

# Extending the Digital Botanical Infrastructure

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# Significance of grey boxes

- I have added a text box to each slide to clarify its main point.

Faculty member  
Grasses  
Teaching  
Herbarium  
Digitization

Floristics and  
data  
mobilization

Biodiversity  
Program  
Data sharing

# Digital Infrastructure

**Access to more resources**  
**Development of new resources**  
**Expanding one's collaborations**  
**Answering new questions**

What digital infrastructure makes possible

# Digital Infrastructure

## Basics

- Physical facilities
- People
- Software
- Data
- Enhanced data
  - Linked
  - Georeferenced

1960 Informal discussions started

1985 **TDWG** (Taxonomic Databases Working Group)

2001 **GBIF** (Global Biodiversity Information Facility)

2009 **Symbiota** (Sharing herbarium data)

2015 **OpenHerbarium**

2019 **1.3 BILLION** records in GBIF (241 million vascular plants) from specimens, DNA samples human & machine observations



It starts in the field...



May move to lab

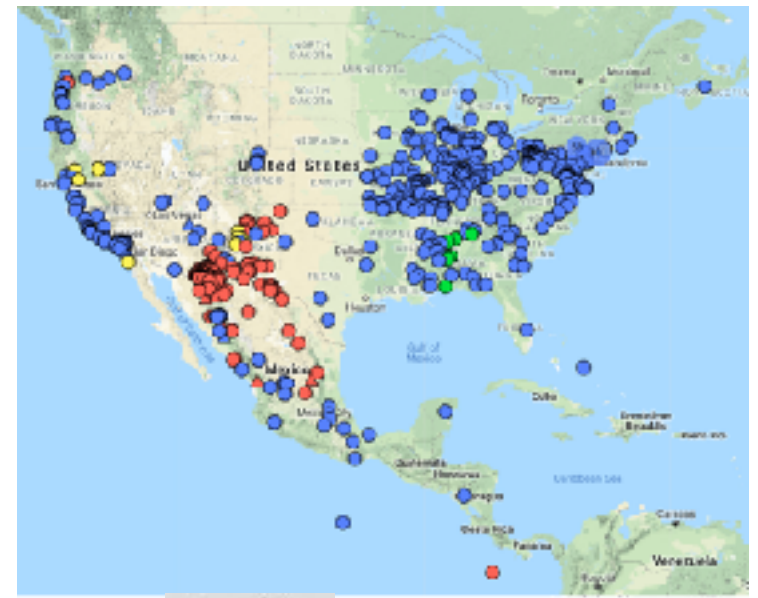
....

# Understand your data!

Grosjean, M. 2019. GBIF Blog [Sequenced-based data on GBIF - What you need to know before analyzing data](#)

