

# RAPID ENHANCEMENT OF BIODIVERSITY OCCURRENCE RECORDS USING UNCONVENTIONAL SPECIMEN DATA

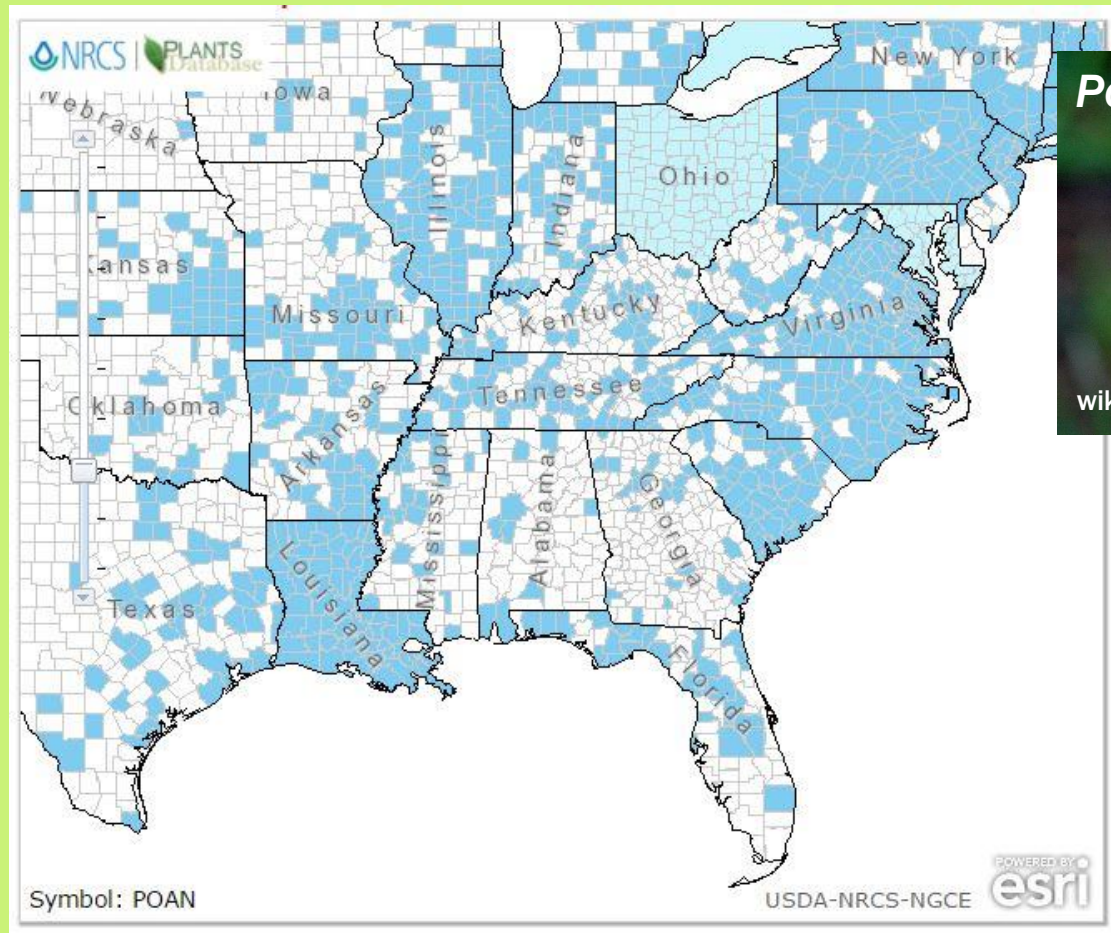
Katelin D.  
Pearson

*Accepted*



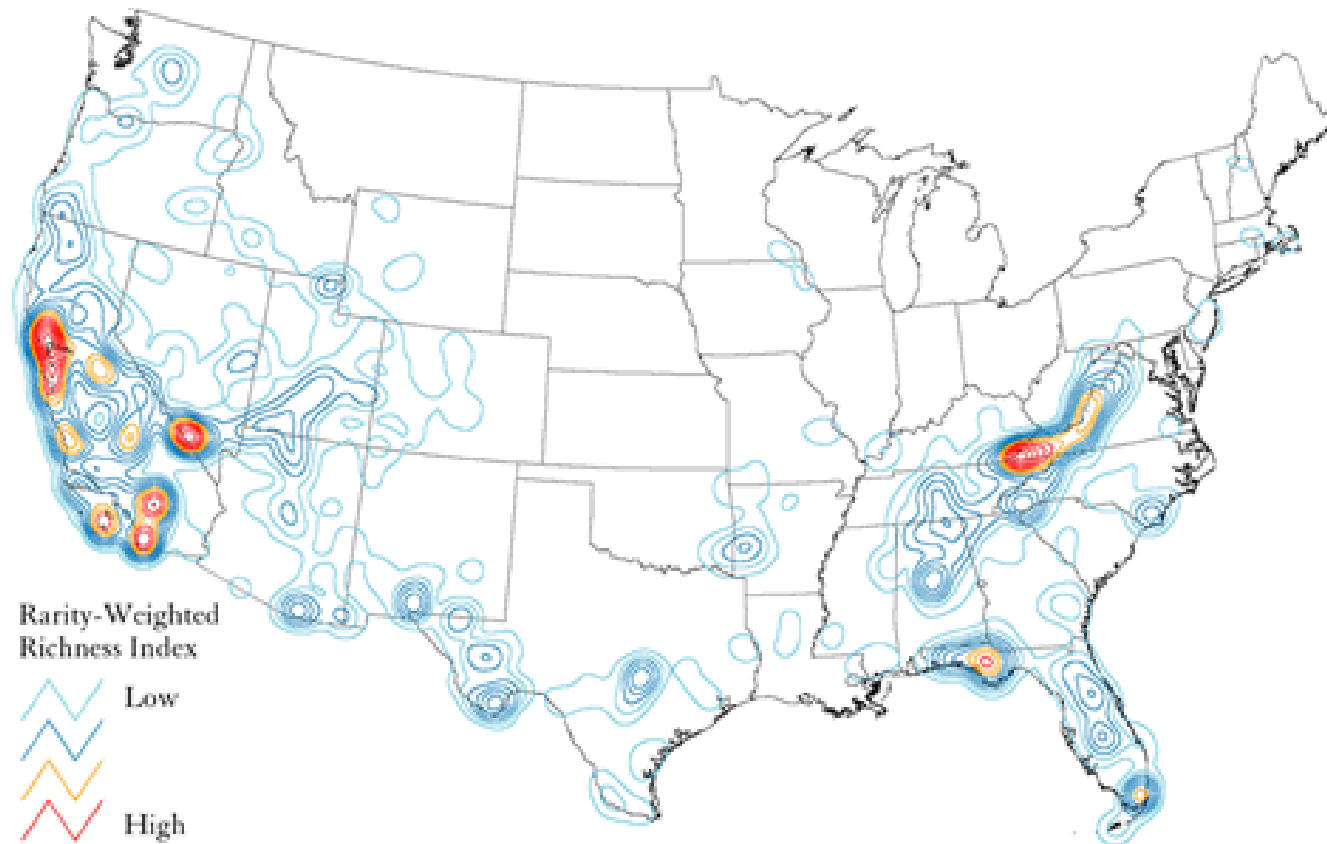
# THE PROBLEM

- Our knowledge of species distributions is incomplete

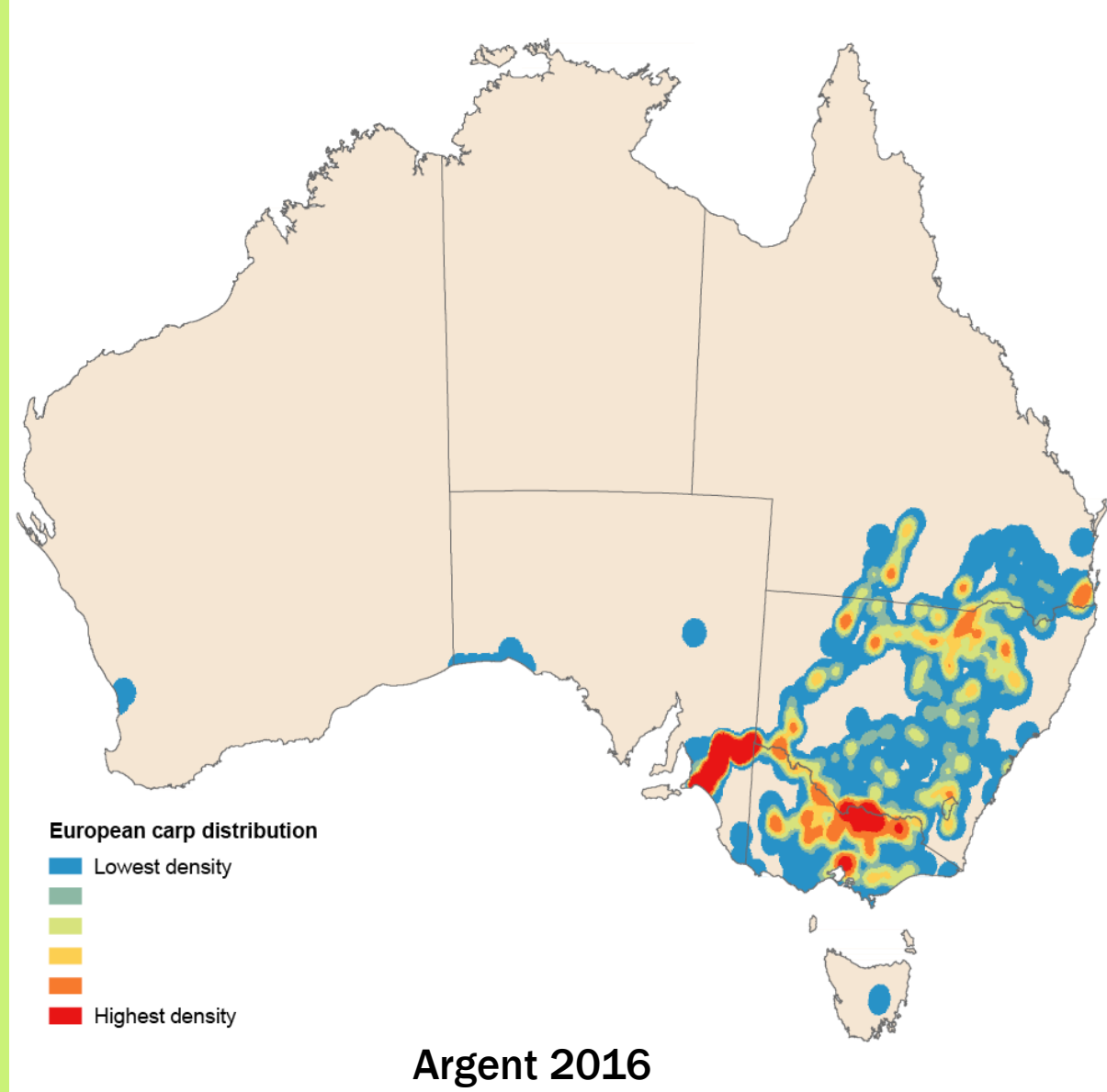


- Identify natural areas for protection

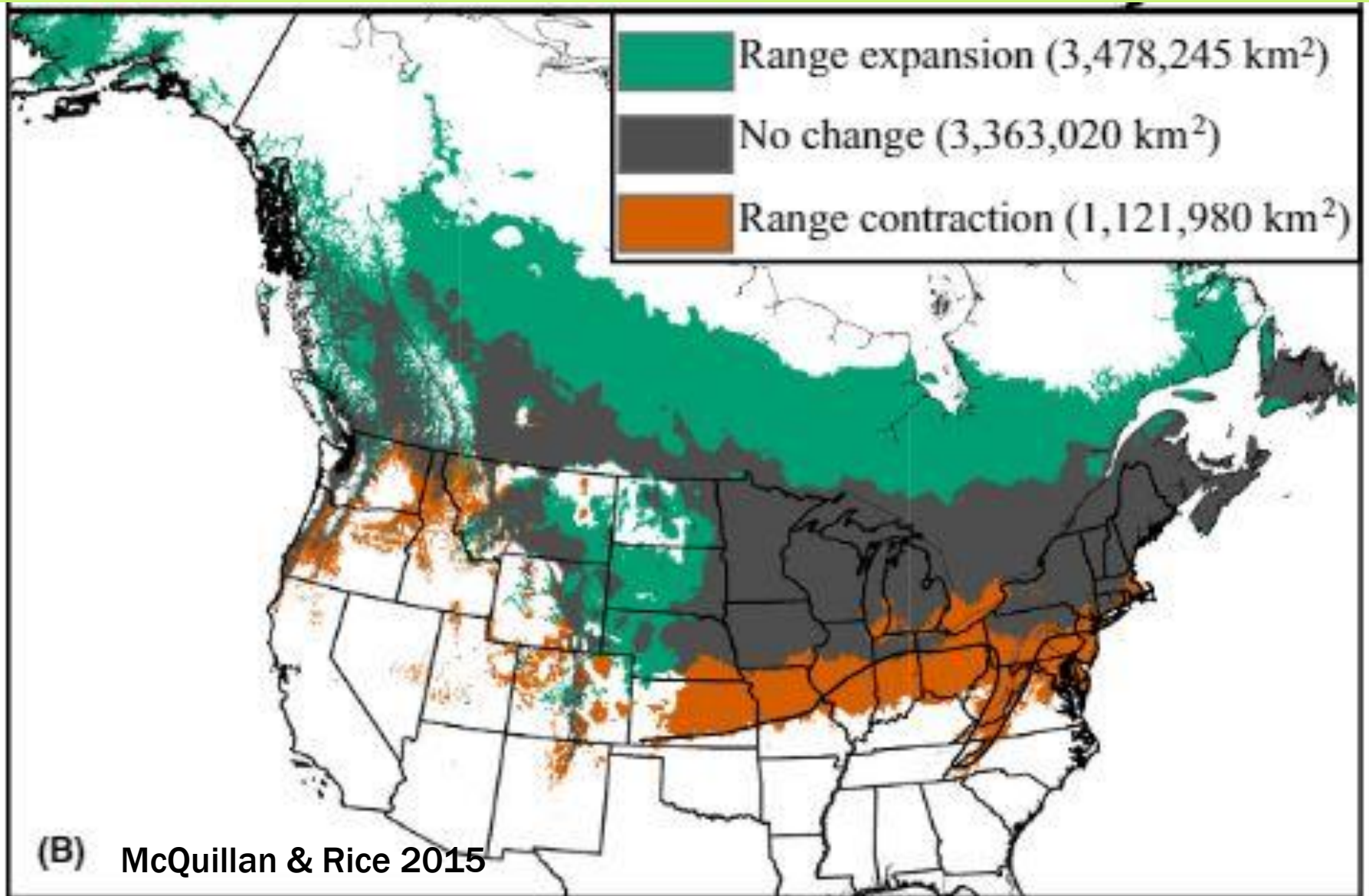
## Hot Spots of Rarity and Richness



- Plan invasive species management



- Forecast future range shifts





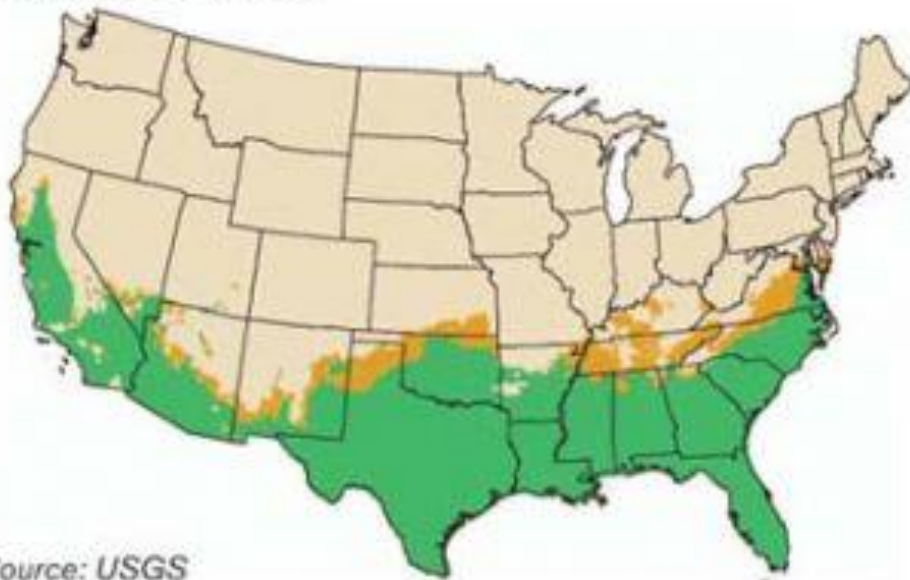
- Forecast future range shifts

## Climate change could enlarge potential habitat for invasive species

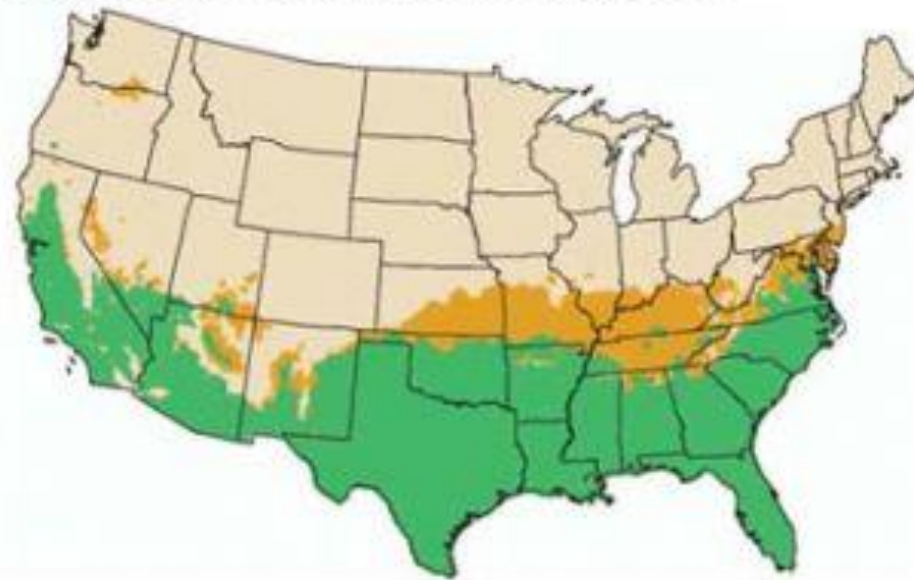
An invasive species in south Florida, Burmese pythons would find conditions suitable in a larger area of the United States under climate projections based on global warming models for the end of the century.

Climate similarity to pythons' native range in Asia: ■ Yes ■ Maybe ■ No

**CURRENT CLIMATE**



**PROJECTED CLIMATE IN THE YEAR 2100**



Source: USGS

TODD TRUMBULL / The Chronicle

# POTENTIAL SOLUTIONS

- Collect more?



# POTENTIAL SOLUTIONS

- Collect more?
  - Limited by overcrowding, sustainability, and funding
- Collect observational occurrence data?
  - Cannot provide historical occurrence data



**GBIF**

Global Biodiversity  
Information Facility



**iNaturalist**

**EDD** **MapS**

Early Detection & Distribution Mapping System





