Welcome!

California Phenology TCN Kickoff Meeting

Agenda

- Introductions
- Project overview
  - Goals
  - Implementation: imaging, phenological scoring, georeferencing
  - Education and Outreach
  - Timeline
- Imaging workflow
  - Symbiota 101
  - Equipment recommendations
  - Image processing
  - Image storage
  - Reporting
- Next steps
- Q&A
- Individual meetings

Introductions

CAL POLY
SAN LUIS OBISPO

Berkeley
UNIVERSITY OF CALIFORNIA

Rancho Santa Ana
Botanic Garden
California's Native Garden

Santa Barbara Botanic
the GARDEN

HUMBOLDT
STATE UNIVERSITY

theNAT
SAN DIEGO NATURAL HISTORY MUSEUM

SAN DIEGO STATE
UNIVERSITY

California Department of
Parks and Recreation

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.

Organization

Consortium of California Herbaria
(CCH)
Organization of 38 participants

The CCH organization manages

CCH2

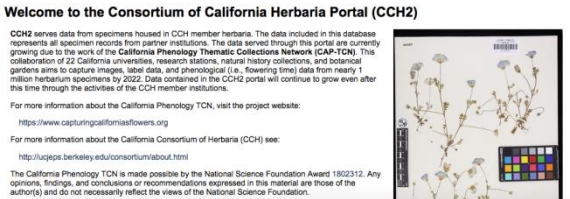
Symbiota Portal –
Specimen data of all plant groups from all CCH members

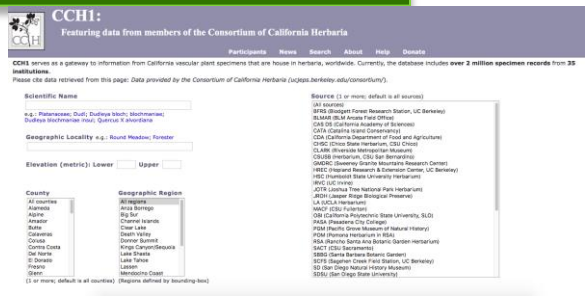
data flow

CCH1

Specimen data of California vascular plants from herbaria worldwide (not limited to CCH2)

periodic
error reports
to participants





Goals of CAP – TCN

- Image 904,200 specimens
- Database 302,400 specimens
- Georeference 300,000+ specimens

Goals (cont'd)

- Capture phenological data for all 900,000+ specimens

Digitizing institution	Total records in this project	Specimens to image only	Specimens to fully database
BSCA – Colorado Desert District, California Dept. of Parks and Recreation	5,000	0	5,000
CHSC – CSU Chico	**30,000**	**22,000**	**8,000**
CSLA – CSU Los Angeles	35,000	0	35,000
CSUSB – CSU, San Bernardino	**4,200**	**4,000**	**200**
DAV – UC Davis	50,000	50,000	0
FSC – CSU Fresno	**40,000**	**0**	**40,000**
HSC – CSU, Humboldt	30,000	30,000	0
IRVC – UC, Irvine	**35,000**	**0**	**35,000**
LA – UC, Los Angeles	45,000	0	45,000
LOB – CSU, Long Beach	**11,000**	**0**	**11,000**
MACF – CSU, Fullerton	25,000	0	25,000
OBI – California Polytechnic State University, San Luis Obispo	**40,000**	**0**	**40,000**
RSA – Rancho Santa Ana Botanic Garden	100,000	80,000	20,000
SBBG – Santa Barbara Botanic Garden	**80,000**	**70,000**	**10,000**
SD – San Diego Natural History Museum	71,000	67,000	4,000
SDSU – San Diego State University	**20,000**	**20,000**	
SFV – CSU, Northridge	25,000	15,000	10,000
SJSU – CSU, San Jose	**10,200**	**10,200**	**0**
UC/JEPS – UC, Berkeley	100,000	100,000	0
UCR – UC, Riverside	**105,000**	**100,000**	**5,000**
UCSB – UC, Santa Barbara	34,000	30,000	4,000
UCSC – UC, Santa Cruz	**7,000**	**4,000**	**3,000**

Goals (cont'd)

- 22 target families
  - Oldest records
  - Most diverse families
  - Most endemic and threatened families
- 250 additional taxa

USA npn National Phenology Network

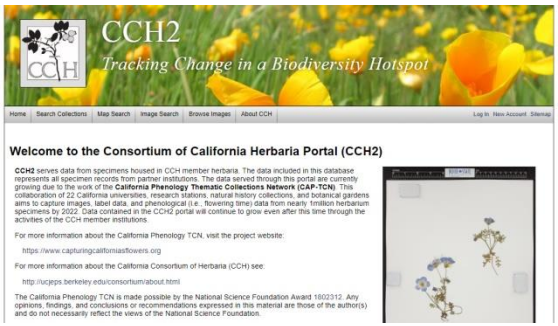
Target Families	Native taxa	Invasive taxa	Endemic taxa
Adoxaceae	4	2	0
Agavaceae	23	0	5
Asteraceae (*Ericameria*, *Eriophyllum*, *Erigeron*)	133		
Boraginaceae	358		
Brassicaceae	254		
Ericaceae	140		
Fabaceae (*Lupinus*, *Trifolium*)	158	20	74
Fagaceae	33	2	10
Lamiaceae	136	18	72
Melanthiaceae	19	0	6
Onagraceae	189	14	82
Orobanchaceae	128	4	61
Papaveraceae	34	8	15
Phrymaceae	73	0	30
Plantaginaceae	164	31	58
Polemoniaceae	252	1	123
Polygonaceae	327	36	156
Ranunculaceae	116	13	38
Rhamnaceae	84	2	47
Rosaceae	194	36	63
Sapindaceae	6	2	0
Zygophyllaceae	5	3	0
Remaining NPN Taxa	250	–	–
Totals	3080	291	1189

