

Reference Collections in herbaria:

A versatile but underutilized tool to enhance teaching, outreach and research.



Neil Snow
Director, T.M. Sperry Herbarium
Department of Biology
Pittsburg State University
Pittsburg, KS 66762
nsnow [at sign] pittstate.edu



Eugenia plurinervia
(New Caledonia)

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Species-rich temperate genera

Astragalus – loco weeds (Fabaceae)

Carex – sedges (Cyperaceae)

Crataegus – hawthorns (Rosaceae)

Poa – blue grasses (Poaceae)

Quercus – oaks (Fagaceae)

Rubus – blackberries & allies (Rosaceae)

Salix – willows (Salicaceae)

Solidago – goldenrods (Asteraceae)



Astragalus alpinus



Solidago altisissima ssp. *altisissima*

“Difficult” temperate genera

Astragalus – loco weeds (Fabaceae)

Carex – sedges (Cyperaceae in general)

Crataegus – hawthorns (Rosaceae)

Poa – blue grasses (Poaceae in general)

Quercus – oaks (Fagaceae)

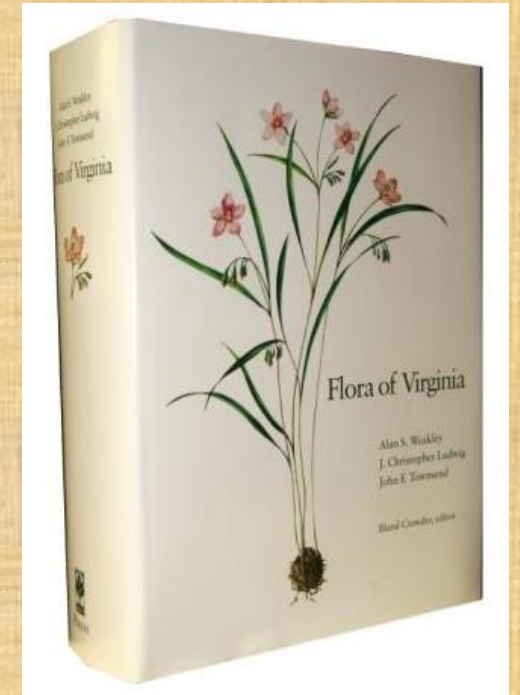
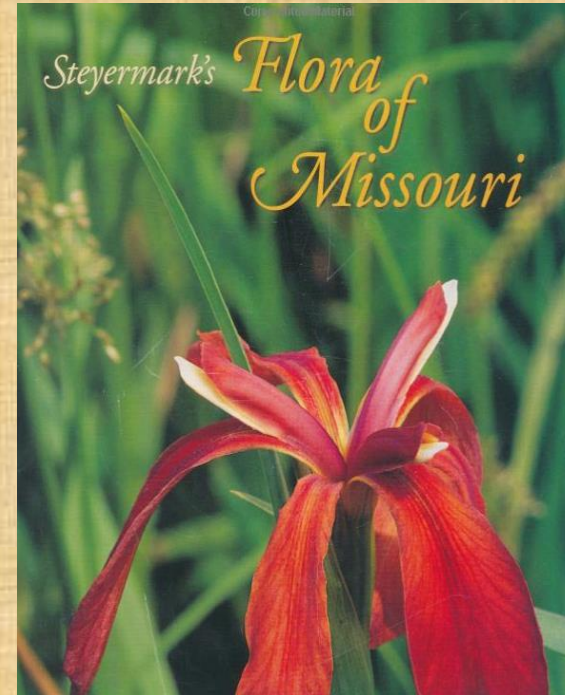
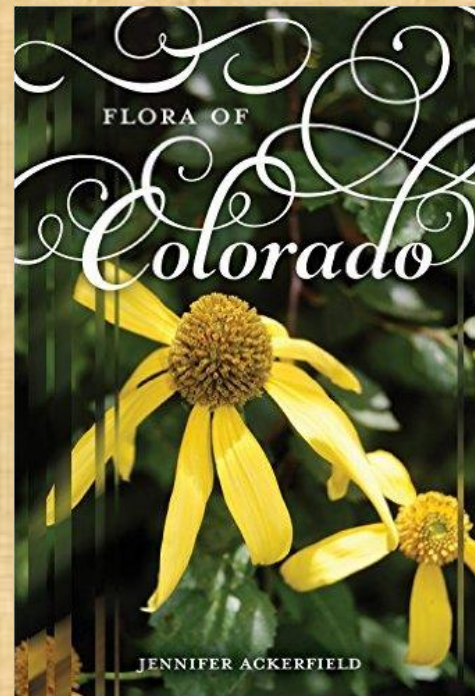
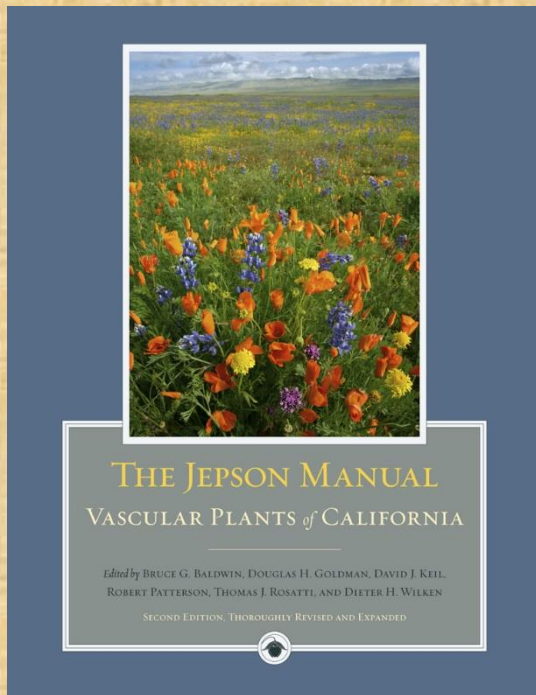
Rubus – blackberry and allies (Rosaceae)

