



SEINet: Two Decades of Bio-collaboration Building a North American Specimen Network

Edward Gilbert

Thomas R. Van Devender

Nico Franz

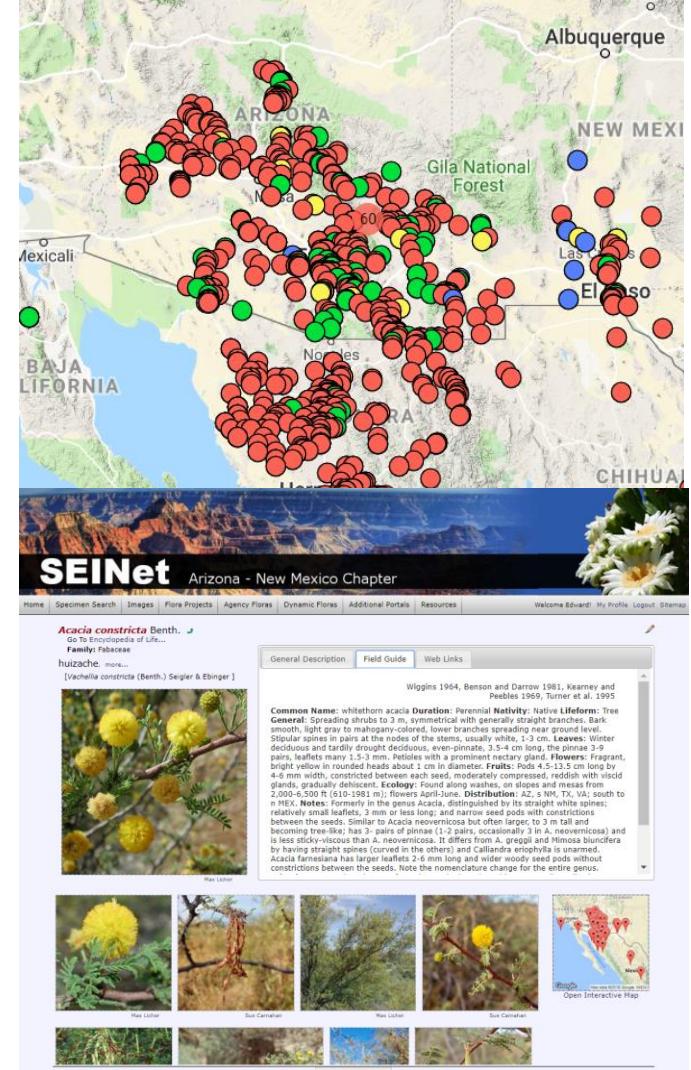
Gil Nelson



National Science Foundation
WHERE DISCOVERIES BEGIN

SEINet - 2000 to present

- Vascular plants
- North America
- Virtual flora
 - 13.7M specimens
 - 7.6M images
 - Distribution maps, species lists, keys, descriptions, etc
- Field research, wildlife managers, plant inventories, amateur biologist
- 20,000 / month



SEINet version 1.0 - 2000 to 2008

- Southwest Environmental Information NETwork
- JSP, MS SQL
- Distributed specimen DBs
 - ASC, ASU, ARIZ, DES
- Pros: progressive, lightweight
- Cons: connectivity, slow-ish
- NSF-ABI: 2000-2002
 - Peter McCartney, Corinna Gries
 - Grad students: Ed Gilbert, Robin Schroeder
- NSF-BRC: 2003-2008
 - Landrum, McLaughlin, Ayer

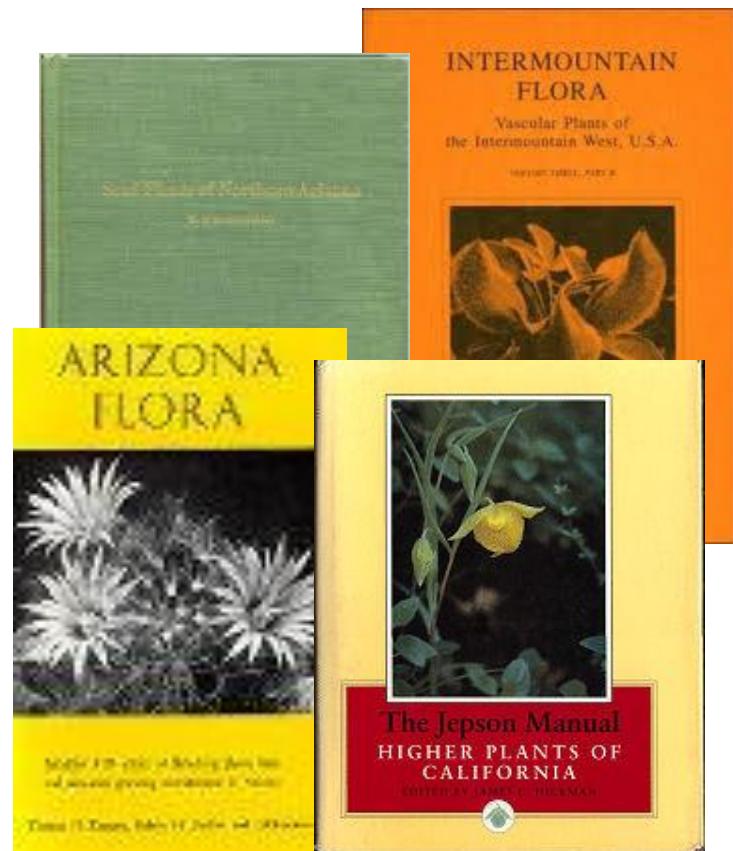
West Fork of Oak Creek Flora

- Flora and Vegetation of the West Fork of Oak Creek Canyon
- Master thesis □ 1999-2002
- 10mi N. of Sedona
- Over 500 taxa



