

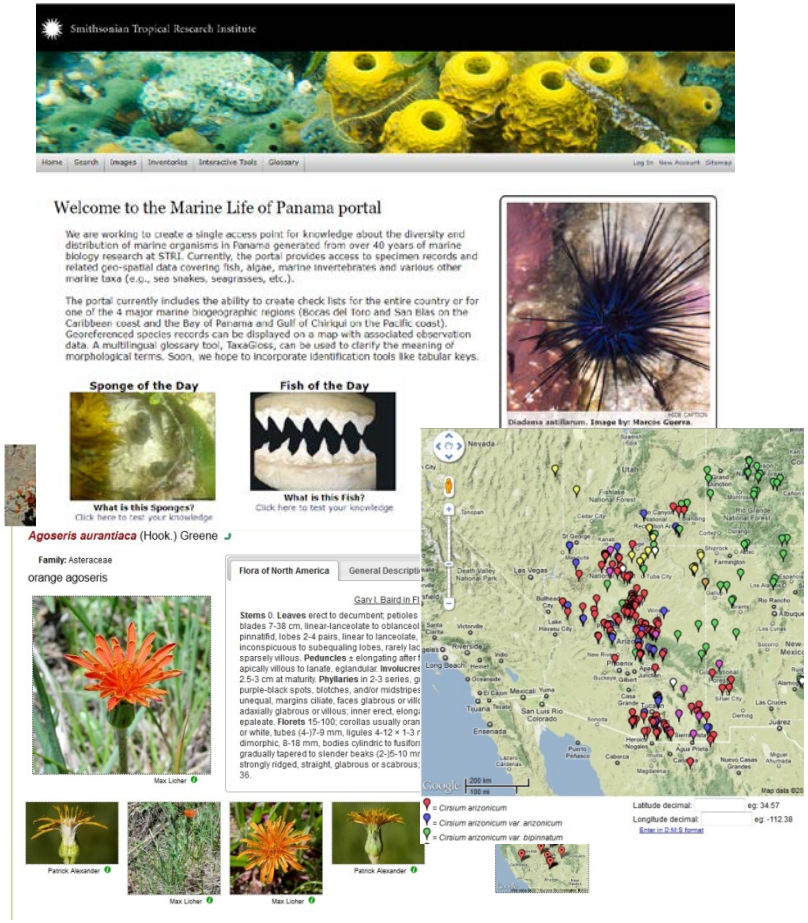
SYMBIOTA: specimen-based platform to support digitization, publication, and public outreach

Edward Gilbert
Nico Franz

National Science Foundation
WHERE DISCOVERIES BEGIN

Symbiota Software Project

- Open source software
- Virtual fauna/flora
  - Specimen search
  - Images, maps, taxon descriptions, taxonomy, etc
- Data management
  - Specimen digitization
  - Species inventories
  - Identification keys



Symbiota Data Portals

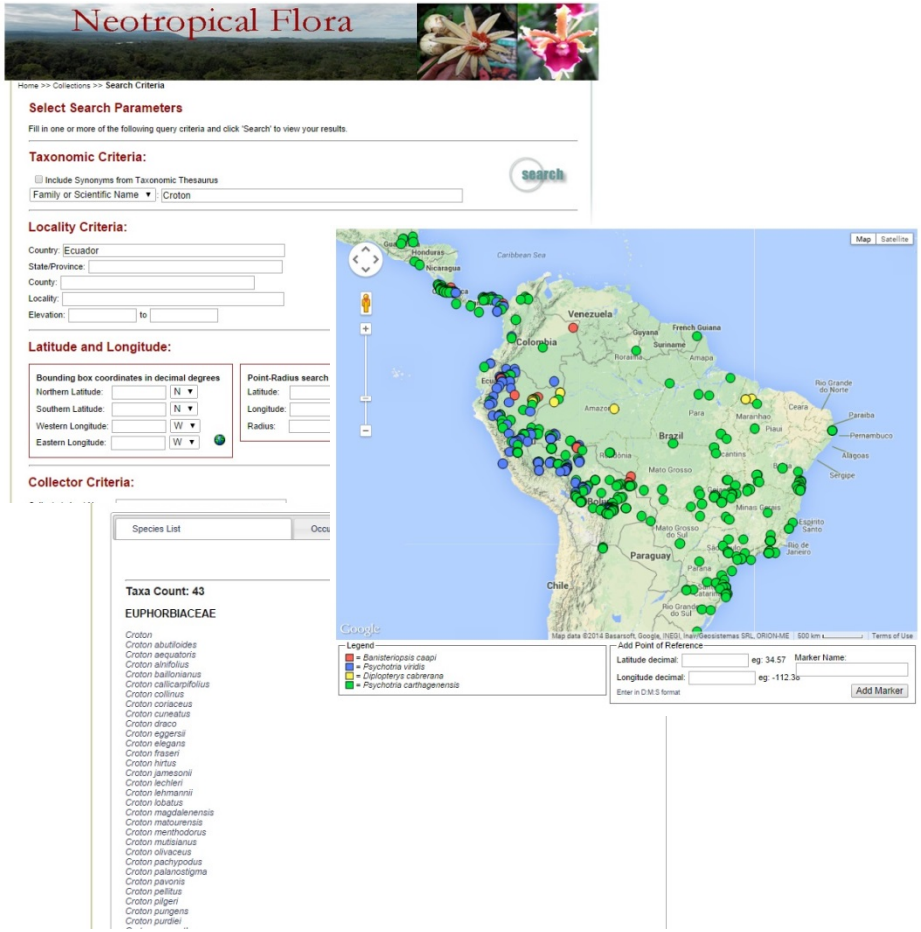
- CMS software
- Themed datasets
  - Taxonomic scope
  - Geographic scope
- Community portals
- Custom look & feel
  - CSS, config files
- 40-60 public portals

Specimen-based Model

- Backbone of taxonomic research
- Baseline data
- Proof of Occurrence
- Expert Reviewed
- Verifiable
- Millions occurrence records

