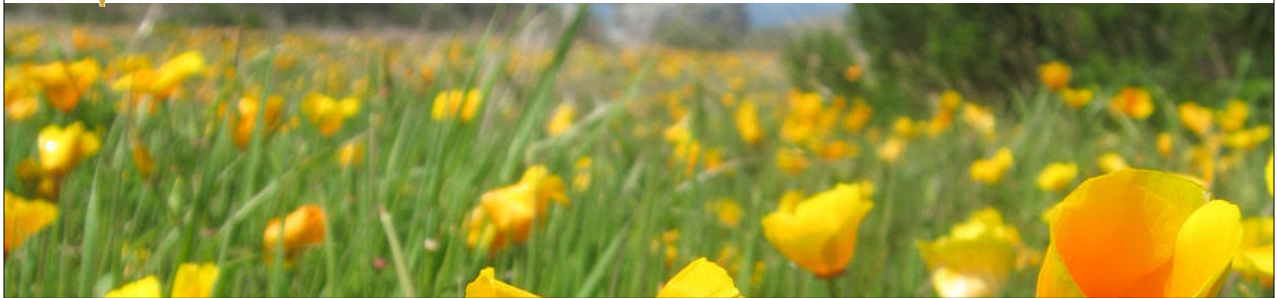


# California Phenology (CAP TCN): Starting Year 4: Thinking about sustainability

Capturing California's flowers: Using digital images to investigate phenological change in a biodiversity hotspot



CAL POLY



## California Phenology (CAP) TCN + PEN



CAL POLY



Oregon State University



Berkeley  
UNIVERSITY OF CALIFORNIA



California  
BOTANIC GARDEN

Santa Barbara Botanic  
the GARDEN



Stanislaus



HUMBOLDT  
STATE UNIVERSITY

theNAT  
SAN DIEGO NATURAL HISTORY MUSEUM



SAN DIEGO STATE  
UNIVERSITY



Pacific  
Union  
College



CALIFORNIA DEPARTMENT OF  
FOOD & AGRICULTURE

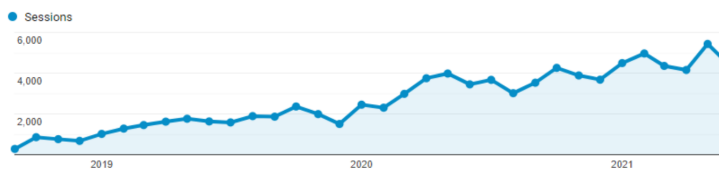
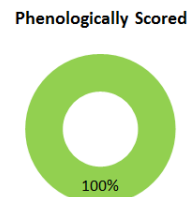
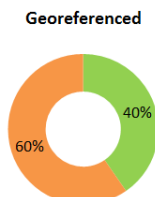
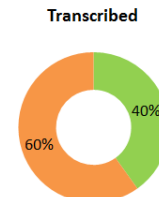
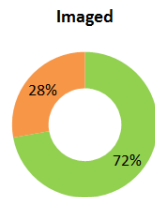
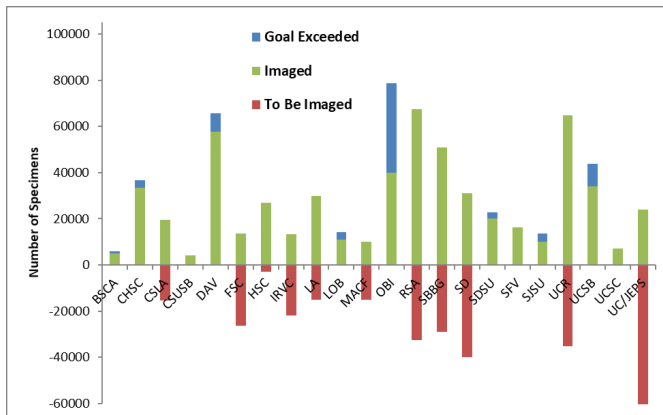


California Department of  
Parks and Recreation

UNLV



# Progress and Tracking



Google Analytics

**Figure 3.** Site traffic (in number of sessions) of the CCH2 data portal since the start in year 1 through now (September 2018 to July 2021). The number of site visits has steadily increased. (Google Analytics).