Traditional Floristic Treatments

- Taxonomic information
(synonyms, family, vernacular names, etc)
- Descriptions
- Images or illustrations
- Distribution maps
- Identification keys
- Voucher information



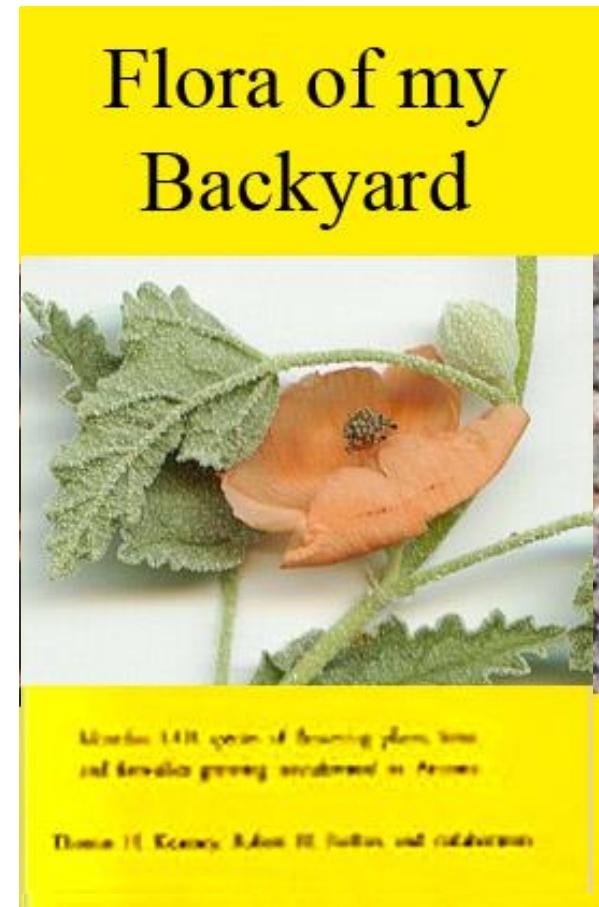
Virtual Floras / Virtual Herbaria

- Inexpensive
- Numerous Images/Illustrations
- Continuously Updatable
- Flexible
- Collaborative Efforts
- A Living Document

The screenshot illustrates the interface of virtual floras. On the left, a Mozilla Firefox window shows the eFloras.org page for *Acourtia wrightii*, providing a detailed botanical description and a small illustration. On the right, another Mozilla Firefox window shows the LIAS NavKey Module for the Dacampiaceae family, featuring a search function and a list of characters used for identification. Below these windows, a banner for the "Northern Arizona Flora" is displayed, which is described as a photographic catalog of Northern Arizona vascular plants.

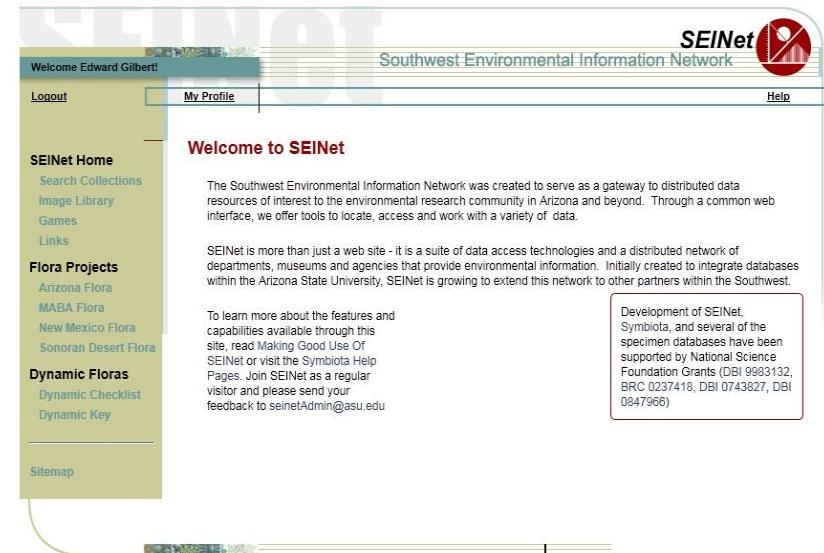
Potential of Virtual Environment

- Arizona Flora
- Annuals of the Grand Canyon
- Poaceae of Pima Co.
- Asteraceae within 30km of 34.2° , -112.4°
- My Backyard Flora



SEINet version 2.0 - 2008 to 2011

- NSF-ABI: 2008 to 2012
 - Corinna Gries
 - Tom Nash
 - Edward Gilbert
- PHP & JavaScript
- MySQL backend
- Data cache model
 - 30 collections
 - NAVA, DES, USON, URC, UNM...
- Improved connectivity, faster



