

Symbiota: a specimen-based biodiversity portal platform

Edward Gilbert
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National Science Foundation
WHERE DISCOVERIES BEGIN

Symbiota Software Project

- Open source
- Virtual flora/fauna
  - Specimen search engine
  - Biodiversity inventories
  - Identification keys
- Images, maps, descriptions, common names, etc

Specimen Centric Model

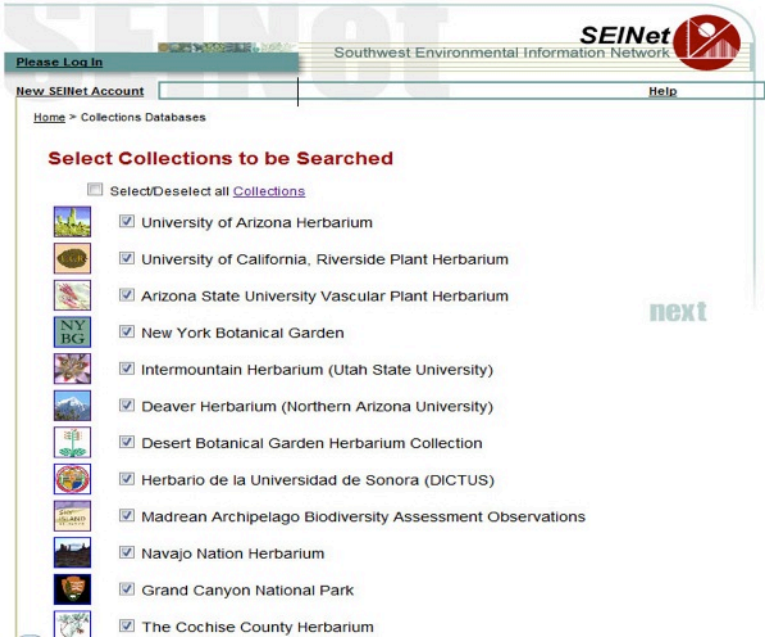
- Baseline data
- Expert reviewed vouchers
- Verifiable
- Proof of occurrence
- Reproducible
- Millions of occurrence records

History - Initial Funding

- NSF Award DBI-0847966
- 2008 – 2011
- Integrate systems
  - Symbiota Keys
  - SEINet
- Data exchange
- Web services

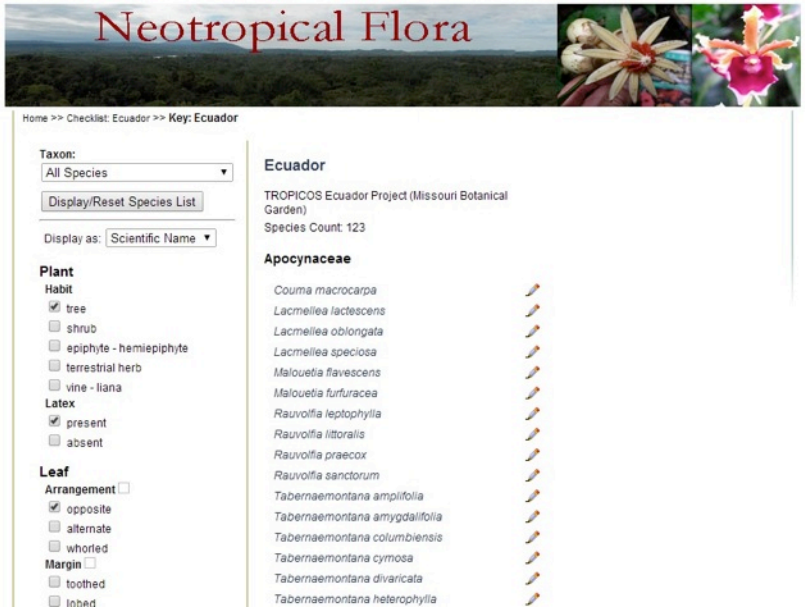
History -> SEINet

- Prototype: 2001
- Specimen search engine
- Java/JSP & MS SQL
- Distributed databases
- Arizona herbaria
  - DES, ARIZ, ASC, ASU
- Taxonomic thesaurus
- Read-only



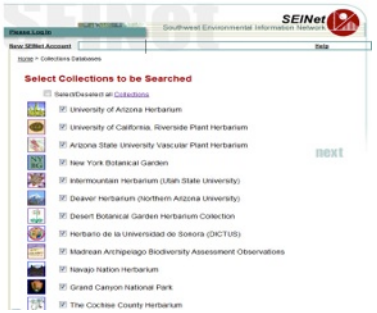
History -> Symbiota Key

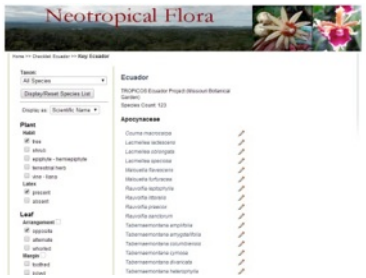
- Interactive Key
- PHP / MySQL
- Character “matrix”
  - DELTA standard
  - Relational database
- Taxonomy
- Static checklists
- Keys for complex lists
- Issue: No specimens



History -> Change or Plans

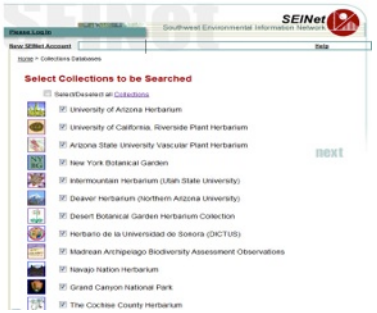
- SEINet issues
- Unstable
- Problematic infrastructure
- Offline databases
- Limited use of standards
- Solution: merge!