## The power of a portal in a virtual world



Home Search Collections Map Search Image Search Browse Images Data Use Policy About CCH Log In New Account Sitemap

### Welcome to the Consortium of California Herbaria Portal (CCH2)

CCH2 serves data from specimens housed in CCH 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 Collections Network (CAP-TCN)**. This collaboration of 22 California universities, research stations, natural history collections, and botanical gardens aims to capture images, label data, and phenological (i.e., flowering time) data from nearly 1 million herbarium specimens by 2022. Data contained in the CCH2 portal will continue to grow even after this time through the activities of the CCH member institutions.

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>

The California Phenology TCN is made possible by the National Science Foundation Award 1802312. 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 2016)



# Forming a Community around the portal



CCH2

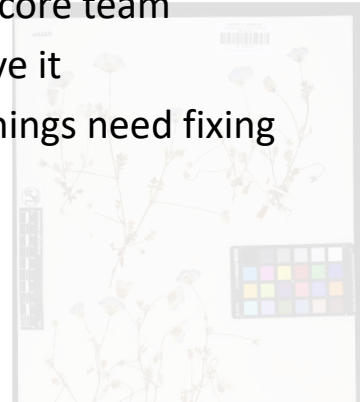
Featuring Data From the California Phenology TCN

Home Search Collections Map Search Image Search Browse Images Data Use Policy About CCH Log In New Account Sitemap

- Set up your super administrators spread out across major collections
- Make sure the supported collections are in the core team
- Give editing access to everyone who should have it
- Allows collections to help each other when things need fixing
- More eyes on the data
- Digitization can happen from afar

The California Phenology TCN is made possible by the National Science Foundation Award 1802312. 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 2016)



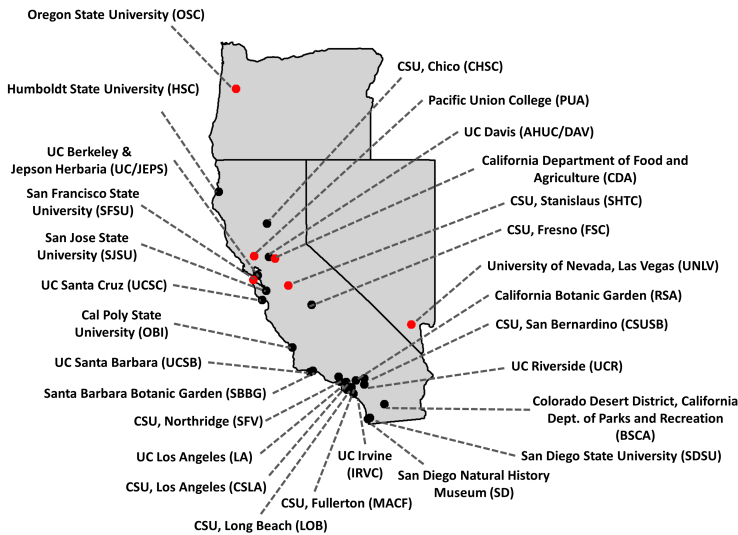
# Connecting Regional Experts to the Portal

- 100 club - georefs
- Expert botanists
- Retired naturalists
- Community building
- Regular work session - zoom
- Ca Native Plant Society

## Georeferencing in CCH2 Training Course



# Leveraging TCN Support: the Consortium



Established monthly zoom meetings

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

**Consortium of California Herbaria (CCH)**

Home About Members News Update History ▾ Donate

# Create long lasting training materials

**California Phenology TCN**  
13 subscribers

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Uploads PLAY ALL SORT BY

- Taxonomic Cleaning Tool in CCH2**  
5 views • 1 month ago
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- Module 3: Shortcuts to Georeferencing in CCH2...**  
29 views • 1 month ago
- Module 2: Accessing Specimens to Georeference...**  
25 views • 1 month ago

## Georeferencing in CCH2 Training Course

### How to use this course

The purpose of this course is to provide a modular learning resource for georeferencing in the herbarium data portal, CCH2. Each module consists of learning objectives, a training video, and a quick quiz.

