contributions to this resource are varied and include the many taxonomists, data managers, and bee ecologists whose work is to determine bee morphology. The Anthro Library is a project to increase the biodiversity data of bee species, the specimen catalogue number, and who determined the species in any publication that references data from this portal. Images are free for reuse, but please cite the institution image.

These data are currently growing due to the work of the Extending Anthropology Research Through Image and Trait Digitization (Bio-ID) project. Bio-ID is a collaboration of 13 universities, research stations, natural history collections, and scientists who aim to share images, labels, and functional traits (e.g., flight time, host plant, body size) data for over 5000 bee species.


Consortium of North American Lichen Herbaria

The Consortium of North American Lichen Herbaria (CNALH) serves as a gateway to biodiversity data of lichens found throughout North America. It provides access to an array of different resources, such as specimen images, vouchers, and species checklists.
A robust content management system and a tool for biodiversity data exploration.

symbiota.org

<table>
<thead>
<tr>
<th>1,400+</th>
<th>46</th>
<th>9mi+</th>
<th>70mi+</th>
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</thead>
<tbody>
<tr>
<td>Biodiversity Collections</td>
<td>Symbiota Portals</td>
<td>Images Published</td>
<td>Occurrences Published</td>
</tr>
</tbody>
</table>
A Symbiota Portal for California

- Serves 4.5 million occurrences
- 2.4 million are georeferenced
- 1.7 million are imaged
- 1.3 phenological data

30 funded partners
74 collections supported
The CCH Community

Curators from all collections

Collectors of plants

Geography experts for georeferencing

Researchers for data use, funding proposals, student training, leverage

Educators for student transcription, student research, training the next generation

Symbiota Support Hub for IT, training, hosting, and backend support

Societies for membership support, financial, digitizing, research

Govt/Non-profits for data uses, rallying members, crowdsourcing digitization
Impact of California Specimen Data

OBI - Robert F. Hoover Herbarium, Cal Poly State University

Published by California Polytechnic State University-San Luis Obispo

Publication date: October 6, 2022
Metadata last modified: October 6, 2022

Hosted by: Symbiota Support Hub

License: CC BY-NC 4.0

Citation:

CSLA - Cal State LA Herbarium (CSLA)

167 citations

DAV - UC Davis Herbarium (DAV)

356 citations
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Symbiota Support Hub Team

Jenn Yost
Community Lead

Katie Pearson
Data Manager

Samanta Orellana
International Community Coordinator

Greg Post
IT & System Administrator

Lindsay Walker
Community Manager

Nico Franz
Management @ASU

Ed Gilbert
IT Management Lead

Laura Prado
Biodiversity Informatician
Permissions in the portal

- Multiple permission levels
  - Editors
  - Administrators
  - Rare species readers
  - Personal observation management
- Checklist management
- You can manage from anywhere!
The momentum is going strong

- SDM is Mesa College ~4,000 collections
  - Mike Simpson is going to image them at SDSU
  - Data transcription within the portal
- National Parks
  - Death Valley NP just imaged!
- Forest Service Collections
- BLM stations
- UC Blue Oak Reserve is getting imaged this weekend
From: Adam Searcy <asearcy@cnps.org>

Subject: CCH2 Portal occurrence: SDSU05197 (05197)

Date: October 27, 2022 at 15:50:00 PDT

to: tdseherbarium@sdsu.edu, <asearcy@cnps.org>

Cc: jyost <jyost@calpolyp.edu>

Hello Drs. Simpson and Yoshit

Dixon 3319 (SDSU05197) is the only record of Ruptera physodes from the Tehama/Butte Co. region, which is outside of Jepson's listed bioregions and far from other physodes specimen records. I suspect that it's R. balli but the few visible stipules (most appear missing, maybe those present are incomplete) don't appear to support balli. Maybe bract measurements (or in-person stipule examination) would help confirm ID one way or another.

Specimen being referenced:

Cheers,
Adam Searcy

Rare Plant Scientific Coordinator, California Native Plant Society | asearcy@cnps.org | www.cnps.org

Adam, 

From the image, I measured what I thought were three good stipules: 11.560 mm, 12.560 mm, 8.544 mm. Jepson stating:
R. physodes: 4-10 mm
R. balli: 15-15 mm
(maybe best fits R. physodes, but quite a range)

And, measured a few flower bracts, got: 8.330, 7.293, 8.809, 7.944, for inflorescence bracts:
R. physodes: 3-7 mm
R. balli: 9-13 mm
(of course, most in between, but one fitting R. balli)

But, I think I see a fruit that has a beak, which R. balli is supposed to fruit macrocarp.

If that is a beak, I think R. balli is the best fit, so that seems a good clue you suspect. I’ll take a closer look to confirm that when I’m in tax

Best,
Mike

Dr. Michael G. Simpson
Department of Biology
SNC Campus Drive
San Diego State University
San Diego, CA 92182-4614, USA.
The 100 Club: Do you know any places?
Help Transcribe Records: Notes from Nature

Active Projects

Get started ↘

Herbaria across the California Floristic Province need help transcribing.

Fresno State University (part 5)  Oregon State University (part 3)
Help Transcribe Records: Notes from Nature
Notes from Nature

- 140 undergrads
- 8 grad students
- 243 volunteers

WeDigBio Events
Integrate digitization into the curriculum

• Digitization Zoom Course
  • Taught over 200 students
  • Students from up to 10 different schools meet at the same time
  • Students get credit - BIO 200/300/400 from home school
• 1 instructor, big impact

DIGITAL HERBARIUM DATA CREATION & CURATION
Fall 2020
Undergraduate Research Courses

Exploring Plant Phenology Using Herbarium Specimens

An undergraduate research course developed by the California Phenology Network

We're published! You can also find our materials on
QUBES: https://qubeshub.org/publications/1956/1
www.capturingcaliforniasflowers.org

In this course, students will design and conduct original research to examine the effect of climate on plant phenological events (e.g., flowering) using herbarium specimen data. Students will augment existing specimen records with phenological and georeference data in the CCH2 data portal. They will then visualize, clean, and analyze herbarium specimen data and climate data using Excel and R code (through RStudio). Each student will present their research as a scientific report, poster, and/or a lightning talk. During weekly class meetings, important topics and guidance regarding the research process will be discussed.