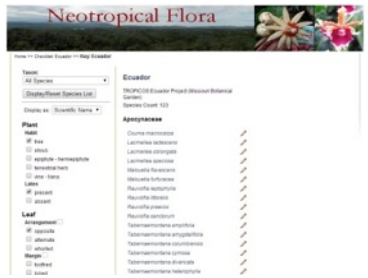




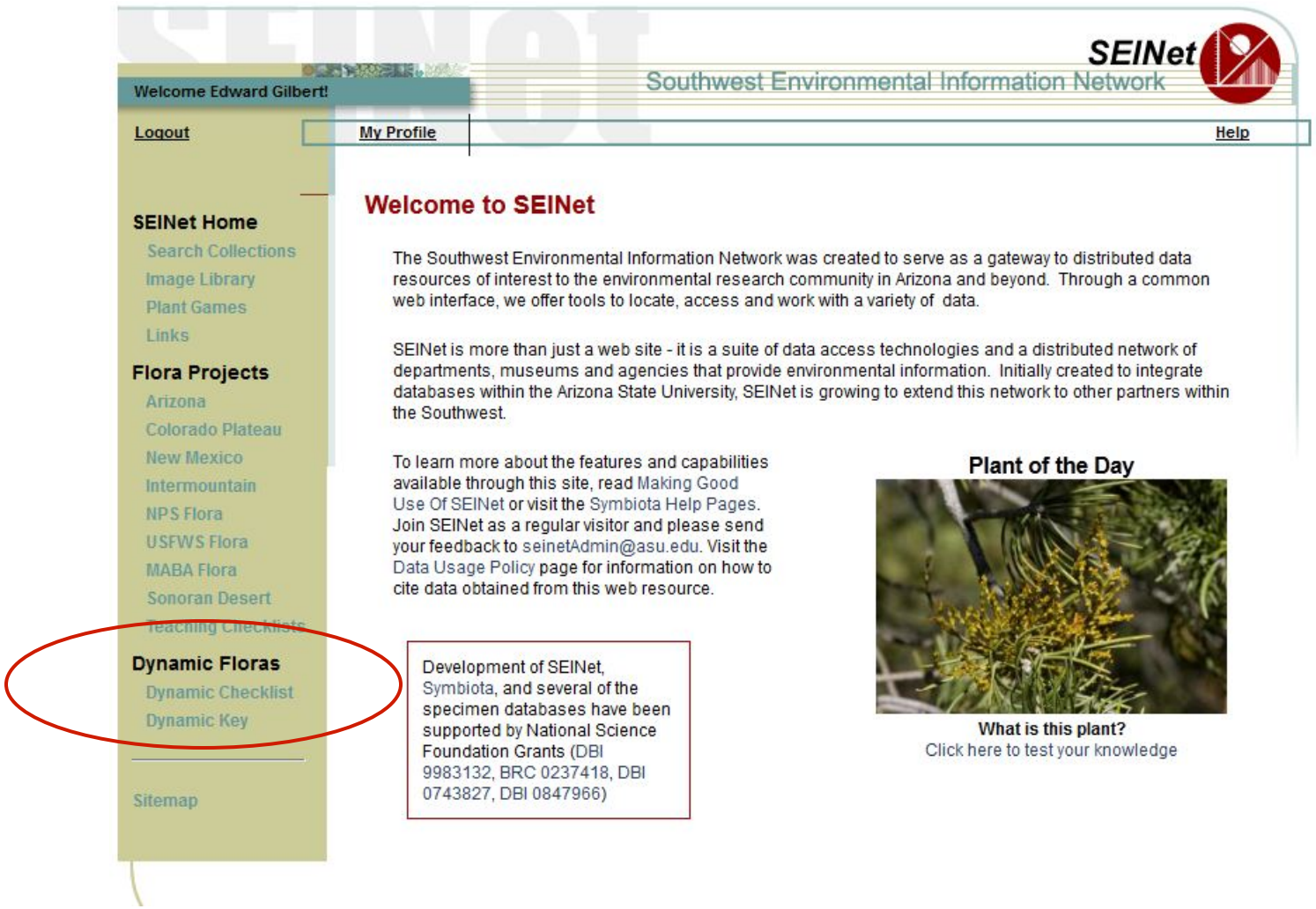
Symbiota - Prototype

- SEINet functionality merged into Symbiota
- Centralized cache of specimen data
- Robust indexing
- Dynamic keys
- Central Taxonomic Thesaurus





Power of an Integrated Dataset



Home > **Dynamic Map**

Pan, zoom and click on map to capture coordinates. Upon submitting coordinates, a species list will be generated by looking at all specimens collected within the area. More Details

Point (Lat, Long): **31.81002, -110.41428**

Taxon Filter (optional)

Submit Coordinates

Taxon:
All Species
Display/Reset Species List

Display as: Scientific Name

Plant
habit
- herb
- shrub
- tree
- vine
- grass-like
- cactus-like / desert succulent
- fern & allies
- aquatic

longevity
- annual or biennial
- perennial

31.81002, -110.41428; within 20 miles

Species Count: 1357

Acanthaceae
Anisacanthus thurberi
Carlowrightia arizonica
Carlowrightia linearifolia
Carlowrightia texana
Dicliptera resupinata
Dyschoriste schiedeana
Elytraria imbricata
Justicia sonorae
Ruellia nudiflora
Tetramerium nervosum

Adoxaceae
Sambucus nigra

Aizoaceae
Trianthema portulacastrum

Alismataceae
Alisma triviale

Taxon:
All Species
Display/Reset Species List

Display as: Scientific Name

Plant
habit
- herb
- shrub
- tree

sap
- latex absent (sap clear)
- latex present

Leaves
type
- simple
- compound

stipules
- stipules absent
- stipules present

arrangement
- alternate
- opposite
- whorled
- fascicled/clustered along stem

blade margin

31.81002, -110.41428; within 20 miles

Species Count: 62

Adoxaceae
Sambucus nigra

Anacardiaceae
Rhus microphylla
Rhus virens

Bignoniaceae
Catalpa bignonioides
Chilopsis linearis
Tecoma stans

Cannabaceae
Celtis reticulata

Cupressaceae
Juniperus coahuilensis
Juniperus deppeana

Ericaceae

Taxon:
All Species
Display/Reset Species List

Display as: Scientific Name

Plant
habit
- shrub
- tree

Leaves
type
- simple
- compound

arrangement
- opposite
- whorled

blade margin
- entire
- toothed
- lobed

Fruit
consistency at maturity
- dry/leathery
- fleshy

31.81002, -110.41428; within 20 miles

Species Count: 10

Adoxaceae
Sambucus nigra

Bignoniaceae
Catalpa bignonioides
Tecoma stans

Cupressaceae
Juniperus coahuilensis
Juniperus deppeana

Oleaceae
Fraxinus gooddingii
Fraxinus velutina

Rubiaceae
Cephalanthus occidentalis

Sapindaceae

Taxon:
All Species
Display/Reset Species List

Display as: Scientific Name

Plant
habit
- [ ] shrub
- [x] tree

Leaves
type
- [x] compound

compound type
- [ ] once-pinnately compound
- [ ] trifoliolate (w/ 3 leaflets)

arrangement
- [x] opposite

Inflorescence
position
- [ ] axillary
- [ ] terminal

type
- [ ] raceme
- [ ] umbel
- [ ] panicle

31.81002, -110.41428; within 20 miles

Species Count: 5

Adoxaceae
- *Sambucus nigra*

Bignoniaceae
- *Tecoma stans*

Oleaceae
- *Fraxinus gooddingii*
- *Fraxinus velutina*

Sapindaceae
- *Acer negundo*

Acer negundo L.