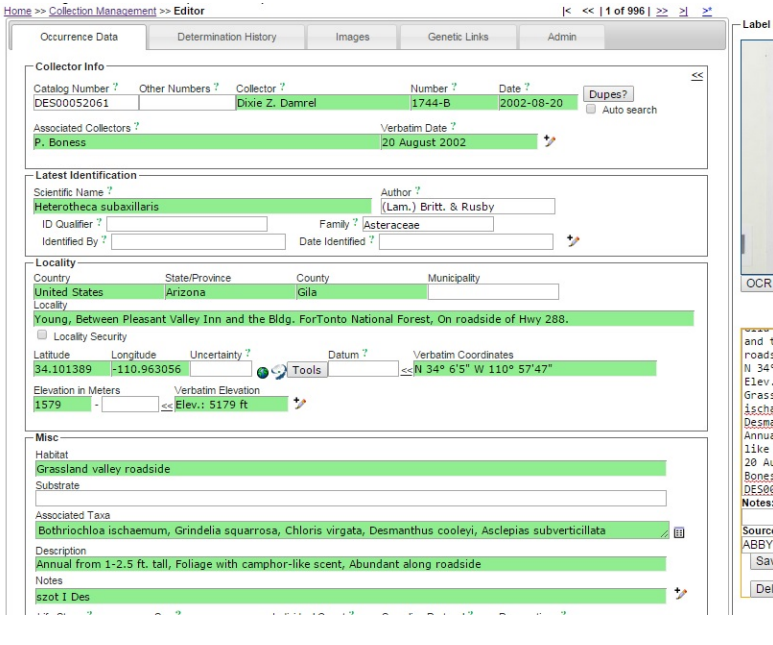
Public Interface

- Search engine
  - Taxon
  - Locality
  - Coordinates
  - Collector
- Data return
  - Specimen list
  - Map
  - Species checklist