Download Syllabus & List of Materials
Download All Course Materials as ZIP file
(coming soon)

Course overview

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Download Syllabus & List of Materials  Download All Course Materials as ZIP file

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Course overview

QLifornia Phenology Network

CALIFORNIA

PHENOLOGY

NETWORK

CapturingCaliforniaFlowers.org

CAL POLY

UCSB

UNIVERSITY OF CALIFORNIA

BERKELEY

NSF
Delphinium spp. flowering influenced by regionally-specific temperature

Introduction
- The species in the genus Delphinium, commonly called poppies, are native within the Mediterranean family and are often found in arid regions.
- They are found throughout much of California and are a variety of Helen’s and plant enthusiasts.
- Helianthus species provide an abundant resource for phenological studies, and there are several species native to all across the country from the past century and south (Hufford et al. 2017).
- We used Helianthus species to study the phenology, flowering, and flowering in response to regional climate temperature, and seasonally (diffuse) from the baseline temperature.
- We used minimum temperature because plants have been shown to respond to minimum temperature that influence vegetation (Phi-Aubrey et al. 2011).

Research Questions
- Does the regional environment influence flowering date?
- Does an area from the regional environment influence flowering date?
- Does the temperature affect sensitivity to annual anomalies from the historical norms?

Methods
- We used species from the California Department of Water Board (CDWF) to analyze flowering days. We used species from all across the country from the past century and south (Hufford et al. 2017).
- Phenological scoring involved scoring species for flowering, where we counted whether the characteristics of interest, such as plant growth, were present or absent.

Results
- For every 1°C increase in regional temperature, the day of flowering decreased by 4.8 days.
- An increase in latitude in spring minimum temperature associated with an increase in flowering (Fig. 3).
- The association between flowering day and winter temperature anomaly (Fig. 4).
- The association between flowering day and temperature anomaly (Fig. 5).

Discussion
- Delphinium plants do flower earlier in areas with warmer baseline temperature and are influenced by seasonal temperature changes.
- Winter minimum temperature did not have an effect on flowering date after adjusting for baseline temperature and spring temperature, which is likely because the winter temperature and spring weather are not independent and there are complex associations in nature.
- Because flowering is affected by spring minimum temperature than winter minimum temperature, which could be because the mean flowering date is occurring later in spring, May 2019.
- Because the interaction term between baseline temperature and autumn and spring temperature anomaly is significant, we cannot find the influence for the two having different sensitivities in terms of flowering in temperature.
- Like other studies using a variety of species over a large latitudinal gradient, such as with Park and Madgwick (2013), we found that there is a large amount of variation in flowering time by species and by regionally-specific weather.
Growing resource for floristics

Species Inventories

California State Parks
- Carmoggi State Vehicular Recreation area
- Hollister Hills State Vehicular Recreation Area
- Hungry Valley State Vehicular Recreation Area
- Malibu Creek State Park

Univ. of California, Natural Reserve System
- Channel Islands National Park
- Lassen Volcanic National Park
- Sequoia and Kings Canyon National Parks
- Steele/Anza-Boorrego Desert Research Center Vascular Plant Checklist
- UC Natural Reserve System
- UC-NRS Burns Pilot Ridge Reserve
- UC-NRS San Joaquin Marsh Reserve
- Yosemite National Park

National Park Service, California Parks
- Cabrillo National Monument
- Channel Islands National Park
- Death Valley National Park
- Devil's Postpile National Monument
- Eugene O'Neill National Historic Site
- Golden Gate National Recreation Area
- John Muir National Historic Site
- Joshua Tree National Park
- Lassen Volcanic National Park
- Lava Beds National Monument
- Manzanar National Historic Site
- Muir Woods National Monument
- National Park Service, California Parks
- Pinnacles National Park
- Point Reyes National Seashore
- Redwood National and State Parks
- Santa Monica Mountains National Recreation Area
- Sequoia and Kings Canyon National Parks
- Whiskeytown National Recreation Area
- Yosemite National Park
How to get involved:

Curators from all collections

Collectors of plants

Researchers for data use, funding proposals, student training, leverage

Geography experts for georeferencing

Educators for student transcription, student research, training the next generation

Societies for membership support, financial, digitizing, research

Symbiota Support Hub for IT, training, hosting, and backend support

Govt/Non-profits for data uses, rallying members, crowdsourcing digitization
Looking forward….

In this session...

- Students in collections at Fresno State
- Forest Service Collections being digitized around the state
- Remodel and reinvigoration of the UCLA herbarium
- Valuable collections like those of Sherwin Carlquist
- Tomorrow the session continues with how these data are advancing our understanding of the flora and being used for research.
Huge thank you to the whole CCH team

- Project manager: Katie Pearson, Cal Poly
- Data manager: Jason Alexander, UC Berkeley
- Ed Gilbert, ASU Symbiota Support Hub
- iDigBio and the ADBC Program at NSF
Thank you!

capturingcaliforniasflowers.org; cch2.org

@CalPhenologyTCN

YouTube: California Phenology TCN

Twitter: @CalPhenologyTCN

Jenn Yost: jyost@calpoly.edu

Project Manager

Katie Pearson: kdpearso@calpoly.edu
The Next Generation

THE INVOLVEMENT OF STUDENTS IN DIGITIZING THE FRESNO STATE HERBARIUM
Katherine Waselkov, CSU Fresno
Outline

❖ The Fresno State Herbarium: history and a new initiative
❖ Students in the Fresno State Herbarium and citizen science
The Fresno State Herbarium

- 35,065 vascular plant specimens dating from 1880s to 2020s
- Large backlog (~5,000 specimens) of unaccessioned and/or unmounted specimens dating back to the 1940s
- Started in 1925 by Dr. Charles Quibell
HERBARIUM
FRESNO STATE NORMAL SCHOOL
DEPARTMENT OF AGRICULTURE
Name: Coral-root
Collected by: A.L. Grant
Date: 1917-18
Locality: Huntington Lake
Remarks:

Mary S. Gibbons Herbarium

Genus: Pellaea
Species: Brewerii
Locality: Twin Lakes
Collector: M.S.G.
Date: Aug. 1909.
Dr. Charles Quibell

- Started the herbarium and built it up to 15,000 specimens
- Collected in the High Sierras around Huntington Lake every summer with his family in the 1950s
What kinds of specimens do we have?