**NARTHECIACEAE**

***Aletris lutea* Small**

**U.S.A. GEORGIA. Camden County: 30.78598N 81.6492W;**  
Kingsland, E of I-95, S of Hwy GA 40; infrequently mowed  
meadow adjacent to shopping center, with *Hypericum suffruticosa*, *H.*  
*stans*, *Juncus*, *Erigeron*, *Rhynchospora*, *Eleocharis tuberculosa*, *Pinguicula*,  
*Drosera*, *Polygala*; plants locally common, flr golden yellow.

Richard Carter 16562  
det. R. Carter

30 Apr 2006

Valdosta State University Herbarium (VSC)

Kodak Gray Scale

A 1 2 3 4 5 6



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# QUESTION

- Can associated taxon records significantly improve our understanding of taxon distributions?

# METHODS

- 84,328 digitized herbarium specimen records



THE FLORIDA STATE UNIVERSITY  
*Biology Department*  
Robert K. Godfrey Herbarium

The screenshot displays the iDigBio website interface. At the top, the iDigBio logo is on the left, and navigation links for "About iDigBio", "Research", "Technical Information", and "Education" are on the right. Below this is a secondary navigation bar with links for "iDigBio Home", "Portal Home", "Search Records", "Learning Center", "Data", "Research Collaboration", and "Feedback".

The "Search Records" section on the left includes a search bar with the placeholder "search all fields" and "Help" and "Reset" links. Below the search bar are checkboxes for "Must have media" and "Must have map point". There are tabs for "Filters", "Mapping", "Sorting", and "Download". A dropdown menu for "Add a field" is set to "Collection Code".

