



Southern Rocky Mountain TCN

ADBC Summit 2021

September 21st 2021

Ryan Allen

Erin Tripp

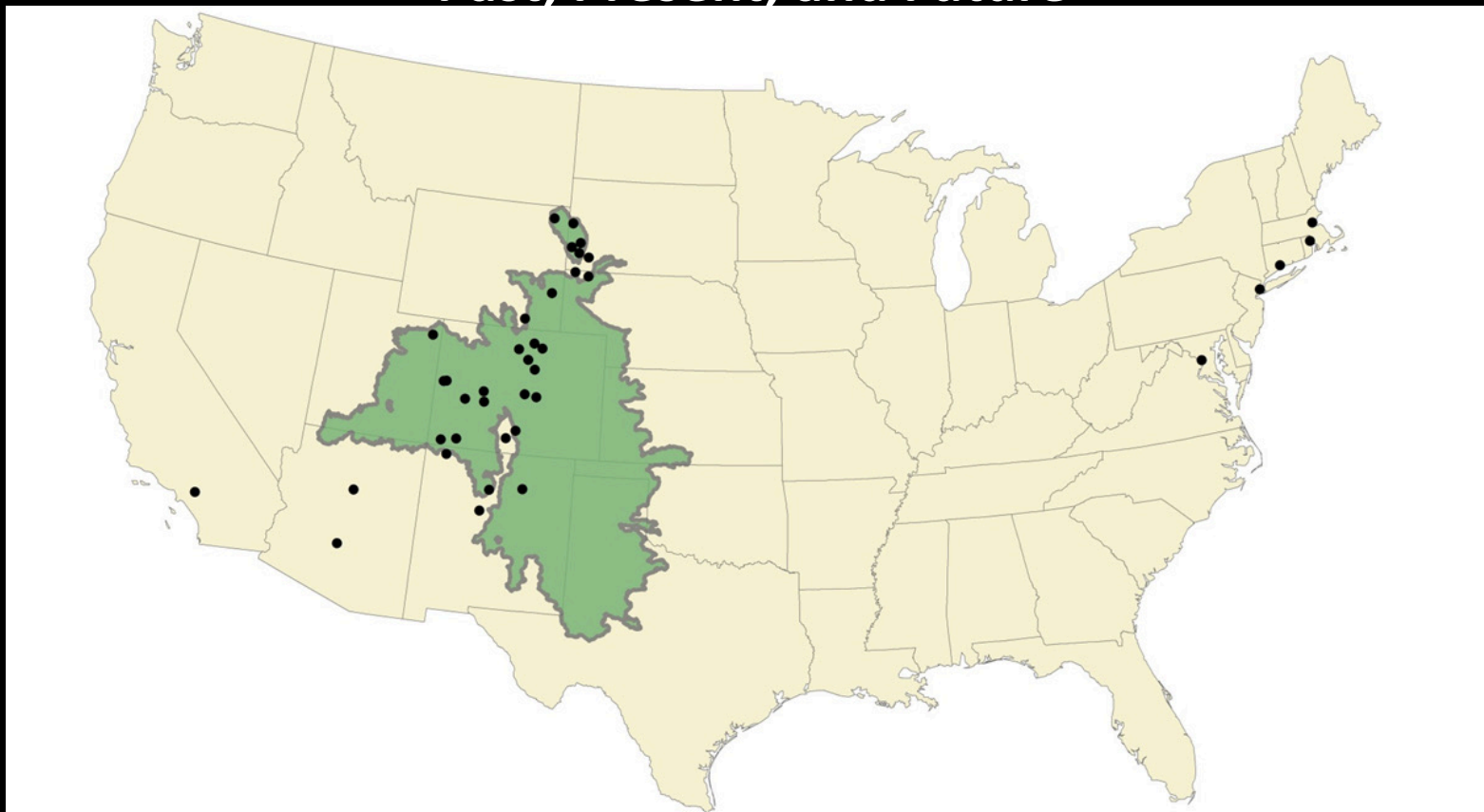
Dina Clark



NSF Award # 1702516



Using Herbarium Data to Document Plant Niches in the High Peaks and High Plains of the Southern Rockies - Past, Present, and Future





