Documenting reproductive phenology using herbarium specimens: experiences from the New England Vascular Plants project

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Yale University Herbarium

Peabody Museum of Natural History

Yale PEABODY MUSEUM OF NATURAL HISTORY

Yale University Herbarium

Mobilizing New England Vascular Plant Specimen Data to Track Environmental Changes

PARTNERS

Consortium of Northeastern Herbaria

PARTNERS

- Brown University (BRU)
- Harvard University (HUH)
- U. of New Hampshire (NHA)
- U. of Massachusetts Amherst (MASS)
- U. of Vermont (VT)
- Yale University (YU)

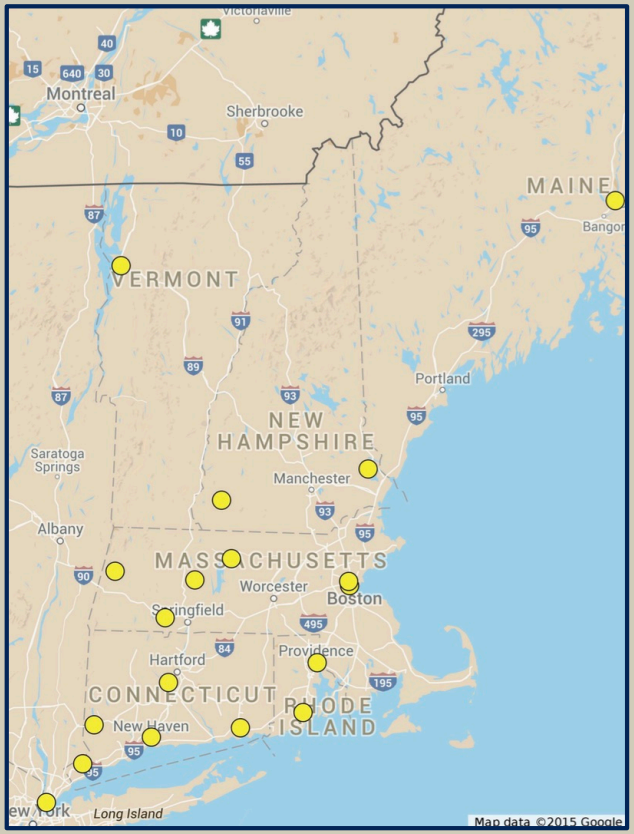
- Bartlett Arboretum (BART)
- Berkshire Museum (BERK)
- Boston University (BSN)
- Central Connecticut State U. (CCSU)
- Connecticut College (CCNL)
- Harvard Forest (HF)
- Keene State (KESC)
- U. of Rhode Island (KIRI)
- Western Connecticut State U. (WCSU)
- Westfield State U. (WSCH)

PENs:

- U. of Maine (MAINE)
- New York Botanical Garden (NYBG)

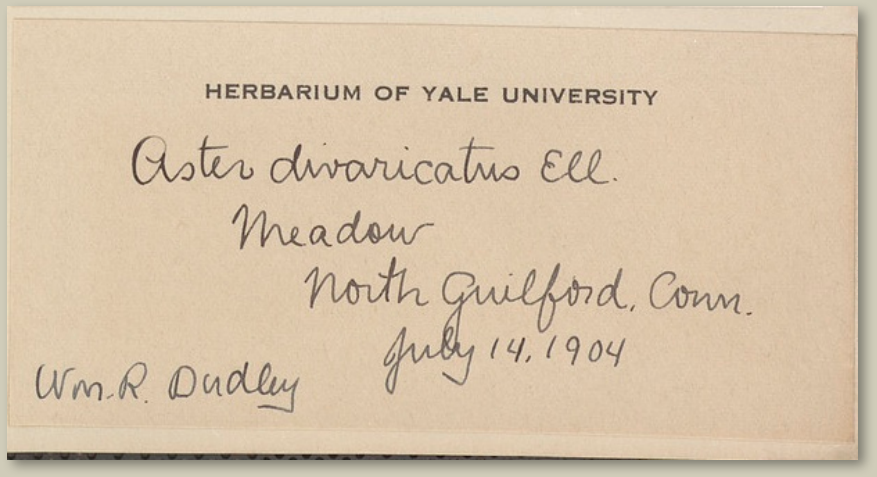
OVERALL OBJECTIVES

- Digitize over one million New England vascular plant specimens from 18 regional herbaria
- Georeference
- Score phenology