Go to Encyclopedia of Life...

Family: Sapindaceae

boxelder, more...

[*Negundo aceroides* (L.) Moench , more]

Max Licher

VPAP Treatment

JANAS 29(1)

Plant: tree; to 10 m high, sparsely to densely pubescent on young growth and lower leaf surfaces, usually dioecious; young twigs glabrous to densely pubescent, often more or less glaucous, the epidermis smooth, greenish or reddish, the older twigs more or less rough, gray; buds covered by two reddish, tan, or yellowish valvate scales, these sparsely to densely hairy, the pubescent inner scales greatly elongating as the bud opens **Leaves**: mainly 3-foliolate, occasionally 3-lobed, 3.5-13.5 cm long, 3.5-18 cm wide, concolorous, the terminal leaflet up to 11 cm long by 8 cm wide, the lateral leaflets up to 9 cm long by 6 cm wide; apex of leaflets acute to acuminate; base of leaflets rounded to cuneate, sometimes oblique in lateral leaflets, sometimes acuminate in terminal leaflets; petiole 2-7.5 cm long, green or reddish; margin of leaflets coarsely toothed or lobed, the teeth acuminate to obtuse **INFLORESCENCE**: inflorescences many flowered, the staminate umbel-like, the pistillate racemose **Flowers**: ca. 5 mm long, less than 1 mm wide at base of perianth, the perianth greenish-yellow, with ca. 4 subelliptic segments ca. 0.2-2 mm long, the receptacle blending with filiform pedicel; pedicels 1-4 cm long **Fruit**: samaras 2.3-3.6 cm long, the wing 0.7-1.4 cm wide, the infructescences up to 15 cm long **Misc**: Riparian habitats and other wet wooded areas; 900-2750 m (3000-9100

Max Licher

Max Licher

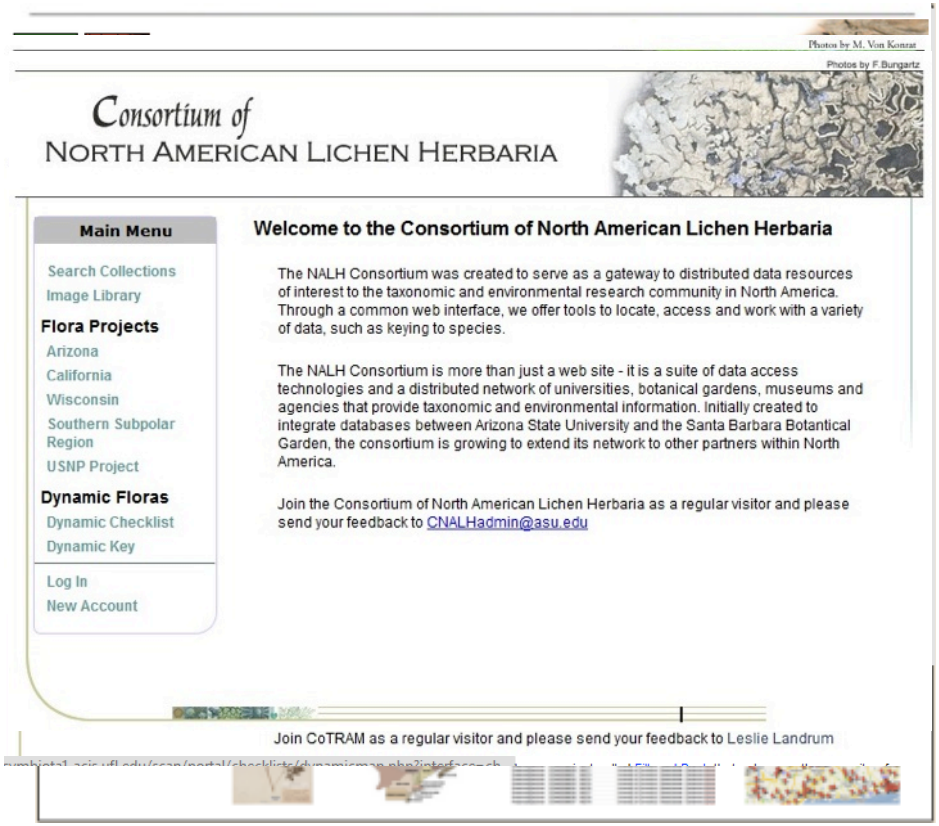
Max Licher

Max Licher

Open Interactive Map

Scientific Community Portals

- Modular famework
- Community-based biodiversity portals
- Distinct datasets
  - Taxonomic scope
  - Geographic scope
- Custom look & feel
  - CSS, config files

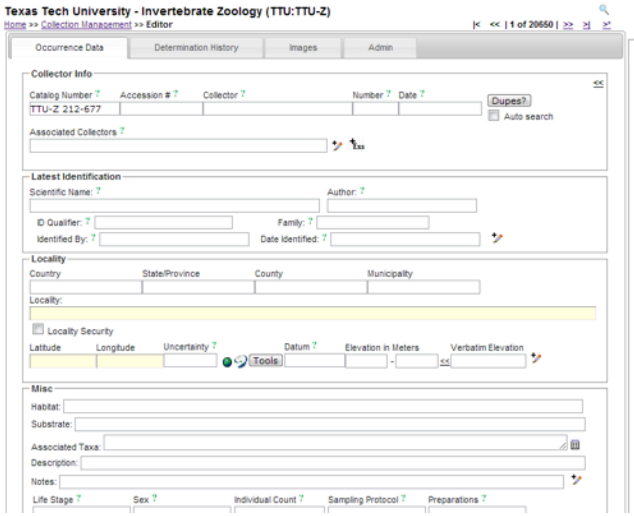


SEINet Network

- Integrated Data
- Distributed Network
  - Great Plains
  - InterMountain
  - MABA
  - SEINet – AZ
  - SEINet – NM
  - SERNEC
  - VPlants