• Geographic specialty: Fresno County and parts of surrounding Inyo, Kern, Madera, Mono, and Tulare Counties
  • 90% from California; ~8% from other U.S. states, ~2% from other countries

• Taxonomically: predominantly vascular plants (ferns, gymnosperms and angiosperms)
  • Small lichen, algae, and bryophyte collections
What kinds of specimens do we have?

- Ecosystems: vernal pools and alkali sinks in the San Joaquin Valley, the foothills and higher elevations of the Sierra Nevada mountains, and the Mojave Desert
- Includes some areas that are now gone, like the Valley ecosystems flooded by the construction of the San Luis Reservoir in 1966
GROWING off roadway on highway 152 about 50 miles from the junction of 152 with Highway 99. Area part of San Luis Reservoir. Soil a gravel-sand mixture and very dry. Ground level. Associated with: Brassica semiculata, Grindelia sp., Bassia hyssopifolia, Atriplex semibaccata.

Collector P.R. Emparan 13
Date 24/X/1964
Importance of the Fresno State Herbarium

Regionally important: largest and oldest herbarium in the San Joaquin Valley

But most people don’t know it exists

Prior to 2016: completely offline
The CAP-TCN Initiative: 2018–2022

- Fresno State is imaging all ~35,000 accessioned specimens in the herbarium
- Aiming to have full label data transcribed and georeferencing finished after the grant period
Why digitize?

• Researchers are now able to see what’s available in the herbarium, online!

• We contribute to several large databases of biodiversity collection data: including the Consortium of California Herbaria 2, the Global Biodiversity Information Facility (GBIF), and CalFlora

• Species distributions are estimated from these georeferenced points!
Why digitize?

• To get Fresno State students and the Fresno community (and beyond!) involved in biodiversity collections-based research!

• 25 students (undergraduate and graduate) have substantially contributed to research with the herbarium so far

• Classes: iDigBio events

• 5 citizen science initiatives via Zooniverse/Notes from Nature
The Fresno State Herbarium: history and a new initiative

Students in the Fresno State Herbarium and citizen science
The Fresno area: challenges/opportunities

- Fresno State: ~24,000 students: 60-70% first-generation college students, ~60% Pell grant eligible

- Fresno city: ~550,000 residents; ~23.5% of people live in poverty

- Fresno county: ~1,000,000 residents; ~17% of people live in poverty, and per capita income as of the last census = ~$25,000

- Student population partially reflects local demographics: ~50-60% Latinx, 12% Asian, ~5% Hmong, but 60% female

- Great opportunity for diversity, equity, and inclusion in natural history collection and biodiversity research---if we get creative!
How to facilitate student participation?

• 25 students (undergraduate and graduate) have contributed to research with the herbarium so far, through different avenues:
  • Volunteering—2
  • Course credit (BIOL 190, undergraduate research credit)—9
  • Federal work-study (partially funded by the Biology Department)—3
  • LSAMP Summer Funding—1
  • Paid by the USDA NRCS—1
  • Paid by the Fresno State Library Digital Services Division—1
  • CAP-TCN NSF funding—8
Why do students participate?

• They want research experience on their resumes for professional programs (mostly medical) or (more rarely) graduate programs
• They are interested in ecology/evolution/plant biology/museum science
• They need a job, and it’s easier if it’s on-campus and/or related to their degree
• Some combination!
What do the students do?

• Time spent and research tasks depend on what their schedule allows!

• 5-20 hours/week

• Students taking course credit also attend my lab meeting: read papers about natural history collections, etc.

• Any combination of:
  • Inventory: includes barcoding
  • Specimen imaging and skeletal data entry
  • Image processing (editing and file conversion)
  • Full label data entry (through CCH2 or Notes from Nature)*
  • Georeferencing*
  • Database cleanup/adding annotations*

* = can be done remotely
Statistics on Student Participation

- 18/25 students have been female; 1 nonbinary student
- 12 Latinx students; 11 Asian students (2 Hmong); 1 Black student; 1 White non-Hispanic student
- 13 students participated in research for more than one semester or summer; 5 undergraduate students began with herbarium research and transitioned to genetics research in my lab
Statistics on Student Participation

- 2 students were in MS programs when they started this research (on the side)
- 3 students started herbarium research as undergraduates and continued into MS programs in plant science or mycology at Fresno State
  - all are now in PhD programs (UC Merced, University of Florida, and University of Illinois)
Undergraduate Class Involvement

• Two upper-division undergraduate plant lab classes: BIOL 140 Plant Anatomy (Fall semester) and BIOL 125 Plant Taxonomy (Spring semester)

• Both courses: encourage participation in WeDigBio online label data transcription events (through extra credit)
  • Using the citizen science platform Zooniverse: Notes from Nature
  • https://www.zooniverse.org/projects/md68135/notes-from-nature-capturing-californias-flowers
Notes from Nature

Notes from Nature - Capturing California's Flowers

ORGANIZATION: NOTES FROM NATURE

Using digital images to investigate phenological change in a biodiversity hotspot

Learn more
Notes From Nature
If you want to get involved…

❖ You can visit Notes from Nature at this link (https://www.zooniverse.org/projects/md68135/notes-from-nature-capturing-californias-flowers) and click on “Fresno State University (part 5)” to help with specimen data transcription anytime!

❖ Email me (kwaselkov@csufresno.edu) if you are interested in volunteering in the herbarium in any capacity! We sometimes have specimen mounting parties in-person
Acknowledgments

Past and present student researchers in the Fresno State Herbarium:


Fresno State Herbarium non-student volunteers:

Maria Pena, Renaldo Gjoshe, Rebecca Ozeran, Reagen O’Leary, Patrick Walker, Emma Fryer, Audrey Agbayani

NSF CAP-TCN Principal Investigators and Technical Support:

Jenn Yost and Katelin Pearson, Cal Poly SLO; Jason Alexander, UC Berkeley
Questions?