### Module 1: What is georeferencing?

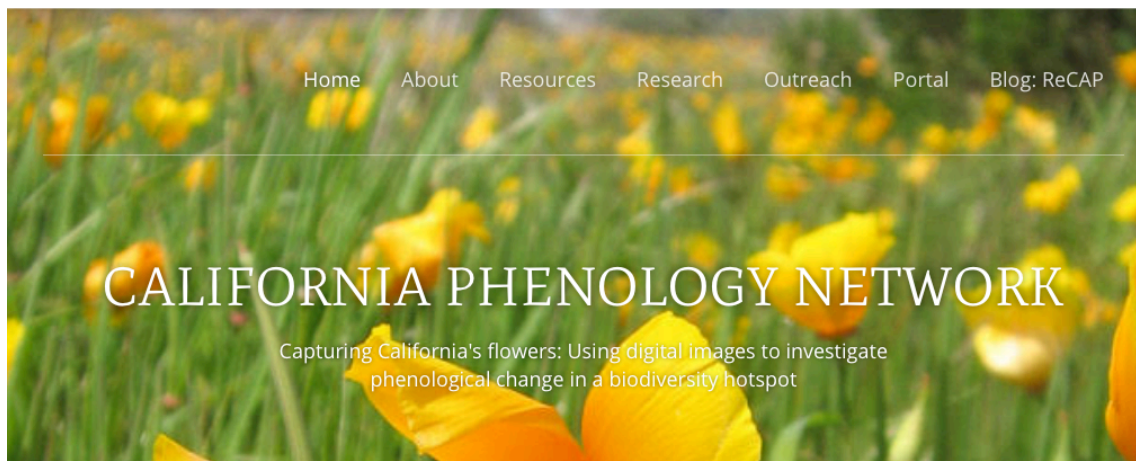
#### Learning objectives

Upon completion of this module, you should be able to:

- Understand the basic practice of georeferencing and why it is important
- Define the terms: **occurrence**, **locality**, **uncertainty/error**, **geodetic datum**
- Identify different types of coordinate systems you may encounter when georeferencing U.S. specimen records, including **decimal degrees**; **degrees, minutes, seconds**; **UTMs**; and **township, range, section**.



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



Upcoming event:

DO YOU **DIG** PLANTS?

## Data Portal Tutorials

### Guide to Using a Symbiota-based Portal

developed for users of the Consortium of California Herbaria (CCH2) Portal

This guide was developed to instruct users of the CCH2 Portal, the Symbiota instance used by the California Phenology TCN, in basic use of the portal and its many available tools.

Download

This guide is under constant development. If you would like to request additional content for the guide or other training materials, please fill out the form on the [Document Library](#) page.

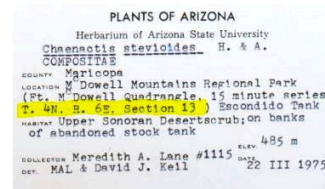
### What do T, R, and sec. mean on a label?

5/5/2020

0 Comments

#### Problem

A label has T#N or T#S, R#W or R#E, and a section (sec.) value on it, like in the example below. What does this mean, and how do I enter this information in CCH2?  
How do I georeference a specimen with TRS information?



#### Our Solution

The letters and numbers you're seeing, like in the above example, are called township, range, and section coordinates, which are part of the U.S. Public Land Survey System, a system of defining locations that dates back to the 1700s. (Read more about it here: [https://en.wikipedia.org/wiki/Public\\_Land\\_Survey\\_System](https://en.wikipedia.org/wiki/Public_Land_Survey_System))

The T value is the "township", which designates a 6-mile by 6-mile squares. The R value is the "range", which measures the distance east or west of the meridian. The section or "sec." is a numbered square within the township, measuring 1-mile by 1-mile.