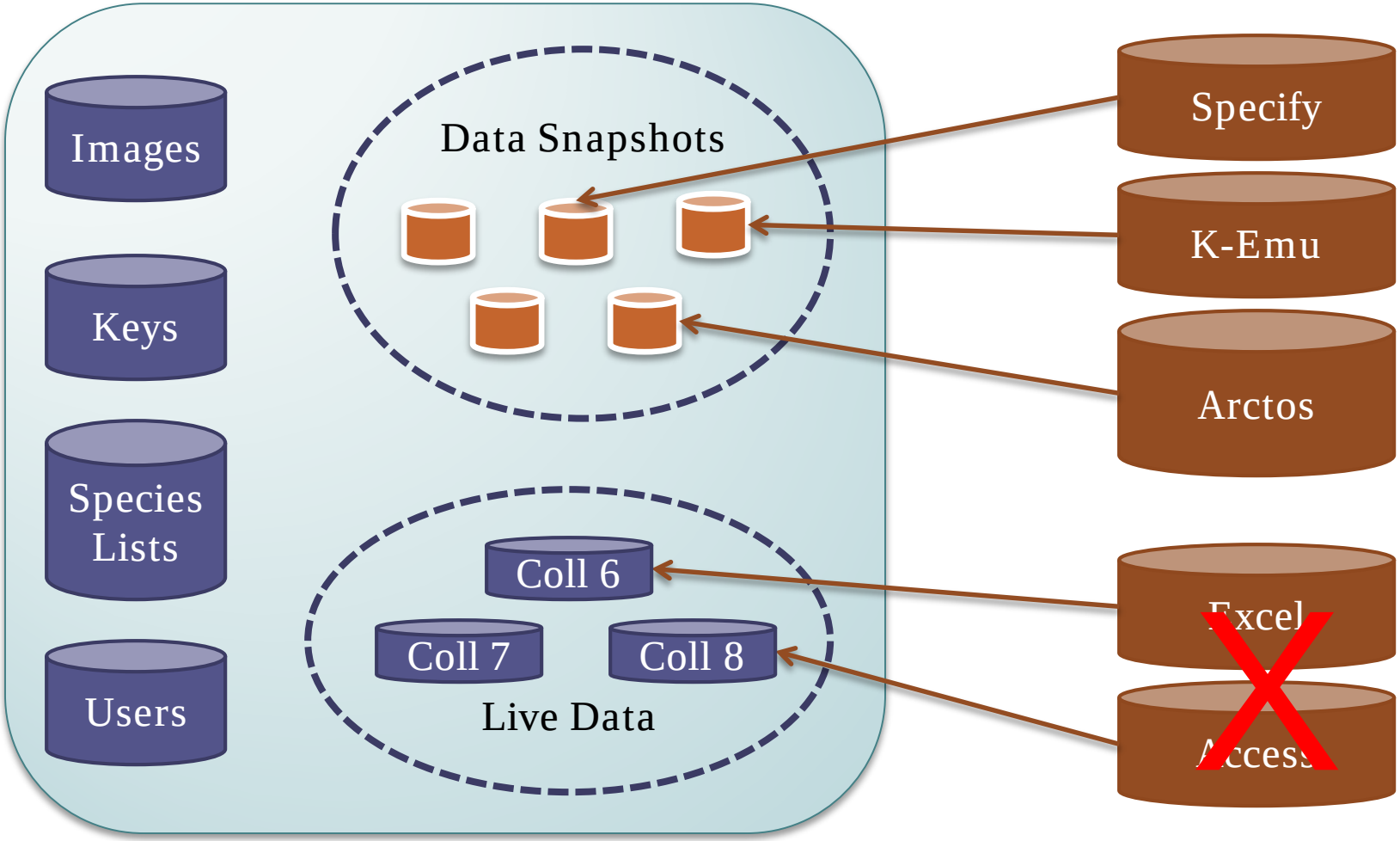


Symbiota - Biodiversity CMS

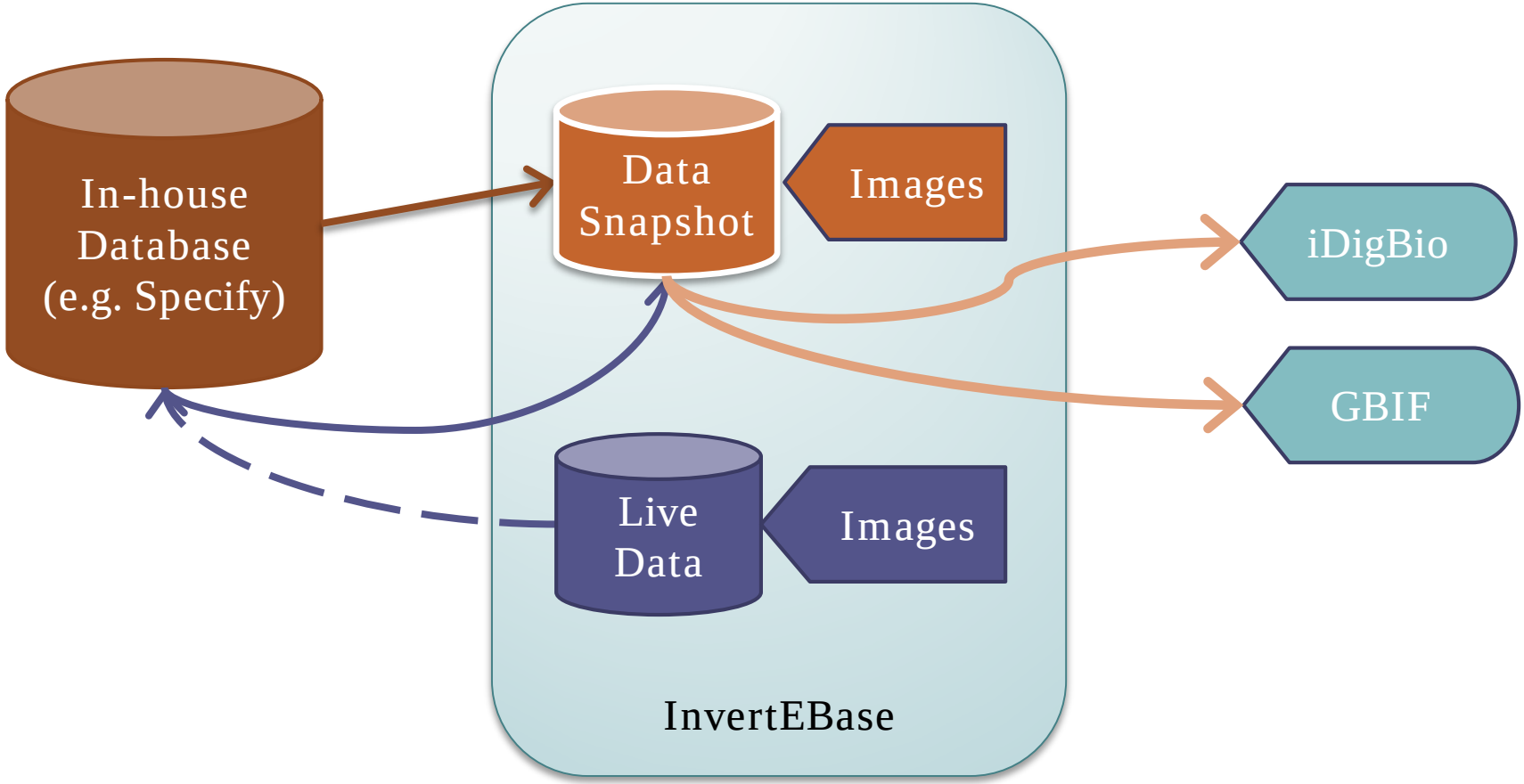
- Read-only user interface
- Password Protected
  - Browser-based
  - Platform independent
  - Globally accessible
  - No special software installation (free)
  - Make use of web services
  - Data protection (backups)