**Do it once**  
**Do it right**  
**SHARE!**

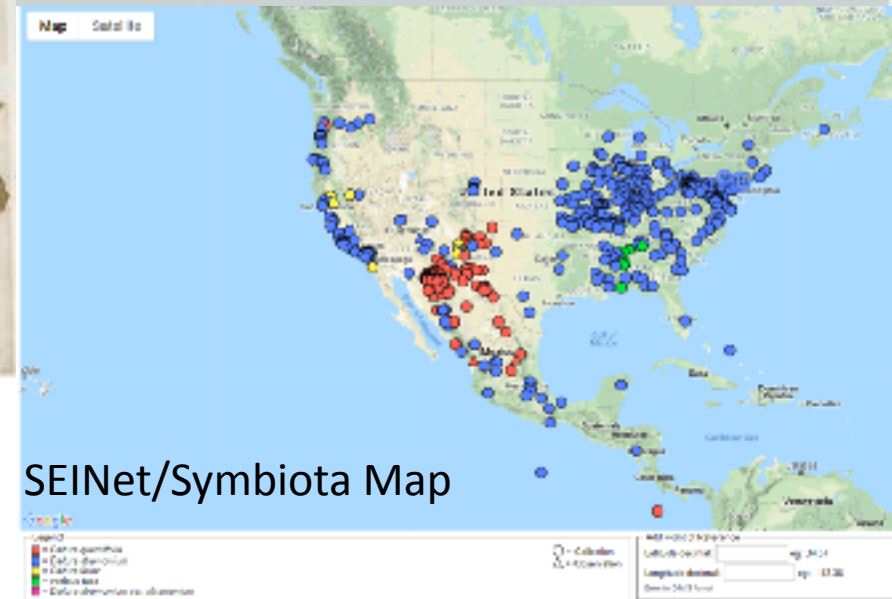
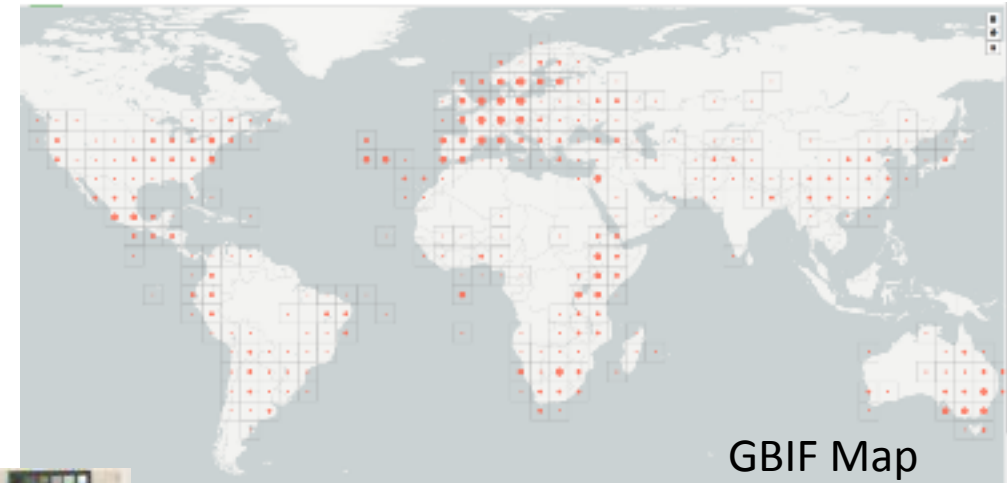
Fundamental principles common to all scientific approaches



Documentation essential

# Starting

- Database label information
  - Generate files for exsiccatae, loans, floras
  - Coarse distribution maps
- Image specimens
  - Comment/annotate
  - Create illustrated checklists
  - Score morphology
- Georeference records
  - Assess species and phylogenetic richness
  - Niche modelling
  - Change of time for flowering
  - Predict earliest flowering
  - Generate “What’s in flower at a location”



From specimen labels and images to illustrated checklists and “what will be in flower?” along your favorite hiking trail.

# FLORAS

**Do it once  
Do it right  
SHARE!**

- ## Components
- Keys
  - Descriptions
  - Illustrations
  - Distribution
  - Specimen citations
  - Nomenclature

- ## Print
- Costly to produce
  - Long time
  - Soon outdated
  - Shelf space
  - Expensive
  - VALUABLE

- ## Digital
- Costly to produce BUT
  - **Change as needed**
    - Maps dynamically
    - Resources shared
  - No shelf space
  - Free???
  - VALUABLE TO MORE

Rethinking floras



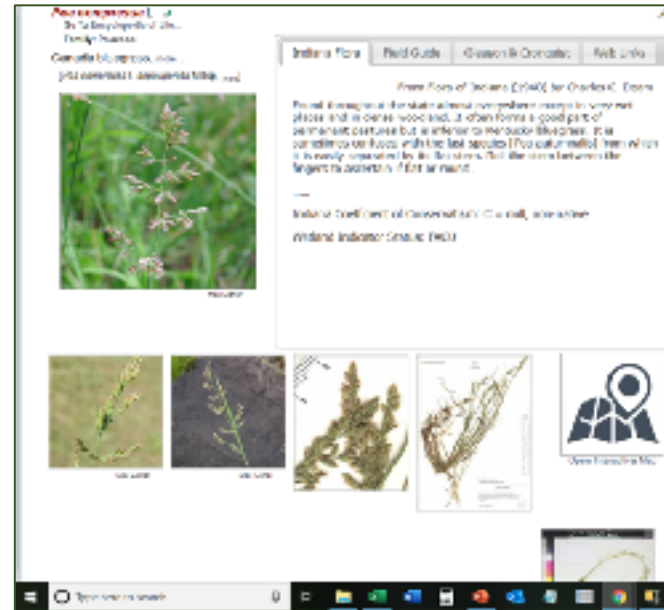
# Grasses of North America north of Mexico

## PART 1

- Symbiota
  - Open source software
- OpenHerbarium.org
  - Descriptions
  - Illustrations
  - Dynamic maps
  - Nomenclature