Symbiota - Biodiversity CMS

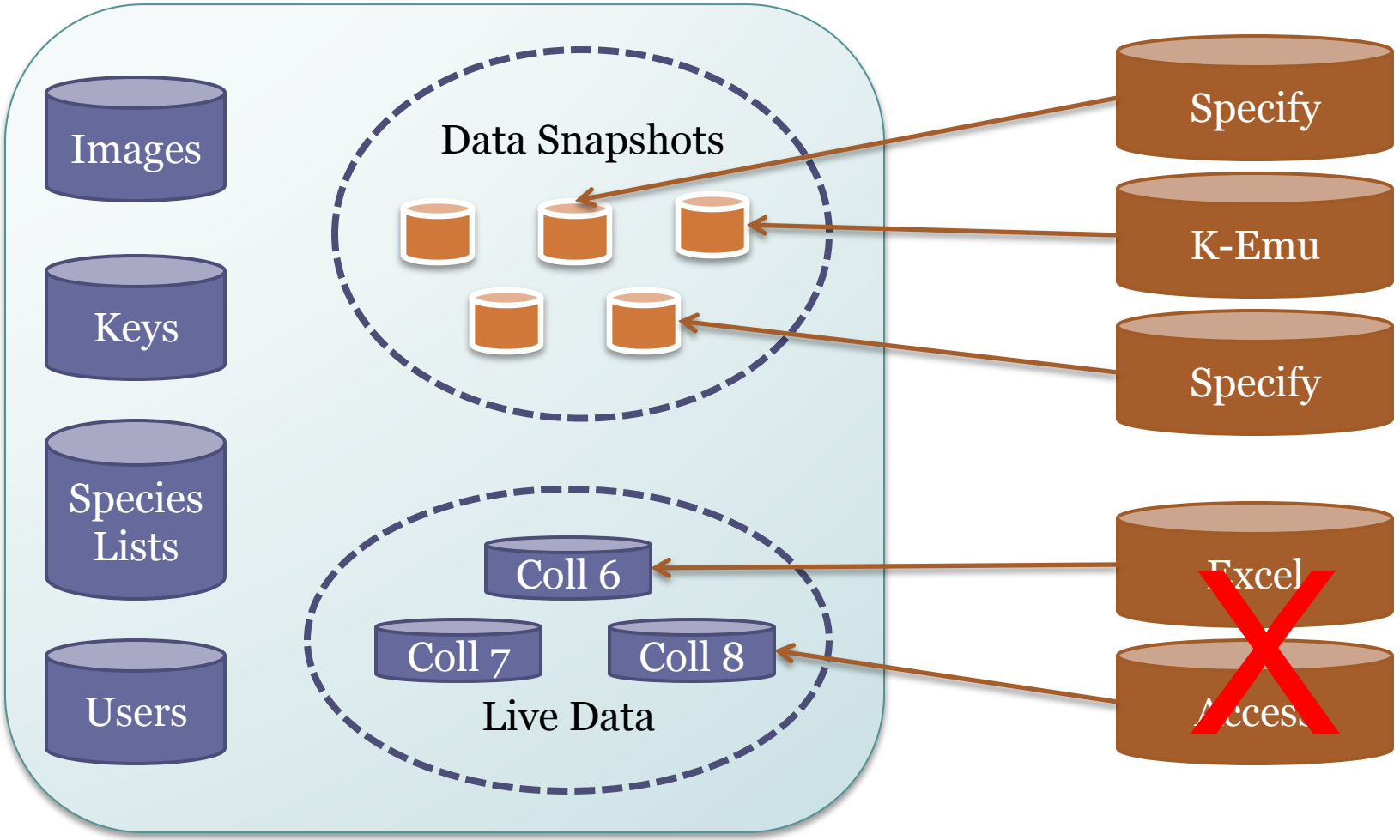
- Read-only user interface
- Password Protected
  - Online Browser-based application
  - Platform independent
  - Globally accessible
  - No special software installation (free)
  - Make use of web services



Additional Features

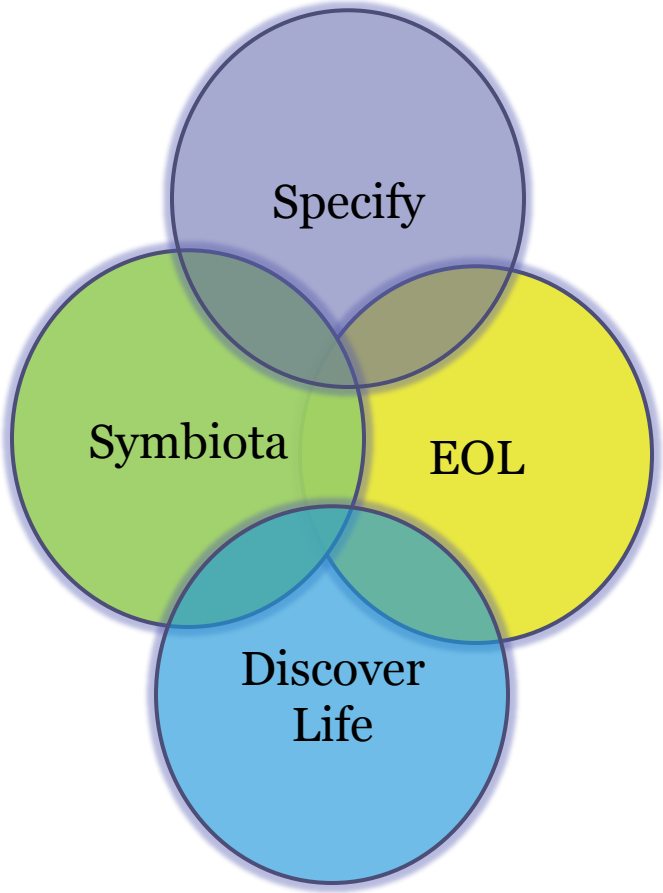
- Duplicate linking
- Exsiccati
- Loan management
- Genetic linkages
- Specimen comments
- OCR / NLP
- Crowdsourcing
- Versioning of Edits
- Batch georeferencing
- Darwin Core Archive Publishing
- Data Cleaning
- Multiple taxonomic thesauri