Mini-Aggregator: Snapshot vs Live



Snapshot Digitation Workflows



Digitization Services

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

GeoLocate CoGe Interoperability

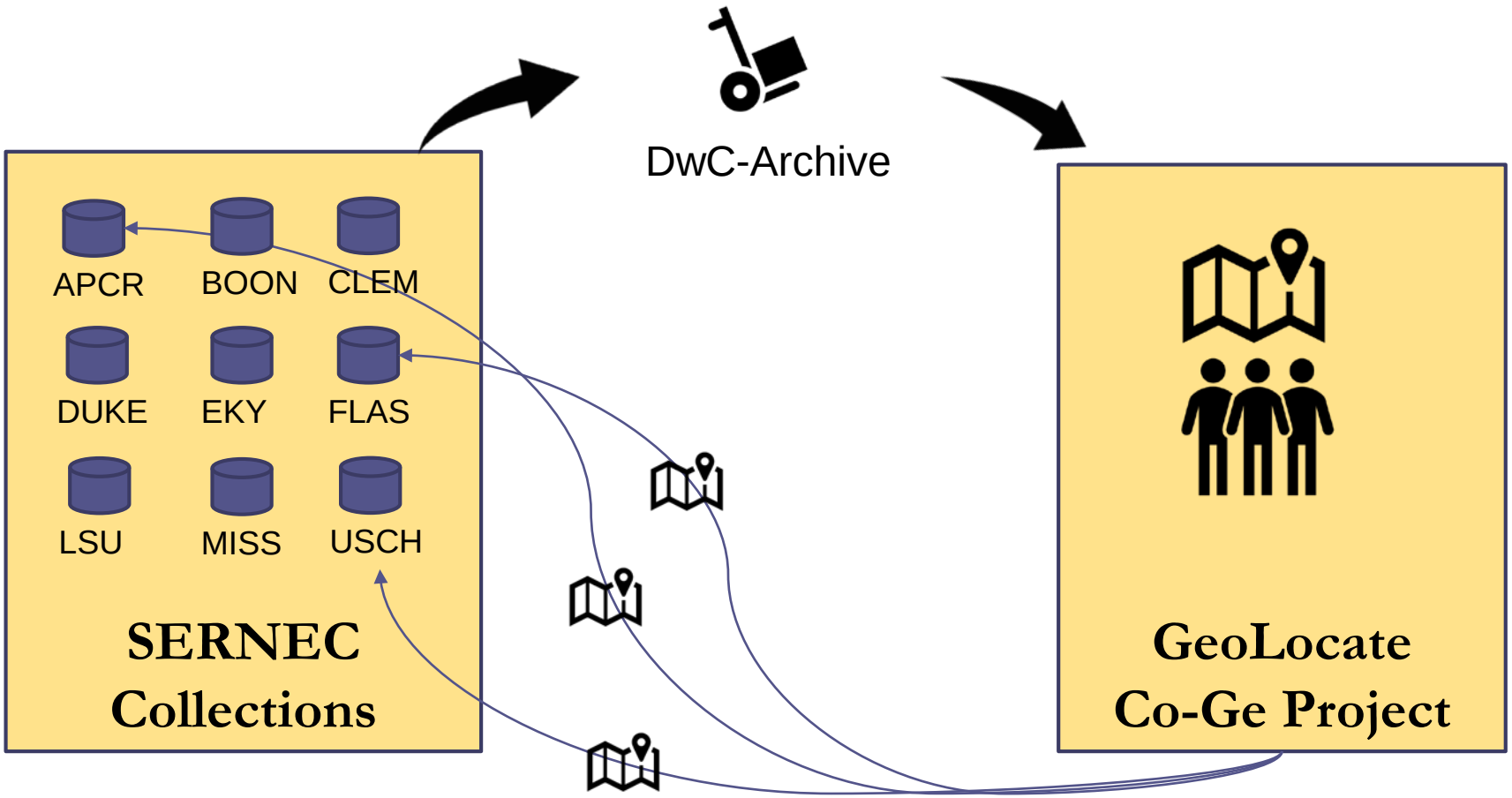
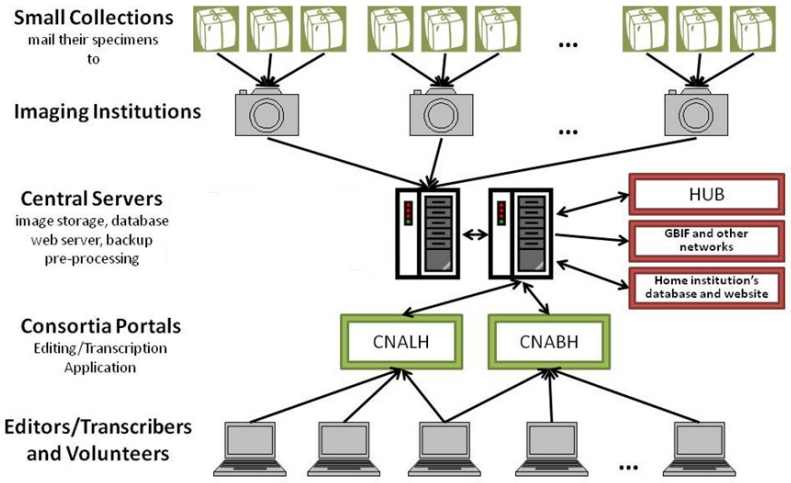
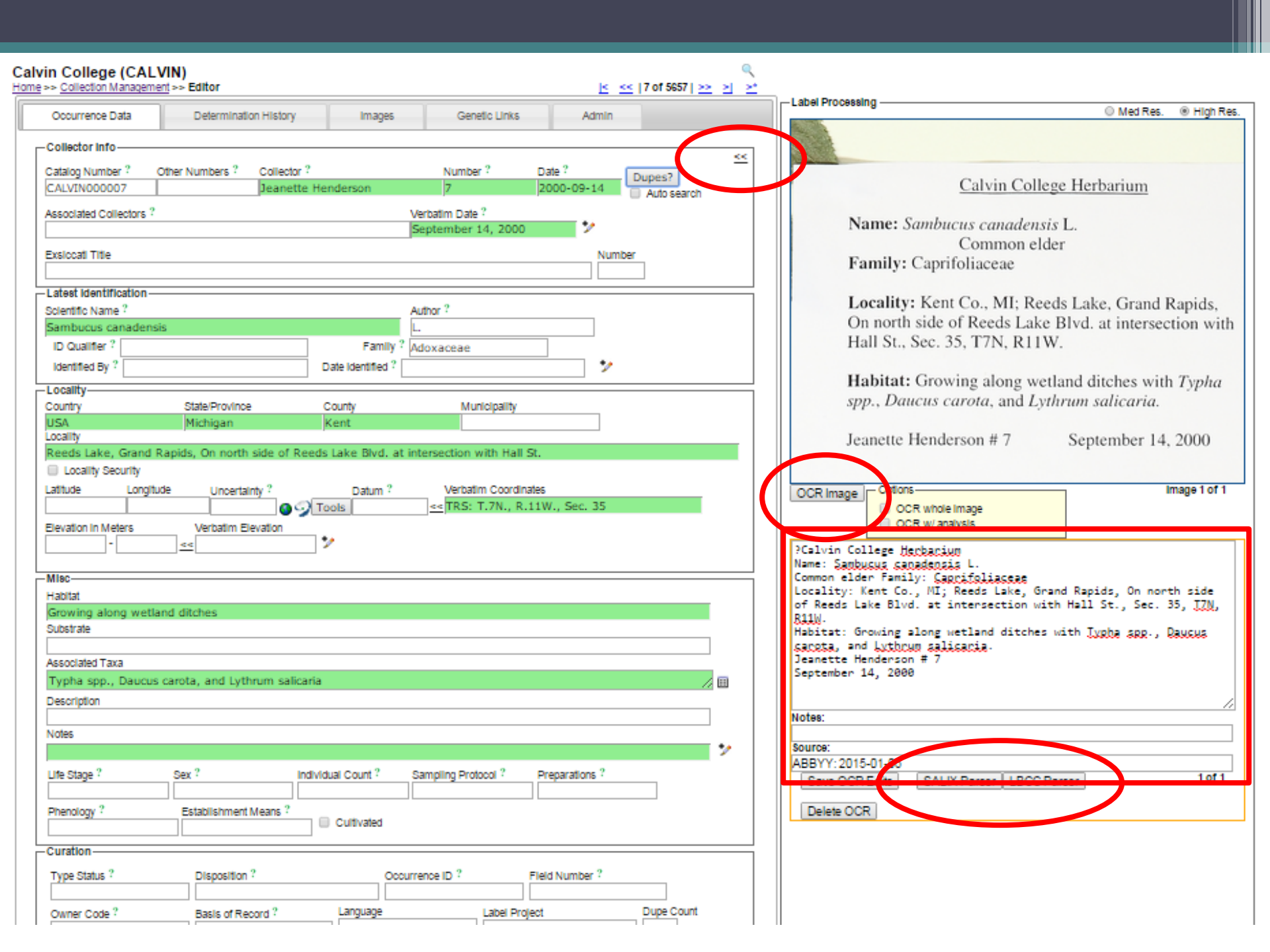