Thanks for listening!
HIGH SIERRA HERBARIA+ ON THE DIGITIZATION TRACK

Blake Engelhardt, Inyo National Forest
INF Herbarium includes ~ 3 cabinets, moss collections, and Mary Dedecker’s personal library.

Mary’s notecards - Eastern Sierra Museum, Independence, CA

Collections by INF staff, local botanists, and duplicates

Located at the Inyo NF Supervisor’s Office in Bishop, CA

Bishop BLM Field Office 1 cabinet

How many specimens? What is in there? What do we have?

Catalogue of the INF Herbarium a work in progress.
SURVEY OF CA NATIONAL FORESTS, NOVEMBER 2021
(COMPILED BY KATIE PEARSON)
DIGITIZATION OPPORTUNITY!!!
ADD EXISTING DATA TO CCH2

- Est. Number of Specimens
- Est. Digitized Specimens
SOLUTION: MOBILE IMAGING

EQUIPMENT TO BISHOP
Imaging station to Bishop in February. Katie trained INF staff and volunteers (supported by NSF funding). Housing provided in USFS barracks.

IMAGING BLITZ
~90 hours over 6 days (staff & volunteers) to image 4412 specimens; Smart Shooter Tethering Software free 30-day trial

BLM TOO!
Bishop BLM staff imaged their entire cabinet; ~32 hours over multiple days for 1166 specimens

SHARE THE LOVE
Equipment and know-how passed on to Death Valley National Park in April. ~70 hours for 3500 specimens

~ 40-50 SPECIMENS/HOUR
4412 RAW FILES
Each file ~40-50 MB

LIGHTROOM
Create JPEG derivatives (4-8 MB each); Rotate and color-correct (Cropping)

UPLOAD TO CYVERSE
Utilize California Phenology Network account- upload jpegs in batches

IMPORT TO CCH2
Katie imported the photos (4412) and joined them with existing transcribed label data (from excel)

IMAGING COMPLETE, ON TO LABEL TRANSCRIPTION!
HOST A VIRTUAL INTERN

Internships are 8-12 week paid experiences with no cost to the hosting unit. A wide array of projects and work are acceptable (i.e. admin, climate change, natural resources, GIS, tribal engagement, graphic/web design, etc.).

Subject: Does Your Unit Need Help? Virtual Internships Available

- 100% Remote
- Funded by USFS R5 Regional Office (not the Inyo NF)
- 8-16 week length, June-September
- Mobilize Green hires/employs the intern
OUR INTERN:

BRIDGET LEE

Recent graduate from Cal Poly SLO.

Lives in Southern California, worked from home on her own computer.

$15/hr, 40 hrs/week, 16 weeks.

Previous experience working at Cal Poly SLO Herbarium.

Transcribed ~750 specimen labels, reviewed plant ID, wrote article for CNPS newsletter and INF Facebook post, trained INF botany technicians on CCH2 data entry.

Participated in virtual team meetings with INF botany staff, career development.
THE “100 CLUB”

Team of expert California botanists and naturalists

Enthusiastic georeferencers

Geographic expertise - translate textual location descriptions into lat/lon = “dot on map”.

100 CLUB SOCIAL HOUR
August 2022

BEFORE/AFTER:
149 → 1,276 georeferenced
INF: PROGRESS SO FAR

❖ 5200 specimen records
❖ 1276 (25%) georeferenced
❖ 4411 (85%) with images
❖ 1942 (37%) identified to species
❖ 55 families
❖ 263 genera
❖ 612 species
❖ 808 total taxa (incl subsp and var)

HIGHLIGHTS

❖ 20 records 1910-1912
❖ California/Nevada, +8 other western states
❖ Mono/Inyo Counties, +15 others in CA
❖ Bodie Hills, Mono Basin, Sierra Nevada, Whites & Inyos, Owens Valley, Death Valley, Fish Lake Valley, Deep Springs Valley, Kern Plateau
❖ M Bagley, M Dedecker, M Honer, D Pritchett, S McLaughlin, B Miller, J Morefield, K Nelson, K Platou, J&J Reveal, M Slaton
Inyo NF botany technicians to continue label transcription & georeferencing

Seeking volunteers through local CNPS chapter, project on Notes from Nature, etc

Virtual Intern #2
Payment for Services
College student project
### WHAT’S NEXT?

1. Specimens are accessible for research, students, loans
2. Summarize INF collection and identify data gaps
3. Targeted collections by Inyo NF staff (management species and look-alikes not represented)
4. Verify no previously unknown records for the forest—especially CRPR species
5. Phenology scoring

**CALIFORNIA PHENOLOGY NETWORK**

*Capturing California's flowers: Using digital images to investigate phenological change in a biodiversity hotspot*
PROGRESS AT OTHER HERBARIA

**BISHOP BLM**
Imaging complete 1166 specimens, need to post-process & upload to CCH

**DEATH VALLEY NP**
Imaging complete ~3500 specimens, need to post-process & upload to CCH

**KLAMATH NF**
Imaging complete ~6000 specimens, need to post-process & upload to CCH

**SHASTA-TRINITY NF & PSW-REDDING**
Imaging complete ~3800 specimens, need to post-process & upload to CCH; Weaverville collection still needs imaging (at UCD), label transcription for all specimens
THANK YOU!

Katie Pearson
Jenn Yost
Julie Kierstead
Lusetta Sims & Erin Lonergan

INF IMAGING - Corie Cann, Kathleen Nelson, Sue Weis, Rick McNeill, Martin Oliver, Kelly Muller, Jessie Sheldon

POST PROCESSING - Amy Leist Photography

VOLUNTEER COORDINATION - Autumn Conley & Maria Cruz

GEOREFERENCING/CCH 100 Club - Kitty Blasey & Genevieve Walden

Michele Slaton
Sydney Weldon & Martin Purdy

Blake Engelhardt, Inyo NF Botanist, blake.engelhardt@usda.gov
CNPS 2022 Conference
ROOTING TOGETHER
The role of campus collections: 92 years of change at the UCLA Westwood Campus

Annabel Li
Anthony E. Baniaga
UCLA, UCLA Herbarium, Los Angeles, CA, USA
Introduction: UCLA Campus Location