Content Management System (CMS)

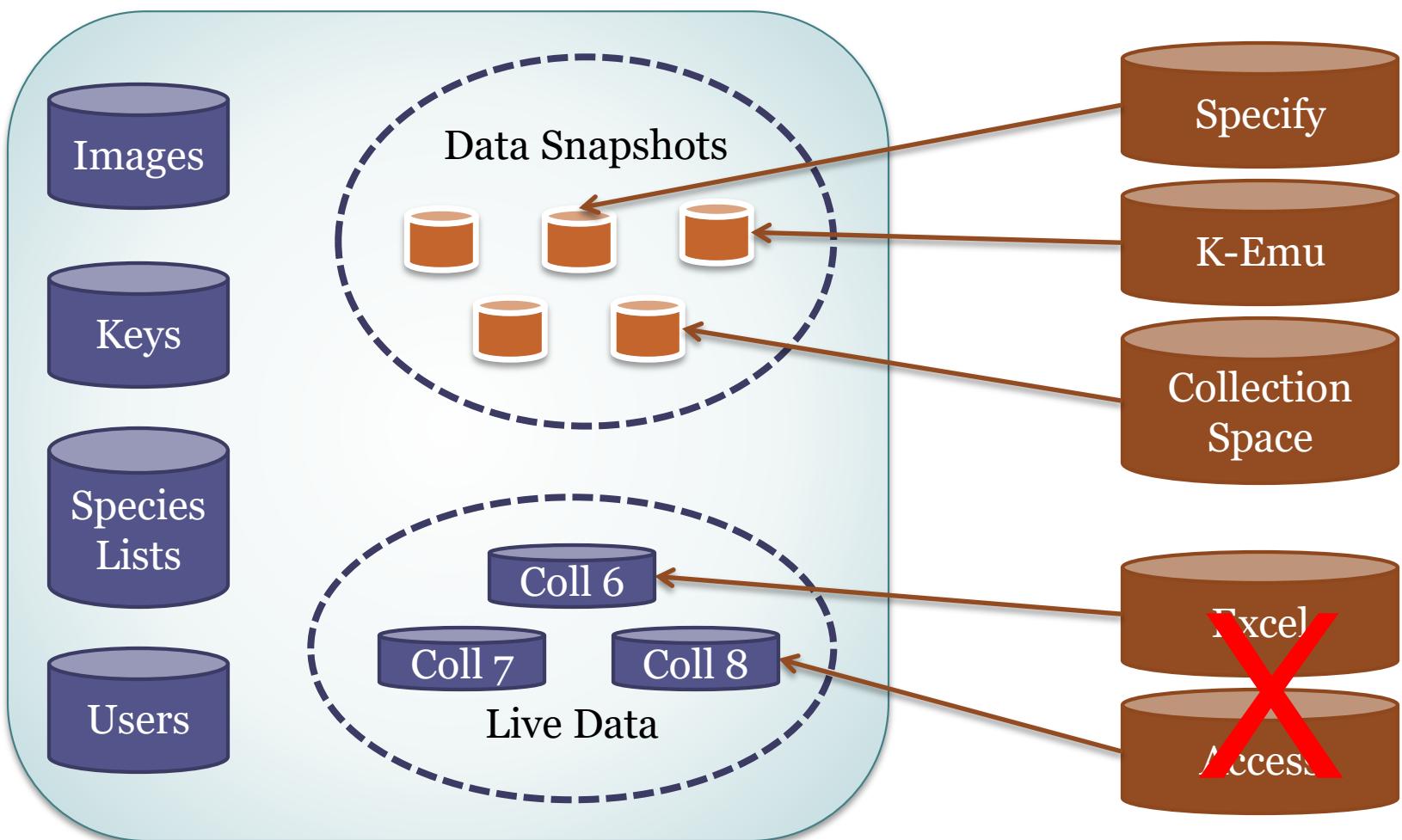
- Read-only user interface
- Password Protected
 - Browser-based application
 - Platform independent
 - Globally accessible
 - No special software installation (free)
 - Make use of web services
 - Data protection (backups)

The screenshot displays a detailed data entry form for an occurrence record, likely from a biological specimen database. The form is organized into several sections:

- Occurrence Data:** Includes fields for Catalog Number (J281888), Occurrence ID, Collector, Number, Date, Associated Collectors, and Other Catalog Numbers.
- Latest Identification:** Fields for Scientific Name, Author, ID Qualifier, Family, Identified By, and Date Identified.
- Locality:** Fields for County, State/Province, County, Municipality, and Locality.
- Locality Security:** Fields for Latitude, Longitude, Uncertainty, Datum, Elevation in Meters, and Verbatim Elevation.
- Misc:** Fields for Habitat, Associated Taxa, Description, and Notes.
- Curation:** Fields for Type Status, Disposition, Reproductive Condition, Establishment Means, Owner Code, Basis of Record (set to Preserved Specimen), and Language.
- Other:** A section with a large text area for additional notes.

The interface includes tabs for Occurrence Data, Determination History, Images, and Admin, along with various buttons and validation icons.