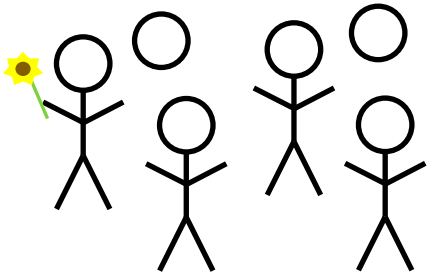
Proportion of California flora targeted:
58% of native species
67% endemic species

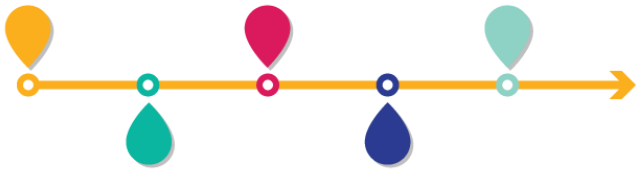
Implementation: Imaging

- Imaging

Symbiota







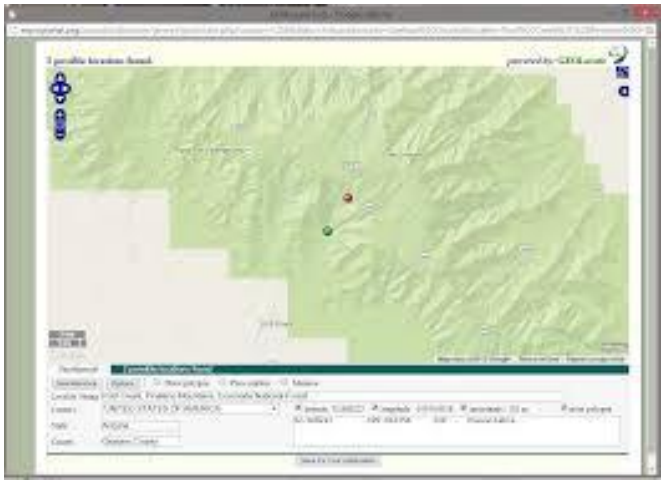
1. Get started in the portal
2. Obtain materials, recruit workers
3. Establish protocols, timeline

Implementation: Imaging (cont'd)

4. Get workers trained

Implementation: Imaging (cont'd)

5. Image specimens, transcribe labels, georeference



Implementation: Imaging (cont'd)

6. **Keep in touch!**
   - Monthly calls
   - Webinars
     - Data cleaning
     - Herbarium curation tasks (e.g., loans, labels, annotations)
     - Georeferencing
     - And more!