Specimen Management



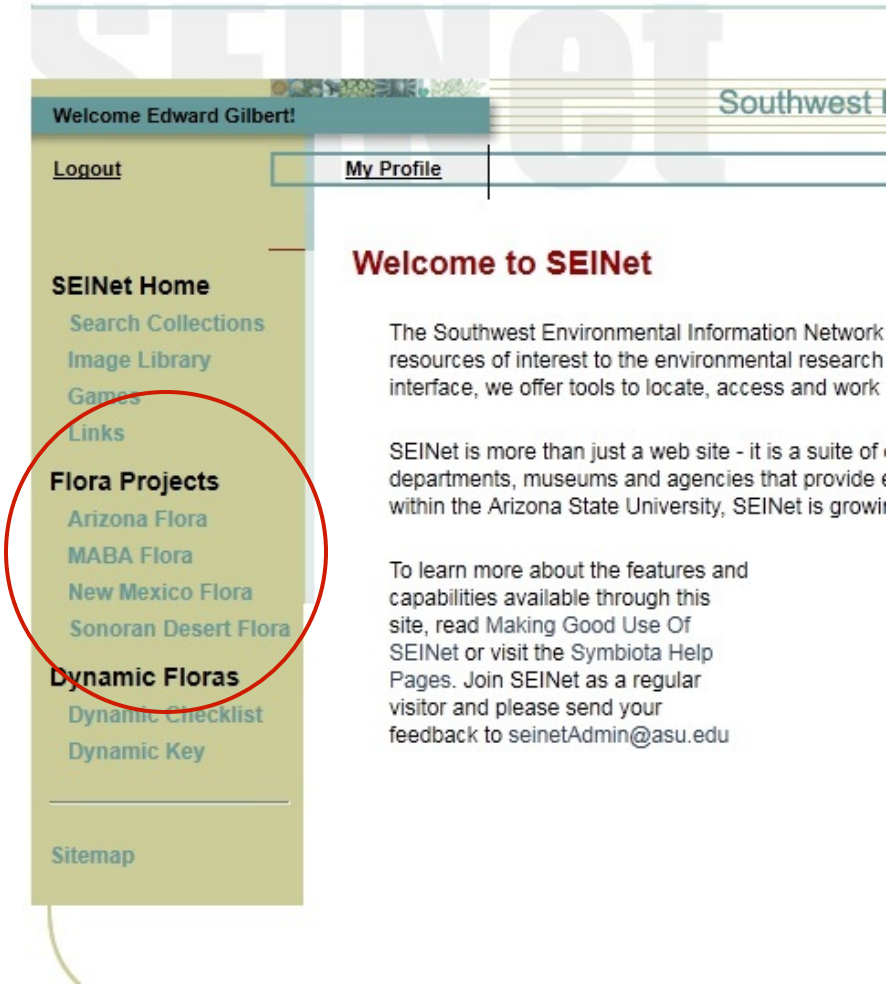
Duplication –vs – Niche Overlap

- Encyclopedia of Life (EOL)
- Specify
- GBIF
- Discover Life
- Navikey / Lucid / Xper2
- Symbiota
  - Community Data Portals
  - Specimen based
  - Biodiversity CMS



Biodiversity Inventories

- Floras & Fauna
- Graduate Research
- Park Service Inventories
- Surveys
- Voucher supported



SEINet Home
- Search Collections
- Image Library
- Games
- Links

Flora Projects
- Arizona Flora
- MABA Flora
- New Mexico Flora
- Sonoran Desert Flora

Dynamic Floras
- Dynamic Checklist
- Dynamic Key

Sitemap

Arizona Flora

Project Managers: Arizona State University Vascular Plant Herbarium

Arizona is the third or fourth most floristically rich state in the US with perhaps as many as 3900 species of vascular plants. Over the last 60 years an average of ca. 12 new species records have been reported annually.

Research Checklists

- Arizona
- Arizona Spring Flora
- ASU Arboretum - Gold Trail
- ASU Arboretum - Maroon Trail
- Buckeye Hills Recreational Area
- Camp Creek
- Canyon de Chelly National Monument
- Casa Grande Ruins National Monument
- Castle Dome Mountains
- Chiricahua National Monument
- Eagletail Mountains Wilderness
- Escudilla Mountains
- Fort Bowie National Historic Site
- Grand Canyon National Park
- GreenLots - Tucson
- Hart Prairie
- Hassayampa River Preserve
- Hummingbird Springs Wilderness
- Lake Pleasant Regional Park
- Maricopa County, Arizona
- McDowell Mountains Regional Park
- Organ Pipe Cactus National Monument
- Papago Park
- Phoenix Cultivated Plants
- Phoenix Flora
- Pinal Mountains
- Pinaleno Mountains
- Saguaro National Park-Rincon Mountain District
- San Pedro National Riparian Conservation Area
- San Tan Mountain Semi-Regional Park
- Santa Catalina Mountains
- Santa Teresa Mountains

San Pedro National Riparian Conservation Area

Games

MD Spp.

Authors: Elizabeth Makings

Publication: Makings, E 2006. Flora of the San Pedro Riparian National Conservation Area. Desert Plants Vol. 22(2); 104 pp. Makings, E 2003. Flora of the San Pedro Riparian National Conservation Area, Cochise County, Arizona. M. S. Thesis, Arizona State University, Tempe

More Details

Species List

Families: 95
Genera: 359
Species: 618 (species rank)
Total Taxa: 627 (including ssp. and var.)

Page **1** of **2**: **1** | 2

Options

Search:

Common Names Synonyms

Filter: Original Checklist

Common Names
Display as Images
Notes & Vouchers
Taxon Authors

Rebuild List

ACANTHACEAE

Anisacanthus thurberi
Carlowrightia arizonica
Carlowrightia linearifolia
Carlowrightia texana
Elytraria imbricata
Ruellia nudiflora

AGAVACEAE

Agave palmeri
Yucca sp.
Yucca elata

AIZOACEAE

Trianthema portulacastrum

AMARANTHACEAE

Alternanthera caracasana
Alternanthera pungens
Amaranthus albus
Amaranthus fimbriatus
Amaranthus palmeri

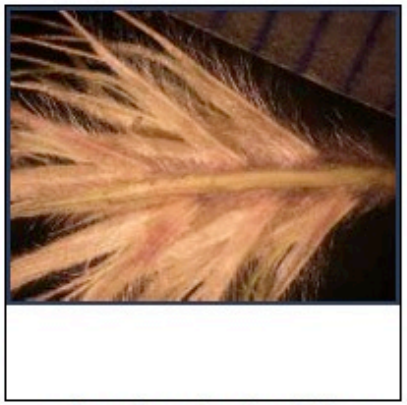
Avena fatua

Bothriochloa barbinodis

Bothriochloa ischaemum

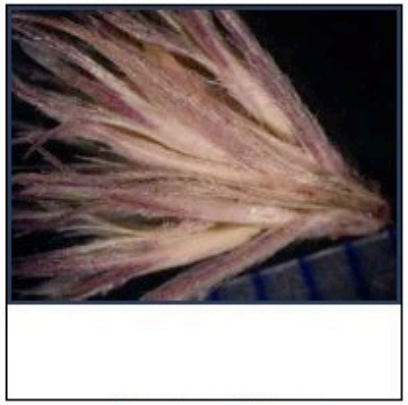
Bothriochloa laguroides ssp. torreyana

Bouteloua barbata



Bouteloua chondrosioides

Bouteloua curtipendula



Bouteloua eludens

Bouteloua eriopoda

San Pedro National Riparian Conservation Area

Games

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Authors: Elizabeth Makings

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More Details

Species List

Families: 1
Genera: 45
Species: 100 (species rank)
Total Taxa: 105 (including ssp. and var.)