The search filters are as follows:

- Collection Code:** Input field contains "FSU". Radio buttons for "Present" and "Missing" are both unselected.
- Scientific Name:** Input field contains "dwc:scientificName". A button for "Add EOL Synonyms" is present. Radio buttons for "Present" and "Missing" are both unselected.
- Date Collected:** "Start:" and "End:" input fields are both empty, with a placeholder "yyyy-mm-dd". Radio buttons for "Present" and "Missing" are both unselected.

At the bottom of the search filters is a "Scroll To Bottom" button.

The right side of the interface features a world map showing specimen distribution points. A legend titled "Top 5 Taxa" is located in the bottom left of the map area:

- Vaccinium stamineum (Green)
- Physalis walteri (Orange)
- Eupatorium perfoliatum (Purple)
- Amorpha fruticosa (Pink)
- Chamaecrista fasciculata (Light Green)
- other (Grey)

The map includes a scale bar for 3000 km and 2000 mi, and a "Leaflet | Map data © OpenStreetMap" footer. A tooltip on the map says "click or hover to wake".

Manual of the grasses of the United States /

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- [Eragrostis campestris var. refracta](#) Chapm.
- [Eragrostis capitata](#) (Nutt.) Nash
- [Eragrostis eragrostis](#) (L.) Beauv.
- [Eragrostis eragrostis var. microstachya](#) (Cusack) ...