Figure 1 (contd).
Santa Monica Mountains
Eastern portion
Introduction: UCLA Campus Location
Introduction: UCLA Campus Location
How has the flora of UCLA’s campus changed throughout the last century?
Methods: CCH2 Checklist

**Vascular Plants of UCLA Campus**

**Authors:** Annabel Li

**Families:** 54
**Genera:** 148
**Species:** 215

**Total Taxa (details):** 219

**Page 1 of 1**

**ADOXACEAE**
- *Sambucus nigra* [CAS, LA, UCJEPS]
  - Raven, Peter H. 11330 [CAS], A.H. Lange s.n. [LA], Peter H. Raven 11330 [UCJEPS]

**AMARANTHACEAE**
- *Amaranthus hybridus* [RSA]
  - L. C. Wheeler 1422 [RSA]
- *Amaranthus retroflexus* [RSA, LA]
  - P. H. Raven s.n. [RSA], Peter H. Raven 14444 [LA]
- *Atriplex lentiformis* [LA]
  - John O'Leary 426 [LA]
- *Atriplex rosea* [RSA]
  - L. C. Wheeler 1382 [RSA]
- *Chenopodium album* [RSA, UCSD]
  - L. C. Wheeler 1421 [RSA], Weibel, H. 343 [UCSD]
- *Chenopodium berlandieri* [UCR, LA]
  - Peter H. Raven 14449 [UCR], G.J. Harrison 1959-09-18 [LA], Louis C. Wheeler 1421 [UCJEPS]
- *Chenopodium berlandieri var. zschackei* [IRVC]
  - Peter H. Raven 14449 [IRVC]
- *Chenopodium californicum* [LA, UCSD]
  - A.M. Johnson 3841 [LA], A.H. Lange 1951-05-17 [LA], Norman Haller 1953-03-04 [UCSD], Richard Bates s.n. [DAV], more...
- *Chenopodium murale* [SDSU, UCSD]
  - Collier, Gerald M135 [SDSU], Norman Haller 1953-03-31 [UCSD]
- *Chenopodium strictum* [LA]
- *Chenopodium strictum var. glaucophyllum* [LA]
  - H. Lewis s.n. [LA]
- *Dysphania multifida* [LA, UCSD]
  - Elizabeth McClintock s.n. [LA], A.M. Johnson 3827 [LA], Elizabeth McClintock s.n. [DAV], Elizabeth McClintock s.n. [DAV]
- *Dysphania pumilio* [RSA, LA]
  - P. H. Raven 14611 [RSA], R. L. Armacost 2386 [LA], Peter H. Raven 14611 [LA]
Methods: Search by Polygon

Click on shape symbol to create a rectangle, circle, or polygon. Close mapping tool to transfer shape definition to search form.
Methods: Checklist Creation

Locality Criteria
Country: 
State/Province: 
County: Los Angeles
Locality: UCLA
Elevation (in meters): to

Search Collections → Download specimen data
Create list of taxa → Remove cultivated specimens
Batch upload to checklist → Fix synonyms → Add vouchers
Methods: Locality Search Terms

“UCLA”
“University of California, Los Angeles”
“University of California”
“U.C.L.A.”
“U.C.L.A. campus”
“U. C. L. A.”
“U. C. L. A. campus”
“UC LA”

“UC LA campus”
“University of California, West Los Angeles”
“Faculty Hill”
“Sage Hill”
“Stone Canyon”
“Botanical Garden”
“UC campus”
“U.C. campus”
Methods: Removal of Cultivated Specimens