Salix – willows (Salicaceae)

Solidago – goldenrods (Asteraceae in general)

These genera species-rich across much or most
of North America (and elsewhere)

Floras alone sometimes inadequate to verify identifications



Positive identification of specimens
often requires comparison to a
verified herbarium specimen

... in other words, a good recent dichotomous key
(even when illustrated) may by
itself be inadequate

Citing just one example....

... ca. 77 species of *Carex* (sedges) in Kansas

17 species in section *Ovales* in adjacent Missouri

many difficult to identify confidently/correctly without

access to authenticated specimens

So..... have YOU ever gone in and out of the main collections repeatedly to fetch taxon folders to compare with your unidentified material....?

[heads in audience hopefully now nodding in agreement...]

If so, then ...

**Reference Collections
to the rescue...**



What is a reference collection?

= a stand-apart collection of herbarium specimens of all native and non-native plant species of a given area

for example:

state-wide

regional

or even taxon-specific



(e.g., my personal temporary R.C. of *Syzygium* of New Caledonia)

What is the primary purpose of a reference collection?

To expedite the reliable identification of plants

Quality control of identifications: a secondary (and often) unstated purpose

Lest we forget...

1. All data associated with a herbarium specimen are wrong if the specimen is misidentified
2. All herbaria have misidentifications

Some herbaria with reference collections

Rocky Mountain Herbarium (University of Wyoming)

University of Northern Colorado (Greeley)

Pittsburg State University (Kansas)

Queensland Herbarium (Brisbane, Australia)