Publishing: Snapshot vs Live



Symbiota Software Project

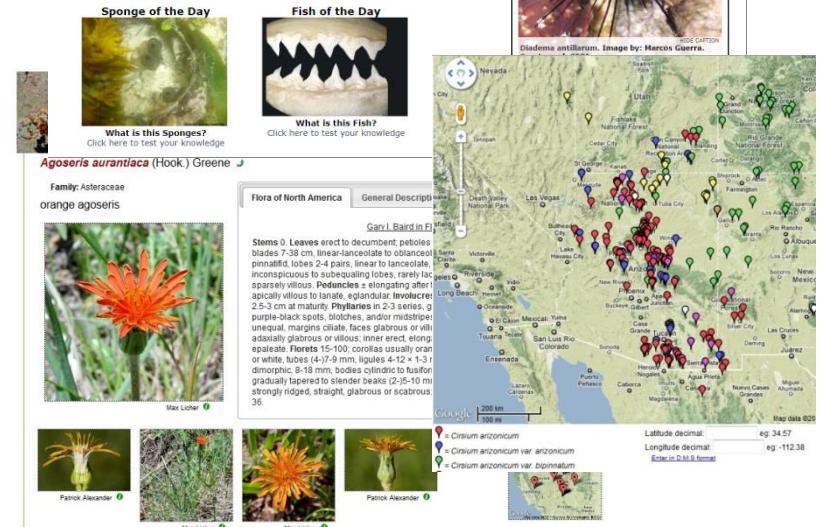
- Darwin Core compliant
- Open source software
- Virtual flora/fauna
 - Specimen search
 - Biodiversity inventories
 - Identification keys
- Images, distribution maps, species descriptions, taxonomy, common names, etc



Welcome to the Marine Life of Panama portal

We are working to create a single access point for knowledge about the diversity and distribution of marine organisms in Panama generated from over 40 years of marine biology research at STRI. Currently, the portal provides access to specimen records and related geo-spatial data covering fish, algae, marine invertebrates and various other marine taxa (e.g., sea snakes, seagrasses, etc.).

The portal currently includes the ability to generate check lists for the entire country or for one of the major marine biodiversity regions (records are from air San Blas to the Caribbean coast and the Gulf of Panama and Gulf of Chiriquí on the Pacific coast). Georeferenced species records can be displayed on a map with associated observation data. A multilingual glossary tool, TaxaGloss, can be used to clarify the meaning of morphological terms. Soon, we hope to incorporate identification tools like tabular keys.



Symbiota Data Portals

- CMS - biodiversity
- Custom look & feel
 - CSS, config files
- Themed datasets
 - Taxonomic scope
 - Geographic scope
- Community portals
- 30-60 public portals

The screenshot shows the homepage of the Mycology Collections Portal. At the top, there's a banner featuring a close-up image of a mushroom. Below the banner, the title "MYCOLOGY COLLECTIONS PORTAL" is displayed in large, bold letters. A navigation bar follows, containing links for Home, Explore, Crowdsource, Checklist Projects, Other Resources, and Acknowledgements. On the right side of the header, there are links for Log In, New Account, and Sitemap.

The main content area starts with a "Welcome to the Mycology Collections data Portal" message. Below this, a section titled "Fungus of the Day" features a photograph of several orange mushrooms growing from a single rhizome. To the right of the photo is a detailed scientific illustration of the same species, labeled *Morchella angusticeps*. Below the illustration, there are arrows for navigating through more images. A caption below the photo reads "What is this fungus? Click here to test your knowledge".

At the bottom of the page, there are two calls-to-action: "Click here to test your knowledge" and "Click here to test your knowledge". On the far right, there's a "Data Usage and Citation" section with icons for sharing and citation.

On the right margin, there's a "News and Events" sidebar with a list of recent updates:

- Microfungi Collections Consortium (MiCC) website now live
- NSF Press Release #15-062 - NSF awards fifth round of grants to enhance America's biodiversity collections
- NSF Press Release #12-062 - US National Science Foundation (NSF) award for The Macrofungi Collection Consortium, a collaboration of 53 institutions across the U.S. for the purpose of databasing some 1.4 million dried scientific specimens of macrofungi (NSF #1205197)
- December 2013 - 1,446,358 new records supplied by 31 different data providers have been integrated into MyCoPortal
- NEW - MiCC records are now part of the Zooniverse project Hosts of Nature. Please help us by transcribing specimen labels ([link](#))
- Image provided by New York Botanical Garden

SEINet vers. 3.0 - 2011 to present

- NSF-ADBC: 2011 to present
 - 12 of 20 TCN use Symbiota
 - 4 are connected to SEINet
- ASU => iDigBio (UFL) servers
- Biodiversity CMS
- Current statistics
 - 313 collections
 - 13.7 million specimens
 - 216 live datasets (6.5m spec)
 - 7.6 million images
 - 1900+ data managers

SEINet Regional Portal Networks

- Consortia of regional herbaria
- ~~Southwest Environmental Information Network~~
- 13 Distributed Network
 - SERNEC
 - Mid-Atlantic
 - Midwest / Great Lakes
 - Southern Rocky Mountain
 - NANSN
 - TORCH
 - Northern Great Plains
 - InterMountain

Welcome to SERNEC

Print out PDF for maintenance during a 4-6 hour period in the afternoon of Saturday, Dec. 14th.