Project Scope

- 40 Partners (including non-digitizing federal partners)
- 20 Partners Digitizing new records
- The original TCN plus RSA PEN
- ~1.8 million specimens from the Southern Rocky Mountain Region
- 546,000 new database entries
- 863,000 new specimen images
- 627,000 new georeferences





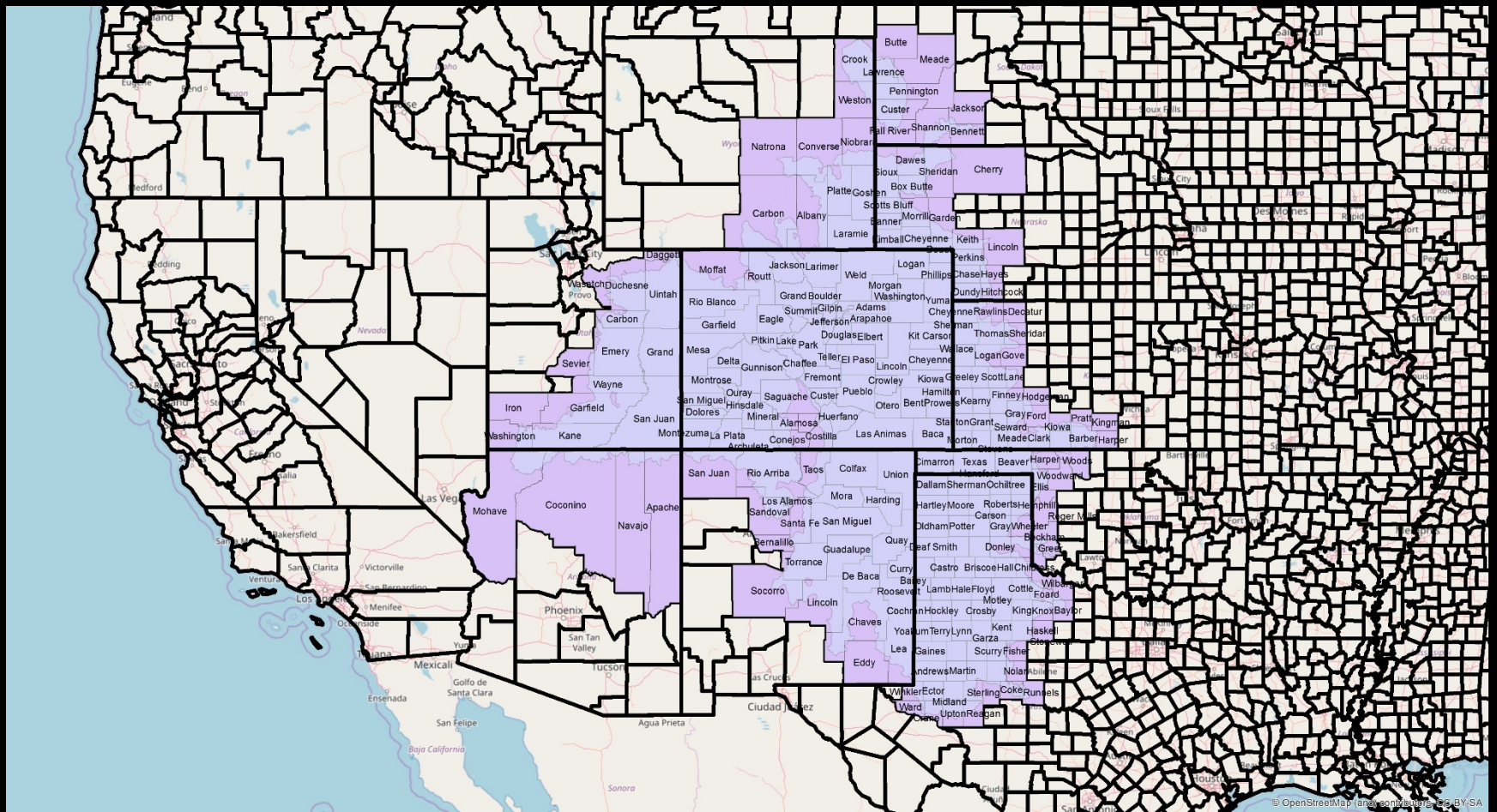
Funded Partners

- Adams State University
- Arizona State University
- Black Hills State University
- California Botanic Gardens
- Chadron State College
- Colorado College
- Colorado Mesa University
- Fort Lewis College
- Harvard University
- Navajo Nation Herbarium
- New York Botanical Garden
- Northern Arizona University
- Rocky Mountain Biological Laboratory Herbarium
- San Juan College
- University of Colorado
- University of New Mexico
- University of Northern Colorado
- University of Wyoming
- Western State Colorado University
- Yale University



