Restoring species diversity: uncovering gaps in the United States native seed market

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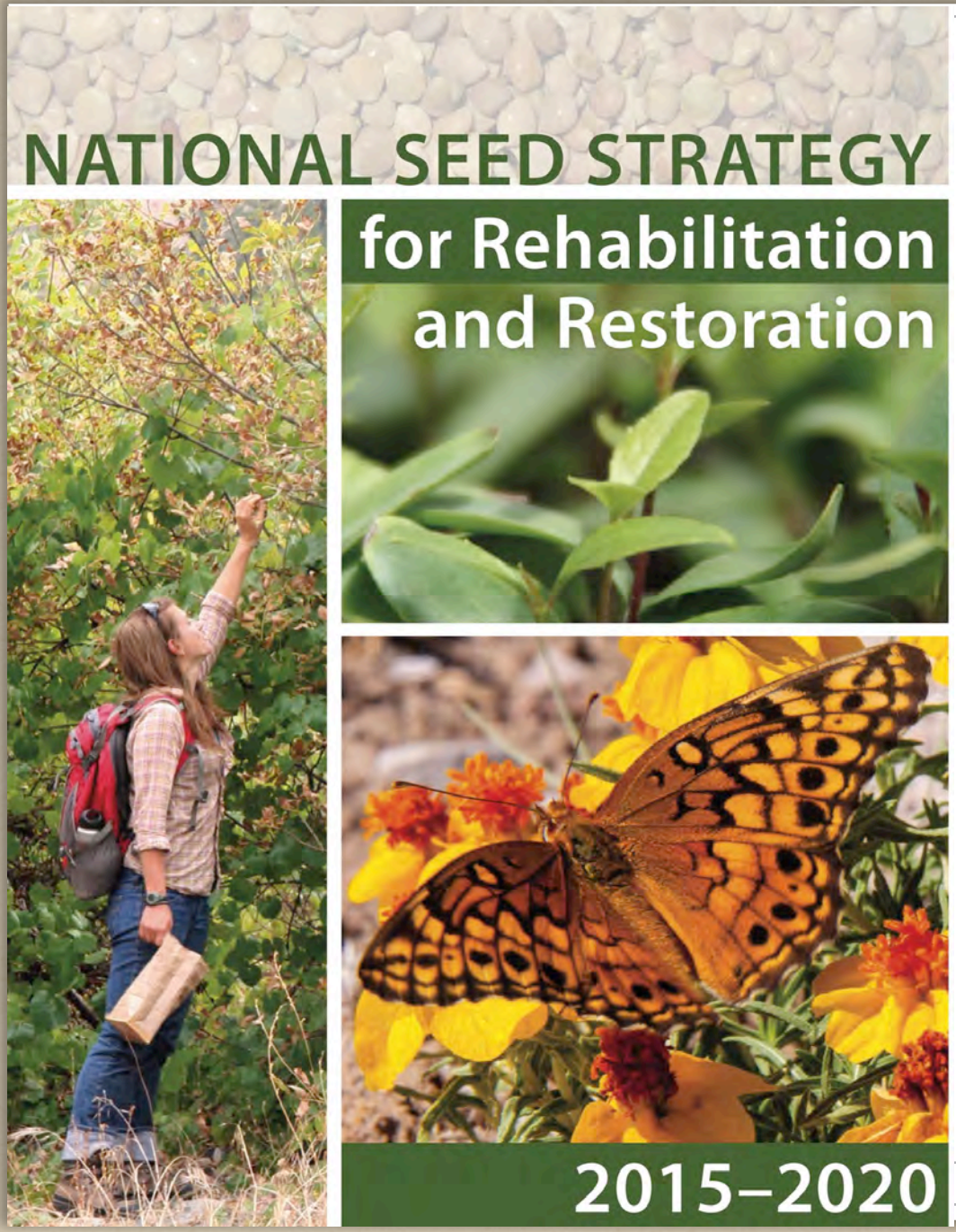
2017 National Native Seed Conference - Washington, D.C.



- Re-establishing native plant communities depends on the availability and effective use of seeds/plant material

THE FOUR GOALS

of the "National Seed Strategy for Rehabilitation and Restoration"

GOAL 1

Identify seed needs, and ensure the reliable availability of genetically appropriate seed.

GOAL 2

Identify research needs and conduct research to provide genetically appropriate seed and to improve technology for native seed production and ecosystem restoration.

GOAL 3

Develop tools that enable managers to make timely, informed seeding decisions for ecological restoration.

GOAL 4

Develop strategies for internal and external communication.