Herbaria are not simple repositories of plant specimens; they are repositories of a tremendous amount of information. Current technologies provide an opportunity to access this information in an unprecedented way. SERNEC is a distributed network of herbaria in the Southwest US and Mexico. Our goal is to facilitate the use of this distributed regional network by making it easier for users to find the information they need. SERNEC is 1) delivering the 230 herbaria in 10 states in southwestern North America, 2) developing a distributed system for the collection and management of data from these herbaria, and 3) providing resources that will be available to scientists, land managers, state and federal agencies, educators and the general public. We hope to facilitate the use of this information by making it easier for users to find the information they need and lead to better research, better management planning and a more well-informed public. SERNEC is a distributed network of herbaria in the Southwest US and Mexico. Our goal is to facilitate the use of this distributed regional network by making it easier for users to find the information they need and by combining 150 years of botanical information housed in herbaria in the Southwest with modern data management tools. SERNEC is a distributed network of herbaria in the Southwest US and Mexico. Our goal is to facilitate the use of this distributed regional network by making it easier for users to find the information they need and by combining 150 years of botanical information housed in herbaria in the Southwest with modern data management tools.

General Data Usage Policy

This site is hosted by Cugito. Please direct all inquiries to the site administrator.

Welcome to the Consortium of Midwest Herbaria

What follows around the Great Lakes drainage basin, the region includes the six states that border the western Great Lakes: Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. The region also includes the southern portion of the Canadian provinces of Manitoba, Saskatchewan, and Alberta. To the south and west of the lakes include lands which form portions of the Mississippi and Missouri River basins. The terrain in the region is varied. The Great Lakes themselves are large and deep, while the rivers and streams are diverse, ranging from broad flood plains to southern herbaceous, prairie, bogs and fens. The region is characterized by its great diversity of habitats. In collaboration with the SEINet herbaria, please send questions or comments to serchbot@uiuc.edu.

Search Term:

Plant of the Day

What is this plant? Click here for more information

Welcome to the North American Network of Small Herbaria

Print out PDF for maintenance during a 4-6 hour period in the afternoon of Saturday, Dec. 14th.

The North American Network of Small Herbaria is an open-access data portal created to facilitate and enhance further synthesis of small collections and herbaria using shared resources. The establishment of this portal is a result of the work done by the North American Small Herbaria Project (NASHP), funded by grants from the USGS (now USGS Biological Resources Program), National Science Foundation (NSF), and the National Science Foundation (NSF). We invite any Mid-Atlantic herbaria to join us online in this endeavor. If you have digitized specimen records, photographs, or other data that you would like to share with the community, please consider joining our working group or contact us at NASHP@gsf.binghamton.edu.

Small herbaria constitute a major source of information for biodiversity studies. Herbaria are typically organized as small collections with strong ecological sensibilities, and often lack the infrastructure to support their collections. The small herbaria in the North American region are often underutilized and underfunded. This is due to the lack of standardization in data formats and the lack of a formal mechanism to share data. The small herbaria in the North American region are often underutilized and underfunded. This is due to the lack of standardization in data formats and the lack of a formal mechanism to share data. The small herbaria in the North American region are often underutilized and underfunded. This is due to the lack of standardization in data formats and the lack of a formal mechanism to share data.

Last month, access to the wealth of knowledge stored in small herbaria was increased through a new application called "Plant of the Day". This application allows users to view a daily image of a plant and learn about its characteristics and uses. The application is designed for educational purposes. With the advent of crowdsourcing, the application has become even more popular. The application is now available on the web and mobile devices. The application is now available on the web and mobile devices. The application is now available on the web and mobile devices. The application is now available on the web and mobile devices.

Plant of the Day

What is this plant? Click here for more information

Welcome to the Mid-Atlantic Herbaria Consortium

The Mid-Atlantic Herbaria Consortium includes Herbaria from New York, New Jersey, Maryland, Virginia, North Carolina, South Carolina, and the District of Columbia. The consortium is a result of the Mid-Atlantic Herbaria Project. We invite any Mid-Atlantic herbaria to join us online in this endeavor. If you have digitized specimen records, photographs, or other data that you would like to share with the community, please consider joining our working group or contact us at NASHP@gsf.binghamton.edu.

Plant of the Day

What is this plant? Click here for more information

Welcome to the Northern Great Plains Regional Herbarium Network

The Northern Great Plains Regional Herbarium brings together information from herbaria in North Dakota, Montana, Wyoming, Colorado, Nebraska, Kansas, and the Dakotas. The region is roughly bounded by the 100th meridian, more or less, though the points of the region whether as a distinct researcher, or member of the public, it will take some time to fully understand the boundaries of the region. The region is roughly bounded by the 100th meridian, more or less, though the points of the region whether as a distinct researcher, or member of the public, it will take some time to fully understand the boundaries of the region.