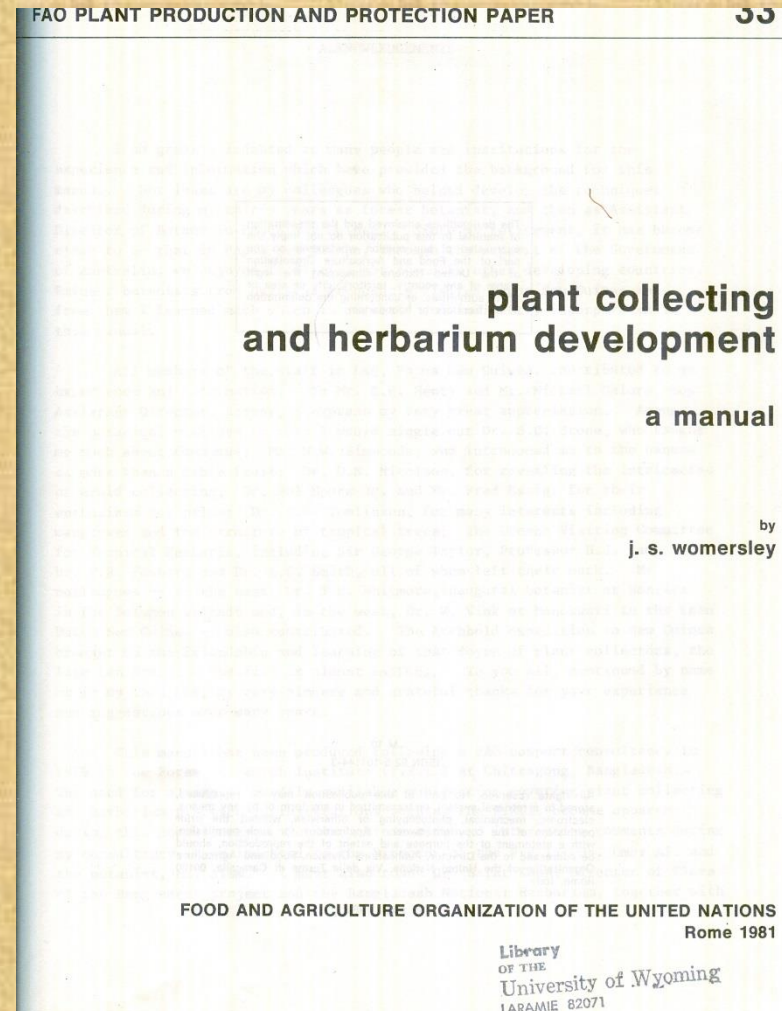
Northern Kentucky University

University of Texas – Austin

Missouri Botanical Garden (for plants of MO)

University of Wisconsin – Madison (effectively its teaching collection)

When did the idea of Reference Collections arise?



Kansas and Regional Reference Collection (KRRC) at Pittsburg State University



Kansas and Regional Reference Collection (KRRC)

Purpose: Inaugurated in the Fall Semester of 2013, the KRRC is a stand-apart collection with the sole purpose of helping users expedite proper identification of unknown specimens by providing easy access to authenticated specimens and identification sources in one location. Having one (or at most two) sheets of each specimen prevents repeat trips into the main collections.

Organization: Major clades (in order, top to bottom) are Ferns and Fern Allies; Gymnosperms; Angiosperms. Families are organized alphabetically (see adjacent list of families and 3-letter abbreviations); genera are alphabetical within families. Each species is protected with a species folder; information is summarized for its distribution in the 4-state area, whether native or non-native, with details of authentication.