Implementation: Scoring phenology

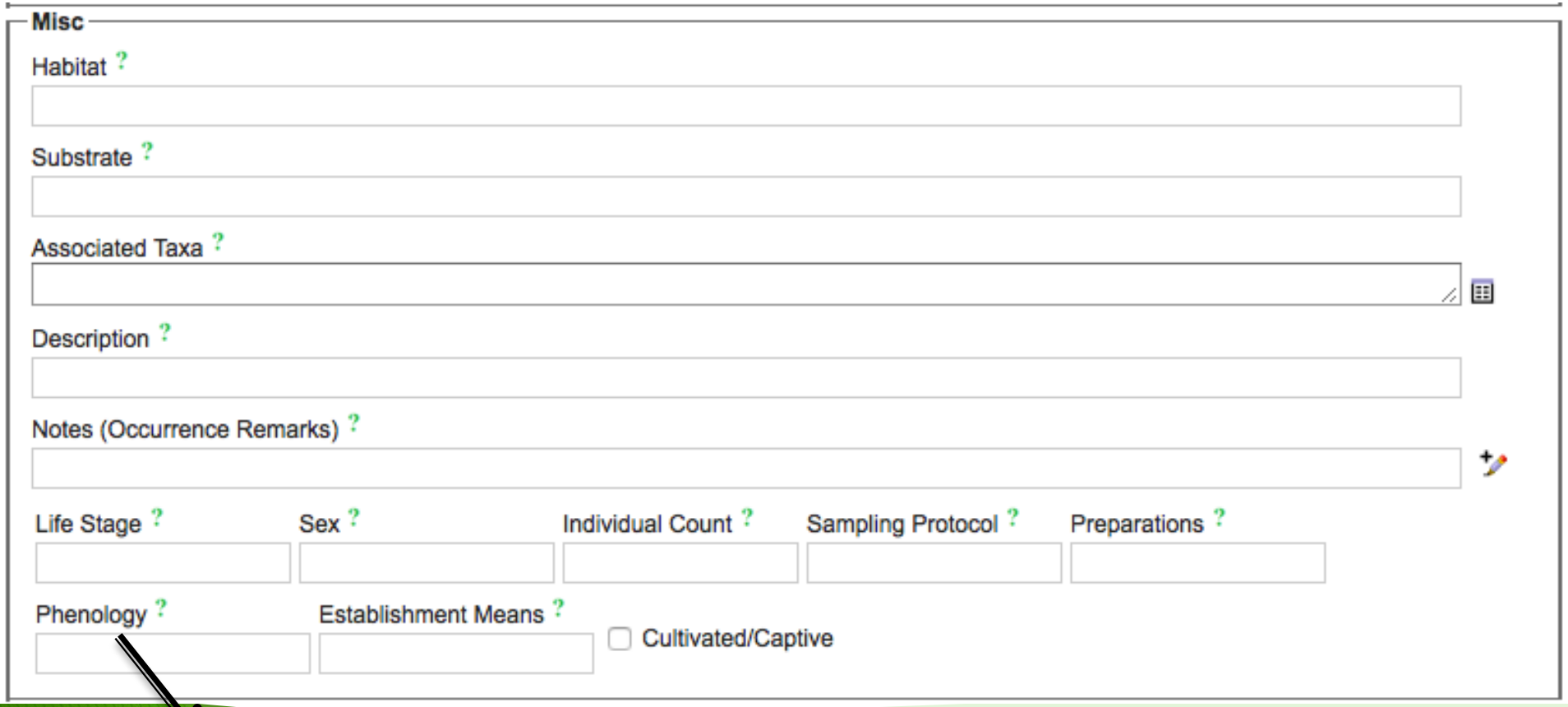
- During transcription
- Notes from Nature
- Phenology courses
  (UCSB, OBI)

Implementation: Scoring phenology (cont'd)

First-order	Second-order	Third-order
Are 'reproductive structures' present? (yes/no/not scorable)	Are 'unopen flowers' present?	Mostly 'unopen flowers?' (or counts)
	Are 'open flowers' present?	Mostly 'open flowers?' (or counts)
		Mostly 'post-mature flowers'? (or counts)
	Are 'fruits' present?	Mostly 'immature fruits'? (or counts)
		Mostly 'mature fruits'? (or counts)
		Mostly 'post-mature fruits'? (or counts)

Yost et al. 2018

Implementation: Scoring phenology (cont'd)



Reproductive structures present: y/n
Unopened flowers present:
Opened flowers present:
Fruits present:

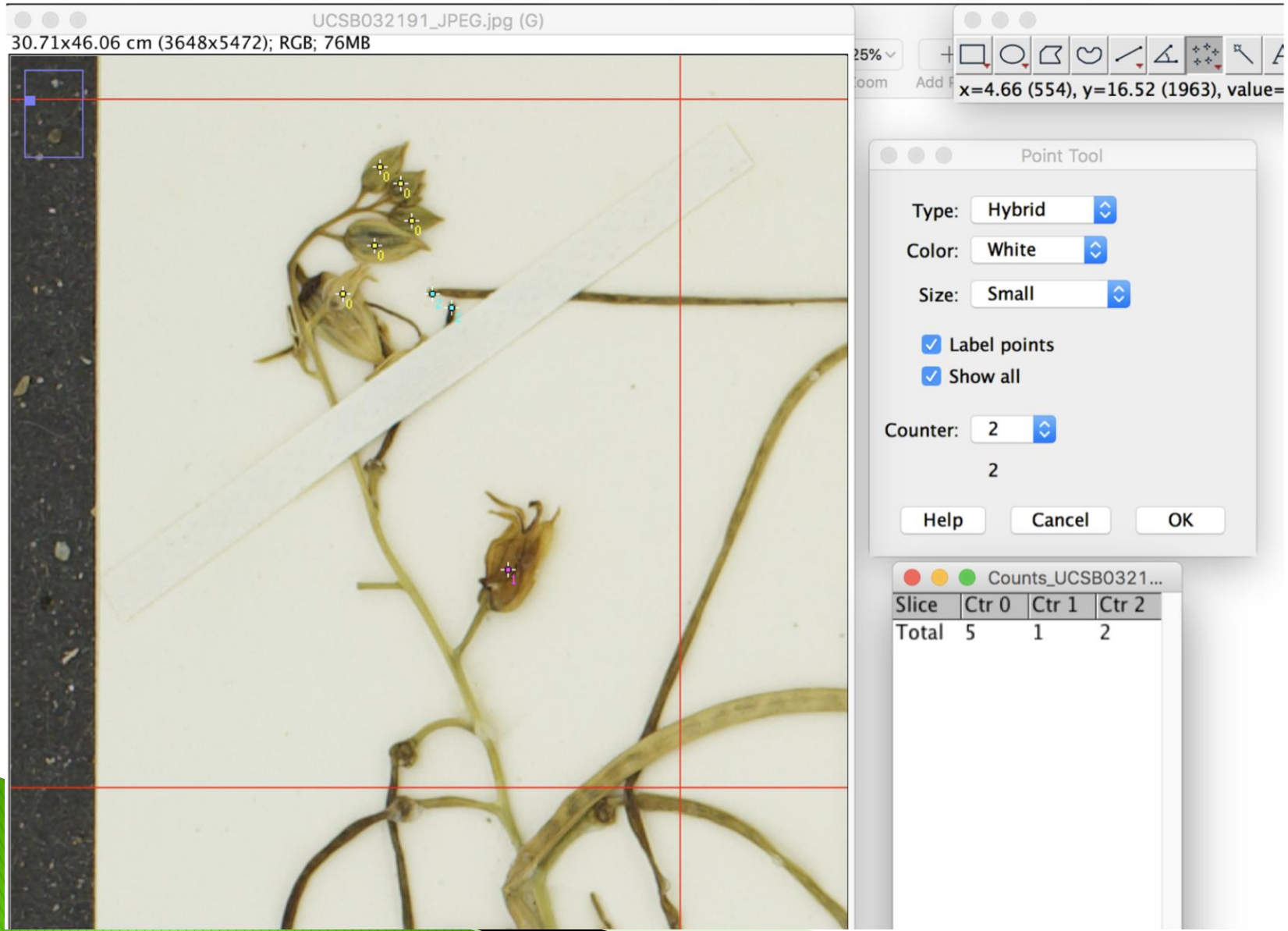
Implementation: Scoring phenology (cont'd)