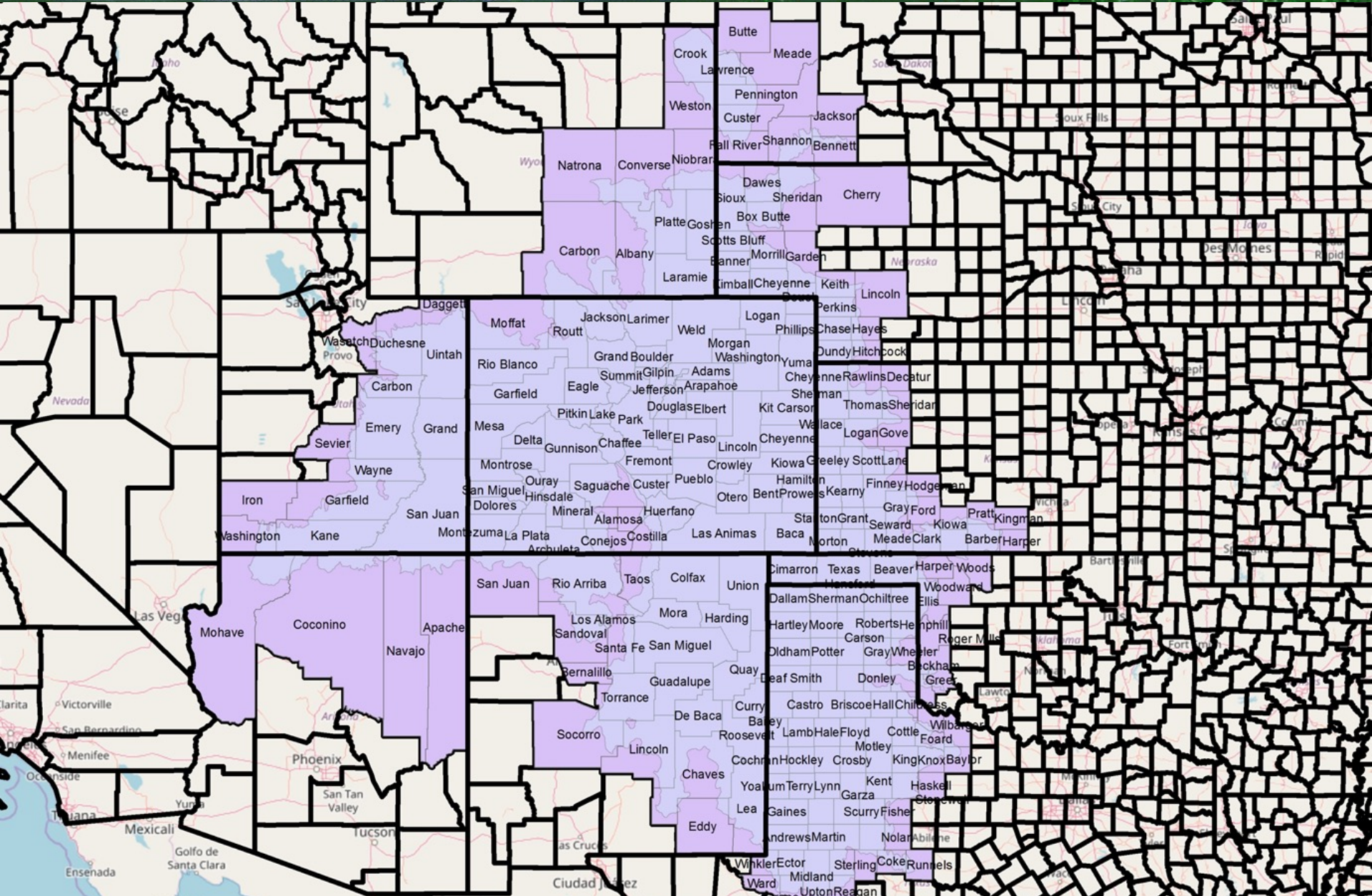


Translate ecological data back to political geography





CONSORTIUM OF SOUTHERN ROCKY MOUNTAIN HERBARIA

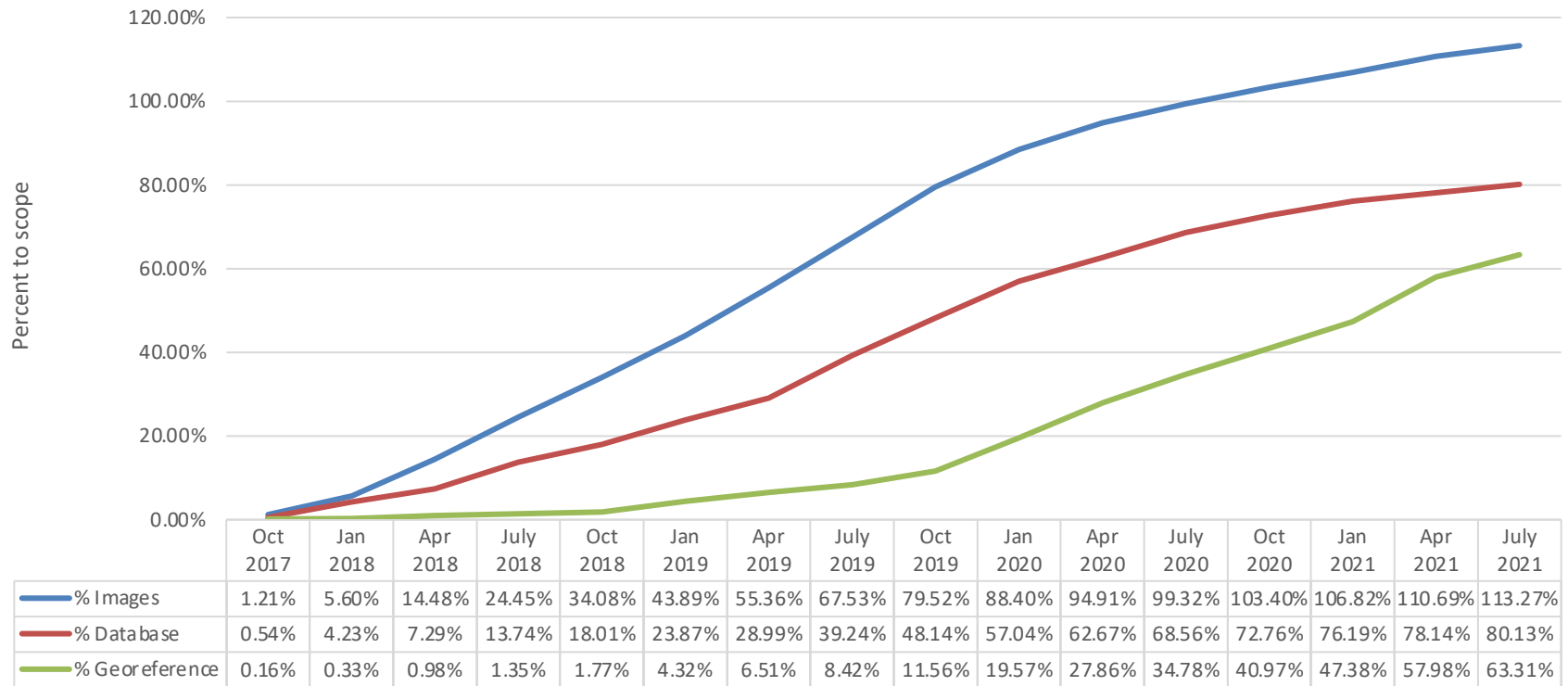




Project Progress

End of July 2021

SoRo Project Progress





Project Progress

End of July 2021

- 442,250 database entries completed ~80.1% (+11.5%)
- 956,399 specimens barcoded ~110.1% (+10.8%)*
- 970,128 specimens imaged ~113.2% (+11.4%)*
- 390,244 specimens georeferenced ~63.3% (+28.5%)





UNIVERSITY OF COLORADO
 91816
 HERBARIUM



WESTERN MOUNTAIN COLORADO UNIVERSITY
 NATURAL & ENVIRONMENTAL SCIENCES
 Col. No. 48-010
 Fisher Scientific

NORTHERN ARIZONA UNIVERSITY
 ASC
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Plants of Arizona
 Litaeae
Calochortus nuttallii Torr. & A. Gray
 USA, Arizona, Coconino County, 6 miles NE of Flagstaff and 0.5 mile south of the AZ-UJ state line.
 36° 48.800' N 112° 28.000' W
 Elev: 1050m (3200ft)
 Canyons-sagebrush woodland in sandy soil.
 G. Goodrich 5271 21 May 2015
 Northern Arizona University
 Denver Herbarium (ASC)



RMBL Herbarium
 Specimen # 04423c

Flora of Colorado
 Ranunculaceae
Pulsatilla ludoviciana A. Heller
 Det. by Williams, Charles F. 2015-07-30
 CO Park W Slope, 4th rd.