<table>
<thead>
<tr>
<th>Species</th>
<th>Family</th>
<th>Genus</th>
<th>Habitat</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trachycyphon Magnoliopsis Gentianaeae</td>
<td>Rubiaceae</td>
<td>Galium</td>
<td>Perigoneae</td>
<td>Galium porrigens</td>
<td>county supplied by Wetherwax</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Pittosporaceae</td>
<td>Pittospora</td>
<td>Billardieria heterophylla</td>
<td>Pittosporum tomentosum</td>
<td>Cultivated.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Pittosporaceae</td>
<td>Pittospora</td>
<td>Billardieria heterophylla</td>
<td>Pittosporum tomentosum</td>
<td>Cultivated.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Pittosporaceae</td>
<td>Pittospora</td>
<td>Billardieria heterophylla</td>
<td>Pittosporum tomentosum</td>
<td>Cultivated.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Geraniaceae</td>
<td>Pelargonium</td>
<td>Hortorum</td>
<td>Cultivated.</td>
<td>Identified by N. Muckey, J. Frauen</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Myrtaceae</td>
<td>Eucalyptus</td>
<td>Globulus</td>
<td>Dense tree 20 ft high, SE exposure, good drainage. Juvenile and mature leaves. Flowers creamy-white</td>
<td>18273 Labill.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Myrtaceae</td>
<td>Eucalyptus</td>
<td>Globulus</td>
<td>Dry fyll.</td>
<td>Access Database Number [Depreciated]: UC1317100</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Myrtaceae</td>
<td>Corymbia</td>
<td>Ficifolia</td>
<td>ex Herb. of Santa Monica Junior College.</td>
<td>14383 F. M. Malva.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Fabaceae</td>
<td>Trifolium</td>
<td>Repens</td>
<td>Flowers white</td>
<td>342131 L. Trifolium repens</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Poaceae</td>
<td>Triticeae</td>
<td>Sexta subsp. fitzgeraldii</td>
<td>G. 746 (A. umbellata); specimen from plants grown at UCLA by B.J. Johnson, 1966. Seed source</td>
<td>134012 L. Ziziphus.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Poaceae</td>
<td>Triticeae</td>
<td>Sexta subsp. fitzgeraldii</td>
<td>Garden weed.</td>
<td>131345 (R. Br.) Mosy.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Poaceae</td>
<td>Solanaceae</td>
<td>Solanum</td>
<td>In flower.</td>
<td>206927 L. Ilex</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Poaceae</td>
<td>Malvaceae</td>
<td>Malva</td>
<td>In flower.</td>
<td>25469 Kellogg. M.P. Malva</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Poaceae</td>
<td>Malvaceae</td>
<td>Malva</td>
<td>In flower.</td>
<td>207508 (Turcz.) A.S.C. Malva</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Poaceae</td>
<td>Rosaceae</td>
<td>Rosaceae</td>
<td>In flower.</td>
<td>124311 L. Rhaphiolepis</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Poaceae</td>
<td>Rosaceae</td>
<td>Rosaceae</td>
<td>In flower.</td>
<td>207898 Thunb. ex Mal.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Poaceae</td>
<td>Myrtaceae</td>
<td>Myrtaceae</td>
<td>In flower.</td>
<td>207361 Wendl. ex M. Syllepsygium</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Poaceae</td>
<td>Malvaceae</td>
<td>Malva</td>
<td>In flower.</td>
<td>17655 (Und.) Ball.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Astereae</td>
<td>Astereae</td>
<td>Astereae</td>
<td>In soil collected at Harvey's Gate, Soco Correo, New Mexico</td>
<td>230648 G. Eringer.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Ericaceae</td>
<td>Ericaceae</td>
<td>Ericaceae</td>
<td>In soil collected at Harvey's Gate, Soco Correo, New Mexico</td>
<td>46311 Eest.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Pittosporaceae</td>
<td>Pittosporum</td>
<td>Torebira</td>
<td>Label says: Herb. California Department of Landscape Horticulture, Davis</td>
<td>207867 (Murray) Hils. Pittosporum</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Myrtaceae</td>
<td>Myrtaceae</td>
<td>Myrtaceae</td>
<td>Locally abundant. Plants solitary, rarely branched; leaves gregarious, red, petal tips slightly</td>
<td>207908 M. Syllepsygium</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Myrtaceae</td>
<td>Myrtaceae</td>
<td>Myrtaceae</td>
<td>Locally abundant. Plants solitary, rarely branched; leaves moss covered granite rock face. Plant</td>
<td>42235 (L.) Britten.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Myrtaceae</td>
<td>Myrtaceae</td>
<td>Myrtaceae</td>
<td>Locally abundant. Plants solitary; leaves green; flowers moss covered granite rock face. Plant</td>
<td>17741 (Nutt.) Britten.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Myrtaceae</td>
<td>Myrtaceae</td>
<td>Myrtaceae</td>
<td>Locally common. Planters top dressed with coarse debris.</td>
<td>19410 Michx.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Malpighiaceae</td>
<td>Malpighiaceae</td>
<td>Malpighiaceae</td>
<td>Moist can.</td>
<td>Soap Plant.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Asteae</td>
<td>Asteae</td>
<td>Asteae</td>
<td>n=36</td>
<td>202452 L. Bidens</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Stellariaceae</td>
<td>Stellariaceae</td>
<td>Stellaria</td>
<td>Native of S. Africa.</td>
<td>207488 (Edl. &amp; Zeyh. Stellaria</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Araceae</td>
<td>Acorus</td>
<td>Acorus</td>
<td>Not common.</td>
<td>207480 (Aster. Acorus)</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>One plant.</td>
<td>Small bushy hill</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Plant originally collected in Ensenada, Baja California, Mexico in January 1963.</td>
<td>75686 Epling</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Plant originally collected in Ensenada, Baja California, Mexico in January 1963.</td>
<td>75668 Epling</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Plant originally collected in Ensenada, Baja California, Mexico in January 1963.</td>
<td>149433 (L.) Hoover</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Plants 3 ft tall; volunteer and weedy in desert section.</td>
<td>Access Database Number [Depreciated]: U.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Plants 3 ft tall; volunteer and weedy in desert section.</td>
<td>Access Database Number [Depreciated]: U.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Lamiaceae</td>
<td>Presence of a reproductive structure.</td>
<td>25774 F. M. Malvaceae.</td>
</tr>
<tr>
<td>Trachycyphon Magnoliopsis Aplaes</td>
<td>Poaceae</td>
<td>Poaceae</td>
<td>Poaceae</td>
<td>Plants 3 ft tall; volunteer and weedy in desert section.</td>
<td>Access Database Number [Depreciated]: U.</td>
</tr>
</tbody>
</table>

**Seed Source:** Dr. Ove Hall, Swedish Seed Assoc., Svalof. G372. | 150293 K. K. K. Triticum. | Triticum dicoccoides |
| Seed Source: Gradina Botanica, Cluj, Romania UCR grass access G767; specimen from seed germination | 133994 L. p.p. | Aeglops ovata |
| Seed Source: Gradina Botanica, Cluj, Romania UCR grass access G767; specimen from seed germination | 133994 L. p.p. | Aeglops ovata |
## Methods: Fixing Synonyms