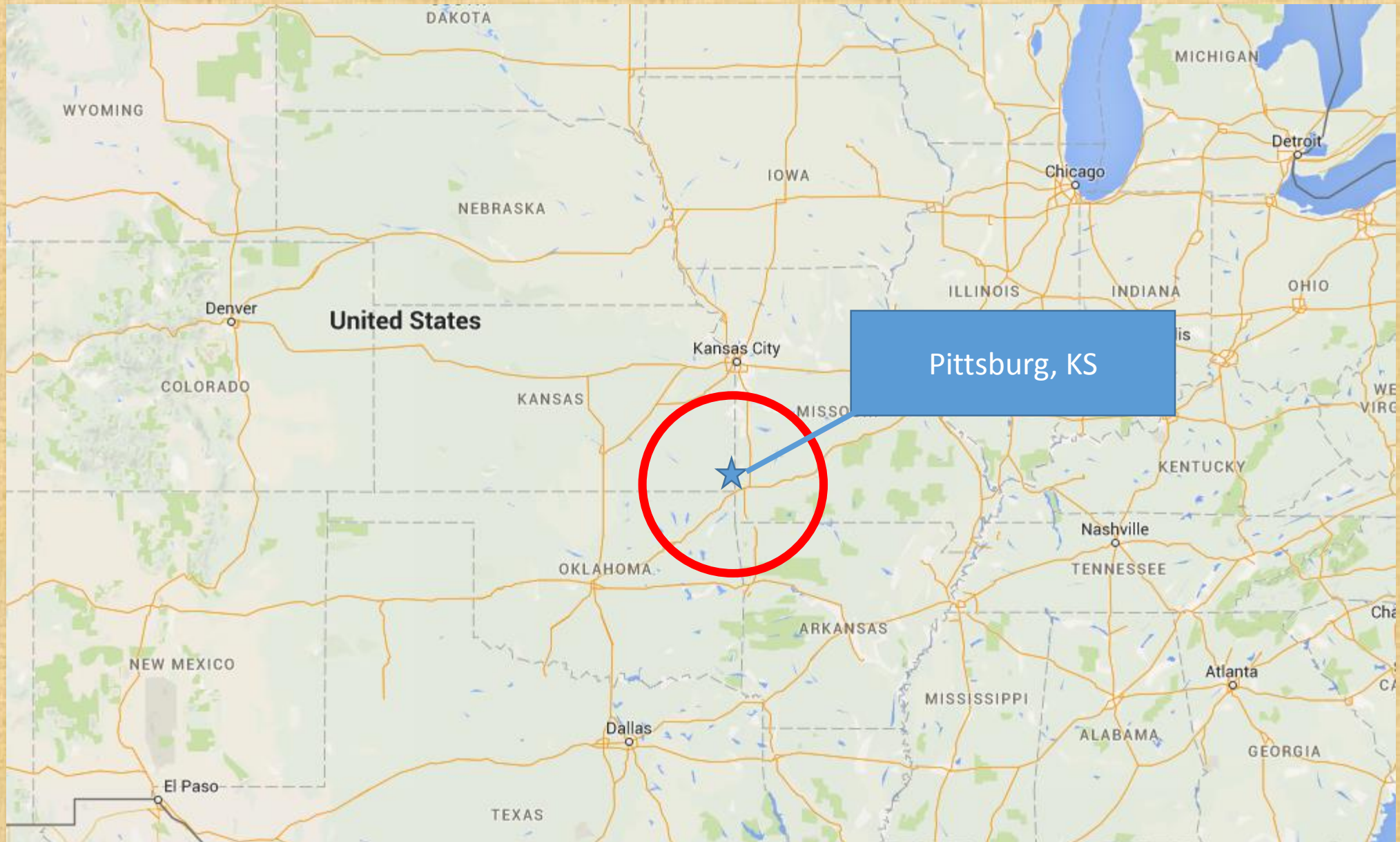


Geographical coverage: All of Kansas and the following counties in the **Gorilla Nation** region, which include a radius of 150 km from Pittsburg (intersection of US Hwy 69 and KS 126) into our three adjacent states:

Arkansas: Benton, Carroll, Madison, Washington

Missouri: Barry, Barton, Bates, Benton, Cass, Cedar, Christian, Dade, Dallas, Greene, Henry, Hickory, Jackson, Jasper, Johnson, Lawrence, McDonald, Newton, Polk, St. Clair, Stone, Taney, Vernon, Webster

Oklahoma: Adair, Cherokee, Delaware, Mayes, Nowata, Osage, Ottawa, Rogers, Wagoner, Washington



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Eugenia plurinervia
(New Caledonia)

Uses in teaching

At Pittsburg State University

Plant Taxonomy – for identification & confirmation of the 20 required plant specimens

Plants and People – new course (Fall 2016)

Independent study courses in herbarium curation at PSU

(specimen preparation; data basing; digitization; georeferencing)

Wetland Plants – tentatively in future

Logically elsewhere

Agrostology (= Grass Taxonomy)