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MANUAL OF THE GRASSES OF THE UNITED STATES 869

190. 1816 follows Pamb. according to Merrill (U. S. Dept. Agr., Div. Agront. Cir. 29, 11, 1904) Elliott's plant is *E. pilosa*.

*Eragrostis edwardsii* Link. Hort. Berol. 1: 181. 1827. North America.

*Poa haldii* Kunth, Rev. Gram. 1: 212. 1829. Based on *Eragrostis aliformis* Link.

*Eragrostis haldii* Steud., Syn. Fl. Glim. 1: 273. 1854. Based on *Poa haldii* Kunth.

(23) *Eragrostis pseudodes* Beauv., Ess. Agront. 182. 1812, name only; ex Beauv. and Schult., Syst. Veg. 2: 572. 1817. Based on *Poa eragrostis* L., *capitata* Jacquin by Hylander, Upposit. Univ. Arkiz. 7: Fl. 1943.

*Poa eragrostis* L., Sp. Pl. 98. 1753. Italy.

*Eragrostis minor* Host, Icon. Gram. Austr. 4: 15. 1809 (name antedate because the genus was not validly published until 1812); Fl. Austr. 1: 133. 1827. Based on *Poa eragrostis* L.

*Eragrostis eragrostis* Beauv., Ess. Agront. 71, 174, pl. 14, f. 11. 1812. Based on *Poa eragrostis* L.

*Eragrostis australis* Link. Hort. Berol. 1: 188. 1827. Based on *Poa eragrostis* L.

*Eragrostis vulgaris* Presl ex Steud., Nom. Bot. ed. 2: 1. 564. 1840, as synonym of *E. panderana* Link.

*Eragrostis vulgaris* Cusack and Geun., Fl. Eur. Paris 2: 641. 1845. Based on *Poa eragrostis* ex *Hecla eragrostis* L., the two species named var. *microstachya* and *mesostachya*, respectively.

*Eragrostis vulgaris* var. *mesostachya* Cusack and Geun., Fl. Eur. Paris 2: 641. 1845. Based on *Poa eragrostis* L.

*Eragrostis eragrostis* var. *microstachya* (Fernald) Amer. Midl. Natl. 10: 306. 1927. Based on *E. vulgaris* var. *microstachya* Cusack and Geun.

*Eragrostis vulgaris* subsp. *pandora* Donn in Bosc., Fl. Comp. 12: 32. 1927-32. Based on *E. panderana* Beauv.

(44) *Eragrostis refracta* (Michx.) Scribn., Turrey Bot. Club Mem. 3: 46. 1894. Based on *Poa refracta* Michx.

*Poa refracta* Beauv. ex Roemer, Col. Bot. 1: 124. 1809. Virginia.

*Poa refracta* Michx. in Ell. Bot. S. C. and Ga. 1: 162. 1816. North Carolina. Name only. Michx., Col. Fl. 12. 1812.

*Eragrostis refracta* Trin., Acad. 26. Friburg, Mem. V. 84. Nat. 2: 72. 1836. North America.

*Eragrostis refracta* Steud., Syn. Fl. Glim. 1: 272. 1854. Carolina, Cuba.

*Eragrostis refracta* Steud., Syn. Fl. Glim. 1: 272. 1854. Based on *Poa refracta* Beauv.

*Eragrostis refracta* var. *refracta* Chapm., Amer. Bot. Soc. 56: 1869. Based on

Fl. South. U. S., vol. 2, 612. 1897. Based on *Poa refracta* Michx.

*Poa refracta* Ell. ex Scribn. and Merr., U. S. Dept. Agr., Div. Agront. Cir. 27. 5. 1900, as synonym of *Eragrostis refracta* Scribn.

This species was described under the name *Poa exaltata* L. in Michx., Fl. Bor. Amer. 1: 67. 1803.

(10) *Eragrostis repens* (Michx.) Nees, Agront. Berol. 214. 1828. Based on *Poa repens* Michx.

*Poa repens* Michx., Fl. Bor. Amer. 1: 62, pl. 11. 1803. Illinois, Michigan.

*Poa repens* Michx. ex Dur., in Lam., Encycl. 5: 87. 1804, erroneously cited as synonym of *E. appressiva* Lam., Kaskaskia River, Ill., Michigan.

*Eragrostis repens* Beauv., Ess. Agront. 74, 167, 175. 1812. Based on *Poa repens* Michx.

*Poa repens* Hooker, ex Trin., Acad. 26. Friburg, Mem. VI. Math. Phys. Nat. 1: 410. 1829, as synonym of *Eragrostis repens* Nees, Dutch Guinea, Borneo.

*Poa repens* Vent. ex Kunth, Enum. Pl. 1: 330. 1835, as synonym of *E. repens* Michx.

*Poa repens* Nutt., Amer. Phil. Soc. Trans. (n. s.) 3: 146. 1837. Arkansas River, Natchez.

*Eragrostis repens* Nash in Britton, Man. 1842. 1901. Based on *Poa repens* Nutt.

*Eragrostis repens* Nash, Acad. Sci. Louisiana, Trans. 13: 178. 1893. Based on *Poa repens* Hooker.

*Eragrostis repens* Hooker, Acad. Sci. Louisiana, Trans. 13: 180. 1893. Based on *Poa repens* Hooker.

(2) *Eragrostis acutigloma* Burkh., Acad. Nat. Sci. Phila. Proc. 1862: 97. 1862. Austin, Tex., Harding.

*Diplachne repens* Vasey, U. S. Dept. Agr., Div. Bot. Bot. 12: pl. 44. 1894. Texas (type: *Eragrostis* in 1870), and New Mexico, northward to Kansas.

*Diplachne repens* Munz ex Vasey, U. S. Dept. Agr., Div. Bot. Bot. 12: pl. 44. 1901, as synonym of *Diplachne repens* Vasey.

*Eragrostis rigida* Scribn., Acad. Nat. Sci. Phila. Proc. 1891: 304. 1891. Based on *Eragrostis rigida* Vasey.

*Acamptoclados cuneiformis* Nash in Fernald, Fl. Southeastern U. S. 140. 1903. Based on *Eragrostis acutigloma* Burkh.

(38) *Eragrostis silvatica* Swallen, Amer. Jour. Bot. 10: 438, f. 8. 1912. Tolu, Tex., Silvestra 300.

(12) *Eragrostis similis* Scribn., U. S. Dept. Agr., Div. Agront. Bul. 7 (vol. 5): 230, f. 241. 1903. Florida, Cuba 6072. *Eragrostis*, American Botanical Co., Chicago. 12.

Global Names Recognition and Discovery

gnrd.globalnames.org

Barcode	Species	Collector	Date	State	County	Locality	Habitat
40097	<i>Eragrostis virginica</i>	Bruce and JoAnn Hansen	1975-09-18	FL	Okaloosa	Eglin AFB, 4 1/2 mi. W of Mary Esther.	Around margin of small artificial pond. With <i>Eragrostis refracta</i> , <i>Juncus abortivus</i> , <i>J. megacephalus</i> , <i>J. debilis</i> , <i>Rhexia virginica</i> ...