Seed planning and production

Seed planning and production

Capacity to meet seed needs for restoration

Seed planning and production

Capacity to meet seed needs for restoration

Identify seed n
reliable availa
appro

Assess the Seed Needs of Federal Agencies and the Ca
and Federal Produce

Increasing Federal agency
seed will stimulate seed su
smaller organizations and
more native plant material
objective will lead to a bet
overall capacity of Federal
stabilization, rehabilitation
with native plant materials

Action 1.1.2 Identify and inventory agency and private sector seed collections, nurseries, and storage capacity.

Assess seed supplies

This action will identify existing agency seed supplies and related staff, nurseries, storage facilities, tools, equipment, and costs. It will seek information specifically on seed supplies that help resist nonnative plant competition and that provide habitat for at-risk species, including pollinators. It will also identify strengths and weaknesses in seed production and facilities networks and needs for new infrastructure, staffing, and training. Production

Seed planning and production

Objective 1.1

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The right seed in the right place at the right time

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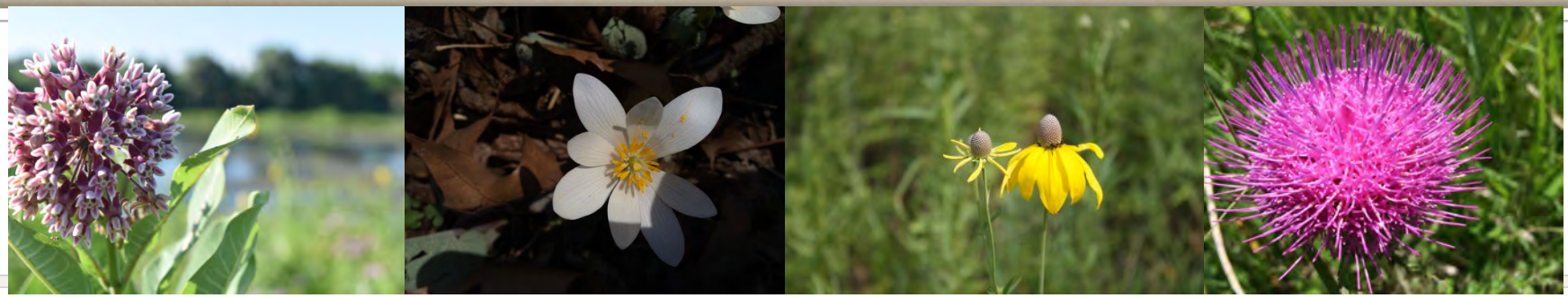
Diverse set of needs

- Small-scale vs. Landscape-scale
  - Variable quantities
- Variety of ecosystems (e.g., prairies, woodlands, deserts, grasslands, forests)
  - Many different species
- Local material
- Genetically diverse material
- Readily available



- Difficult to get the right seed for particular species and places
- Relying solely on wild collection is not feasible
  - Hard to find/limited access
  - Unpredictable seed production
  - Over-harvesting remnant populations
- Demand for locally collected seed exceeds supply
- Issue of scale

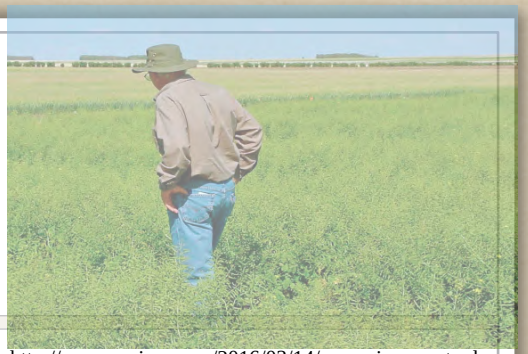
Native Plant Market

- Large, diverse, and growing industry
- Coincided with growth in restoration efforts (~1950s)
- Functions as a reliable and cost-effective supply of native plant materials to support restoration efforts
  - Overcome supply shortages
- Wide range of producers and consumers
  - (Government agencies, NGOs, private sector industries, universities, small independent vendors)

Picture: http://www.heritageseedlings.com/

Dumroese et al. 2012

Effective Partnerships



http://www.grainews.ca/2016/03/14/managing-mustard-on-the-prairies/

- Commercial industry can have a direct impact on restoration success
  - Species diversity, quality of seed, etc.
- Partnership between land managers and seed producers to identify needs is critical
  - Native plant market is at the intersection of those two parties


What do we know about this industry?