Options

Search: Poaceae
Common Names Synonyms

Filter: Original Checklist

Common Names
Display as Images
Notes & Vouchers
Taxon Authors

Rebuild List

POACEAE

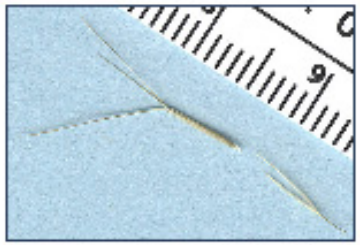
Achnatherum eminens
Elizabeth Makings (1538)
Andropogon glomeratus
rare; Elizabeth Makings (827) , Elizabeth Makings (1682)
Aristida adscensionis
Elizabeth Makings (824) , Elizabeth Makings (594) , Elizabeth Makings (762) , Elizabeth Makings (1300)
Aristida purpurea var. longiseta
Elizabeth Makings (865) , Elizabeth Makings (1513)
Aristida purpurea var. nealleyi
Elizabeth Makings (803) , Elizabeth Makings (1075) , Elizabeth Makings (1366)
Aristida ternipes
Elizabeth Makings (503)
Aristida ternipes var. gentilis
Elizabeth Makings (685) , Elizabeth Makings (492) , Elizabeth Makings (688) , Elizabeth Makings (488)
Aristida ternipes var. ternipes
Elizabeth Makings (1214) , Elizabeth Makings (1330)
Arundo donax
Elizabeth Makings (1650) , Elizabeth Makings (813)
Avena fatua
Elizabeth Makings (229)
Bothriochloa barbinodis
Elizabeth Makings (512) , Elizabeth Makings (1040) , Elizabeth Makings (472)
Bothriochloa ischaemum
Elizabeth Makings (1272) , Elizabeth Makings (1659)
Bothriochloa laguroides ssp. torreyana
Elizabeth Makings (822) , Elizabeth Makings (1024) , Elizabeth Makings (1048) , Elizabeth Makings (423)
Bouteloua barbata
Elizabeth Makings (1385) , Elizabeth Makings (599) , Elizabeth Makings (646)
Bouteloua chondrosioides

Arizona State University Vascular Plant Herbarium

ASU

Family: Poaceae **Accession #:** 247202
Taxon: *Aristida adscensionis* L.
Collector: Elizabeth Makings (#762)
Date Collected: 07 September 2001
Habitat: alluvial terrace, old agricultural field with scattered sacaton
Associated Species: *Sporobolus wrightii, Solanum eleaegnifolium, Machaeranthera gracilis, annuals Conyza coulteri, Chloris virgata, Xanthocephalum gymnospermoides*
Description: Common annual 60 cm
Locality: USA; Arizona; Cochise County
Upper San Pedro River floodplain, "Cottonwood" site, approx 1 mile south of Hwy 90, ~100m west of San Pedro
31.8456993 -110.2279968
Elevation: 1239m.





For more information on this specimen, please contact Leslie Landrum (les.landrum@asu.edu)

San Pedro National Riparian Conservation Area

Games

MD Spp.

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Search: Poaceae
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Filter: Original Checklist
Common Names
Display as Images
Notes & Vouchers
Taxon Authors
Rebuild List

POACEAE

Achnatherum eminens
Elizabeth Makings (1538)
Andropogon glomeratus
rare; Elizabeth Makings (827) , Elizabeth Makings (1682)
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Bouteloua barbata
Elizabeth Makings (1385) , Elizabeth Makings (599) , Elizabeth Makings (646)
Bouteloua chondrosioides

San Pedro Riparian National Conservation Area

Search statement: (o.county LIKE "%Cochise%") AND (o.locality LIKE "%San Pedro%")

Non-Vouchered Taxa | Missing Taxa | Voucher Conflicts | Children Vouchers | Reports