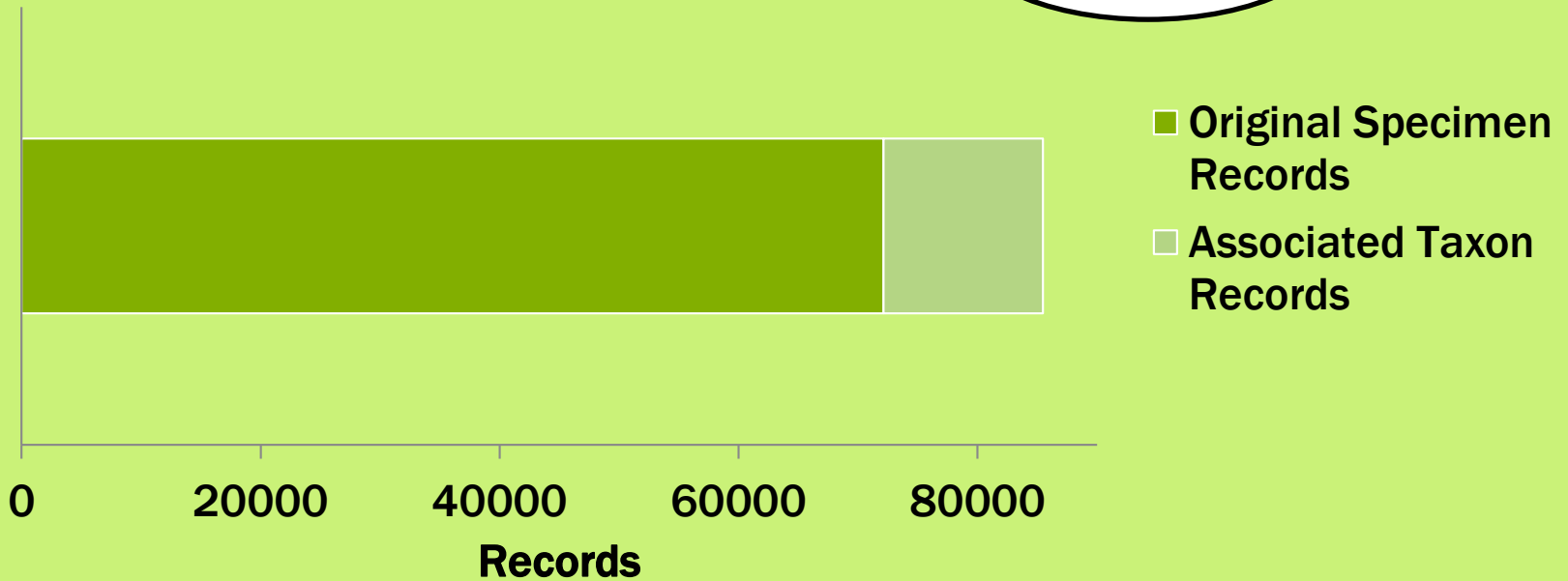
Barcode	Species	Observer	Date	State	County	Locality	Habitat
40097	<i>Eragrostis virginica</i>	Bruce and JoAnn Hansen	1975-09-18	FL	Okaloosa	Eglin AFB, 4 1/2 mi. W of Mary Esther.	Around margin of small artificial pond. With <i>Eragrostis refracta</i> , <i>Juncus abortivus</i> , <i>J. megacephalus</i> , <i>J. debilis</i> , <i>Rhexia virginica</i> ...
40097	<i>Juncus abortivus</i>	Bruce and JoAnn Hansen	1975-09-18	FL	Okaloosa	Eglin AFB, 4 1/2 mi. W of Mary Esther.	Around margin of small artificial pond. With <i>Eragrostis refracta</i> , <i>Juncus abortivus</i> , <i>J. megacephalus</i> , <i>J. debilis</i> , <i>Rhexia virginica</i> ...
40097	<i>Juncus megacephalus</i>	Bruce and JoAnn Hansen	1975-09-18	FL	Okaloosa	Eglin AFB, 4 1/2 mi. W of Mary Esther.	Around margin of small artificial pond. With <i>Eragrostis refracta</i> , <i>Juncus abortivus</i> , <i>J. megacephalus</i> , <i>J. debilis</i> , <i>Rhexia virginica</i> ...
40097	<i>Juncus debilis</i>	Bruce and JoAnn Hansen	1975-09-18	FL	Okaloosa	Eglin AFB, 4 1/2 mi. W of Mary Esther.	Around margin of small artificial pond. With <i>Eragrostis refracta</i> , <i>Juncus abortivus</i> , <i>J. megacephalus</i> , <i>J. debilis</i> , <i>Rhexia virginica</i> ...
40097	<i>Rhexia virginica</i>	Bruce and JoAnn Hansen	1975-09-18	FL	Okaloosa	Eglin AFB, 4 1/2 mi. W of Mary Esther.	Around margin of small artificial pond. With <i>Eragrostis refracta</i> , <i>Juncus abortivus</i> , <i>J. megacephalus</i> , <i>J. debilis</i> , <i>Rhexia virginica</i> ...