In CCH2, you can enter TRS coordinates as they are, and you can convert them into a latitude, longitude, and error radius using GeoLocate. To do so, click the F button on the occurrence editor to open the formatting tools. A box in which you can enter TRS data is on the right (circled below).

## Workflow and Protocols

### 3. Edit/convert images:

- [Image processing protocol and checklist](#) last updated August 5, 2020

### 4. Upload JPEGs to CyVerse and load into CCH2:

- [Protocol for set up and upload of images to CyVerse, then CCH2 using CyberDuck](#) last updated August 10, 2020
- [Protocol for uploading images to CyVerse through the Data Store](#) last updated June 14, 2021

### 5. Update catalog numbers:

- [Protocol for associating barcode \(catalog\) numbers with accession numbers](#)

### 0. Prepare collection for imaging:

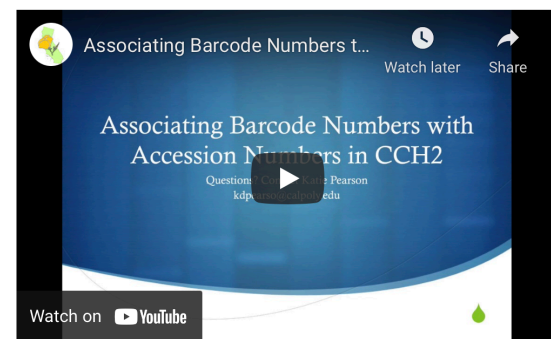
- [How to prepare your collection for imaging](#)
- [Equipment recommendations](#)

### 1. Barcode specimens:

- [Barcode recommendations](#)
- [Barcoding protocol](#) last updated June 19, 2019

### 2. Image specimens:

- [Imaging protocol](#) last updated August 5, 2020
- [Combined barcoding & imaging protocol](#) last updated August 5, 2020
- [Imaging station setup checklist](#)

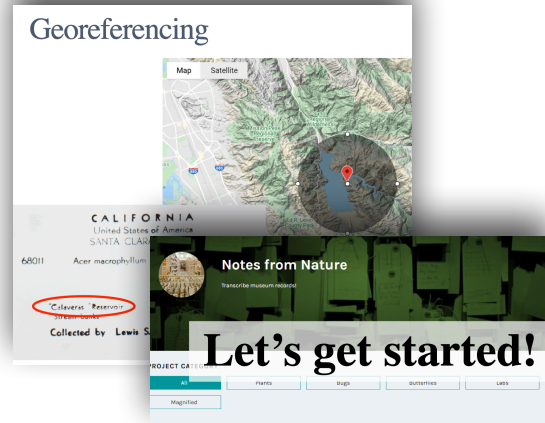


### Transcribe data:

- [Guide to transcribing label data in CCH2](#)
- Recorded [data entry webinar](#)

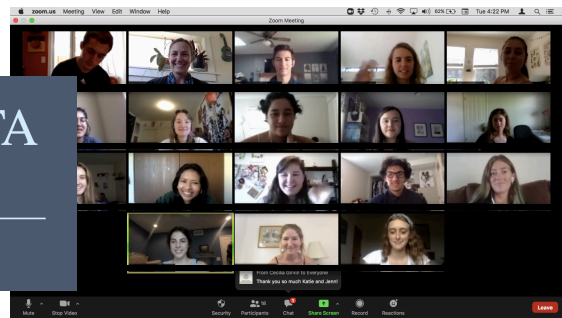
# Integrate digitization into the curriculum

- Digitization Zoom Course
  - Taught by the project manager Katie Pearson
  - Students from 10 different schools meet at the same time
  - Students get credit - BIO 200/300/400 from home school
  - 1 instructor, big impact