Knowledge based almost entirely on a handful of reports/studies

- Late 1990s - early 2000s
- Western-focused
- Small number of vendors
- Surveys

Dunne and Dunne 2003

RESEARCH ARTICLE

Market Perceptions and Opportunities for Native Plant Production on the Southern Colorado Plateau

Donna L. Peppin,[1,2] Peter Z. Fulé,[1] Janet C. Lynn,[1,3] Anne L. Mottek-Lucas,[4] and Carolyn Hull Sieg[5] 2010

Dunne and Dunne 2002

Potts et al .2002

To date, there has been no nationwide quantitative assessment of the native plant industry

Gaps in our knowledge

- Very little known about the industry
  - Species availability?
  - Seed collection protocols?
  - Economic constraints?
  - Effective communication among producers, consumers, land managers, and researchers?


What are we missing?

Identifying Gaps

- Many approaches:
  - 1) Species richness

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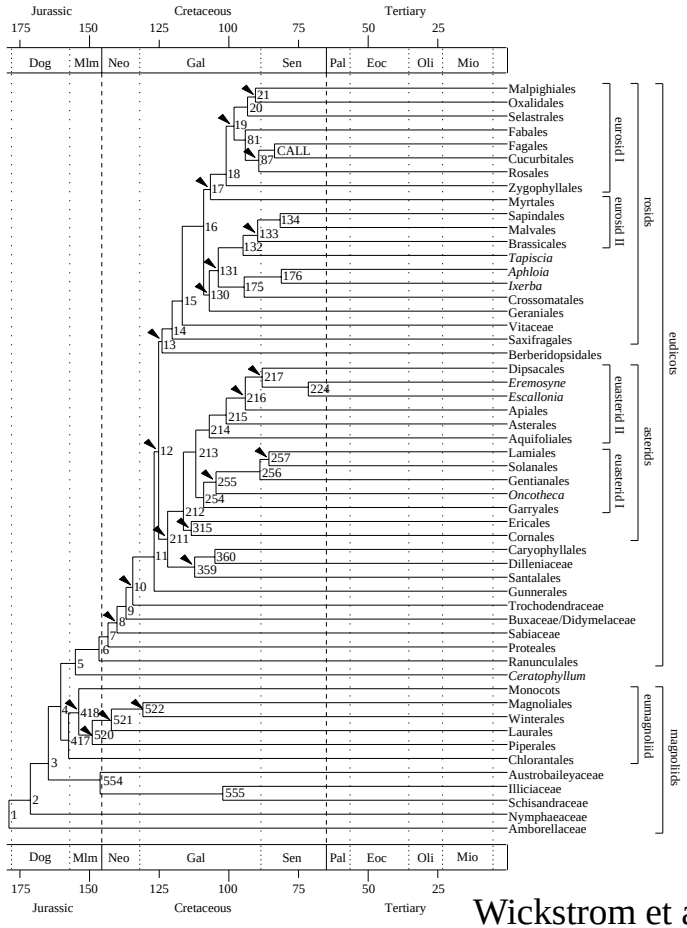
Identifying Gaps

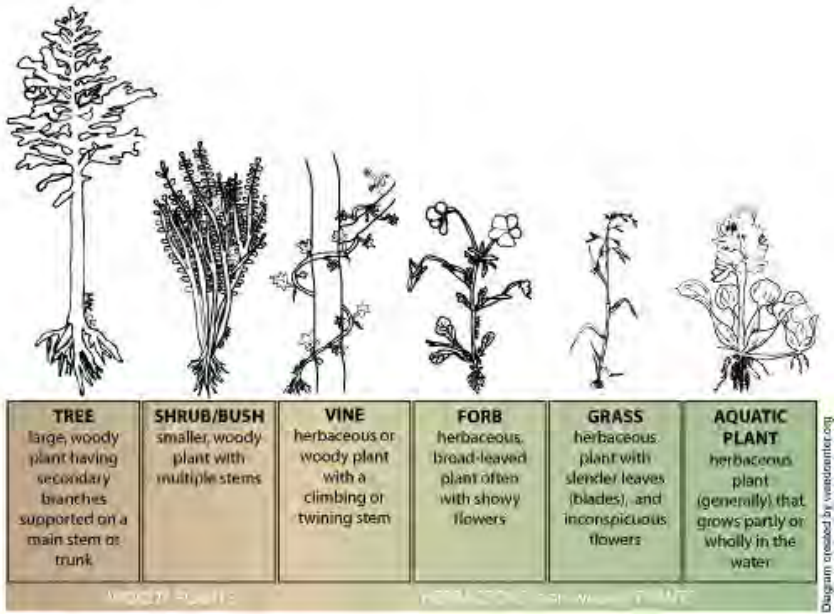
- Many approaches:
  - 1) Species richness
  - 2) Taxonomic (Families)