- Four undergraduates in Mazer's lab at UCSB have earned $750 awards and course credit to conduct specimen-based research linking specimen collection dates (for flowering specimens) to historical and recent climatic conditions in:

  Streptanthus tortuosus (Brassicaceae)
  Streptanthus polygaloides (Brassicaceae)
  *Nemophila menziesii (*Boraginaceae)

- Using ImageJ to score images

Implementation: Scoring phenology (cont'd)



Implementation: Georeferencing

- Symbiota georeferencing tools
- Everyone should georeference!

Education and outreach

- K-12 phenology lesson plans

UNIVERSITY OF CALIFORNIA, SANTA BARBARA
CCBER
CHEADLE CENTER FOR BIODIVERSITY & ECOLOGICAL RESTORATION

- Undergraduate courses at OBI and UCSB
- UCSB School of Education internships
- Citizen science: phenology expeditions
- Public phenology workshops at UCSB, SBBG, RSA and/or UCB

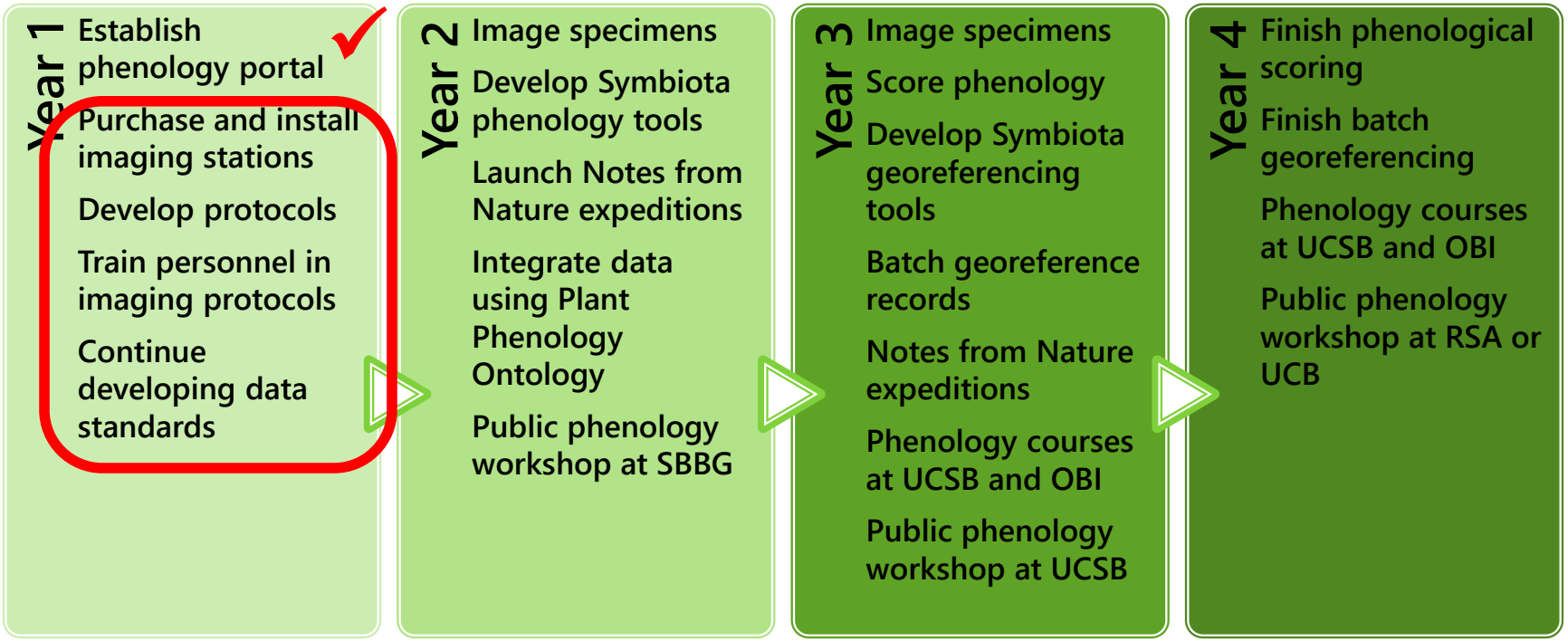
Education and outreach (cont'd)