Image to Specimen Workflow

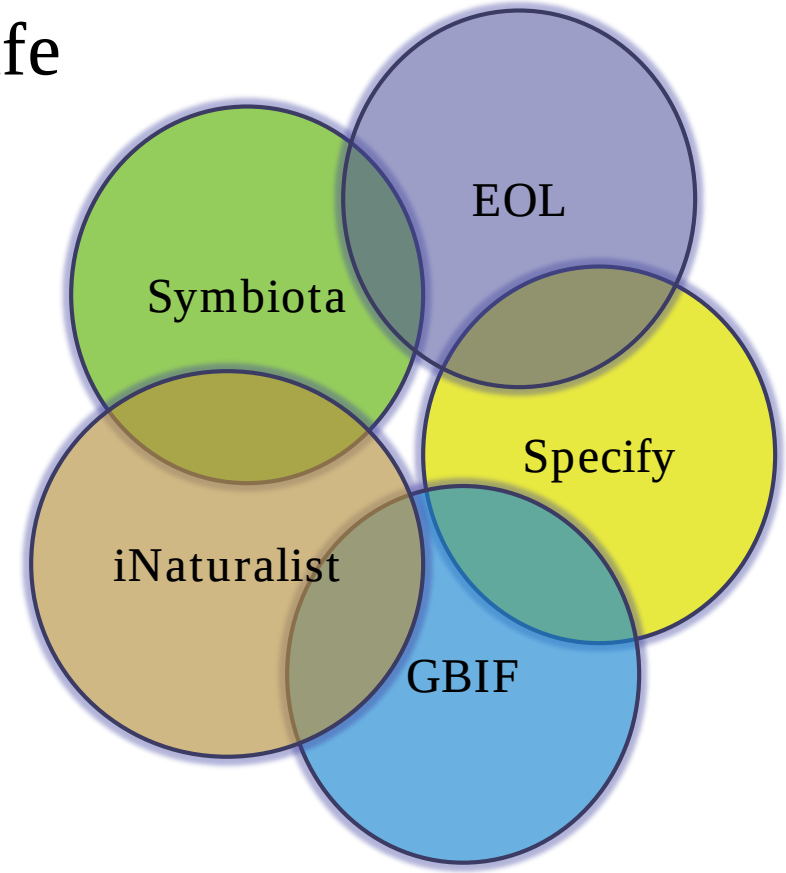
- Batch loading images
  - SFTP image drop
  - iDigBio Media Ingest
  - iPlant image loading
- Skeletal data capture
  - SFTP skeletal file drop
  - Manual upload
  - via Symbiota