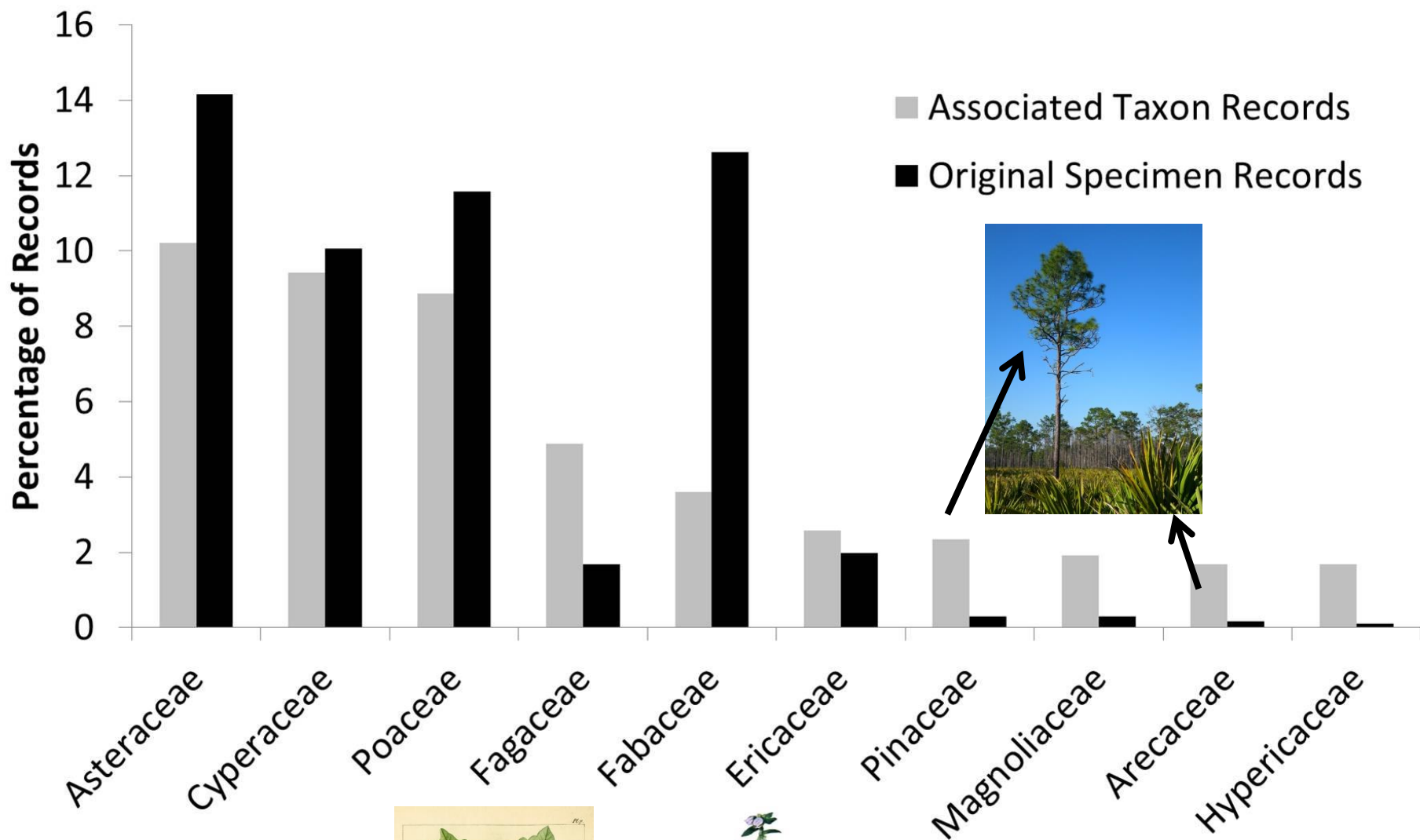


# RESULTS

- 72,120 unique original specimen records
- 13,372 associated taxon records

**18.5%**





- **Federally listed**

- **Threatened: 25 records (7 spp.)**
- **Endangered: 41 records (14 spp.)**



*Conradina glabra*



*Harperocallis flava*

IMPERILED  
SPECIES

## ■ State listed

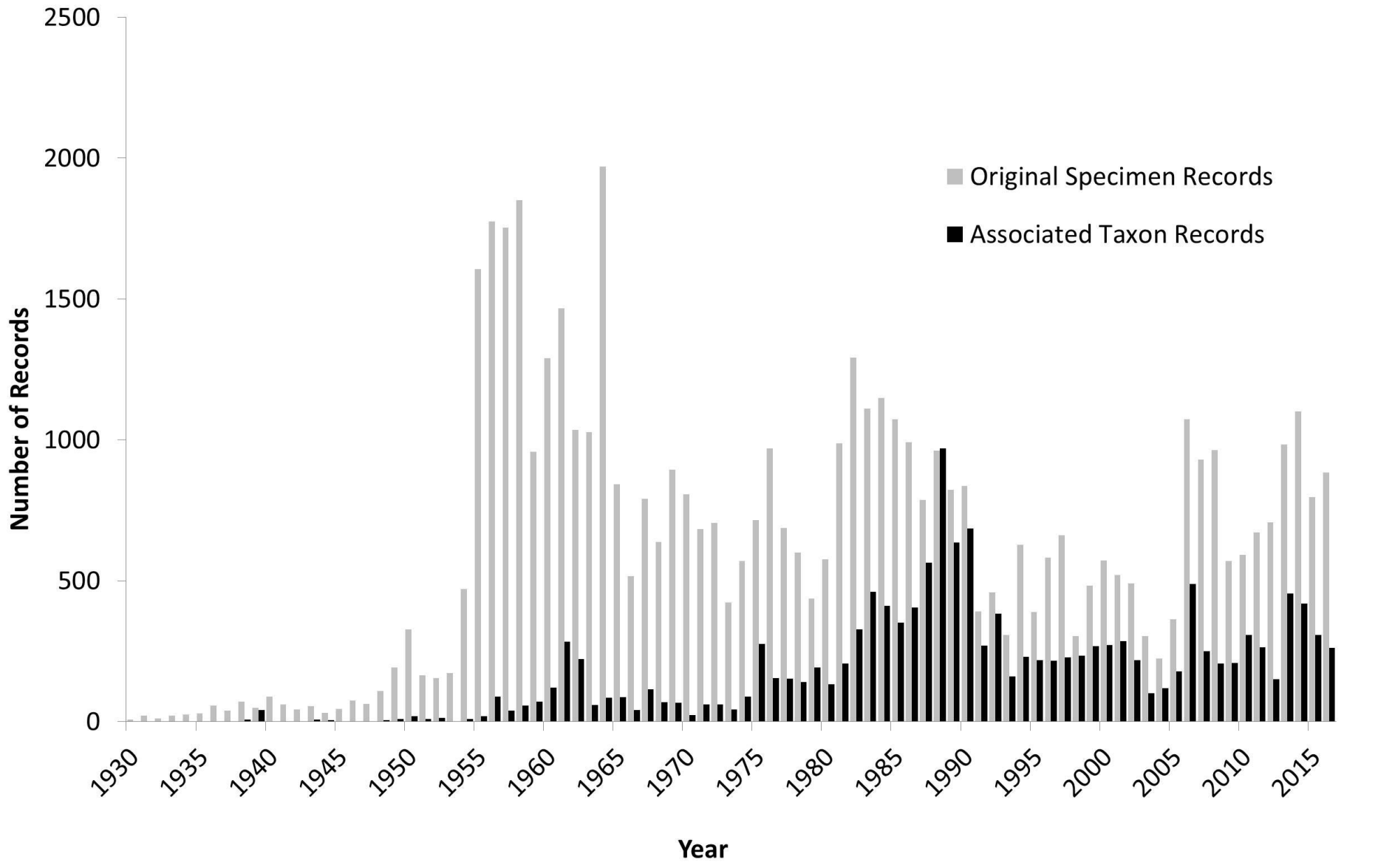
- Threatened: 223 records (52 spp.)
- Endangered: 326 records (108 spp.)

*Warea cuneifolia*

Photo by David Stewart



IMPERILED  
SPECIES





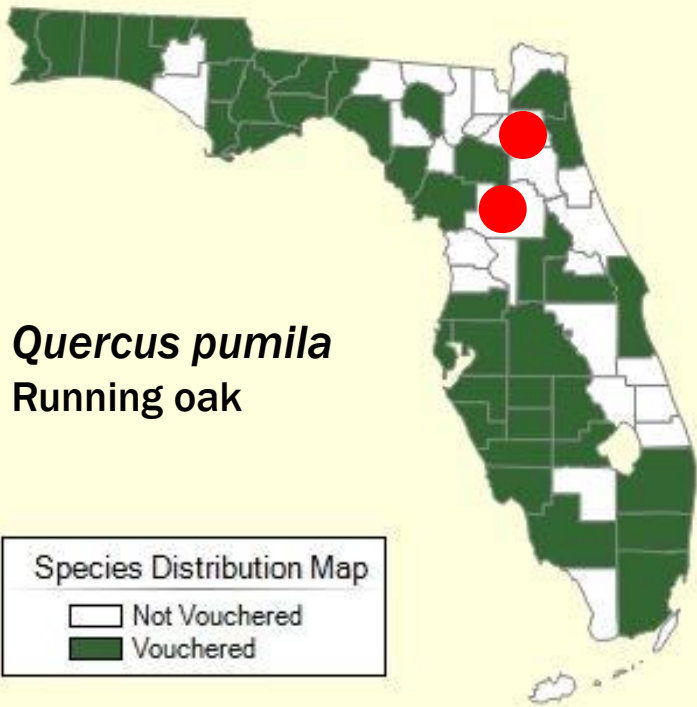
- 247 Florida records



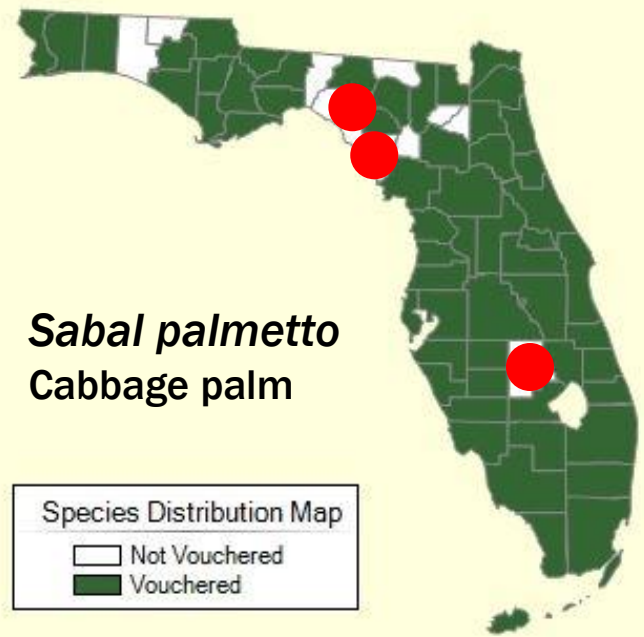
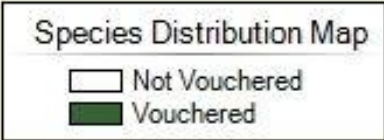
- 900-1500 U.S. records