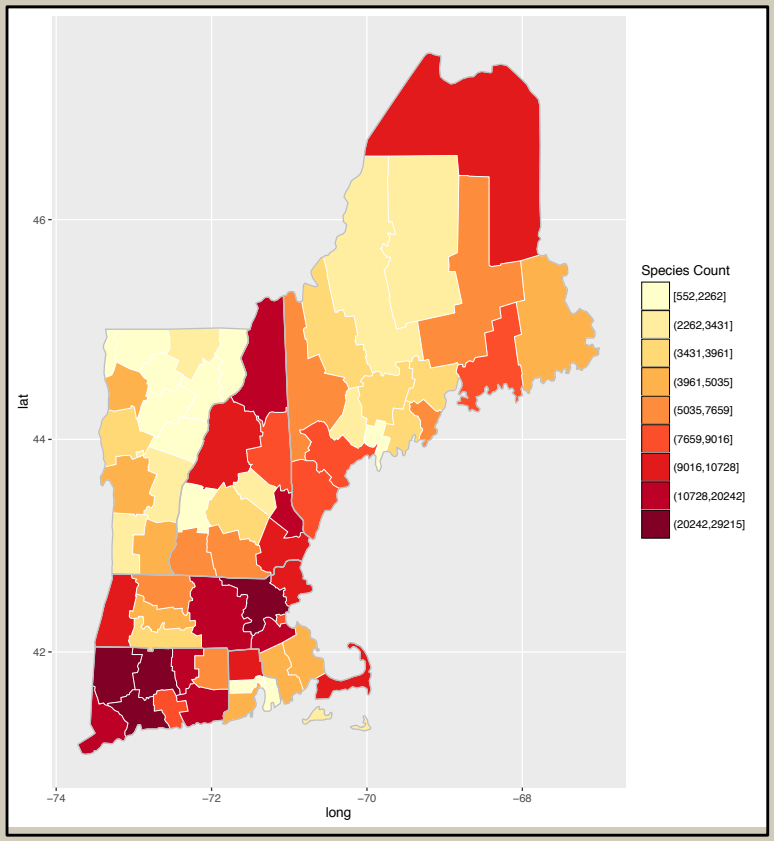


DIGITIZATION

- **Capture an image and a subset of label data**



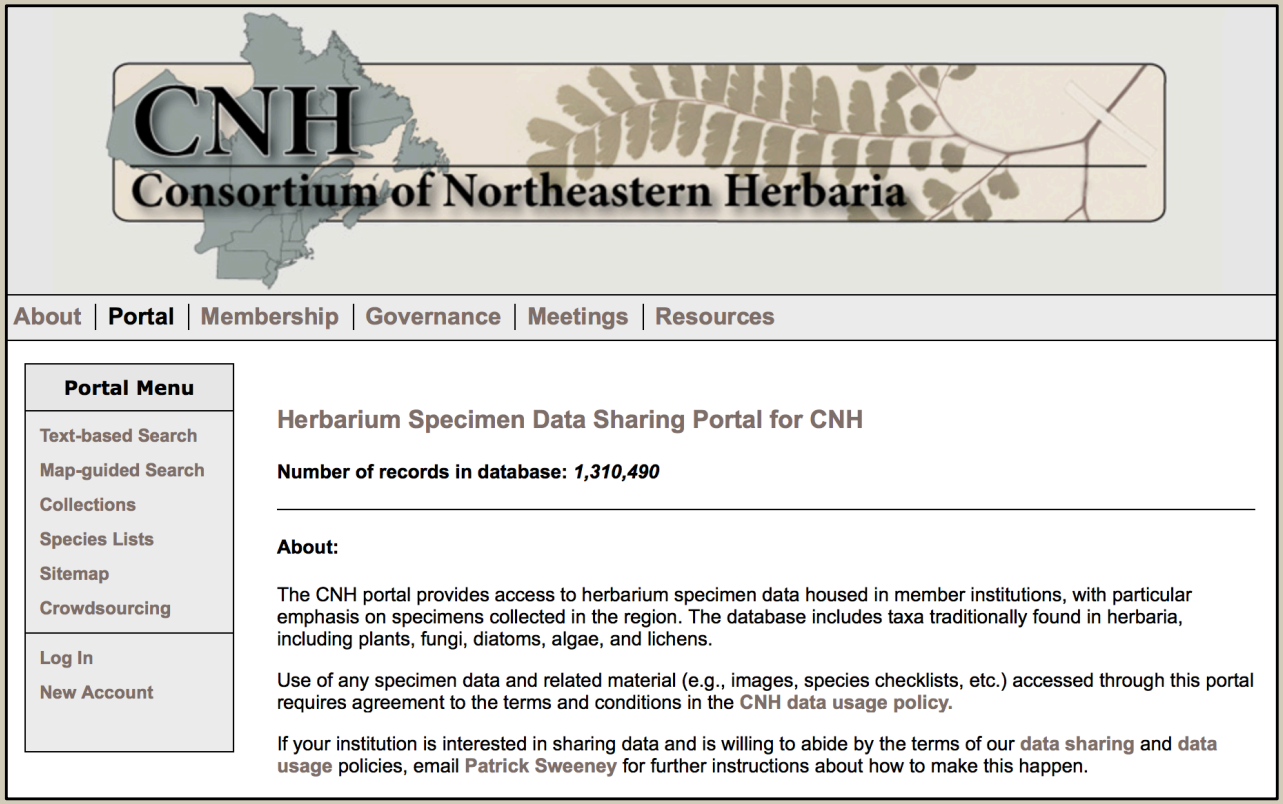
DIGITIZATION: RESULTS



DISSEMINATION: PORTAL

symbiota.org

portal.neherbaria.org



PHENOLOGY

PHENOLOGY

- Involves humans scoring reproductive phenology (flowering & fruiting state) from images of specimens.

PHENOLOGY: TARGET TAXA

Prioritized list of target taxa

Acer pensylvanicum
Acer rubrum
Acer saccharum
Acer spicatum
Sagittaria latifolia
Ilex mucronata
Ilex verticillata
Asarum canadense
Betula lenta
Betula papyrifera
Betula populifolia
Cakile edentula
Cardamine concatenata
Cardamine diphylla
Lobelia cardinalis
Lobelia inflata
Diervilla lonicera
Lonicera canadensis
Viburnum lentago
Viburnum nudum var. cassinoides
Clethra alnifolia
...

PHENOLOGY: CONTROLLED VOCABULARY

1) Developed with input from users of data
2) Simplicity
3) Broad applicability
4) Subcategories within major stages put finer point on scorings, make it possible to spot subtler trends and measure flowering and fruiting periods.
5) A key point is that people using this system will need some level of training before they can start scoring specimens.