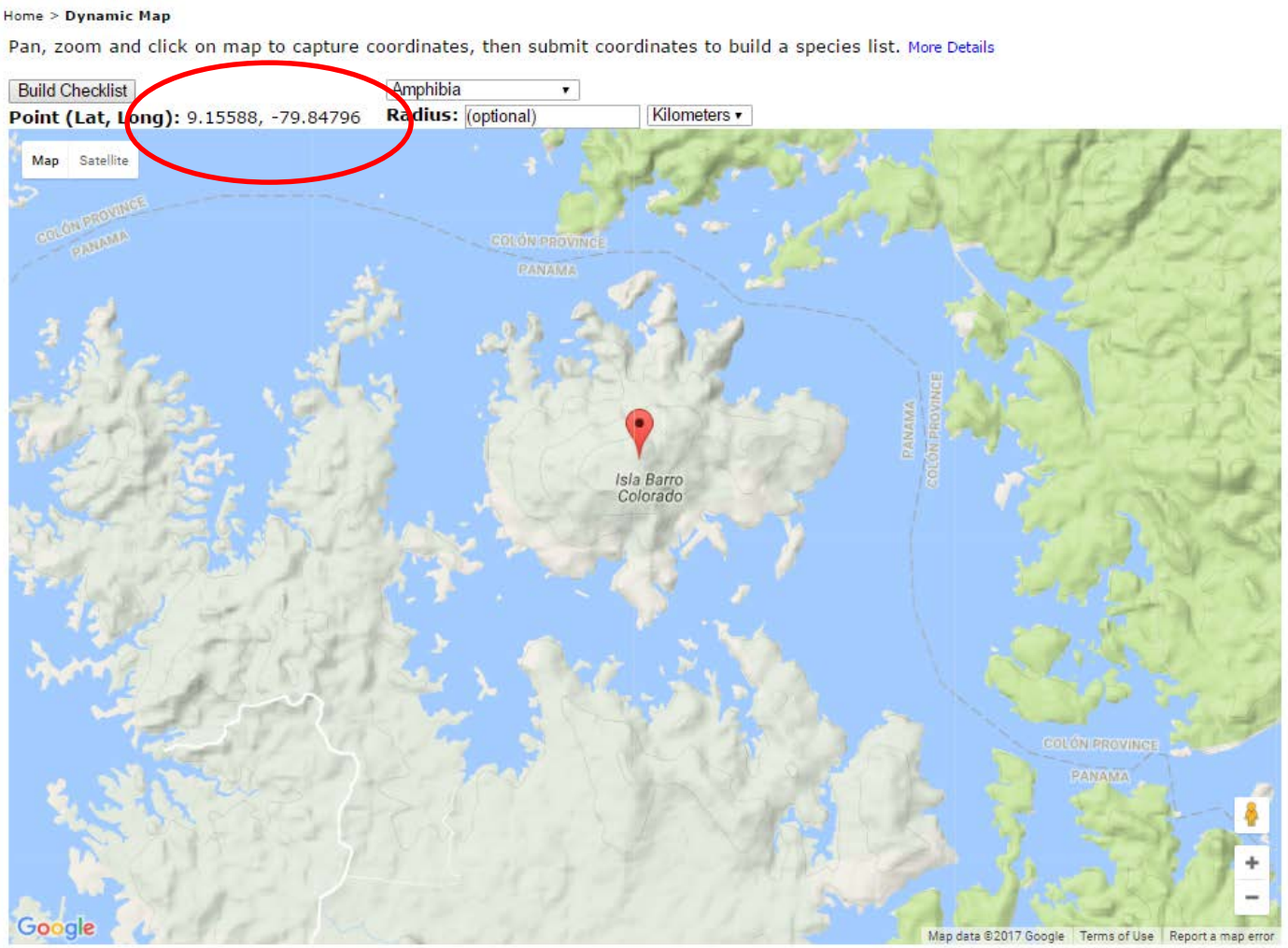

Calvin College (CALVIN)
Home >> Collection Management >> Editor
|< << | 7 of 5657 | >> >| >*
Occurrence Data
Determination History
Images
Genetic Links
Admin
Collector Info
Catalog Number ?
Other Numbers ?
Collector ?
Number ?
Date ?
Dupes?
Auto search
CALVIN000007
Jeanette Henderson
7
2000-09-14
Associated Collectors ?
Verbatim Date ?
September 14, 2000
Exsiccati Title
Number
Latest Identification
Scientific Name ?
Author ?
Sambucus canadensis
L.
ID Qualifier ?
Family ?
Adoxaceae
Identified By ?
Date Identified ?
Locality
Country
State/Province
County
Municipality
USA
Michigan
Kent
Locality
Reeds Lake, Grand Rapids, On north side of Reeds Lake Blvd. at intersection with Hall St.
Locality Security
Latitude
Longitude
Uncertainty ?
Datum ?
Verbatim Coordinates
Tools
TRS: T.7N., R.11W., Sec. 35
Elevation in Meters
Verbatim Elevation
Misc
Habitat
Growing along wetland ditches
Substrate
Associated Taxa
Typha spp., Daucus carota, and Lythrum salicaria
Description
Notes
Life Stage ?
Sex ?
Individual Count ?
Sampling Protocol ?
Preparations ?
Phenology ?
Establishment Means ?
Cultivated
Curation
Type Status ?
Disposition ?
Occurrence ID ?
Field Number ?
Owner Code ?
Basis of Record ?
Language
Label Project
Dupe Count
Label Processing
Med Res.
High Res.
Calvin College Herbarium
Name: Sambucus canadensis L.
Common elder
Family: Caprifoliaceae
Locality: Kent Co., MI; Reeds Lake, Grand Rapids, On north side of Reeds Lake Blvd. at intersection with Hall St., Sec. 35, T7N, R11W.
Habitat: Growing along wetland ditches with Typha spp., Daucus carota, and Lythrum salicaria.
Jeanette Henderson # 7
September 14, 2000
OCR Image
Options
OCR whole image
OCR w/ analysis
Image 1 of 1
?Calvin College Herbarium
Name: Sambucus canadensis L.
Common elder Family: Caprifoliaceae
Locality: Kent Co., MI; Reeds Lake, Grand Rapids, On north side of Reeds Lake Blvd. at intersection with Hall St., Sec. 35, T7N, R11W.
Habitat: Growing along wetland ditches with Typha spp., Daucus carota, and Lythrum salicaria.
Jeanette Henderson # 7
September 14, 2000
Notes:
Source:
ABBYY: 2015-01-
1 of 1
Delete OCR

Outreach: Biodiversity Exploration

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



Power Aggregation of Collections



Taxon:
All Species
Display/Reset Species List

Display as: Scientific Name

Plant

Habit

- tree
- shrub
- terrestrial herb
- vine - liana
- epiphyte - hemiepiphyte
- succulent
- parasite - saprophyte
- aquatic herb

Leaf

glands on blade or petiole

- present
- absent

9.15568 -79.84881 within 16.1 km

Species Count: 1504

Acanthaceae

Aphelandra sinclairiana
Blechum costaricense
Elytraria imbricata
Herpetacanthus panamensis
Hygrophila guianensis
Justicia graciliflora
Justicia pectoralis
Mendoncia gracilis
Mendoncia litoralis
Mendoncia retusa
Nelsonia brunelloides
Ruellia metallica
Teliostachya alopecuroidea
Thunbergia erecta
Trichanthera gigantea

Actinidiaceae

Saurauia laevigata
Saurauia yasicae

Agavaceae

Cordyline fruticosa

Alismataceae

Sagittaria lancifolia

Amaranthaceae

Alternanthera ficoidea
Alternanthera sessilis
Chamissoa altissima
Cyathula prostrata
Gomphrena decumbens
Iresine angustifolia
Iresine diffusa

Amaryllidaceae

Amaryllis belladonna
Crinum erubescens
Hymenocallis pedalis

Anacardiaceae

Anacardium excelsum
Anacardium occidentale
Astronium graveolens
Mangifera indica

Taxon:
All Species
Display/Reset Species List

Display as: Scientific Name

Plant

Habit
- [x] tree
- [ ] shrub
- [ ] terrestrial herb
- [ ] vine - liana
- [ ] epiphyte - hemiepiphyte
- [ ] succulent

Latex
- [ ] present
- [ ] absent

Armature
- [ ] unarmed
- [ ] stem or leaves armed

Leaf

Type
- [ ] simple
- [ ] compound

Arrangement
- [ ] alternate
- [ ] opposite
- [ ] whorled
- [ ] fascicled
- [ ] basal rosette

Margin
- [ ] entire
- [ ] toothed
- [ ] lobed

Stipules
- [ ] present
- [ ] absent

Leaf Punctations

9.15568 -79.84881 within 16.1 km

Species Count: 590

Acanthaceae
Trichanthera gigantea

Actinidiaceae
Saurauia laevigata
Saurauia yasicae

Agavaceae
Cordyline fruticosa

Anacardiaceae
Anacardium excelsum
Anacardium occidentale
Astronium graveolens
Mangifera indica
Mosquitoxylum jamaicense
Spondias mombin
Spondias purpurea
Spondias radlkoferi
Tapirira guianensis

Annonaceae
Anaxagorea panamensis
Annona acuminata
Annona glabra
Annona hayesii
Annona muricata
Annona purpurea
Annona spraguei
Cremastosperma panamense
Cymbopetalum lanugipetalum
Desmopsis panamensis
Guatteria amplifolia
Guatteria dumetorum
Mosannona garwoodii
Oxandra longipetala
Unonopsis pittieri
Xylopia aromatica
Xylopia frutescens
Xylopia macrantha

Apocynaceae
Aspidosperma cruentum
Aspidosperma megalocarpon
Aspidosperma spruceanum
Rauvolfia littoralis

Araliaceae

Taxon:
All Species
Display/Reset Species List

Display as: Scientific Name

Plant

Habit
- tree
- shrub
- vine - liana

Latex
- present
- absent

Plant Scent
- without noticable scent
- obviously odiferous

Leaf

Type
- simple

Arrangement
- alternate
- opposite
- whorled

Venation
- pinnate
- palmate

Leaf Punctations
- present
- absent

glands on blade or petiole
- present
- absent

Inflorescence

Placement
- terminal

9.15568 -79.84881 within 16.1 km

CM

Species Count: 23

Apocynaceae
- *Rauvolfia littoralis*

Lythraceae
- *Adenaria floribunda*

Melastomataceae
- *Mouriri completens*
- *Mouriri myrtilloides*

Myrtaceae
- *Calycolpus warszewiczianus*
- *Calyptranthes schiediana*
- *Chamguava schippii*
- *Eugenia coloradoensis*
- *Eugenia galalonensis*
- *Eugenia nesiotica*
- *Eugenia octopleura*
- *Eugenia oerstediana*
- *Eugenia principium*
- *Eugenia uniflora*
- *Eugenia venezuelensis*
- *Myrcia fosteri*
- *Myrcia gatunensis*
- *Myrciaria floribunda*
- *Myrcia zetekiana*
- *Psidium anglohondurense*
- *Psidium friedrichsthalianum*
- *Psidium guajava*
- *Syzygium jambos*

Calycolpus warszewiczianus O. Berg

Go to Encyclopedia of Life...