The region includes most of the land east of the Rocky Mountains to the western edge of the eastern forests. The climate is continental with warm summers and cold winters. Precipitation decreases from east to west, and the vegetation generally reflects this shift: grass prairies in the western mixed grass and tall grass prairies as one moves eastward. The region is roughly bounded by the 100th meridian, more or less, though the points of the region whether as a distinct researcher, or member of the public, it will take some time to fully understand the boundaries of the region.

Plant of the Day

What is this plant? Click here for more information

Welcome to the Intermountain Regional Herbarium Network

The Intermountain Region is basically the region between the Sierra Nevada and the Rocky Mountains. It is roughly bounded by the 100th meridian, more or less, though the boundaries are not as clear as one might think. The region is roughly bounded by the 100th meridian, more or less, though the boundaries are not as clear as one might think. The region is roughly bounded by the 100th meridian, more or less, though the boundaries are not as clear as one might think. The region is roughly bounded by the 100th meridian, more or less, though the boundaries are not as clear as one might think.

Plant of the Day

What is this plant? Click here for more information

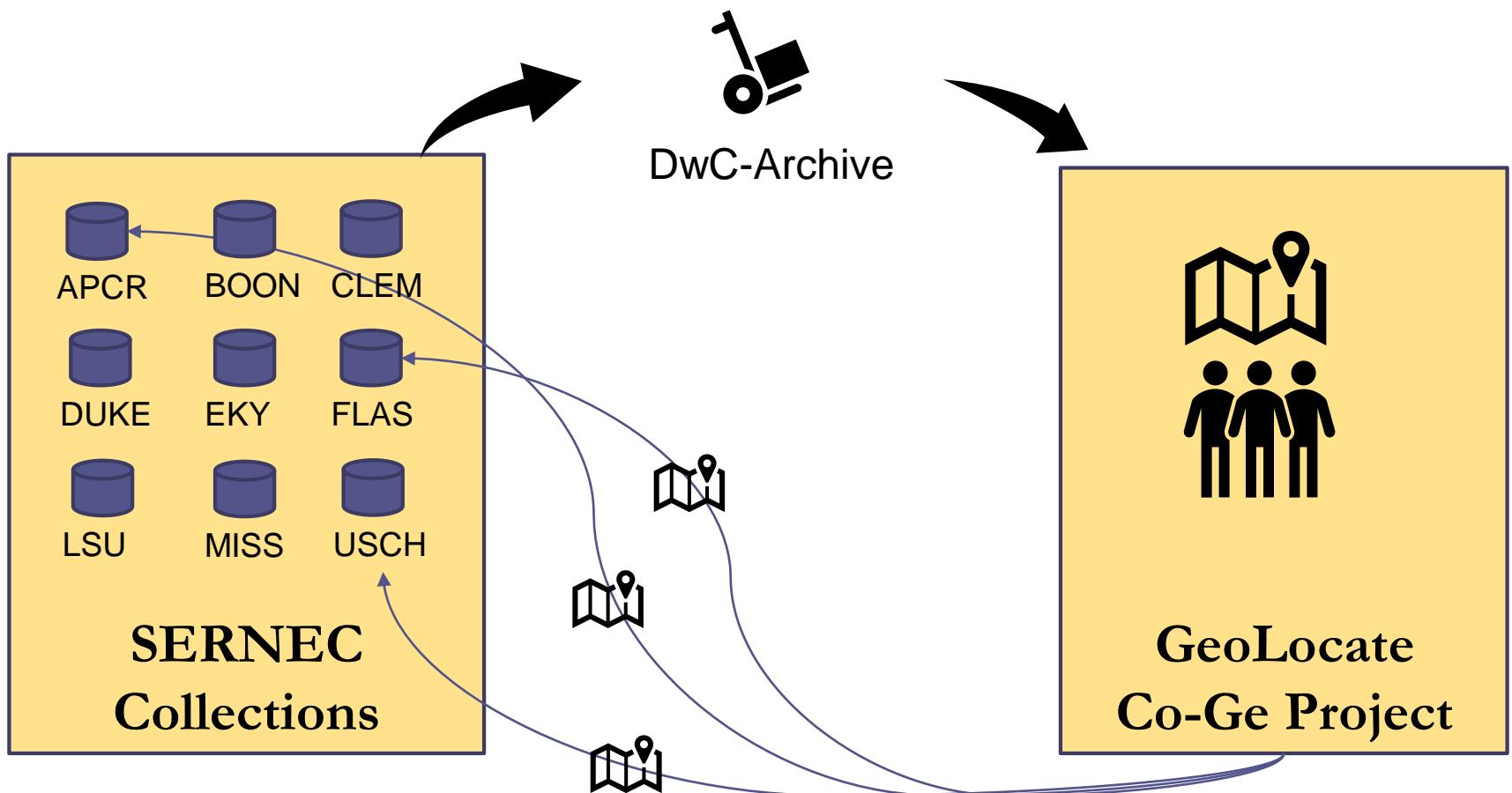
Digitization Services

- Exsiccati
- Loan management
- Genetic linkages
- Specimen comments
- OCR / NLP
- Crowdsourcing
- Versioning of edits
- Batch georeferencing
- GeoLocate collaborations
- Darwin Core Archive publishing
- Pensoft publishing
- Duplicate linking
- Vouchered inventories
- Multiple taxonomic thesauri

SEINet vers. 4.0 - 2018 to...