PHENOLOGY: CONTROLLED VOCABULARY

iDigBio
Integrated Digitized Biocollections

CAL POLY
SAN LUIS OBISPO

Jenn Yost

Coding Phenological Data from Herbarium Sheets

Add this event to your calendar:
iCal

This invited 2-day workshop will address standards and practices for research-driven phenological character extraction from imaged herbarium specimens.

The workshop will focus on data standards for finding consistent ways to code phenological data from herbarium sheets to make digitized data from museums more useful in large scale research endeavors.

Please visit the workshop wiki page for the latest updates.

Start Date:
Saturday, March 12, 2016 (All day) to Sunday, March 13, 2016 (All day)
Location:
The University of California, Berkeley and Jepson Herbaria
City:
Berkeley
State:
California
printer-friendly version

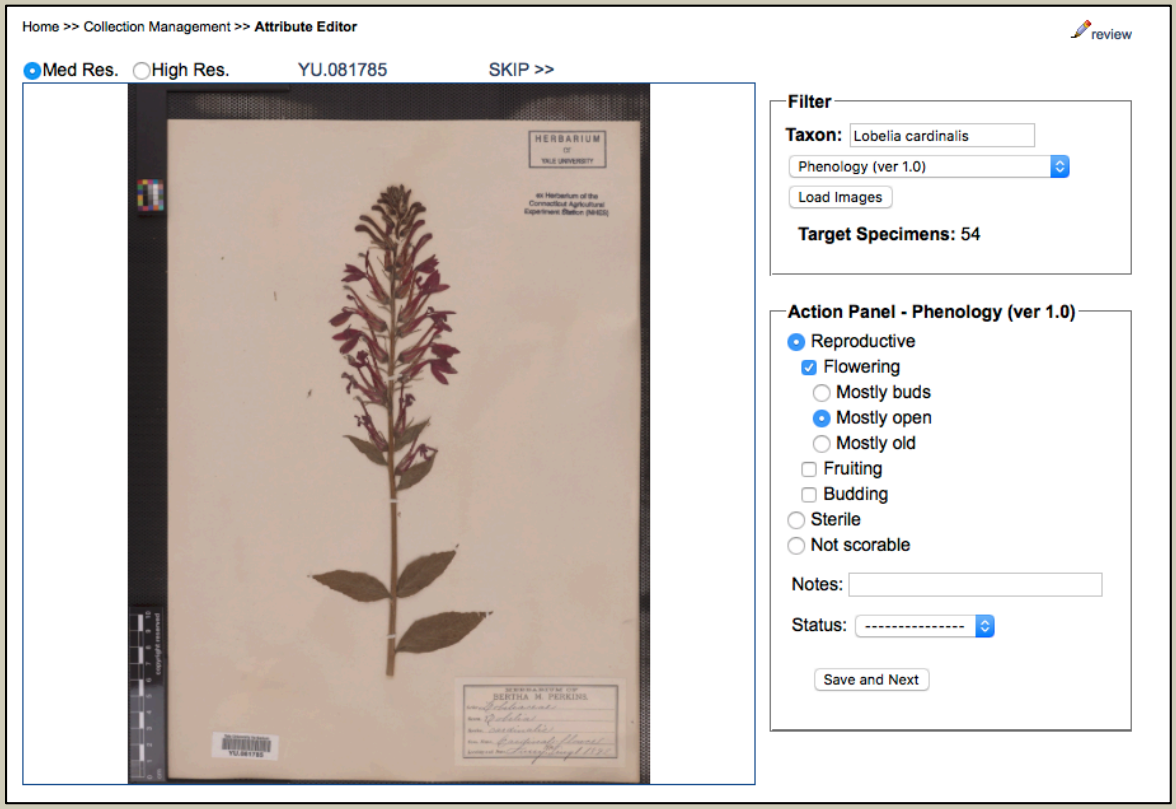
https://www.idigbio.org/wiki/index.php/Coding_Phenological_Data_from_Herbarium_Sheets