Family: Myrtaceae

(spanish: Guayabillo, guayabito de monte)

Andrés Hernández

Description | Tree Atlas - Español

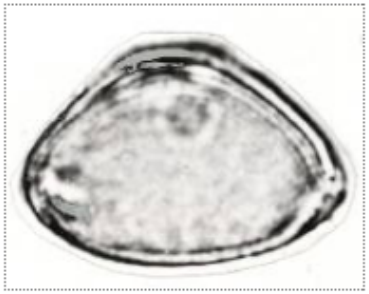
A revision of Calycolpus by L. R. Landrum. Systematic Botany (2010), 35(2): pp. 368–389

Calycolpus warszewiczianus O. Berg: Shrub or tree 2–7 m high, mainly glabrous to sparsely strigose; hairs simple, whitish to reddish brown, to ca. 0.3 mm long; young twigs more or less terete to weakly 4 angled, glabrous-sparsely strigose, light reddish brown, the older twigs usually gray, the older bark often somewhat stringy; leaves elliptic, lanceolate, or oblong-lanceolate, 4–9 cm long, 1–3.6 cm wide, (1.7–) 2.5–3.5 times as long as wide; apex acuminate to acuminate-caudate; base rounded to acute; petiole shallowly channeled, 2–5 mm long, ca. 1 mm thick, glabrous to sparsely strigose; midvein impressed above, prominent below; lateral veins about 20–30 pairs, faint, nearly straight; marginal vein about equaling laterals, approximately paralleling the margin; blades subcoriaceous, drying dark reddish brown, somewhat darker above than below, dull above. Flower buds 8– 12 mm long; peduncles solitary or in collateral pairs, uniflorous (rarely triflorous), subterete to flattened, 0.6–2.5 (–3) cm long, ca. 1 mm wide; bracteoles subtriangular, 1–2 mm long, ca. 1 mm wide; calyx-lobes clearly divisible into base and appendage, normally with no tearing

Andrés Hernández

Andrés Hernández

Andrés Hernández



Open Interactive Map

Click to Display
27 Total Images

Biological Inventories

- Online demo

West Fork of Oak Creek *Games*

Authors: Edward Gilbert, Max Licher
Citation: Gilbert, E. E. 2002. Flora and Vegetation of the West Fork of Oak Creek Canyon, Coconino County, Arizona. M.S. thesis. Arizona State University, Tempe.
More Details

Families: 92
Genera: 334
Species: 580
Total Taxa (*details*): 583

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

ADOXACEAE

Sambucus nigra
Edward Gilbert 921 [ASU] , Edward Gilbert 177 [ASU] , Edward Gilbert 561 [ASU] , C.F. Deaver 3105 [ASC] , more...

Sambucus nigra subsp. cerulea
infrequent, riparian; Elinor Lehto L-21331 [ASU]

AMARANTHACEAE

Amaranthus blitoides
Call of the Canyon only

Amaranthus powellii
locally frequent, Call-of-the-Canyon and upper canyons; Edward Gilbert 970 [ASU] , M. Licher 13 [ASU] , Edward Gilbert 825 [ASU] , Edward Gilbert 392 [ASU]

Amaranthus retroflexus
Edward Gilbert 480 [ASU]

Chenopodium album
rare, thoughout canyon & Call of the Canyon; Edward Gilbert 790 [ASU] , Edward Gilbert 862 [ASU]

Chenopodium atrovirens
Edward Gilbert 852 [ASU]

Chenopodium capitatum

Chenopodium capitatum var. parvicapitatum
M. Licher 5 [ASU]

Chenopodium fremontii

Options

Search:
Common Names
Synonyms

Filter:
Original Checklist
Display Synonyms
Common Names
Display as Images
Notes & Vouchers
Taxon Authors
Show Taxa Alphabetically
Rebuild List

Arizona State University Vascular Plant Herbarium

ASU : Plants

Catalog #: ASU0077238
Occurrence ID (GUID): 828c4eac-7c94-4b08-92a9-a76104953749
Secondary Catalog #: 242898
Taxon: *Chenopodium atrovirens* Rydb.
Family: Amaranthaceae
Determiner: Nuri Benet-Pierce (3 April)
Show Determination History
Collector: Edward Gilbert 852
Date: 2001-09-03
Locality: USA, Arizona, Coconino, Upper canyon of the West Fork of Oak Creek, about 10 miles NNE of Sedona. Short ways down Fernow Draw from forest service road 231, just below first confluence.
35.0147 -111.858
Verbatim Coordinates: DMS: 35d 0m 52.9s N; 111d 51m 29.2s W
Elevation: 1982 meters
Verbatim Elevation: 6500ft
Habitat: riparain
Reproductive Condition: flowers

Specimen Images

Open Medium Image
Open Large Image

Amaranthus blitoides S. Watson

Go To Encyclopedia of Life...

Family: Amaranthaceae

Mat Amaranth

[*Amaranthus blitoides var. reverchonii*]

Max Licher

FNA | Indiana Flora | Field Guide | Gleason & Cronquist | Web Links

Sergei L. Mosyakin & Kenneth R. Robertson in Flora of North America (vol. 4)