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>Current Name</th>
<th>Fixed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Family</td>
<td>ScientificName</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>FABACEAE</td>
<td>Acmispon glabrus var. glabrus</td>
<td>Acmispon glaber</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td>POACEAE</td>
<td>Bromus carinatus</td>
<td>Bromus sitchensis var. carinatus</td>
<td>✓</td>
</tr>
<tr>
<td>4</td>
<td>MONTIACEAE</td>
<td>Calandrinia ciliata</td>
<td>Calandrinia menziesii</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>EUPHORBIACEAE</td>
<td>Croton setigerus</td>
<td>Croton setiger</td>
<td>✓</td>
</tr>
<tr>
<td>6</td>
<td>PHRYMACEAE</td>
<td>Mimulus aurantiacus</td>
<td>Diplacus aurantiacus</td>
<td>✓</td>
</tr>
<tr>
<td>7</td>
<td>THEMIDACEAE</td>
<td>Dicholestemma capitatum</td>
<td>Dipterostemon capitatus</td>
<td>✓</td>
</tr>
<tr>
<td>8</td>
<td>THEMIDACEAE</td>
<td>Dicholestemma capitatum subsp. capitatum</td>
<td>Dipterostemon capitatus</td>
<td>✓</td>
</tr>
<tr>
<td>9</td>
<td>AMARANTHACEAE</td>
<td>Chenopodium multifidum</td>
<td>Dysphania multifida</td>
<td>✓</td>
</tr>
<tr>
<td>10</td>
<td>AMARANTHACEAE</td>
<td>Chenopodium pumilio</td>
<td>Dysphania pumilio</td>
<td>✓</td>
</tr>
<tr>
<td>11</td>
<td>POLYGONACEAE</td>
<td>Eriogonum elongatum</td>
<td>Eriogonum elongatum var. elongatum?</td>
<td>✓</td>
</tr>
<tr>
<td>12</td>
<td>POLYGONACEAE</td>
<td>Eriogonum fasciculatum subsp. foliolosum</td>
<td>Eriogonum fasciculatum var. foliolosum</td>
<td>✓</td>
</tr>
<tr>
<td>13</td>
<td>POACEAE</td>
<td>Lolium perenne</td>
<td>Festuca perennis</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>POACEAE</td>
<td>Gastridium ventricosum</td>
<td>Gastridium phleoides</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>POACEAE</td>
<td>Leptochloa fascicularis</td>
<td>Leptochloa fusca subsp. fascicularis</td>
<td>✓</td>
</tr>
<tr>
<td>16</td>
<td>PLANTAGINACEAE</td>
<td>Linaria dalmatica</td>
<td>Linaria dalmatica subsp. dalmatica?</td>
<td>✓</td>
</tr>
<tr>
<td>17</td>
<td>MYRSINACEAE</td>
<td>Anagallis arvensis</td>
<td>Lysimachia arvensis</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>MALVACEAE</td>
<td>Sida hederacea</td>
<td>Malvella leprosa</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>ONAGRACEAE</td>
<td>Oenothera stricta</td>
<td>Oenothera stricta subsp. stricta?</td>
<td>✓</td>
</tr>
<tr>
<td>20</td>
<td>POACEAE</td>
<td>Poa pratensis</td>
<td>Poa secunda subsp. juncifolia</td>
<td>✓</td>
</tr>
<tr>
<td>21</td>
<td>PRIMULACEAE</td>
<td>Dodecatheon clevelandii</td>
<td>Primula clevelandii</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>POACEAE</td>
<td>Setaria gracilis</td>
<td>Setaria parviflora</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Authoritative source:** Jepson
Methods: Adding Vouchers to Checklist

APOCYNACEAE
Asclepias eriocarpa  [LA]  [CAS]
    Robert G. Engman [LA]
Asclepias speciosa  [LA]  [CAS]
    H. F. Copeland s.n. [RSA]

ASTERACEAE
Acuria microcephala  [LA]  [CAS]
    Peter H. Raven 15410 [LA], W. O. Griess s.n. [LA], Peter H. Raven 15410 [UCJEPS]
Artemisia californica  [LA]  [CAS]
    Peter H. Raven 11320 [CAS], Peter H. Raven 11330 [UCJEPS]
Artemisia douglasiana  [LA]
    Peter H. Raven 11319 [CAS], Peter H. Raven 11319 [UCJEPS]
Artemisia dracunculus  [LA]
    Peter H. Raven 11318 [CAS], Peter H. Raven 11318 [CAS], Gaines s.n. [CAS], Gaines s.n. [CAS], Gaines s.n. [RSA], mora...
Baccharis salicifolia  [LA]
Baccharis salicifolia subsp. salicifolia  [LA]  [CAS]
    Peter H. Raven 11338 [CAS], Peter H. Raven 11338 [UCJEPS]
Bidens pilosa  [LA]
    Peter H. Raven 14617 [CAS], Peter H. Raven 9406 [CAS], Peter H. Raven 14617 [LA], Peter H. Raven 9406 [LA]
Centaura melitensis  [LA]  [CAS]
    Ambrose Schindler s.n. [RSA], Mary V. Hood 37-30 [LA]
Centromadia parryi  [LA]
Centromadia parryi subsp. australis  [LA]
    Peter H. Raven 11332 [CAS], Peter H. Raven 11332 [UCJEPS]
Cirsium occidentale  [LA]  [CAS]
    A. E. Harsh s.n. [RSA]
Cirsium occidentale var. venustum  [LA]
    Peter H. Raven 9666 [CAS]
Corethrogynne laginfolia  [LA]
    Wheeler, Louis 1420 [CAS], Peter H. Raven 11336 [CAS], L. C. Wheeler 1420 [RSA], Peter H. Raven 11336 [LA]
Cotula australis  [LA]
    Wheeler, Louis C. 887 [CAS], L. C. Wheeler 687 [RSA], Louis C. Wheeler 687 [LA]
Cotula coronopifolia  [LA]
    Wheeler, Louis C. 842 [CAS]
Methods: Determining Extirpated Species

- Removed taxa that had collections in last 50 years
- Removed taxa that have been observed on iNaturalist
- Removed taxa that we have observed
Results: Specimens

580 specimens total

UCLA Herbarium: 234 specimens
UCSB Herbarium: 62 specimens
California Botanic Garden Herbarium: 96 specimens
California Academy of Sciences: 55 specimens
Trichostema lanceolatum Benth.
[Lamiaceae]
**Collector:** Martha Hilend
**Date:** 28 January 1930
Results: Taxa with Most Specimens

**Asteraceae**
family with most specimens (136)

**Deinandra fasciculata**
species with most specimens (10)
Results: Collection Intensity Histogram

UCLA Campus Specimen Collection Intensity 1902-2018

#Specimens Collected

Year

Results: Statistics

54 families
227 taxa

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Results: Potentially Extirpated Taxa

100 potentially extirpated taxa

72 native
Calochortus catalinae
Gutierrezia californica
Gutierrezia sarothrae
Pentagramma triangularis
subsp. triangularis
Polypodium californicum
Trichostema lanceolatum

28 naturalized
Discussion: Campus Development Timeline

- 1929: UCLA's Westwood campus opens to students
- 1947: The Arroyo is filled in
- 1950: Median collection year
- 1959-1963: Development of Faculty Hill into dorms (Dykstra, Sproul, Reiber)
- 1962: Sage Hill is cleared for fire experiments
- 1980-1984: Continued development of Faculty Hill into dorms (Hitch, Saxon, Hedrick)
- 1987-1995: Development of Stone Canyon Creek into Anderson School of Management
Discussion: Arroyo
Discussion: Sage Hill
CNPS 2022 Conference
ROOTING TOGETHER
Advancing the extended specimen network: curating and digitizing the Sherwin Carlquist Collection
Herbarium specimens:
A lens into the past and means to envision the future
Digitization

Reshaping herbarium access, use, inclusion of digital data, and the ways in which we conduct biodiversity research
A single plant specimen...