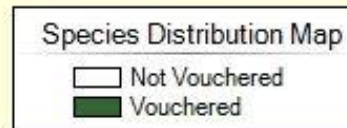
NEW  
COUNTY  
RECORDS



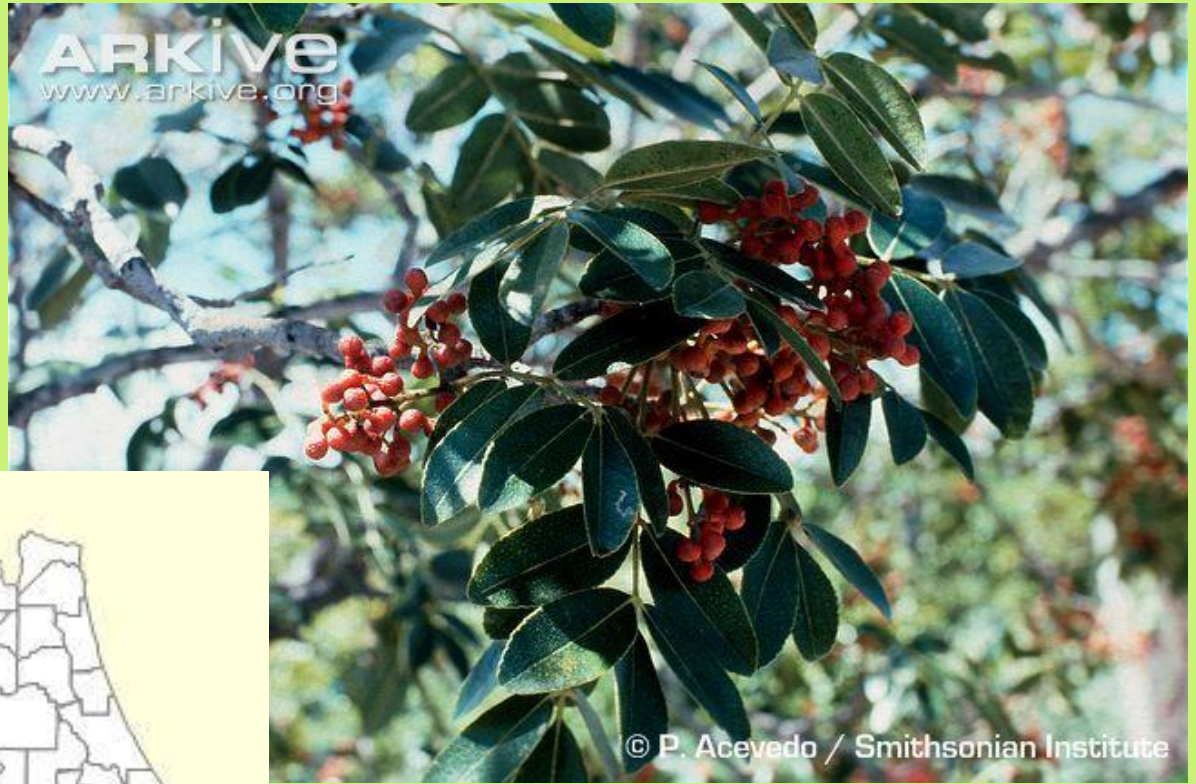
*Quercus pumila*  
Running oak



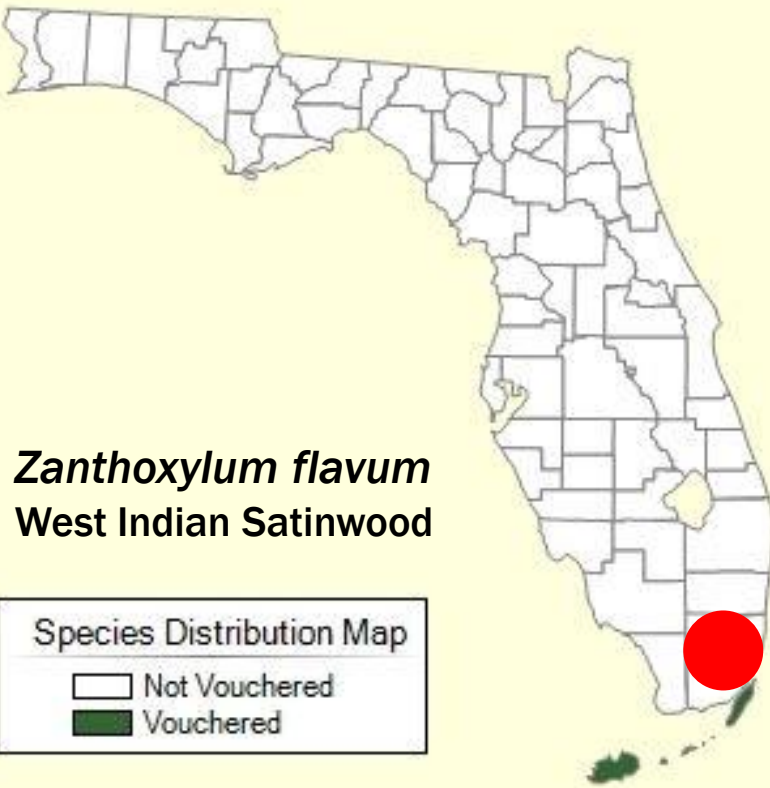
*Sabal palmetto*  
Cabbage palm







**State-endangered**



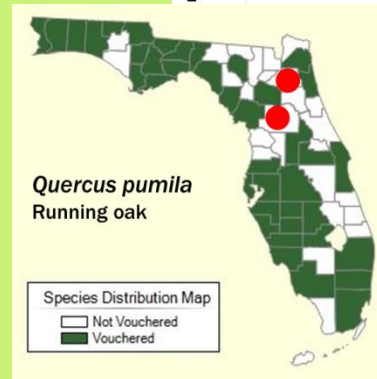
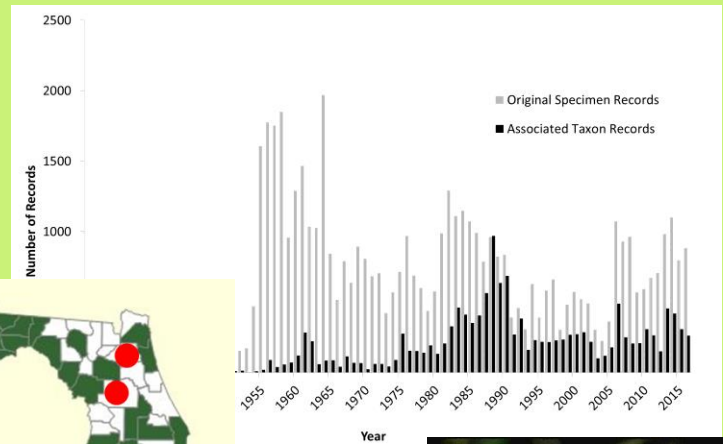
***Zanthoxylum flavum***  
**West Indian Satinwood**