Plants annual, glabrous. **Stems** prostrate or ascending (very rarely suberect), much-branched (usually from base), (0.1-)0.2-0.6(-1) m. **Leaves:** petiole ± 1/2 as long as blade; blade obovate, elliptic, or spatulate, 1-2(-4) × 0.5-1(-1.5) cm, base cuneate and tapering, margins usually entire, plane, rarely slightly undulate, apex obtuse, rounded, mucronulate. **Inflorescences** axillary glomerules, green. **Bracts** of pistillate flowers narrow, thin, 1.5-5 mm, ± equaling or slightly exceeding tepals. **Pistillate flowers:** tepals (3-)4-5, narrowly ovate to broadly linear, unequal or subequal, 1.5-3 mm, thin, apex acute or acuminate; style branches spreading; stigmas 3. **Staminate flowers** intermixed with pistillate; tepals 3(-4); stamens 3. **Utricles** broadly ovoid, 1.7-2.5 mm, equaling tepals, mostly smooth (slightly verrucose or rugose in dry plants), dehiscence regularly circumscissile. **Seeds** black, lenticular to broadly plumply lenticular, 1.3-1.6 mm diam., rather dull. Flowering summer-fall. Disturbed habitats: roadsides, riverbanks, railroads, fields, waste places, sandy flats; 0-2200 m; Alta., B.C., Man., Ont., Que., Sask.; Ala., Alaska, Ariz., Ark., Calif., Colo., Conn., Del., D.C., Fla., Ga., Idaho, Ill., Ind., Iowa, Kans., Ky., La., Maine, Md., Mass., Mich., Minn., Mo., Mont., Nebr., Nev., N.H., N.J., N.Mex., N.Y., N.Dak., Ohio, Okla., Oreg., Pa., R.I., S.C., S.Dak., Tenn., Tex., Utah, Vt., Va., Wash., W.Va., Wis., Wyo.; introduced and often completely naturalized in South America, Eurasia, and other regions. The name *Amaranthus graecizans* often has been misapplied to both *A. blitoides* and *A. albus* in older North American floras and manuals. *Amaranthus blitoides* was probably originally native to central and partly eastern United States, but now it is widely and successfully naturalized almost everywhere in temperate North America and in many subtropical to warm-temperate regions. It has not been reported from Mississippi or North Carolina but since it is found in all other conterminous United States it can be expected to occur in these two as well.

Varieties have been described within *Amaranthus blitoides*; most of them are of no taxonomic significance, being mostly ecologic

Max Licher

Max Licher

Max Licher

Max Licher

Open Interactive Map

West Fork of Oak Creek *Games*

Authors: Edward Gilbert, Max Licher
Citation: Gilbert, E. E. 2002. Flora and Vegetation of the West Fork of Oak Creek Canyon, Coconino County, Arizona. M.S. thesis. Arizona State University, Tempe.
More Details

Families: 92
Genera: 334
Species: 580
Total Taxa (*details*): 583

Page **1** of **6**: **1** | 2 | 3 | 4 | 5 | 6

Options

Search:
Common Names
Synonyms

Filter:
Original Checklist
Common Names
Display as Images
Show Taxa Alphabetically
Rebuild List


Sambucus nigra [ADOXACEAE]


Sambucus nigra subsp. cerulea


Amaranthus blitoides [AMARANTHACEAE]


Amaranthus powellii


Amaranthus retroflexus


Chenopodium album


Chenopodium atrovirens


Chenopodium capitatum


Chenopodium capitatum var. parvicapitatum


Chenopodium fremontii


Chenopodium hians


Chenopodium pratericola


Dysphania graveolens


Salsola tragus


Allium bisceptrum [AMARYLLIDACEAE]


Allium bisceptrum var. palmeri









West Fork of Oak Creek

Coconino; West Fork

New Vouchers | Missing Taxa | Voucher Conflicts | 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: 3

	Checklist ID	Voucher Specimen	Corrected Specimen ID	Identified By
☐	Quercus X pauciloba	Edward Gilbert (189)	Quercus gambelii x turbinella	
☐	Quercus X pauciloba	Edward Gilbert (437)	Quercus gambelii x turbinella	
☐	Viola nephrophylla	Edward Gilbert (15)	Viola sororia subsp. affinis	

☑ Remove taxa from checklist if all vouchers are removed

Batch Action: Link Vouchers to Corrected Identification

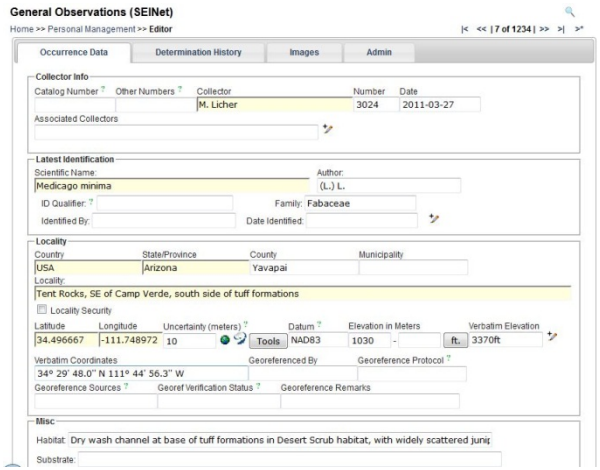
* Corrected taxon will be added to checklist if not yet present

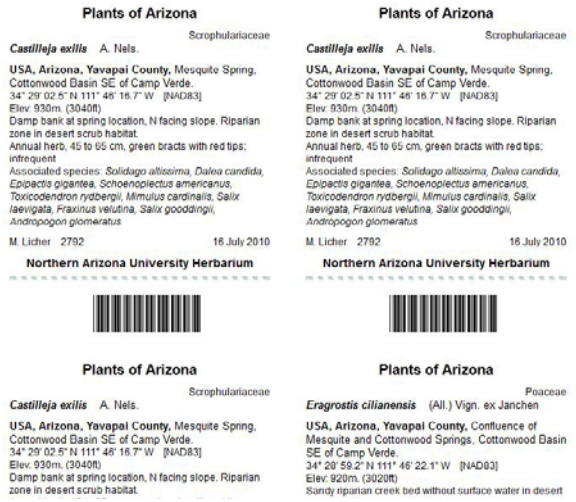
Support Grassroot Collaborations

- 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

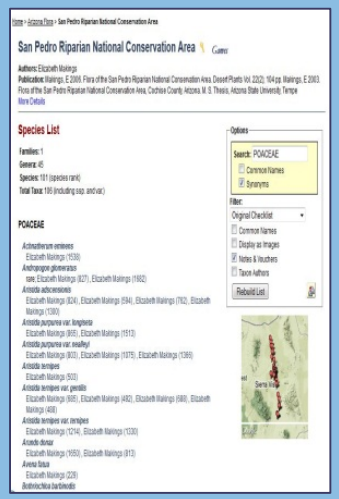
Personal Specimen Management

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



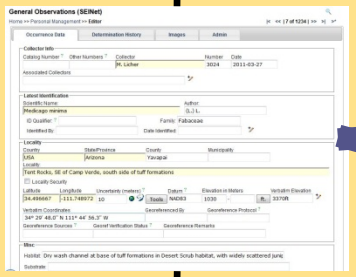


Voucher Network



Public View

GenBank #



Original Observation

Anno 1

Anno 2

ASC

MNA

Physical Specimens

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