PHENOLOGY: CONTROLLED VOCABULARY

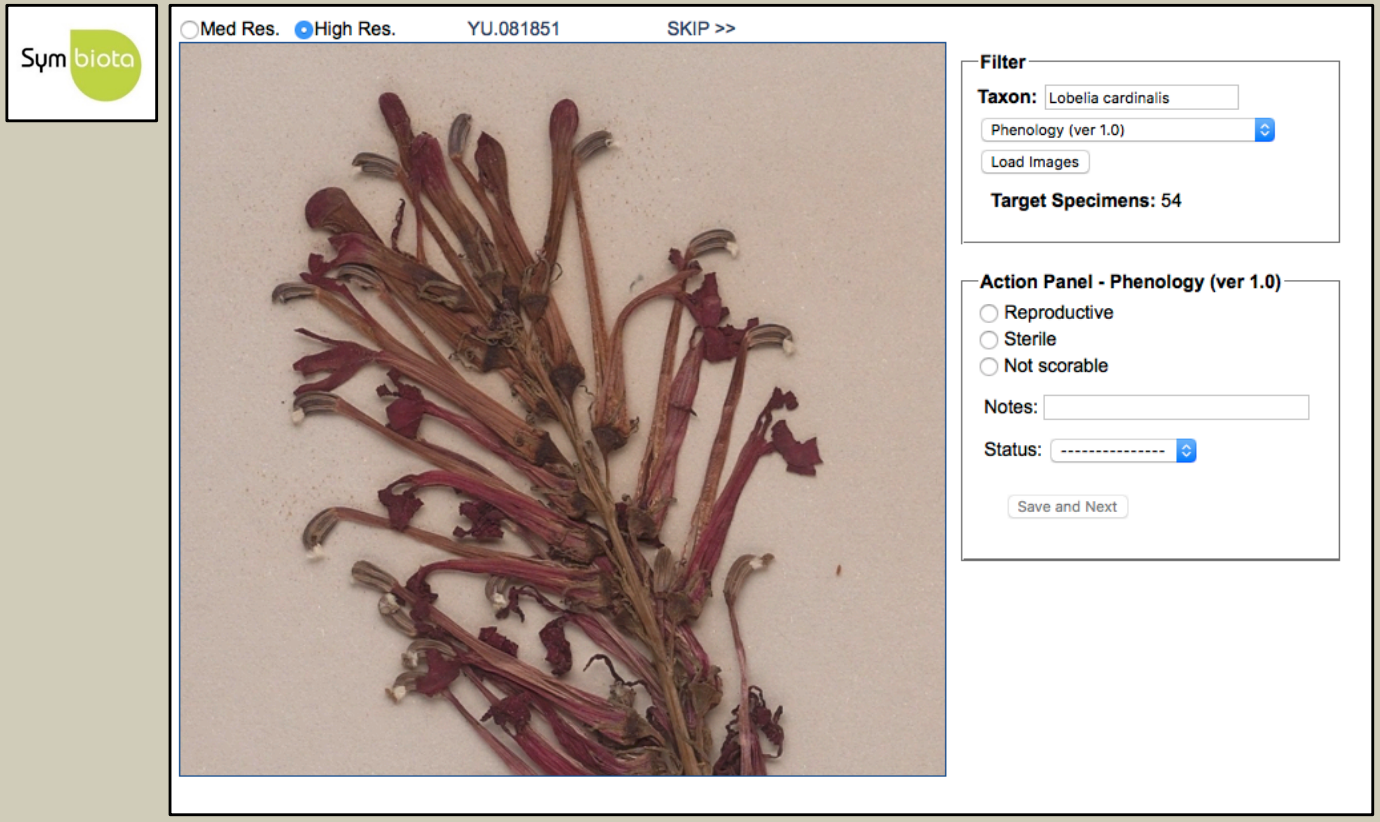
NEVP Phenology Term/Concept			URI
			http://purl.org/nevp/vocabulary/reproductive-phenology#00
reproductive condition			http://purl.org/nevp/vocabulary/reproductive-phenology#01
	sterile		http://purl.org/nevp/vocabulary/reproductive-phenology#02
	reproductive		http://purl.org/nevp/vocabulary/reproductive-phenology#03
		budding	http://purl.org/nevp/vocabulary/reproductive-phenology#04
		number buds present	http://purl.org/nevp/vocabulary/reproductive-phenology#05
		flowering	http://purl.org/nevp/vocabulary/reproductive-phenology#06
		number flowers present	http://purl.org/nevp/vocabulary/reproductive-phenology - 07
		mostly buds	http://purl.org/nevp/vocabulary/reproductive-phenology#08
		mostly open	http://purl.org/nevp/vocabulary/reproductive-phenology#09
		mostly old	http://purl.org/nevp/vocabulary/reproductive-phenology#10
		fruiting	http://purl.org/nevp/vocabulary/reproductive-phenology#11
		number fruits present	http://purl.org/nevp/vocabulary/reproductive-phenology#12
		mostly young	http://purl.org/nevp/vocabulary/reproductive-phenology#13
		mostly mature	http://purl.org/nevp/vocabulary/reproductive-phenology#14
		past maturity	http://purl.org/nevp/vocabulary/reproductive-phenology#15
	not scorable		http://purl.org/nevp/vocabulary/reproductive-phenology#16

http://purl.org/nevp/vocabulary/reproductive-phenology
SKOS (Simple Knowledge Organization System)

