Florida Plant Diversity
In a Changing Climate

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Global Biodiversity Hotspots: NA Coastal Plain the Most Recent
Biodiversity Hotspots

What is a biodiversity hotspot?

- >1500 endemic plant species
- >70% habitat loss
- Conservation priority!

North American Coastal Plain
Noss et al. (2015)
Vegetation of Eastern US/ North America

Level III Ecoregions

EPA

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Flora of Florida

• 4,810 species of land plants
  – 3,302 natives
  – 1,508 non-natives
• ~4,300 species of vascular plants
  – 3,000 natives
  – 1,300 non-natives

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Atlas of Florida Plants
Florida Division of Plant Industry
Flora of Florida at Risk

- 48 species are Federally Endangered
- 10 species are Federally Threatened
- 401 State Endangered
- 108 State Threatened
- 8 species commercially exploited

IN ALL:
- 449 endangered
- 118 threatened

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Lake Wales Ridge: Many Rare Species
Lake Wales Ridge Habitat Loss

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Lake Wales Ridge: Many Plant Endemics

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Lake Wales Ridge: Many Other Rare Endemicals

Wild Florida

Nature Closeups

US FWS

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Focus of Our Talk

• Diversity of Florida plants
• Threats to Florida plants by climate change
• ‘New’ data to help predict species’ responses to climate change
• Uses of data to help conserve Florida plants
• Prospects for the future
Museum Collections

1-2 billion specimens in the US
3-4 billion specimens worldwide

~1,600 natural history collections in the US

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Herbaria Worldwide

3,400 herbaria
350,000,000 specimens!
Systematics & Taxonomy

Carl Linné, aka Carolus Linnaeus

Linnea (twinflower)

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Carl Linné, aka Carolus Linnaeus
Museum Collections

...Species interactions
Phenology
Biogeography
More!

Genetics
Genomics
Chemistry...

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Smithsonian
Museum Collections

Most specimens locked away in cabinets, unavailable for general use.

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Most specimens locked away in cabinets, unavailable for general use.

DIGITIZATION!!!!
Smithsonian

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Label Data from Herbarium Specimens

- Scientific name – including authority
- Date
- Collector
- Location – state, county, specific site, GPS coordinates
- Associated species
- Notes For personal educational use only. Do not reproduce, post or use without express permission from the author.
Images of Museum Specimens

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iDigBio:  www.idigbio.org

National Coordinating Center
For Digitization of Biodiversity Collections
Ingest, serve, integrate data:
Localities
Dates
Images

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Digitized Data & Biodiversity Research

Integrated Digitized Biocollections

Making data and images of millions of biological specimens available on the web.

117,541,038 Specimen Records
29,143,017 Media Records
1,594 Recordsets

Why digitize?
More about what we do and why

Digitization
Learn, share and develop best practices

Sharing Collections
Documentation on data ingestion

Working Groups
Join in, contribute, be part of the community

Proposals
New tool and workshop ideas

Citizen Scientists
How can you help biological collections?

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www.idigbio.org
Specimen Localities in iDigBio

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Search Specimen Records

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Search Specimen Records
Search Specimen Records

Acer rubrum, Wats. ARCH, herbarium, ARCH01366

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Record Provided By
Archbold Biological Station
http://www.archbold-station.org/
The Archbold Biological Station herbarium has over 4200 vascular plant specimens and is located in the laboratory of the Plant Ecology Program in the Richard Archbold Research Center at Archbold Biological Station in Lake Placid, FL. The collection consists predominately of plants collected from central and south Florida, with a strong emphasis on the southern Lake Wales Ridge near and on the property of Archbold.
Search Specimen Records

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LOTS of Herbarium Specimens!

Welcome to the iDigBio Portal

If you are familiar with our portal's interface, you can start searching Specimen Records. If this is your first time here, you might consider browsing our tutorial. Our data are based on the Darwin Core and Audubon Core standards.

Search 1,567 Recordsets: [Scientific Name]

Jump To: Advanced Search, Publishers List, Tutorial, iDigBio API

Specimen Records
111,577,185

Animalia 46%
Plantae 48%
Fungi 5.1%
Chromista 0%
other 1%
Protozoa 1%
Eubacteria 1%

Media Records
24,461,713

Plantae 9.6%
Animalia 7.3%
Fungi 82.0%
Chromista 0%
Eubacteria 0%
other 0%
Protozoa 0%

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Other Data Aggregators

- iDigBio
- VertNet
- Global Biodiversity Information Facility
- National Specimen Information Infrastructure
- Canadensys
- Atlas of Living Australia

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What to Protect?
Phylogenetic Diversity: How much of the Tree of Life is present in a geographic area?

Oaks

Vs.

Location 1

Location 2
Florida Plant Tree of Relationships (Phylogeny)

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Phylogenetic Diversity in Florida

How much of the Tree of Life occurs in a region?

Species list at each pixel

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8,045 pixels_communities 16 km² per pixel.
Phylogenetic Diversity: Florida Plants

min = 0.16  max = 0.64

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Conservation Areas:
How well do they capture phylogenetic diversity?

min = 0.16  max = 0.64

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Conservation Areas: How well do they capture phylogenetic diversity?

Preserved, low PD

Not Preserved, high PD

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Phylogenetic Diversity vs. Floridians

Phylogenetic diversity and Human population

- Low PD, Low Population
- High PD, Low Population
- Low PD, High Population
- High PD, High Population

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Florida Plants and a Changing Climate

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Modeling the Distribution of Species

- Location information and environmental data
  - Environmental features: temperature, precipitation, soil
- Software to model the range of each species
- Project onto future climate conditions
- For Florida plants:
  - 1548 plant species (of 4100 species)
  - >511,000 georeferenced points (GPS)
Responses to Climate Change: Winners and Losers

_Abildgaardia ovata_ (flatspike sedge)

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_Prúnus geniculatá_ (scrub plum)
Lake Wales Ridge:
Present and 2070 projections for *Dicerandra christmanii*

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Coastal *Dicerandra*:
Present and 2070 projections for *D. thinicola*

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Responses to Climate Change: Wetlands

Ecological Niche Model
Current

Ecological Niche Model
2070

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Polygala lewtonii

12% decrease in suitable area
Responses to Climate Change: Wetlands

Cumulative change in suitability for FL wetland communities under projected climate change in 2070

Red = severe impact
Florida Plant Diversity: 2018-2050

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Sea Level Rise

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Conclusions

• Herbarium collections as powerful resources for big data analyses of biodiversity

• Phylogenetic diversity a valuable approach for assessing areas of conservation concern

• Climate projections suggest rapid changes in the Florida floristic landscape - an overall decrease in diversity
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