- https://www.youtube.com/watch?v=SNNPNlyj8Hc

Education and outreach (cont'd)

- https://www.youtube.com/watch?v=SNNPNlyj8Hc

Timeline


Year 1
Establish phenology portal
Purchase and install imaging stations
Develop protocols
Train personnel in imaging protocols
Continue developing data standards
Year 2
Image specimens
Develop Symbiota phenology tools
Launch Notes from Nature expeditions
Integrate data using Plant Phenology Ontology
Public phenology workshop at SBBG
Year 3
Image specimens
Score phenology
Develop Symbiota georeferencing tools
Batch georeference records
Notes from Nature expeditions
Phenology courses at UCSB and OBI
Public phenology workshop at UCSB
Year 4
Finish phenological scoring
Finish batch georeferencing
Phenology courses at UCSB and OBI
Public phenology workshop at RSA or UCB

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- **Imaging workflow**
  - Symbiota 101
  - Equipment recommendations
  - Image processing
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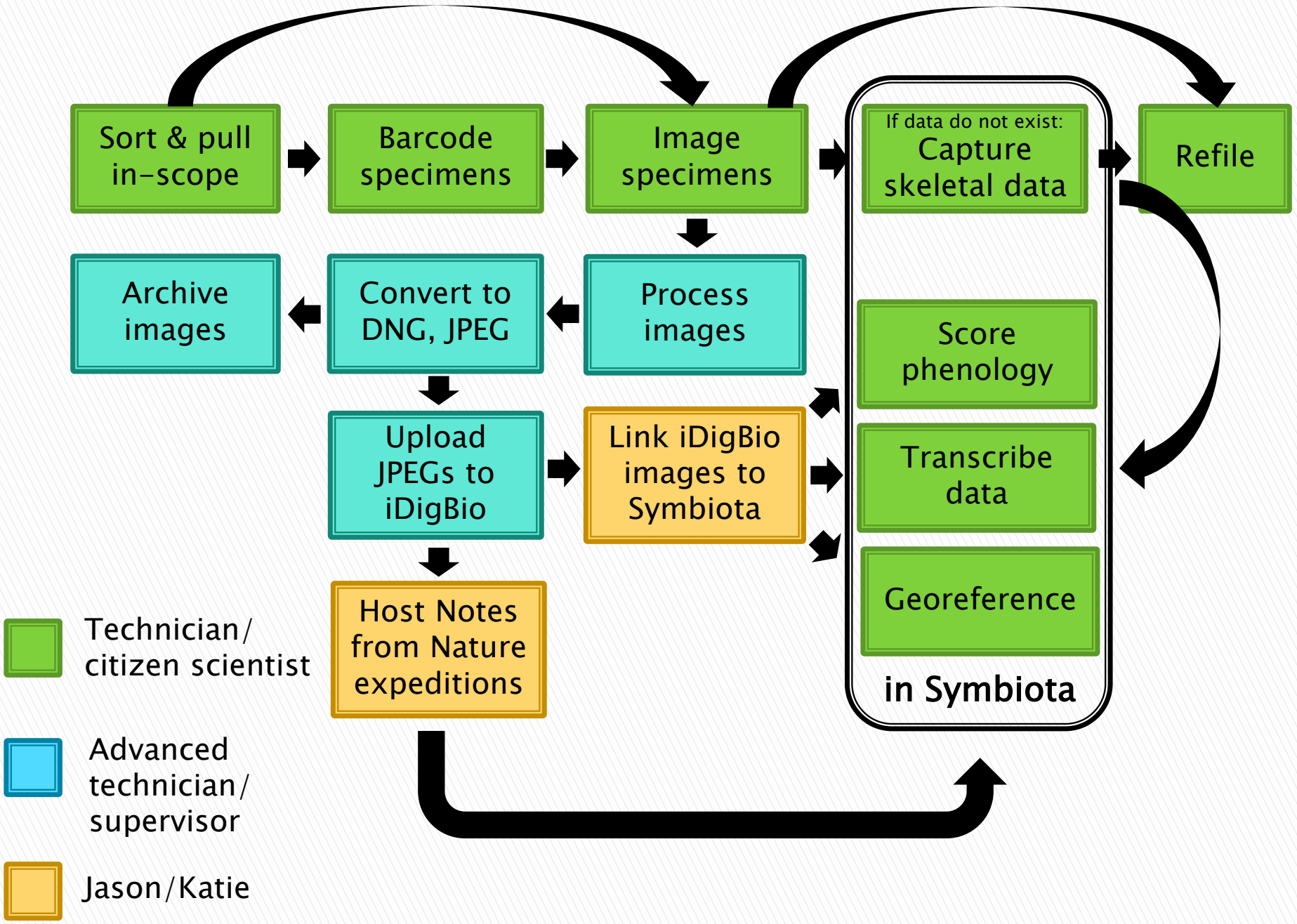
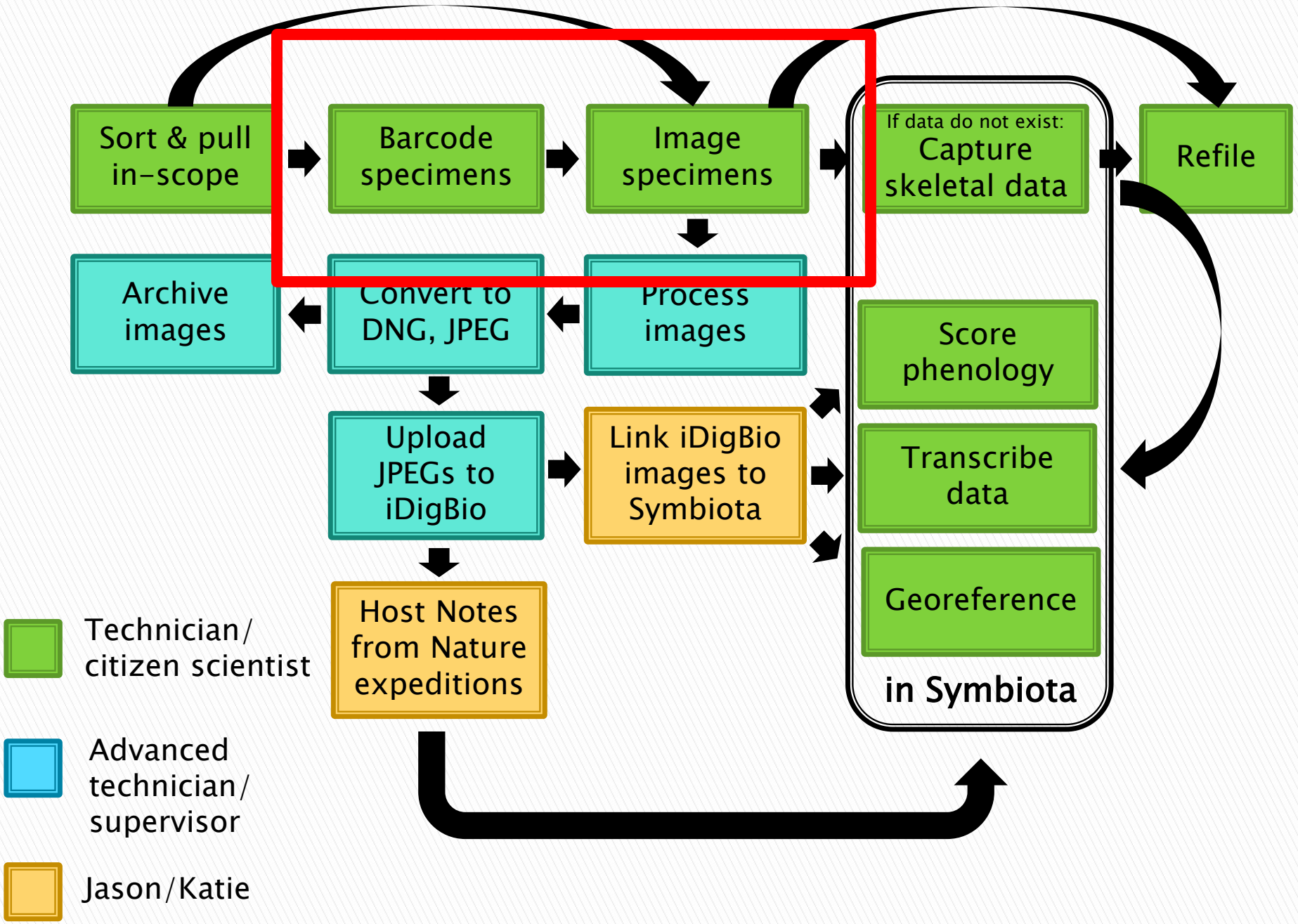

Sort & pull in-scope
Barcode specimens
Image specimens
If data do not exist:
Capture skeletal data
Refile
Archive images
Convert to DNG, JPEG
Process images
Score phenology
Upload JPEGs to iDigBio
Link iDigBio images to Symbiota
Transcribe data
Georeference
Host Notes from Nature expeditions
in Symbiota
Technician/ citizen scientist
Advanced technician/ supervisor
Jason/Katie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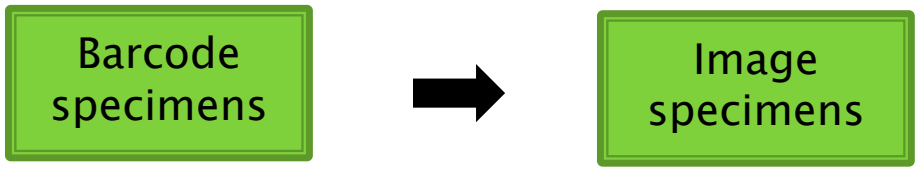