 USA, Colorado, Gamscoen County, One-half mile below Crested Butte
 Rocky ridge between tulgepole pine.
 Stanley, Harriet G. s.n.
 23 June 1919
 Rocky Mountain Biological Laboratory (RMBL)



Project Progress

- Website soroherbaria.org integrated into SEINet/Symbiota infrastructure
- All funded partners now have data in the Southern Rocky Mountain Portal most have specimen images
- Well over 100 volunteers, undergraduate and graduate students have been trained in biodiversity informatics tasks under the project





Goals for NCE

- Georeferencing is going to be the biggest focus
- Finalize local infrastructure for images
- Integrate federal partner data
- Database and SEINet/SoRoherbaria improvements
- Share with GBIF ~1/2 of collections are sending data, several more will start this project year





COVID

- All of the SoRo collections actively digitizing except for two closed in March 2020 due to COVID
- Our backlog of images helped us to shift to remote work (important to build a pipeline early).
- Several collections stopped volunteer programs and many digitizers opted to stop working rather than working remote
- We never got back to full capacity





Project Highlights

- 3 Field to Digital Object Workshops
- 2 Georeferencing Workshops
- Mobilizing data, expanding SoRo portal (was previously just a node/ sub collection)
- Previously offline databases now accessible online (over 50,000 records not included in database numbers)





SoRo impact on biodiversity data

- ~4.5 million records for the 10 SoRo states
- ~2.45 million have an image
- Approximately 40% of images for these states in Symbiota portals were generated in this project





SoRo impact on biodiversity data

- ~1.965 million specimens are listed in Symbiota from the SoRo counties across all collections (underestimate does not include state without county)
- Roughly 25% of these were databased and georeferenced under this project
- Percentage of completed georeferences and transcription much higher (many of these records are skeletal or lack a georeferenced)





Lessons Learned

- Do not take silence for “everything is okay”
- Do not be afraid to ask for help!
- Pandemics are a good time to proof your data
- Start Georeferencing now! Change the curve!
- Skeletal and controlled data (dropdown menus) help to filter data, reduce keystroke errors and create a searchable database
- Students thrive when working on various tasks 2-3 hours max!
- Equipment changes / backups / updates?