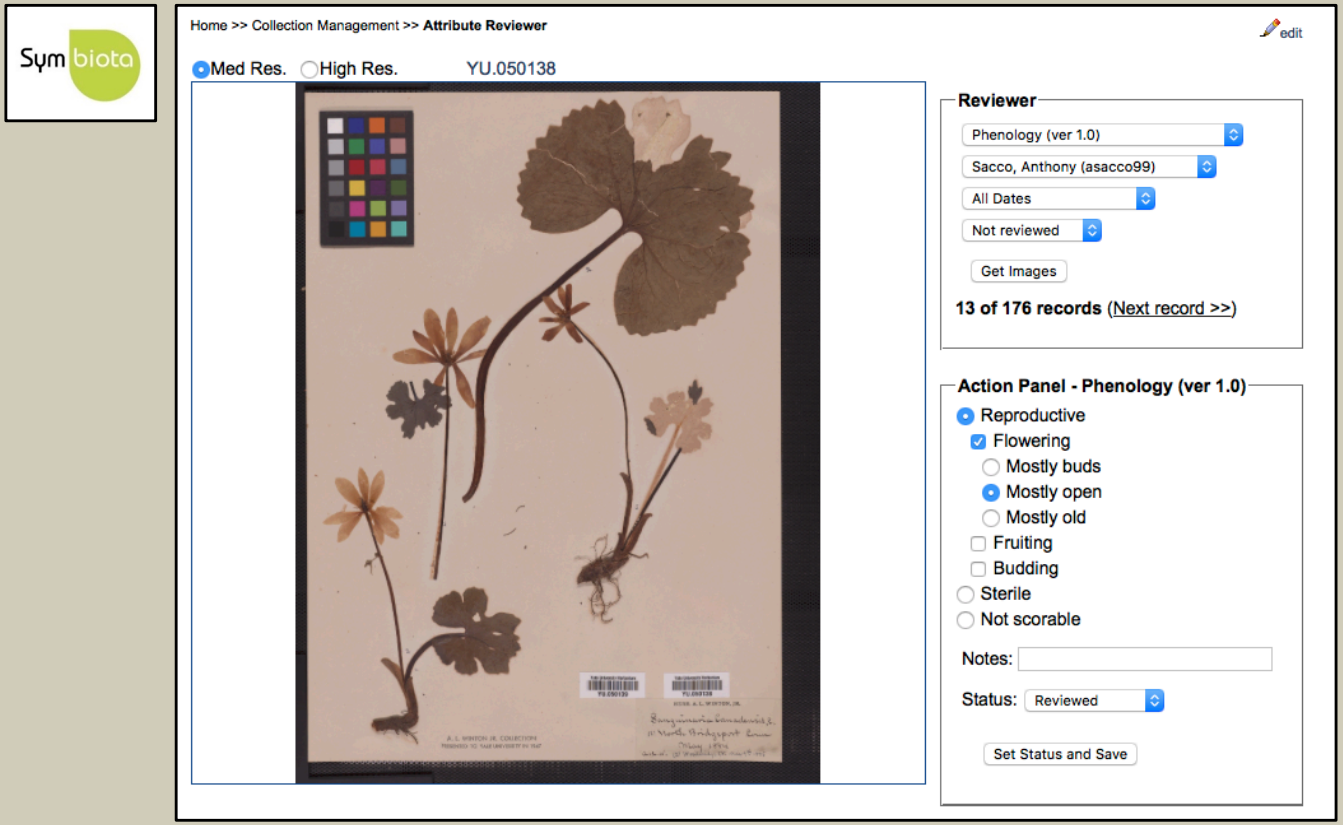
PHENOLOGY: WORKFLOW
SYMBIOTA IMAGE SCORING TOOL



PHENOLOGY: WORKFLOW
SYMBIOTA IMAGE SCORING TOOL



PHENOLOGY: WORKFLOW
SYMBIOTA IMAGE SCORING TOOL

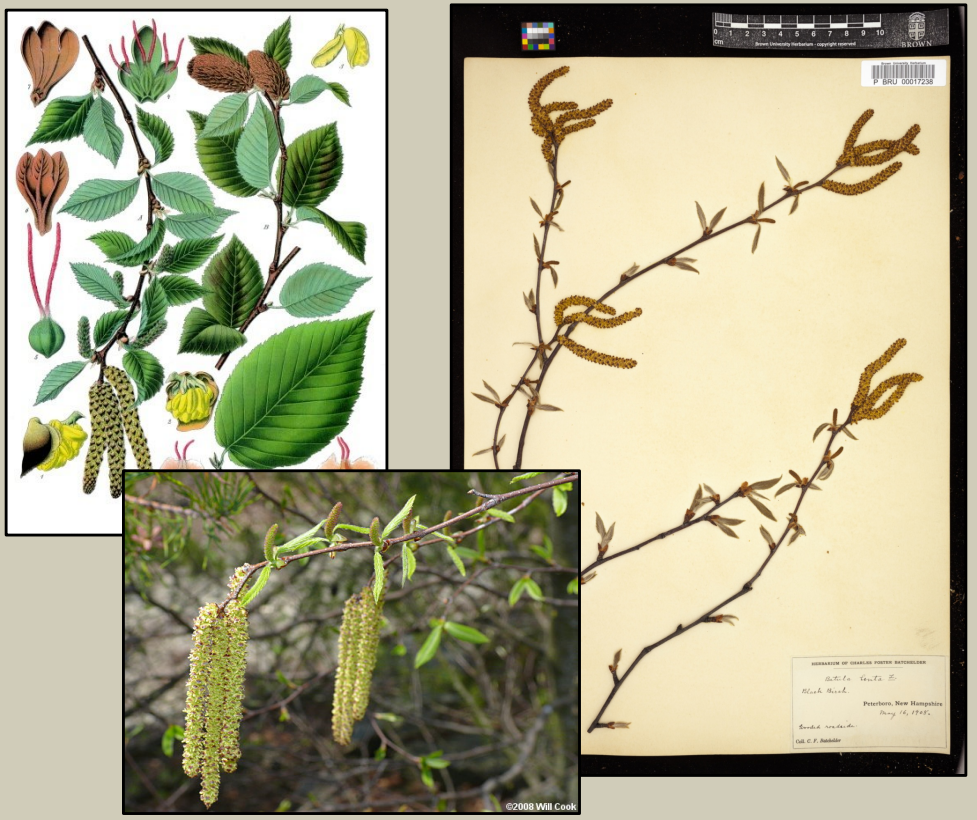


PHENOLOGY: WORKFLOW

- A key point is that people using this system will need some level of training before they can start scoring specimens.
  - Many people have only a limited idea of plant morphology.
  - Many plants have peculiarities, so that people may need to have some training for each species or each genus that they work on.