- Mobilization of specimen data
 - Digitization – specimen and images
 - Open-Data – iDigBio, GBIF
- Interoperability
 - Bi-directional data flow
- Bio-collaboration
 - Field research
 - Regional floras
 - Outreach and education
 - Wildlife managers
- Long-term Sustainability

GeoLocate CoGe Interoperability



Support Grassroot Collaborations

- 1900+ data managers
- 1700+ floras/inventories
- 600 checklist editors
 - Jesus Sanchez, Steve Buckley
- 100+ field researcher
- 40,000 field images
- 300+ photographers
 - Patrick Alexander, Max Licher, Sue Carnahan, Liz Making



Personal Specimen Management

- Data entry
- Data Management
- Label Printing
- Cloud management
 - Password Protected
 - Web browser
 - Platform independent
 - Globally accessible
 - No special software
- Initially “Observations”

General Observations (SEINet)

Home >> Personal Management >> Editor

Occurrence Data		Determination History		Images		Admin	
Catalog Number	Other Numbers	Collector	Number	Date			
Associated Collectors		3024		2011-03-27			
Latest Identification							
Scientific Name		Author:					
<i>Medicago minima</i>		(L.) L.					
ID Qualifier		Family:	Fabaceae				
Identified By:		Date Identified:					
Locality							
Country	State/Province	County	Municipality				
USA	Arizona	Yavapai					
Locality:							
Tent Rocks, SE of Camp Verde, south side of tuff formations							
<input type="checkbox"/> Locality Security							
Latitude	Longitude	Uncertainty (meters)	Datum	Elevation in Meters	Verbatim Elevation		
34.496657	-111.748972	10	NAD83	1030	ft. 3370ft		
Verbatim Coordinates		Georeferenced By		Georeference Protocol			
34° 29' 48.0" N 111° 44' 56.3" W							
Georeference Sources		Georef Verification Status		Georeference Remarks			
Misc							
Habitat: Dry wash channel at base of tuff formations in Desert Scrub habitat, with widely scattered juniper.							
Substrate:							

Plants of Arizona		Plants of Arizona	
<i>Castilleja exilis</i> A. Nels.	Scrophulariaceae	<i>Castilleja exilis</i> A. Nels.	Scrophulariaceae
USA, Arizona, Yavapai County, Mesquite Spring, Cottonwood Basin SE of Camp Verde.		USA, Arizona, Yavapai County, Mesquite Spring, Cottonwood Basin SE of Camp Verde.	
34° 29' 02.5" N 111° 46' 16.7" W [NAD83]		34° 29' 02.5" N 111° 46' 16.7" W [NAD83]	
Elev. 930m. (3040ft)		Elev. 930m. (3040ft)	
Damp bank at spring location, N facing slope. Riparian zone in desert scrub habitat.		Damp bank at spring location, N facing slope. Riparian zone in desert scrub habitat.	
Annual herb, 45 to 85 cm, green bracts with red tips; infrequent		Annual herb, 45 to 85 cm, green bracts with red tips; infrequent	
Associated species: <i>Solidago altissima</i> , <i>Dalea candida</i> , <i>Epipactis gigantea</i> , <i>Schoenoplectus americanus</i> , <i>Toxicodendron rydbergii</i> , <i>Mimulus cardinalis</i> , <i>Salix laevigata</i> , <i>Fraxinus velutina</i> , <i>Salix gooddingii</i> , <i>Andropogon glomeratus</i>		Associated species: <i>Solidago altissima</i> , <i>Dalea candida</i> , <i>Epipactis gigantea</i> , <i>Schoenoplectus americanus</i> , <i>Toxicodendron rydbergii</i> , <i>Mimulus cardinalis</i> , <i>Salix laevigata</i> , <i>Fraxinus velutina</i> , <i>Salix gooddingii</i> , <i>Andropogon glomeratus</i>	
M. Licher 2792	16 July 2010	M. Licher 2792	16 July 2010
Northern Arizona University Herbarium			

Plants of Arizona		Plants of Arizona	
<i>Castilleja exilis</i> A. Nels.	Scrophulariaceae	<i>Eragrostis ciliaris</i> (All.) Vign. ex Janchen	Poaceae
USA, Arizona, Yavapai County, Mesquite Spring, Cottonwood Basin SE of Camp Verde.		USA, Arizona, Yavapai County, Confluence of Mesquite and Cottonwood Springs, Cottonwood Basin SE of Camp Verde.	
34° 29' 02.5" N 111° 46' 16.7" W [NAD83]		34° 28' 59.2" N 111° 46' 22.1" W [NAD83]	
Elev. 930m. (3040ft)		Elev. 920m. (3020ft)	
Damp bank at spring location, N facing slope. Riparian zone in desert scrub habitat.		Sandy riparian creek bed without surface water in desert	

Voucher Network

Public View

San Pedro Riparian National Conservation Area
Author: Elizabeth Maring
Published: Mar 2001
Recorded: San Pedro Riparian National Conservation Area, Desert Ruth Mtn (322), 194.2a Maring, E. 2001
Flora of the San Pedro Riparian National Conservation Area, Chiricahua County, Arizona. M.S. Thesis, Arizona State University, Tempe, AZ.