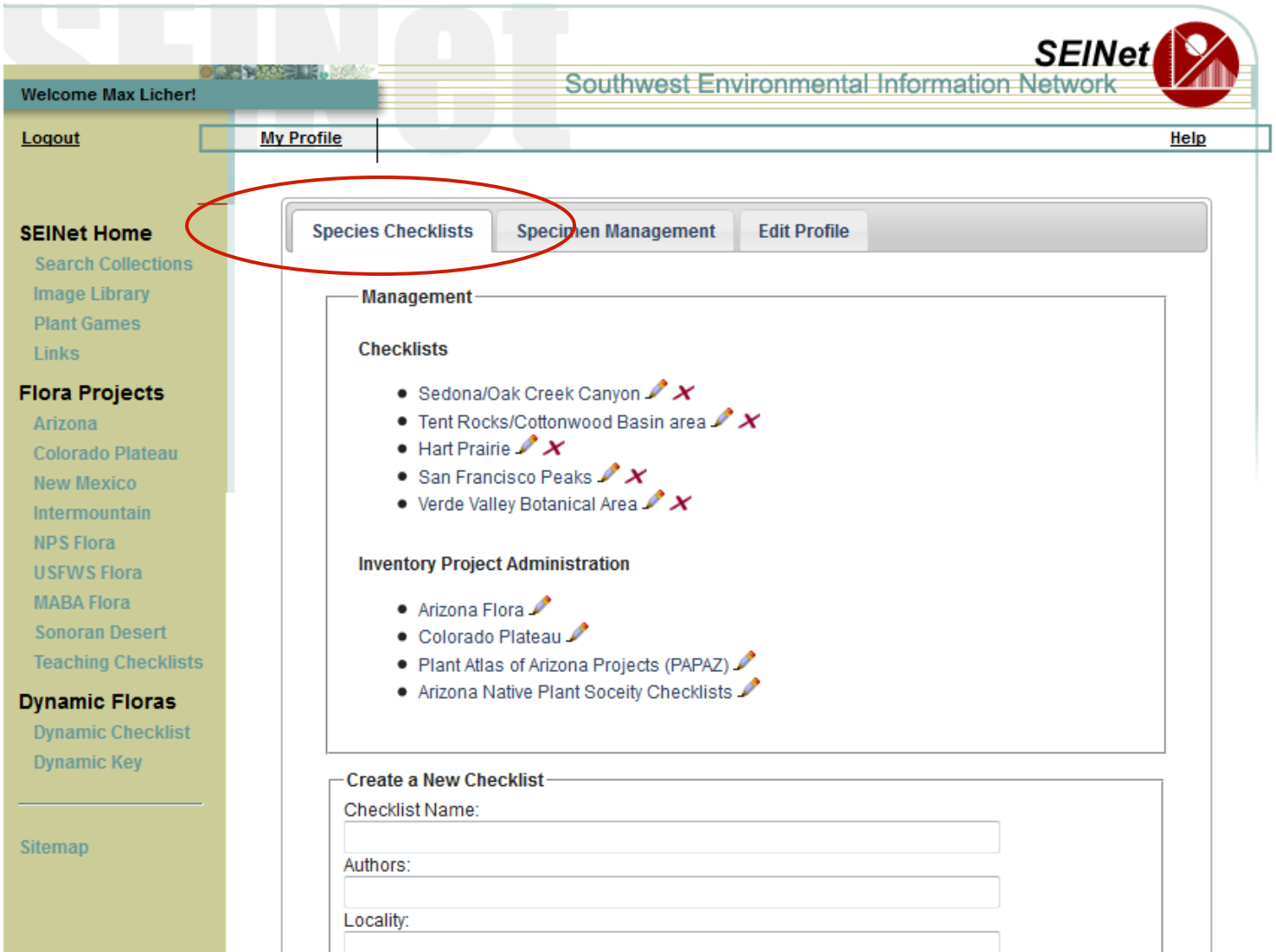
Possible Voucher Conflicts

List of specimen vouchers where the current identifications conflict with the checklist. Voucher conflicts are typically due to recent annotations of specimens located within collection. Click on Checklist ID to open the editing pane for that record.

Conflict Count: 21

Checklist ID	Collector	Specimen ID	Identified By
Abutilon palmeri	Elizabeth Makings (1331)	Abutilon abutiloides	C. J. S. Davis (Dec 2011)
Abutilon palmeri	Elizabeth Makings (1277)	Abutilon abutiloides	C. J. S. Davis (Dec 2011)
Abutilon palmeri	Elizabeth Makings (1317)	Abutilon abutiloides	C. J. S. Davis (Dec 2011)
Chamaesyce stictospora	Elizabeth Makings (1404)	Chamaesyce prostrata	Liz Makings (June 2012)
Cyperus odoratus	Elizabeth Makings (569)	Cyperus esculentus	Liz Makings
Eleocharis parishii	Elizabeth Makings (1049)	Eleocharis palustris	Liz Makings

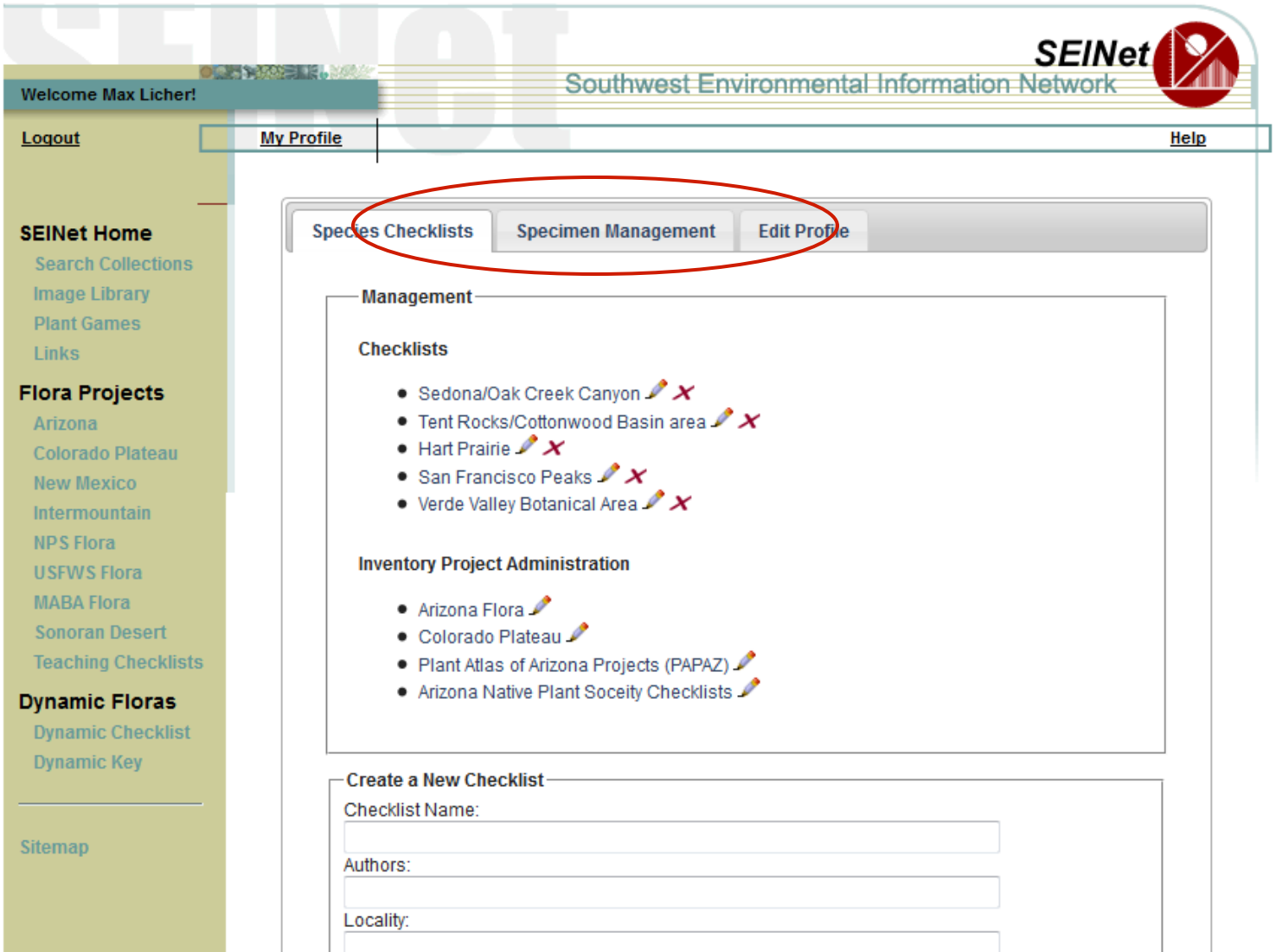
“My Profile”


SEINet
Southwest Environmental Information Network
Welcome Max Licher!
Logout
My Profile
Help
SEINet Home
Search Collections
Image Library
Plant Games
Links
Flora Projects
Arizona
Colorado Plateau
New Mexico
Intermountain
NPS Flora
USFWS Flora
MABA Flora
Sonoran Desert
Teaching Checklists
Dynamic Floras
Dynamic Checklist
Dynamic Key
Sitemap
Species Checklists
Specimen Management
Edit Profile
Management
Checklists
Sedona/Oak Creek Canyon
Tent Rocks/Cottonwood Basin area
Hart Prairie
San Francisco Peaks
Verde Valley Botanical Area
Inventory Project Administration
Arizona Flora
Colorado Plateau
Plant Atlas of Arizona Projects (PAPAZ)
Arizona Native Plant Soceity Checklists
Create a New Checklist
Checklist Name:
Authors:
Locality:

Plant Atlas of Arizona Project

- Arizona Native Plant Society
- Grand Canyon Trust
- Desert Botanical Garden
- U.S. Forest Service
- Northern Arizona University
- Museum of Northern Arizona

My Profile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San Francisco Peaks
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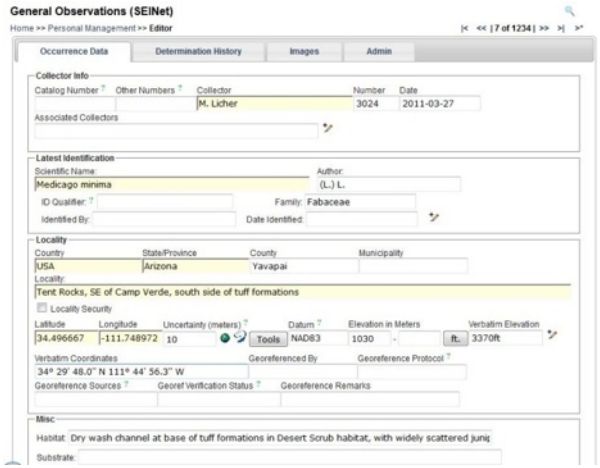
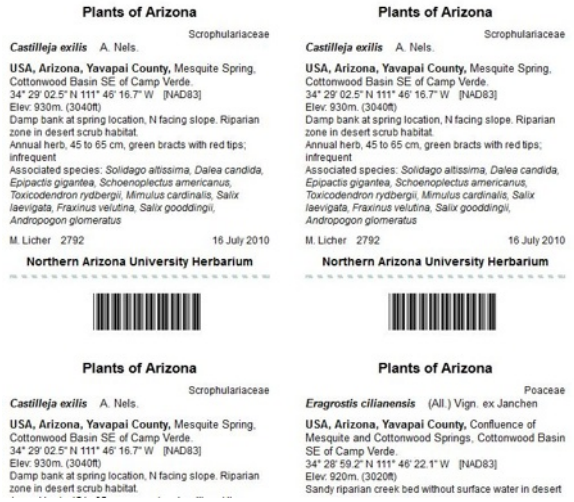
Arizona Flora
Colorado Plateau
Plant Atlas of Arizona Projects (PAPAZ)
Arizona Native Plant Soceity Checklists
Create a New Checklist
Checklist Name:
Authors:
Locality:

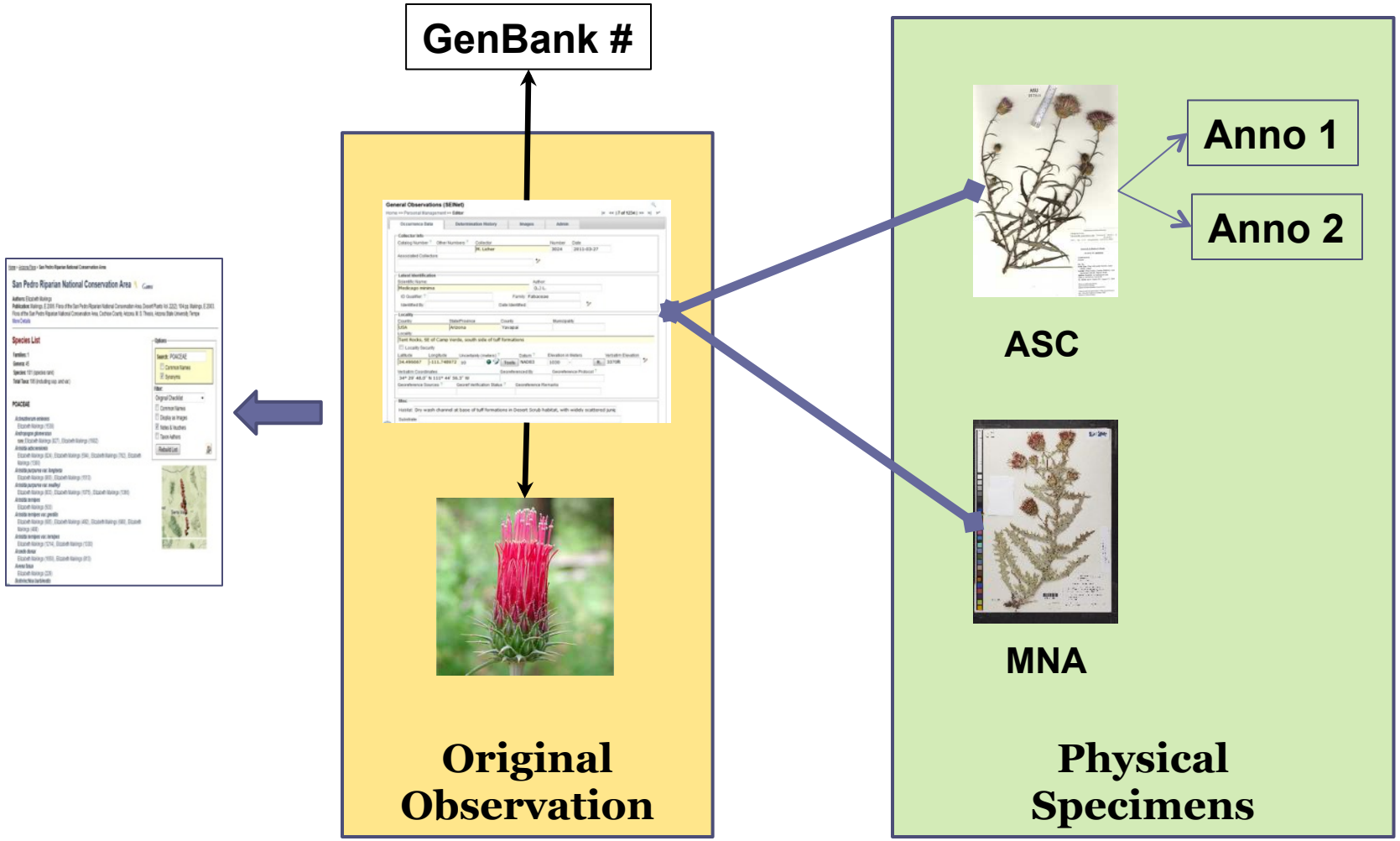
Personal Specimen Management

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





Voucher Network



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