Local flora classes



Korean exchange student
mounting plants

Uses in outreach

1. State and Federal land management agencies
(USFS, BLM, USFWS, NPS, etc.)
2. Use by biologists with conservation NGOs
3. Environmental consultants
4. County extension agents
5. Native plant societies
6. Herbarium tours
7. Ad hoc identification of specimens by curator (or students) for colleagues



Uses in research

Taxonomic revisions

Floristic studies



Plant ecology

Soil ecology

Plant biogeography, e.g.:



Ficaria verna
(Ranunculaceae)

Anacker, B.L., S. Y Strauss. 2014. The geography and ecology of plant speciation: range overlap and niche divergence in sister species. Proc. Royal Acad. Sci B: 281. <http://dx.doi.org/10.1098/rspb.2013.2980>.

Recommendations regarding assembly

1. Do not assume specimens in main collections (source) are correctly identified
2. Use specimens that show diagnostic characters following local keys
3. Preferentially use specimens annotated by specialists (but check these against recent local Floras)
4. Organize folders alphabetically by family (outside users uninterested in phylogenetic arrangement)
5. Use a separate folder for each genus
6. Use a “flimsy” cover (+/- = newsprint thickness) to protect each specimen
7. Use 1 specimen per taxon, unless flowering and fruiting material are needed for positive identification

Genus folders for *Solidago*
(spp A to L and M to Z)

AST

KANSAS & REGIONAL
REFERENCE COLLECTION

Solidago

①

A → L

AST

KANSAS & REGIONAL
REFERENCE COLLECTION

Solidago

②

M → Z

Species covers for some species of *Solidago*
(note different folder for two subspecies)