- Pollinators
- Phylogenetic systematics
- Ecological niche modeling
- Geographic distribution
- Phenology
- Evolution of morphological characters

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Extended Specimen Network

“The biodiversity specimen extends beyond the singular physical object to potentially limitless additional physical preparations and digital resources.”

- Lendemer et al. 2020
Extended Specimens In Action: Appalachian Lichens

Field Collection

Digital Specimen Image

NYBG Virtual Herbarium
Barcode: 02808629
IRN: 3350635

Physical Specimen

Digital Specimen Record

Morphological Data

Ecological Data

Environmental Samples

Tissue Samples

Primary Extensions

Field Images

Molecular Data

Secondary Extensions

Mitogenome: MH221526.1
BioSample: SAMN09711114
BioProject: PRJNA462682

Tertiary Extensions

IUCN: Least Concern

Conservation Status

Species Distribution

Evolutionary Inferences

Species Description

Functional Traits

Biotic Interactions

Microbial Communities

Migration Scenarios

Applying the Digital Extended Specimen: building collections and integrating data

Sara Hansen¹, Rachel Hackett², Blake Cahill¹, David Cuthrell², Michael Monfils³, Michael Belitz³, Ryan Goebel¹, Logan Rowe³, Anna Monfils¹

¹Central Michigan University, Mount Pleasant, United States, ²Michigan Natural Features Inventory, Michigan State University, Lansing, United States, ³University of Florida, Gainesville, United States

(MI) MIDS - A digitisation standard for natural history collections, Lecture Theatre 1, Appleton Tower, 11 Crichton Street, EH8 9LE, June 7, 2022, 9:30 AM - 11:00 AM

The Extended Specimen
Emerging Frontiers in Collections-Based Ornithological Research

Extending the Digital Extended Specimen

- Amanda Harmon, A.C. Moore Herbarium (USCH), South Carolina Department of Natural Resources (SCDNR)
- Calla Cisaki, South Carolina Department of Natural Resources (SCDNR), A.C. Moore Herbarium (USCH)
- Avery Browning, A.C. Moore Herbarium (USCH)
- Herrick, Brown, A.C. Moore Herbarium (USCH)
- (Name of Herrick Brown also known as Kyle Swanson (USCH volunteer))

Collections Education: The Extended Specimen and Data Acumen

Anna K. Monfils®, Erica R. Krimmel, Debra L. Linton, Travis D. Marsico, Ashley B. Morris, and Brad R. Ruhfel
Sherwin Carlquist (1930 – 2021)

- Professor, CGU & Pomona College
- Plant Anatomist, CalBG
- Research Botanist, SBBG
- Plant systematics, wood anatomy, island plant diversity
“What people don’t realize about my research is that although I was always doing studies in terms of taxonomic groups, the central pivots of my research were always concepts, evolutionary phenomena, and features that operate across taxonomic lines.”

- Sherwin Carlquist, 2020
The Carlquist Collection:

RSA

30,770 biological collections
herbarium specimens
  - mounted, not digitized
  - unmounted
wood specimens
  - with non-archival labels
  - no labels
fluid preserved specimens
wood anatomy microscope slides
The Carlquist Collection:

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The Carlquist Extended Specimen Network

• NSF Infrastructure & Capacity for Biological Research
• Funded June 2022, 4-year project
The Carlquist Extended Specimen Network

- NSF Infrastructure & Capacity for Biological Research
- Funded June 2022, 4-year project

Objectives:

1. Curate the Carlquist Collection for long-term preservation
2. Digitize and mobilize data for the biological collections and archival objects
3. Link transcribed collection information, images, and metadata
4. Publish and make publicly available through open-access platforms
Project Staff

Mare Nazaire, Lead PI

Ana Niño, Co-PI
BRIT Librarian

Jason Best, S.P.
Director, Biodiversity Informatics

Sara Dave,
Project Manager

TBD,
Project Archivist
Project Staff

- Undergraduate interns
- Graduate students
- Volunteers

Ixchel Maston, Curatorial Intern
Carlquist #2154, *Pteralyxia macrocarpa*
Kunia Trail, Waianae Mts., Oahu, Hawaiian Islands
Carlquist #2154, *Pteralyxia macrocarpa*
Kunia Trail, Waianae Mts., Oahu, Hawaiian Islands
## Collections Inventory

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RSA: Digitization & Curation

- Pull mounted specimens from main collection
- Update nomenclature
- Data transcription
- Image
RSA: Digitization & Curation

- Pull wood specimens with non-archival labels
- Match with transcribed herbarium specimens
- Make labels
- Barcode with xylarium #
- Sleeve
- Image
RSA: Digitization & Curation

- Wood specimens without labels
- Match collections with transcribed herbarium specimens
- Make labels
- Barcode with xylarium #
- Sleeve
- Image
RSA: Digitization & Curation

- Replace jars / replenish fluids for some spirit collections
- Barcode
- Image: 4 images per specimen
RSA: Digitization & Curation

- Unprocessed specimens with no collection notebooks
# RSA: Digitization & Curation

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RSA: Digitization
BRIT: Digitization & Curation

- Notebooks digitized in 2017 by RSA
- Many entries previously transcribed for herbarium specimens
BRIT: Digitization & Curation

- QR codes encoded with filenames are placed on small acid-free separators.
- Denotes start and end of a “container” (i.e., slide box, negative sleeve, etc.)
- Separator used downstream to read QR codes during slide- and negative-imaging process to create the root filename for all following slides.
BRIT: Digitization & Curation

- Copy stand imaging for slide boxes
- Camera capture of slides (lightbox placed below to illuminate slides)
BRIT: Digitization & Curation

- Deciphering handwriting
- Using DropBox to share images
Publishing & Linkage

Preliminary:

Enhancements to create network:

• API read-write capability for external resources

• Bulk upload web interface for adding external resources

• Searches based upon the presence of external resource and resource type (e.g., field notebook, field photograph, etc.)

• A checkbox to delimit searches by external resource type
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