PHENOLOGY: WORKFLOW

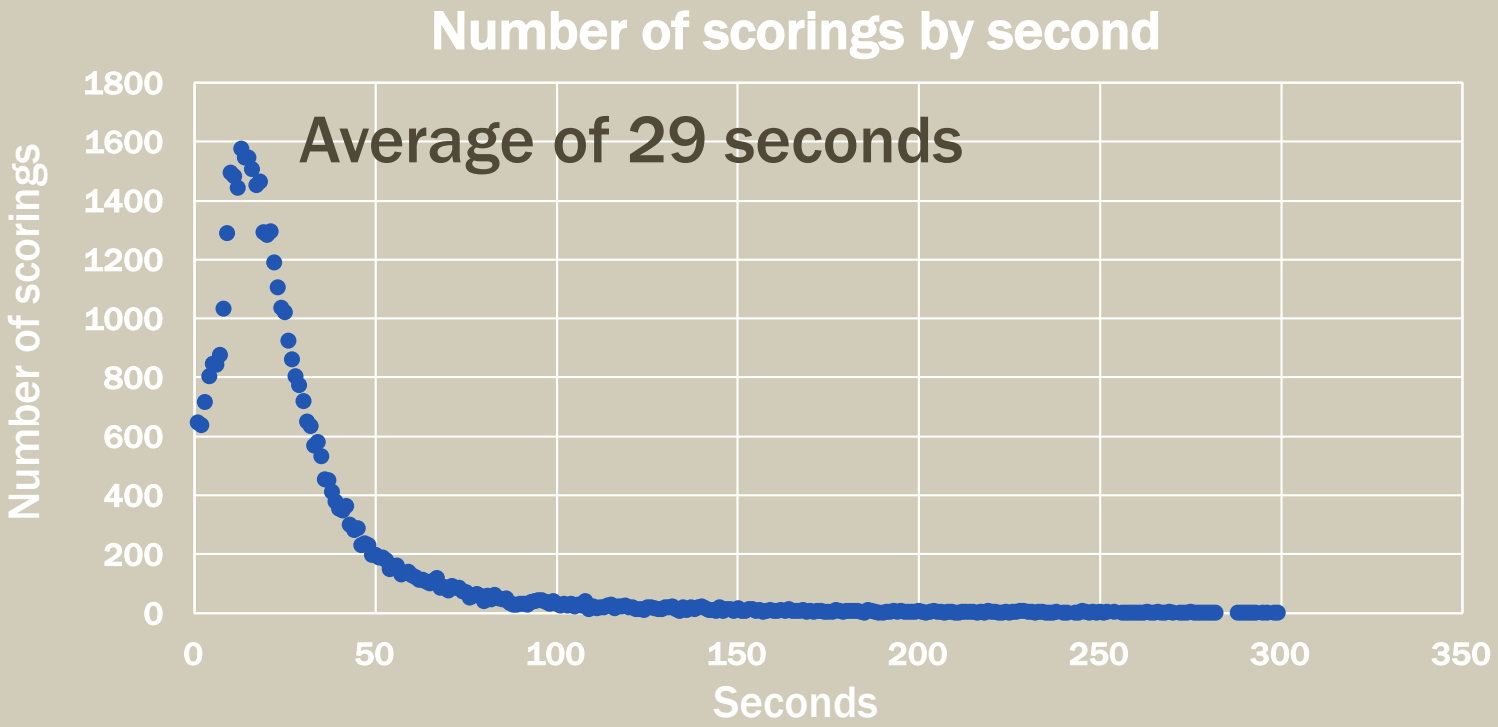
- Training
  - Images of plants in nature
  - Illustrations
  - Physical Herbarium specimens
  - Practice sessions with oversight
  - Review and correction



PHENOLOGY: WORKFLOW

- What cannot be scored easily from images…
  - grasses, sedges
  - small flowers

PHENOLOGY: WORKFLOW



PHENOLOGY: LEGACY DATA

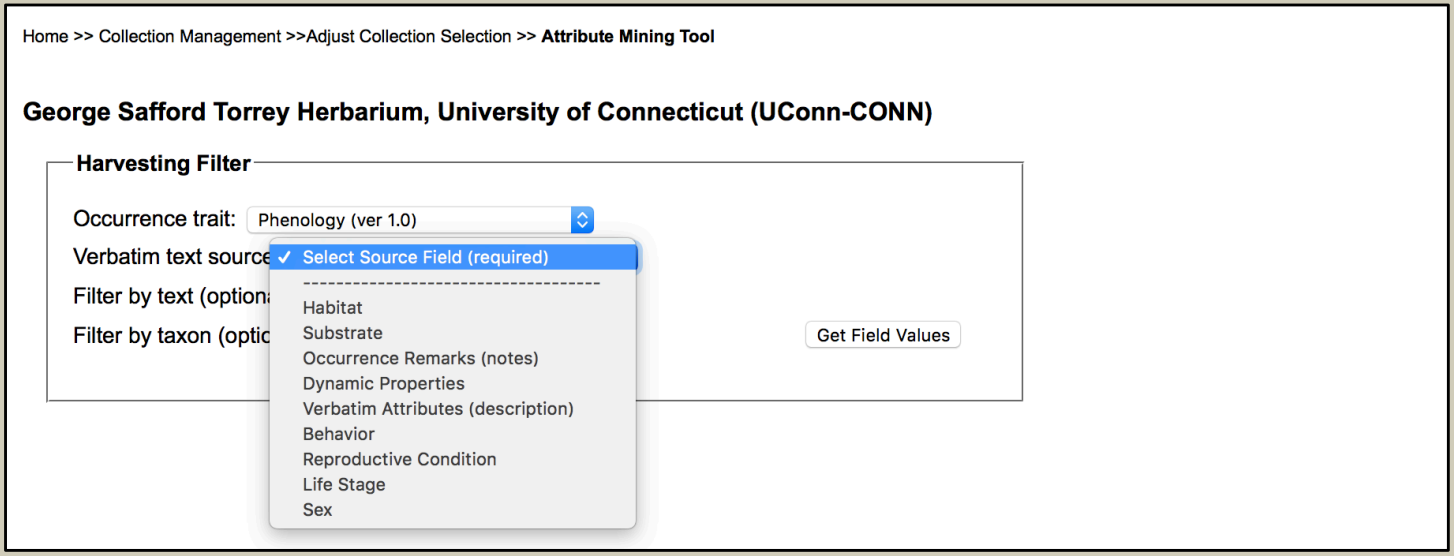
- Legacy Data
  - Custom fields
  - Darwin Core
    - dwc:reproductiveCondition
    - dwc:occurrenceRemarks
    - dwc:dynamicProperties