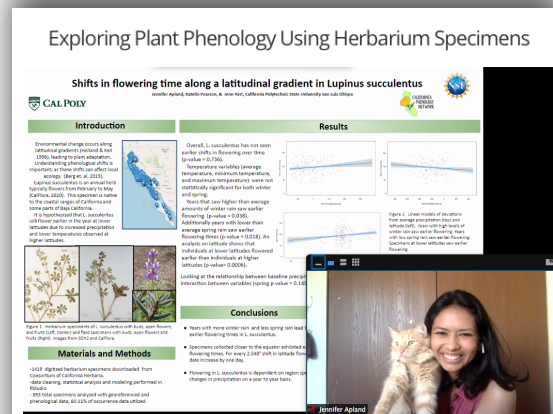
## DIGITAL HERBARIUM DATA CREATION & CURATION

Fall 2020

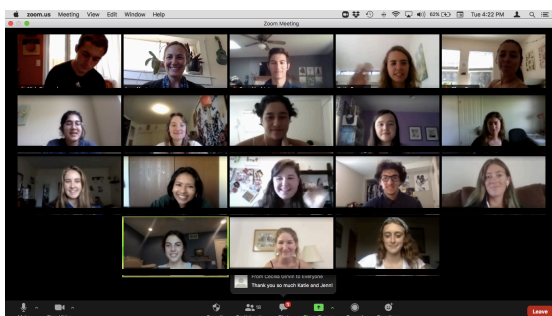


# Integrate digitization into the curriculum

- Phenology research course
  - Students ask a question about a climate variable and flowering time
  - Create data annotations
  - Download data
  - Analyze the results in a pre-made R script
  - Present a paper or poster



Course overview





- Full course is published on our website and QUBES: <https://qubeshub.org/publications/1956/1>
- New 3 hr lab posted
  - <https://qubeshub.org/publications/2476/1>

## 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>

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



## Developing Standards

- Establish the framework for which trait-based data can be shared via Darwin Core Archives



### Digitization protocol for scoring reproductive phenology from herbarium specimens of seed plants

Jennifer M. Yost<sup>1,2\*</sup>, Patrick W. Sweeney<sup>2</sup>, Ed Gilbert<sup>3</sup>, Gil Nelson<sup>4</sup>, Robert Guralnick<sup>5</sup>, Amanda S. Gallinat<sup>6</sup>, Elizabeth R. Ellwood<sup>7</sup>, Natalie Rossington<sup>8</sup>, Charles G. Willis<sup>9,10</sup>, Stanley D. Blum<sup>11</sup>, Ramona L. Walls<sup>12</sup>, Elspeth M. Haston<sup>13</sup>, Michael W. Denslow<sup>14</sup>, Constantin M. Zohner<sup>15</sup>, Ashley B. Morris<sup>16</sup>, Brian J. Stucky<sup>2</sup>, J. Richard Carter<sup>17</sup>, David G. Baxter<sup>18</sup>, Kjell Bolmgren<sup>19</sup>, Ellen G. Denny<sup>20</sup>, Ellen Dean<sup>21</sup>, Katelin D. Pearson<sup>22</sup>, Charles C. Davis<sup>9</sup>, Brent D. Mishler<sup>18,23</sup>, Pamela S. Soltis<sup>5</sup>, and Susan J. Mazer<sup>8</sup>

Biodiversity  
Information  
Standards  
T D W G



# Phenological Data Standards

- Convened a task group within Specimens & Observations - Quintin Groom
- Have a charter
- Our team: James Macklin, Ramona Walls, Gil Nelson, Kathy Gerst, Liz Matthews, Ed Gilbert, Rob Guralnick, John Wieczorek, Patrick Sweeney, Brian Stucky, Libby Ellwood, Deb Paul, Stan Blum

Biodiversity  
Information  
Standards  
T D W G

## SYMBIOTA Trait SCORING Tools

- Trait mining from verbatim text
- Trait coding from images

- 1.4 million scored
- By one person
- Went collection by collection searching same words
- 30-40 hours total

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

This module maps Occurrence Traits to specimens based on verbatim text field content... more

Harvesting Filter

Occurrence trait:

Verbatim text source:

Filter by text (optional):

Filter by taxon (optional):