Species Distribution Map

- Not Vouchered
- Vouchered

# CONCLUSIONS

- Associated taxon records can increase sampling in:
  - Time
  - Space
  - Taxonomic diversity
- Strengths:
  - Common species
  - Systematically under-collected species (e.g., protected spp.)
- Limitations:
  - May introduce new biases
  - Not verifiable (possible mis-IDs)



# FUTURE DIRECTIONS

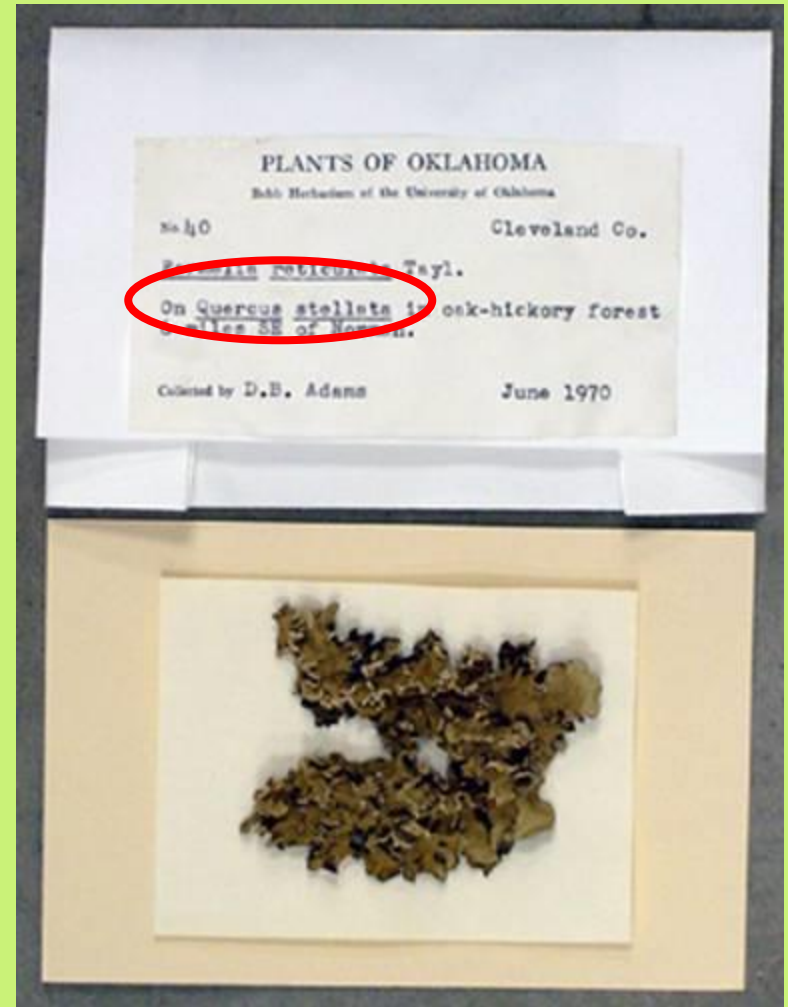
- Method improvement
  - Currently 4 seconds per record
  - Common names not recognized





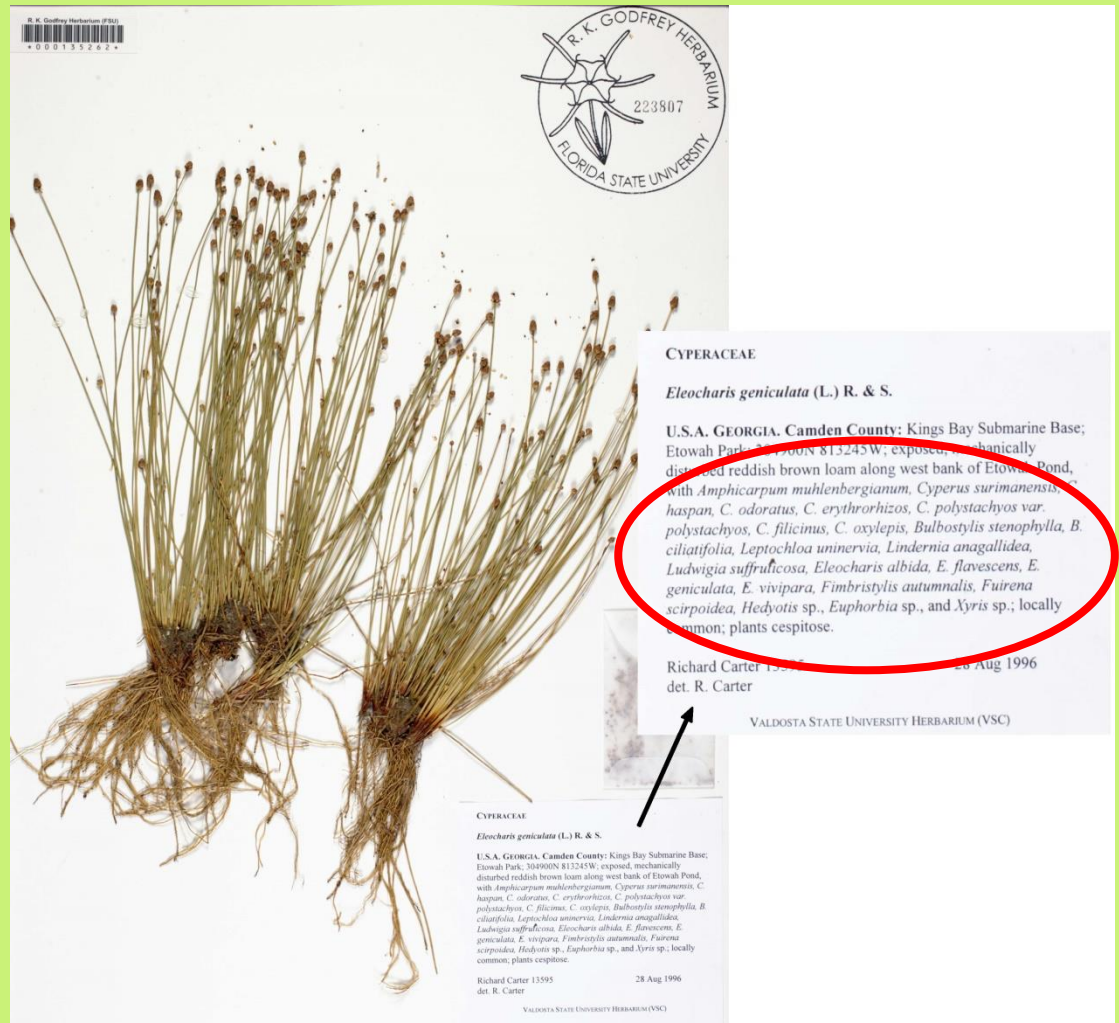
# FUTURE DIRECTIONS

- Other specimen types



# FUTURE DIRECTIONS

## ■ Informing collection practices



# ACKNOWLEDGEMENTS: THANK YOU!

- Austin Mast
- Committee:
  - Gil Nelson
  - Scott Burgess
  - Greg Riccardi



Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.



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