Lessons Learned

- Staggering start dates allows maximum contact time with new institutions (4 PI and 9 subawards started digitizing year one 5 subawards plus COLO collection started year two). Also splits collections into themes (small scope under 15,000 mid scope under 100,000 large scope over 100,000)
- Everyone's data counts!
- Site visits are invaluable





Lessons Learned

- Have collections record their own data in a central spreadsheet (do not leave it up to interpretation).
- Had to correct some metrics at the “end” of the project due to double counts at one collection.





Outreach and Training

- Workshops through NAVA, SJNM and BHSC trained and provide museum experience to undergraduate students. Three workshops held over the summer one at SJNM and two at BHSC
- Worked with St. Johns University for a GIS class using SoRo Penstemon Data
- 2 Georeference workshops across SoRo to learn georeferencing and best practices for recording data.
- 2 presentations at SPNHC





Conferences

- SPNHC 2019
- Do we really want to do this again!? Taking advantage of aggregators to harvest existing digital data to efficiently grow your natural history collection. Dina Clark
- SPNHC 2021
- Stop Digitizing YOUR Collection: Notes from iDigBio's Southern Rocky Mountain Thematic Collections Network to Help Strategize Digitization across Consortia and Regional Projects. J Ryan Allen





Southern Rocky Mountain TCN Field to Digital Workshop in New Mexico

- Field to Digital Object Workshop
- Nineteen students from Dine College, Northwestern Indian College, San Juan College, Fort Lewis College and Northern Arizona University participated.
- Arnold Clifford, co-author of the Flora of the Four Corners Region, shared both his taxonomic and Navajo ethnobotanical expertise.





 **Field to Digital Object**
San Juan College



Field to Digital Object San Juan College





Field to Digital Object San Juan College





Southern Rocky Mountain TCN Field to Digital Workshop in South Dakota

- Black Hills State University (BHSU) and Oglala Lakota College (OLC) held a workshop for students and faculty from Oglala Lakota College.
- Field to Digital Object Theme. Two days in the field and one day in the museum.





 **Field to Digital Object**
Black Hills State University



Field to Digital Object Black Hills State University





Collaboration with NYBG, St Johns University and the SoRo Consortium

- Built Story Maps using SoRo Penstemon data.
- Several collections stepped in to georeference Penstemon specimens used by the class.





Analysis of the Penstemon griffinii and Penstemon degeneri by Deion Awah and Mikayla Doherty

Deion and Mikayla

- 1** Analysis of the Penstemon griffinii and Penstemon degeneri
- 2** About the Penstemon degeneri
- 3** About the Penstemon griffinii
- 4** Penstemon Species Distribution (Interactive)

For this project we did extensive research on two Penstemon species. We created maps using ArcGIS to compare contrast different attributes of the two species. Throughout our research we compared the plants through highlighting different elevation levels, vegetation land-use, precipitation in inches, and slope and terrain. There is analysis next to each map explains our findings and a brief description of our species is also listed below as well.

<https://cnhp.colostate.edu/rareplants/guide.asp?id=21773>





A Story Map

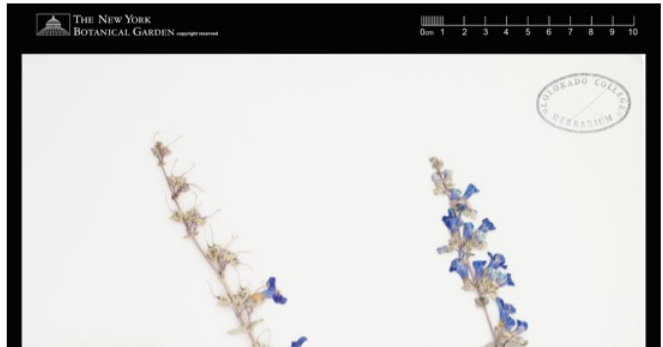


Penstemon Auriberbis and *Penstemon Versicolor* Distribution within Colorado

Penstemon Versicolor

- Habitat: dry rocky slopes
- Color: rose to blue
- Soil: Dry, sandy, sandy loam well drained
- Size: 20-30cm
- Bloom Period: May-June
- Annual Precipitation: 8-15 inches