PHENOLOGY: LEGACY DATA

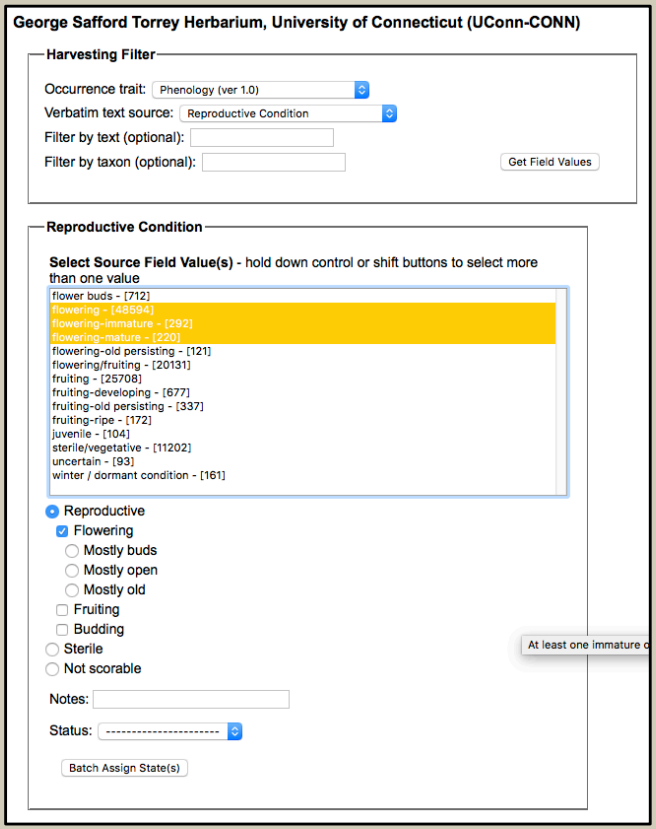
- e.g., CNH
  - reproductiveCondition populated for 235,544 records from 39 institutions
  - 443 unique strings

fl	Flowering , Fruiting
fl, fr	flowering ?
fl, fr, v	flowering and fruiting
fl, v	Flowering(?)
fl. & fr.	Flowering, Flowering
flo	Flowering, Fruiting
floering	Flowering, Fruiting, Post-fruiting
floweirng	Flowering, some flowers already pollinated and shedding petals.
Flower	flowering-immature
flower and fruit	flowering-mature
flower & fruit	flowering-old persisting
flower and fruit	Flowering.
Flower and Fruit | Fertile	Flowering. Flowers open and some anthers have started to shed p
Flower and Fruit | See notes	flowering/ fruiting
flower bud present	flowering/fruit
flower bud visible, closed	flowering/fruiting
flower buds	flowering/going to seed
flower buds present	Flowering: contains flowers that have 5 petals and are bright pink
Flower clear yellow, red spots inside	flowering: mostly old flowers (<1/2 open)
Flower with seeds	flowering: mostly open flowers (>1/2 open)
Flower | Fertile	flowering; fruiting
Flower | Fertile | Fruit	flowering; w last yrs fruiting stalk
Flower | Flower	Flowering?
Flower | Fruit	flowers
Flower | Fruit | Fertile	Flowers and fruit
Flower | Fruit | Fruit	flowers & fruit
flower,Fruit	Flowers and capsules are both present on the specimen.
FlowerAndFruit	Flowers and Fruit
floweriing/fruiting	Flowers and Fruits
flowerinf	flowers in buds but not in bloom, vegetative
flowering	flowers present in an inflorescence but not in bloom
Flowering & fruiiting	flrs
flowering & fruiting	Flw
flowering & fruiting (mature fruit 8/30)	Flwoering, Fruiting
Flowering & Fruiting.	foliage dark green
Flowering & fruitng	fr
flowering & in fruit	fr, fl