Already databased

Update catalog number in the portal when barcode is applied → Image specimen

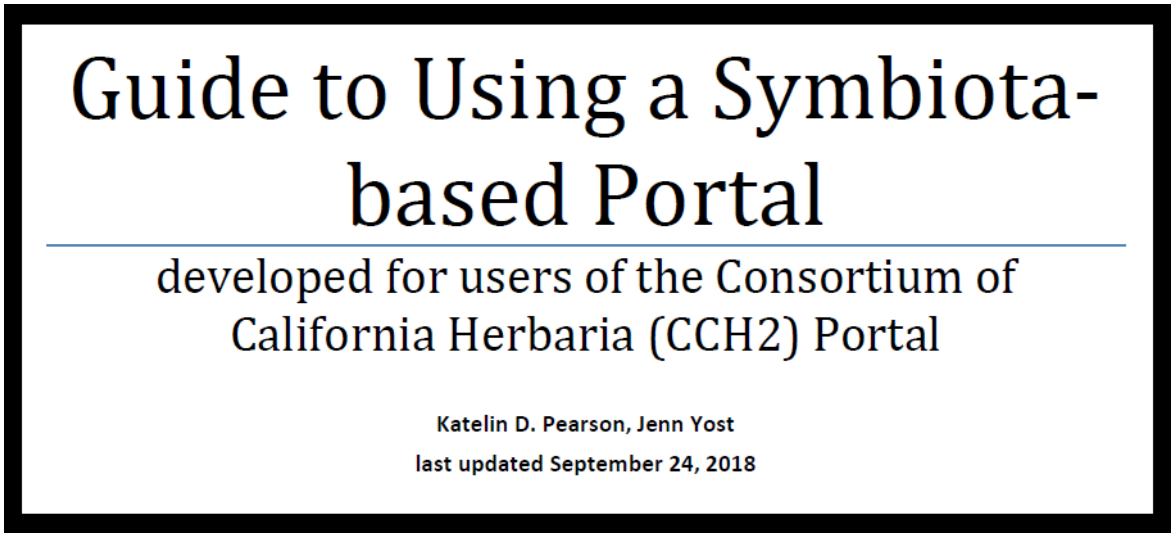
NOT databased

Apply barcode → Create “skeletal record” as specimen is imaged

Symbiota 101

Symbiota 101

- https://www.capturingcaliforniasflowers.org/symbiota-tutorials.html



Symbiota 101

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3.2 Administration Control Panel 4
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6. Searching and sorting specimen records 7
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Symbiota terminology

- **Occurrence record**: specimen record; based on Darwin Core definition of occurrence, which is an existence of an organism at a particular place at a particular time (http://rs.tdwg.org/dwc/)
- **Darwin Core (DwC)**: body of standards (terms and definitions) for documenting and sharing information about biological diversity
- **Apple Core**: body of standards for documenting and sharing biodiversity data, specifically designed for use with herbarium data (https://code.google.com/archive/p/applecore/)

Wait! There's more….!

Symbiota terminology (cont'd)

- **Darwin Core Archive (DwC-A)**: single compressed ZIP file that contains one to several data files along with a meta.xml document that describes the content (http://nansh.org/portal/collections/datasets/datapublisher.php)

- **Metadata**: set of data that describes and gives information about other data

- **GUID**: globally unique identifier; a unique number that can be used as an identifier for anything in the universe (guid.one/guid)

Imaging station recommendations

- Nikon D800E (or D800, D810, D750)
- 50 mm standard lens

Imaging station recommendations
(cont'd)

$1800 with shipping

$150-300

Imaging station recommendations
(cont'd)

Imaging station recommendations
(cont'd)

Imaging station recommendations
(cont'd)

Imaging station recommendations (cont'd)

- Imaging computer (at least 4 GB RAM, as much hard drive storage as possible)
- Accessories
  - AC adapter for camera
  - Remote camera control
  - Barcode scanner
  - Color standards
  - Computer
  - Camera-to-computer cord (micro-USB)
  - Ethernet cable

No need to take notes…this will all be on the website!

Barcode recommendations

Herbarium Name
(+ location if desired)