Description: flowers are second, glabrous, glaucous, leaves thick, the basal obovate, 3-4cm long, stem leaves cordate-amplexicaule, ovate, acuminate, 3-5 cm, sepals 5-6 mm, ovate, corolla 2cm long, glabrous





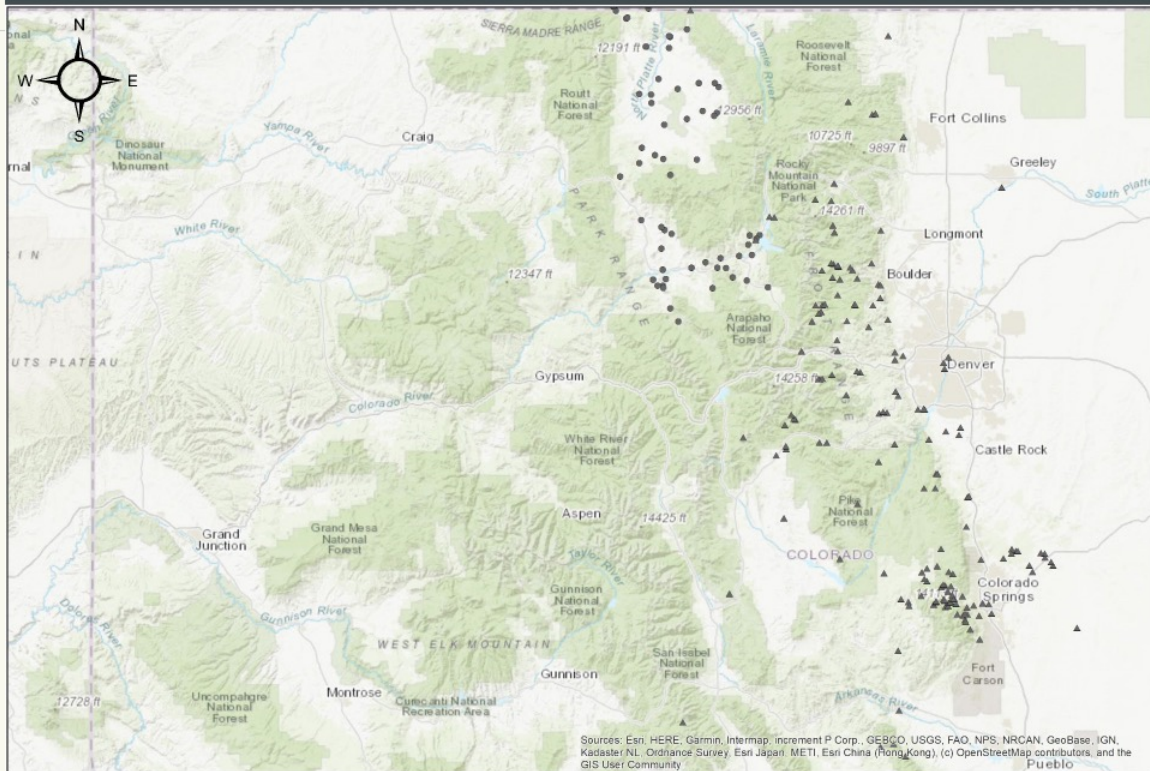
A Story Map



Distribution of *Penstemon cyathophorus* and *Penstemon glaber* in Colorado

Penstemon cyathophorus

- Duration: Perennial
- Size Class: 20-60 cm
- Bloom Color: Purple
- Bloom time: May-June