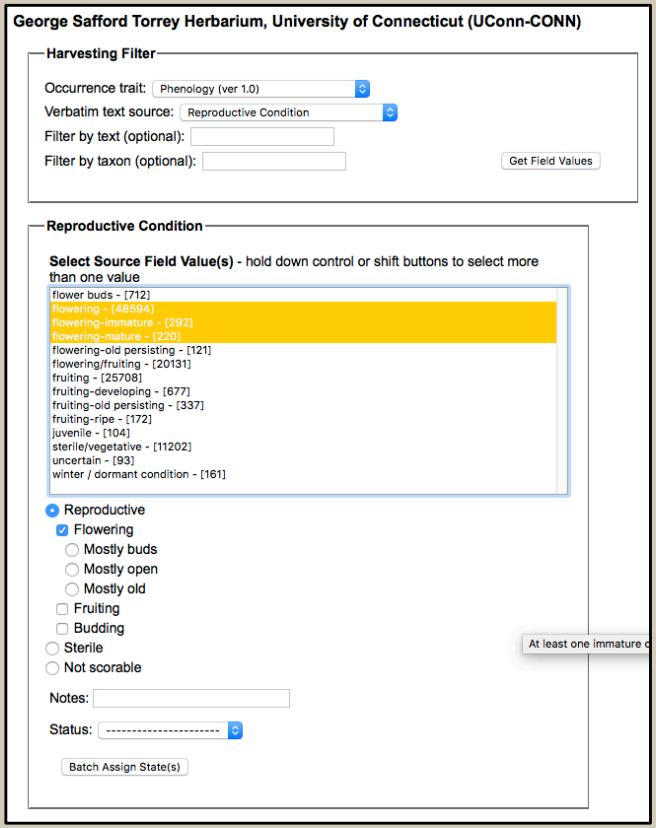
PHENOLOGY: WORKFLOW
SYMBIOTA ATTRIBUTE MINING TOOL

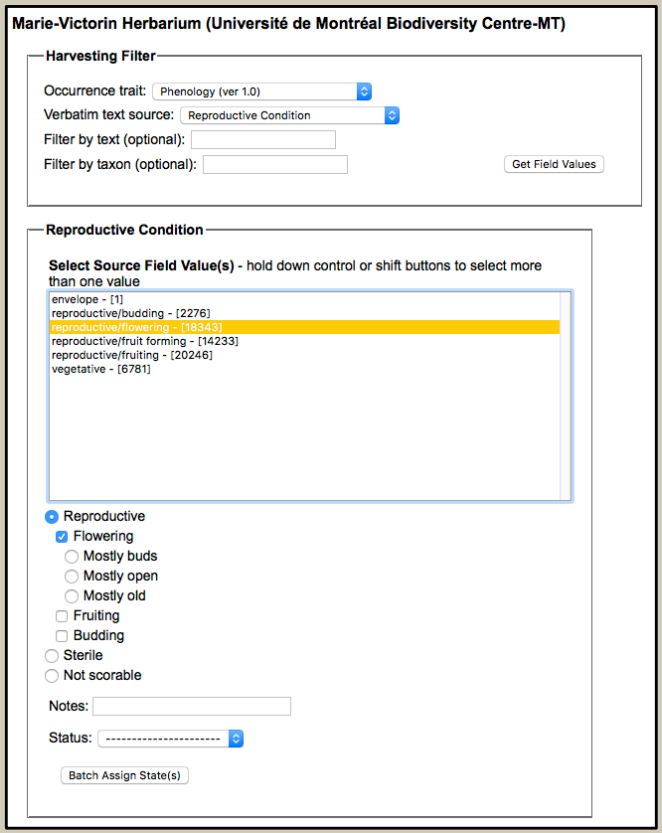


PHENOLOGY: LEGACY DATA
SYMBIOTA ATTRIBUTE MINING TOOL



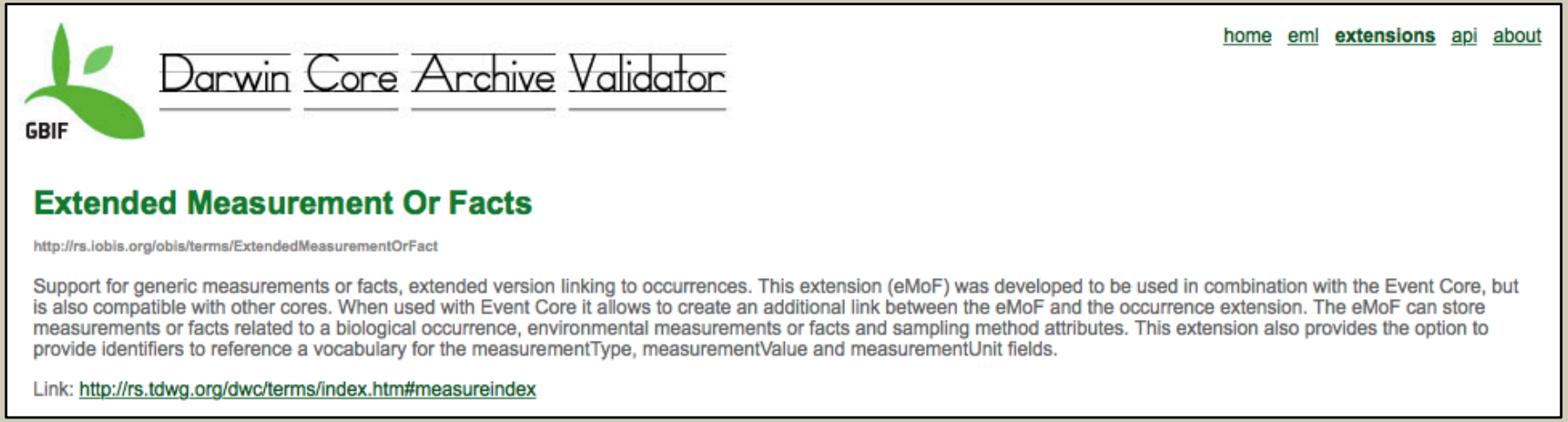
PHENOLOGY: WORKFLOW
SYMBIOTA ATTRIBUTE MINING TOOL





PHENOLOGY: DISSEMINATION

DwC Archives with Extended Measurement Or Facts



https://tools.gbif.org/dwca-validator/extension.do?id=http://rs.iobis.org/obis/terms/ExtendedMeasurementOrFact

ACKNOWLEDGEMENTS

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Symbiota

FilteredPush

Biota of North America