Barcode

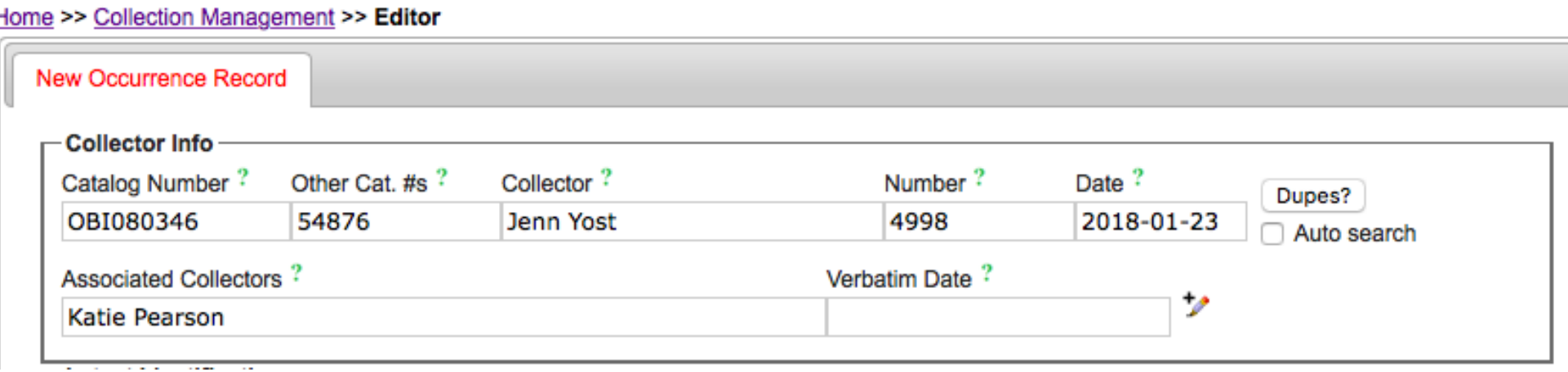
Index Herbariorum
code+ barcode
number of set length

Leading zeros if
number smaller than
set length

Barcode recommendations (cont'd)

GUID = Globally Unique Identifier

Barcode recommendations (cont'd)



Barcode sourcing

Reliance
Barcode Solutions™
14926 35th Ave. W., Suite 100 • Lynnwood, WA 98087 • 866.633.0827

Job Details	
Job Description:	LIB 2 x .611 Paper Rolls 2 x .611 Single labels on 60# Semi Gloss with Matte Lamination Finished in Rolls on Plastic Cores 1000 Labels Per Roll
Comments:	There will be an additional $35.00 Programming Fee UPS Ground shipping is not included in quote.

Component Details			
Component:	LIB 2 x .611 Paper Rolls		
Size:	2 X 0.611	**Stock Description:**	60 Semi Gloss with 757 Heavy Coat Weight 78# Line
Front Colors:	1	**Color:**	White
Back Colors:	0	**BWT:**	0
Bleed:	No	**Thickness:**	.0000

Quantity	Price	Per M
5,000	$215.75	$43.15
10,000	$335.00	$33.50
20,000	$525.00	$26.25
50,000	$1,122.50	$22.45
80,000	$1,740.00	$21.75
100,000	$2,100.00	$21.00

Home About Resources Education & Outreach News Portal

Equipment Recommendations

Below are links to documents that describe the recommended equipment for this project.

Barcodes

Camera and lens

Imaging station

Image processing

Image processing

- Crop, adjust light balance
- Convert into DNGs and JPEGs

Symbiota

iDigBio
Integrated Digitized Biocollections

Florida State University's Robert K. Godfrey Herbarium (FSU)

Home >> Collection Management >> Public Display >> Editor

|< << | 1 of 13 | >> >| >*

Occurrence Data | Determination History | Images | Linked Resources | Admin

Collector Info

Catalog Number: 000176304 | Other Cat. #s | Collector | Number | Date | Dupes? | Auto search

Associated Collectors | Verbatim Date

Exsiccati Title | Number

Latest Identification

Scientific Name: Elephantopus tomentosus | Author: L.

ID Qualifier | Family: Asteraceae

Identified By | Date Identified

Locality

Country: United States | State/Province: Florida | County: Gulf | Municipality

Locality

Locality Security | Deactivate Locality Lookup

Latitude | Longitude | Uncertainty | C | F | Datum | Verbatim Coordinates

Elevation in Meters | Verbatim Elevation | Depth in Meters | Verbatim Depth

Label Processing

Zoom? Rotate: L <> R Med Res. High Res.

OCR Image | Image 1 of 1

Options: OCR whole image | OCR w/ analysis

Image storage

- A hard drive is the worst option
- Contact your IT department for options
  - Cloud storage?
  - BIO-servers?
- Katie can help!

Reporting

- Annual report to NSF due ~~July 31~~ **June 30**
  - Participants
  - Activities and findings
  - Publications and products
  - Contributions (societal, academic, etc.)
  - Conference proceedings
- Quarterly reports
  - Imaging progress
  - Problems
  - New training, collaborations
  - Opportunities for sustainability
  - Education and outreach

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Next steps (now – January)

1. Get set up on Symbiota
2. Purchase barcodes
3. Purchase imaging station equipment
4. Determine institutional image storage solution
5. Coordinate with Katie to establish an institutional imaging protocol

But wait, there's more!

Next steps (now – January)

6. Recruit/hire student workers/imaging technicians
   - Katie will train when she comes to help set up the imaging station
7. Prepare collection for imaging process
   - Strategize imaging station location, identify in-scope specimens, barcode specimens
8. Hype up the project!
   - Campus newspaper, social media, local media, CNPS newsletters, local naturalist groups
   - Email/tweet Katie with any links/stories

Questions?

Thanks!

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