- Legend**
- ▲ Penstemon glaber
 - Penstemon cyathophorus





Northwest Colorado Penstemon Distribution

A Story Map

5 Elevation Map

6 Map showing Landcover

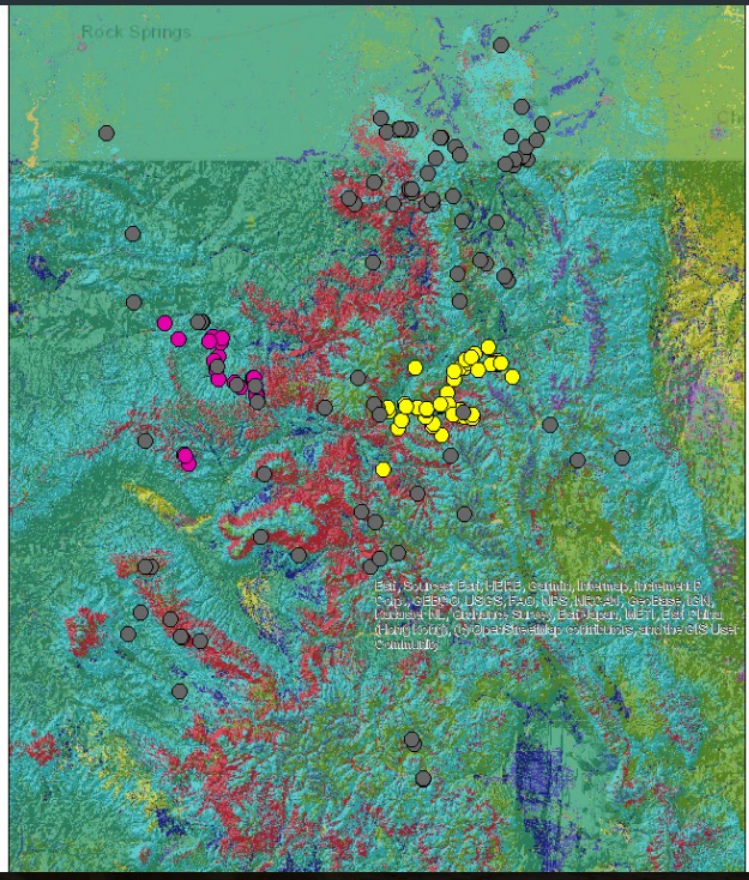
P. Saxosorum : This species frequents areas with conditions similar to that of deciduous forests and evergreen forests. These locations have alfisols which are common in the midwestern region and are the most fertile type of forest soil.

P. Harringtonii : This species frequents areas where there is lots of shrubland and the land is barren and avoids areas where the land is snowy or icy. From this I can tell that this species does not thrive in areas where the land is wet. Since this species is the one found in one main central area on the map, its growing conditions are very specific and crucial to its survival as opposed to the Penstemon Saxosorum plants that is found across a wide variety of land types in the state. It can be concluded that this penstemon species would not thrive in areas of the state that shrubland also does not.

P. Fremontii : A large number of plants of this species is found in shrubland that runs along pastures or hay. Pasture land is normally grazed by domesticated livestock such as horses, cattle, sheep and pigs.

7 Map of Colorado's Precipitation

8 Soil Map of Penstemon Distribution



Land Cover in Colorado

Legend

- Penstemon saxosorum
- Penstemon harringtonii
- Penstemon fremontii

USA NLCD Land Cover 2011

ClassName

- Barren Land
- Cultivated Crops
- Deciduous Forest
- Developed High Intensity
- Developed Low Intensity
- Developed Medium Intensity
- Developed Open Space
- Dwarf Scrub
- Emergent Herbaceous Wetlands
- Evergreen Forest
- Grassland/Herbaceous
- Lichens
- Mixed Forest
- Moss
- Open Water
- Pasture/Hay
- Perennial Snow/Ice
- Sedge/Herbaceous
- Shrub/Scrub
- Woody Wetlands



A Story Map



The Distribution of Two Penstemon Species in Colorado State

Conner Cummings and Samantha Caimares

We have been assigned two species in the *Penstemon* genus and were tasked with investigating why they were distributed as such

Some info:

- There are 275 species in the *Penstemon* genus
- All species except one originate from North America
- *Penstemon* grows on the poor, well-drained rocky or sandy soil

Distribution of *P. hallii* and *P. harbourii*

Hallii distribution: Archuleta, Boulder, Chaffee, Clear Creek, Conejos,