Species List

Family 1
Genus 45
Species 111 (species rank)
Total Taxa 110 (including crop and wild)

POACEAE

Achnatherus erianthus
Elizabeth Maring (158)
Anthonia geniculata
Elizabeth Maring (127), Elizabeth Maring (162)
Anisanthes
Elizabeth Maring (121), Elizabeth Maring (162)
Anisocoma
Elizabeth Maring (121), Elizabeth Maring (54), Elizabeth Maring (112), Elizabeth Maring (118)
Anisocoma polystachya
Elizabeth Maring (161), Elizabeth Maring (172)
*Anisocoma polystachya var. *canescens**
Elizabeth Maring (101), Elizabeth Maring (175), Elizabeth Maring (136)
Anisocoma
Elizabeth Maring (101), Elizabeth Maring (52)
Anisocoma lanigera
Elizabeth Maring (165), Elizabeth Maring (42), Elizabeth Maring (161), Elizabeth Maring (48)
Anisocoma lanigera var. *canescens*
Elizabeth Maring (126), Elizabeth Maring (128)
Anisocoma
Elizabeth Maring (155), Elizabeth Maring (81)
Aster
Elizabeth Maring (155)



GenBank #

General Observations (SEINet)
Home > Personal Management > Editor
Collector Info
Collector Name: "Other Numbers" Collector Number: 2004 Date: 2011-03-27
Associated Collector:
Local Identifier
Scientific Name: Author: G.L.
ID Qualifier: Family: Fabaceae
Identified By:
County: State/Province: County: Municipality:
Elevation: Locality: (Arizona) Yavapai
Habitat: Rock crevices, SE of Camp Verde, south side of tuff formations
Locality Notes:
Latitude: Longitude: University Collection: Date: Elevation in Meters: Verbatim Elevation:
24° 29' 48.0" N 111° 46' 36.2" W
Verbatim Coordinates: Georeference Method: Georeference Sources: Georeference Remarks:
Mac: Habitat: Dry wash channel at base of tuff formations in Desert Scrub habitat, with widely scattered juniper
Santalaceae

Original Observation

ASC

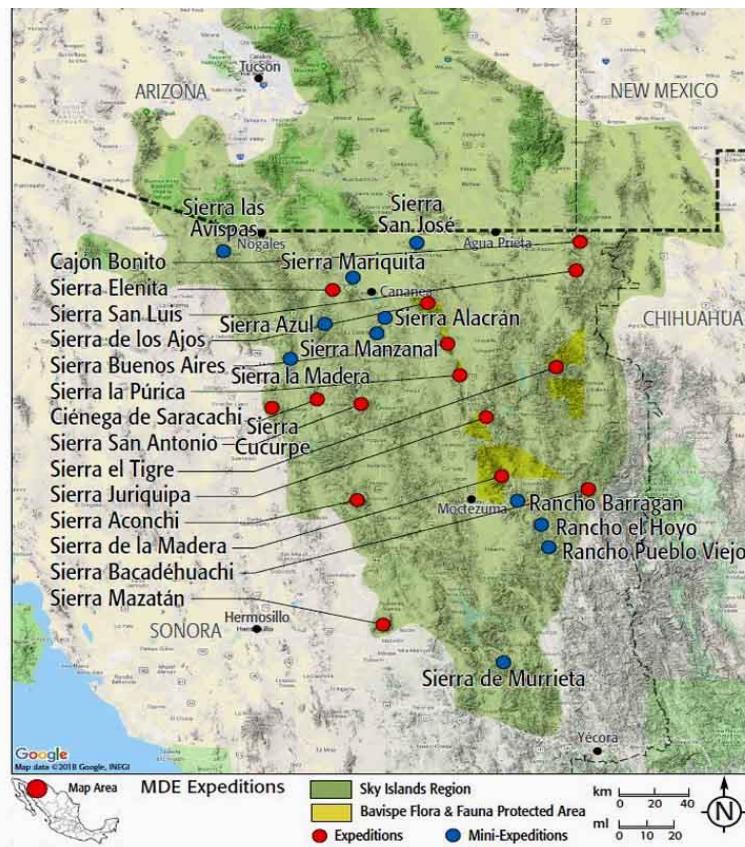
Anno 1

Anno 2

MNA

Physical Specimens

Madrean Discovery Expeditions



Flora Database



[Click here to access hundreds of thousands of plant records in the Sky Island region, build species checklists, view existing checklists, view species images, and customize taxonomic keys for areas of interest.](#)

Fauna Database



[Click here to access hundreds of thousands of animal records in the Sky Island region, build species lists, view existing species lists, and find species images.](#)



Acknowledgments

- National Science Foundation
 - ADBC and iDigBio
- Herbaria, collection managers
- Regional TCN projects
- Individual content providers
- SEINet Steering Committee
 - Gil Nelson, Ed Gilbert, Leslie Landrum, Anna Monfils, Zack Murrell, Richard Rabeler, Patrick Sweeney, Barbara Thiers
- Arizona State University – GIOS, SOLS, BioKic
- Robin Schroeder, Ben Brandt, etc