Occurrence Remarks (notes)

Select Source Field Values - hold down control or shift buttons to select more than one value

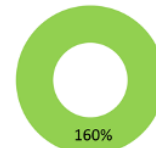
- abundant, none flowering - [1]
- an infusion of the flowers and stems yields a yellow-orange dye. "pauhan" - [1]
- an infusion of the flowers yields a yellow dye; an ethnobotanical study - [1]
- an infusion of the leaves, flowers yields a yellow dye. - [1]
- basal leaves withered, flowers red, fading purple. colorado noxious weed list b. - [1]
- ca. 100 plants; locally rare, flowering - [1]
- ca. 50 plants; locally rare, flowering/fruitletting - [1]
- common and in flower only in the disturbed area - [1]
- common but few flowering culms - [1]
- common but only a few in flower - [1]
- common in burned area, flowering - [1]
- common in burned area, flowering/fruitletting - [1]
- common in dry bed of vernal pool, flowers white. - [1]
- common in grasslands, a few individuals just starting to flower - [1]
- common in shallow water in ditch; herbage strongly scented, flowers purple. - [1]
- common in vicinity, flowering/fruitletting - [1]
- common large flowered plant in deep sands of the dunes along the gulf of mexico, collected at surfside. - [1]
- common on roadside, mostly past flowering. - [1]
- common perennial starting to flower - [1]

Reproductive Unopen Flower:  
 present  
 absent

Open Flower:  
 present  
 absent

Senesced Flower:  
 present  
 absent

Phenologically Scored



# How to use these data now:

## MeasurementOrFact

measurementID	measurementType	measurementValue	measurementAccuracy	measurementUnit	measurementDeterminedBy	measurementDeterminedDate	measurementMethod
measurementRemarks							

MeasurementOrFact		Class
Identifier	<a href="http://rs.tdwg.org/dwc/terms/MeasurementOrFact">http://rs.tdwg.org/dwc/terms/MeasurementOrFact</a>	
Definition	A measurement of or fact about an <a href="http://www.w3.org/2000/01/rdf-schema#Resource">rdfs:Resource</a> ( <a href="http://www.w3.org/2000/01/rdf-schema#Resource">http://www.w3.org/2000/01/rdf-schema#Resource</a> ).	
Comments	Resources can be thought of as identifiable records or instances of classes and may include, but need not be limited to <a href="#">dwc:Occurrence</a> , <a href="#">dwc:Organism</a> , <a href="#">dwc:MaterialSample</a> , <a href="#">dwc:Event</a> , <a href="#">dwc:Location</a> , <a href="#">dwc:GeologicalContext</a> , <a href="#">dwc:Identification</a> , or <a href="#">dwc:Taxon</a> .	
Examples	The weight of an organism in grams. The number of placental scars. Surface water temperature in Celsius.	

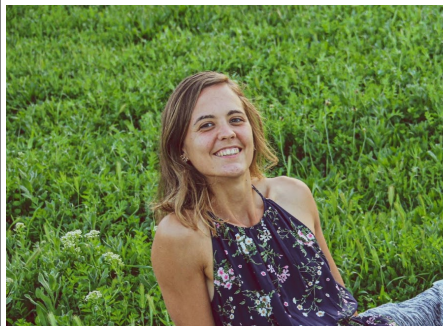
measurementID		Property
Identifier	<a href="http://rs.tdwg.org/dwc/terms/measurementID">http://rs.tdwg.org/dwc/terms/measurementID</a>	

To join specimen data with trait data:

<https://www.capturingcaliforniasflowers.org/phenology.html#Output>


## Huge Thank You to the team

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



# Year 4: Here we come!

[capturingcaliforniasflowers.org](http://capturingcaliforniasflowers.org); [cch2.org](http://cch2.org)

 @CalPhenologyTCN

YouTube: California Phenology TCN

Twitter: @CalPhenologyTCN

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**Project Manager**

**Katie Pearson: [kdpearso@calpoly.edu](mailto:kdpearso@calpoly.edu)**