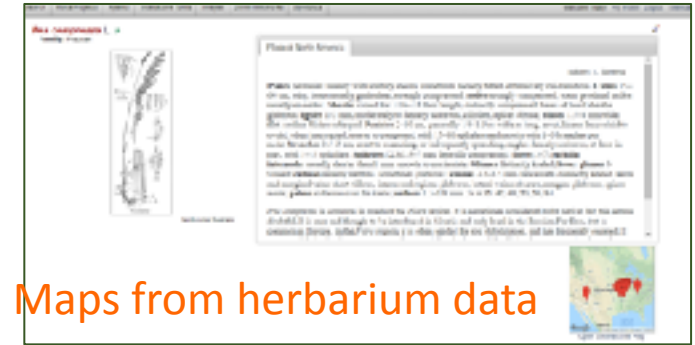
Developing online floristic resources

### Images & Illustrations



Can download record data

### Descriptions



Maps from herbarium data

### *Datura innoxia* Mill. [633662]

editor	taxonomic status	hierarchy	Delete
UnitName1:	Datura		
UnitName2:	innoxia		
UnitName3:			
Author:	Mill.		
Kingdom:	Plantae		
Rank Name:	Species		
Notes:	Art. 40.1 requires correction to "innoxia"; conservation proposal in prep.		
Source:	Tropicos & J. McNeill advice		
Locality:	show all locality data		
Security:			

Nomenclature

Multiaccess  
Key possible

# Grasses of North America north of Mexico

## Part 2. Identification keys

- KeyBase
  - Open source
  - Dichotomous
  - View 3 ways
  - Download
  - Filter
  - Link to taxon pages
- Multiaccess – hard to build
  - Some direction - Symbiota
  - Completely free access
    - DELTA (free but ...)
    - LUCID (not free)



KeyBase Teaching old keys new tricks...

Grasses of North America north of Mexico: Andropogoneae  
By: MARY C. BARRETT

Overview Statistics Included About

Current node

- Leaves sheath of lower gl or glanella, the sheath without glandular depressions on the keel; plants perennial, not reaching reproductive maturity in the Florida region when grown outdoors
- Leaves usually not serrated or, if serrated and sheath of glanella, the sheath with glandular depressions along the keel; and plants annual; plants reaching reproductive maturity in the Florida region

Remaining items (40)

- Andropogon
- Apluda
  - Apluda mollis
- Arthropron
  - Arthropron hirsutus
- Eriochloa
- Chloropogon
- Gonolobus
- Oxy
  - Oxy hirsutus
- Oxybryon
- Dichanthium
- Pipturus



Open Herbarium  
An Open Source Plant Information System

Bambusa angustata (Coul.) Alth & Gold

Line drawing of the plant

From OpenHerbarium

KeyBase for linking dichotomous keys to descriptions, images and maps

# Infrastructure – for students

## INSTRUCTIONS

- High quality specimens
  - Know what is needed
  - Prepare labels and send data to herbaria
- All resources
  - With education
- Acquire new skills
  - Typing!
  - GIS +
  - Database thinking
  - Publication thinking

What is needed for students now and areas that need addressing

- Symbiota
  - Collectors version
    - Enable label generation, data transfer
    - Optional visibility
  - Garden version
    - Events in life of specimen
    - Multiple specimens
- Nomenclature
  - Make reasons for name changes visible
- Discovery
  - Metadata on resources
- Understanding
  - Terminology
  - The dangers of synonymy
  - The Code
  - Methods of data analysis
    - When
    - Why

# Infrastructure – for research

- Access to
  - Political boundary files
  - Environmental files
- Increase links
  - Gene banks
  - People (ORCID)
  - Publications
  - GIS tools

- Enable
  - Convert survey records to occurrence records
  - New analytical tools
    - Phenology
    - Phylogenetic richness
  - Display multitaxon analyses
  - Better communication with collection managers

More on things needed.

# Skills

- Observation
  - Field
  - Lab
- General
  - Typing
  - Record keeping
  - Imaging
  - Programming

## Special

- Programming ?R
- GIS – Georeferencing & beyond
- Niche modelling

## General

- Write succinctly
- Talk succinctly 😊

Skills that will benefit you in the years ahead – in both a digital and non-digital environment.

# Your turn!

What do you want?  
Think big – and strategically

Thank you

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