AST

KANSAS & REGIONAL
REFERENCE COLLECTION

Solidago altissima subsp. *altissima*

AST

KANSAS & REGIONAL
REFERENCE COLLECTION

Solidago altissima subsp. *silvicanescens*

AST

KANSAS & REGIONAL
REFERENCE COLLECTION

Solidago arguta var. *boottii*

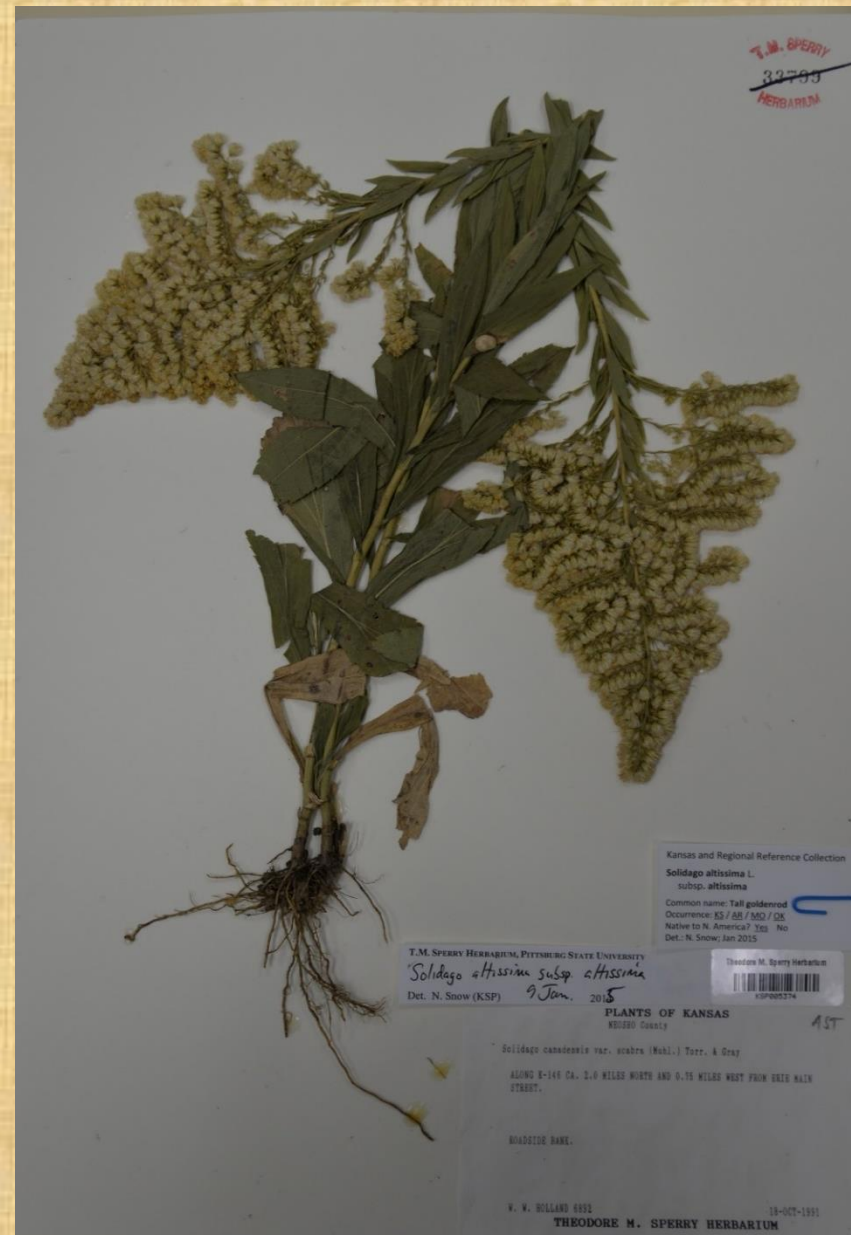
AST

KANSAS & REGIONAL
REFERENCE COLLECTION

Solidago buckleyi

Example of complete specimen

Shows critical diagnostic features,
including root crown, basal and stem leaves,
and abundant flowering/fruitlet material



Close-up of labels. Note original identification was incorrect. Attached label (paper clip) shows relevant information for KRRC area.

Clip and label can be removed if better specimen is eventually obtained.

Kansas and Regional Reference Collection

Solidago altissima L.
subsp. *altissima*

Common name: Tall goldenrod

Occurrence: KS / AR / MO / OK

Native to N. America? Yes No

Det.: N. Snow; Jan 2015

T.M. SPERRY HERBARIUM, PITTSBURG STATE UNIVERSITY

Solidago altissima subsp. *altissima*

Det. N. Snow (KSP)

9 Jan. 2015

Theodore M. Sperry Herbarium



KSP005374

PLANTS OF KANSAS

NEOSHO County

AST

Solidago canadensis var. *scabra* (Muhl.) Torr. & Gray

Suggested best practices

Position the RC near entry to Herbarium

Locate RC adjacent to or near dissecting scope

Include all recent and relevant local Floras at dissecting table for easy access

Have users of RC record their visit in Visitors' Log and indicate usage of RC

Advertise and promote RC locally, e.g.:

within and across Department, native plant societies, environmental consultants, Federal (USFS, BLM, USFWS, NPS) and State ("Fish and Game) agencies, Audubon, 4-H, Boy Scouts, etc.

Hold herbarium open houses, with focus (at least one year) on reference collection

“All politics is local”

Corollary for small to medium-sized herbaria:

Long-term administrative and community support for
small to medium-sized herbaria
must be local

Who cares....?

Every mothballed or closed or consolidated herbarium
may mean one less permanent position
in plant taxonomy

Who cares...?

Making a herbarium a useful and well-known local resource increases odds that plant taxonomy positions will be re-hired at retirements

If a Reference Collection enhances the versatility of a herbarium, then it benefits not just the institution and regional area but the profession overall.

In summary

Reference Collections:

1. Expedite process of correctly identifying specimens
2. Increase percentage of correctly identified incoming specimens (i.e., quality control)
3. Increase students' use of and appreciation of herbaria
4. Enhance many dimensions of outreach of herbaria
5. Provide an important research tool for institution-based taxonomists and ecologists
6. Make the Herbarium more visible to administrators and help to convey the importance of plant taxonomy and botany