Wickstrom et al. 2001

Identifying Gaps

- Many approaches:
  - 1) Species richness
  - 2) Taxonomic (Families)
  - 3) Ecology (Growth Habits)



http://rangelandarchive.ucdavis.edu/Annual_Rangeland_Handbook/Range_Plant_Growth_and_Development/

Identifying Gaps

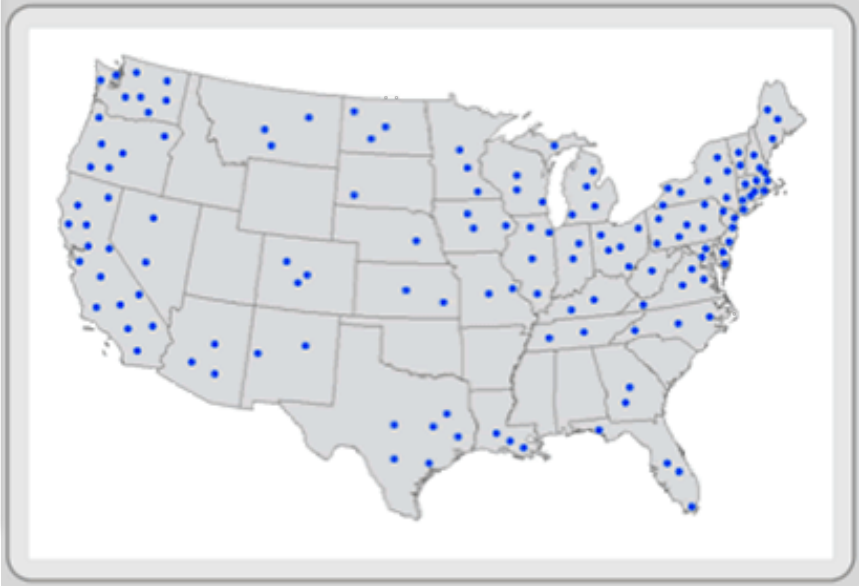
- Many approaches:
  - 1) Species richness
  - 2) Taxonomic (Families)
  - 3) Ecology (Growth Habits)
  - 4) Conservation (By Rank)

NatureServe®

Rank	Definition
GX	**Presumed Extinct** (species)— Not located despite intensive searches and virtually no likelihood of rediscovery. **Eliminated** (ecological communities)—Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.
GH	**Possibly Extinct** (species)— Missing; known from only historical occurrences but still some hope of rediscovery. **Presumed Eliminated**— (Historic, ecological communities)-Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration, for example, American Chestnut (Forest).
G1	**Critically Imperiled**—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	**Imperiled**—At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	**Vulnerable**—At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	**Secure**—Common; widespread and abundant.

Identifying Gaps

- Many approaches:
  - 1) Species richness
  - 2) Taxonomic (Families)
  - 3) Ecology (Growth Habits)
  - 4) Conservation (By Rank)
  - 5) Geography (By Region)
    - Distribution of vendors
    - Sold where they grow?



https://www.boundless.com/

Objectives: **Identify Seed Needs**

Provide a "snapshot" of the native plant industry by…

- 1) Compiling a list of the species commercially available in the United States
- 2) Identifying gaps based on taxonomy, ecology, conservation, and geography
- 3) Crudely assessing how frequently local and genetically diverse material is available

Action 1.1.2 Identify and inventory agency and private sector seed collections, nurseries, and storage capacity.

Online Directories

Directory	Website
Native Seed Network**	http://www.nativeseednetwork.org/
Lady Bird Johnson Wildflower Center National Supplier Directory**	http://www.wildflower.org/suppliers/
Plant Iowa Native	http://plantiowanative.com/
Plant Native	http://www.plantnative.org/nd_idtoks.htm
Grand Prairie Friends	http://grandprairiefriends.org/nurseriesIA.php
Native Plant Material Sources	http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_006679.pdf
Reforestation, Nurseries, and Genetic Resources	http://www.rngr.net/resources/directory
Native Plants for the Intermountain West	http://www.wyoextension.org/westernnativeplants/growers.php

Data collection

- ~1,300 vendors nationwide (L48, AK, and HI)
- Used website URLs or contact information to obtain **species lists** for all possible vendors
  - Updated when necessary
- Noted:
  - 1) Periodic wild collection
  - 2) Continuous nursery propagation
  - 3) Purchase material elsewhere
  - 4) Collected locally

- Data corrected for synonymy and spelling errors using USDA PLANTS database
- Added fields from USDA PLANTS database
  - Taxonomy (Category, Symbol, and Family)
  - All Ecology fields (Duration, Growth habit, and Native Status)
  - Almost all Legal Status fields (e.g., Invasive status, Federal T/E status, State T/E status, etc.)
- Added NatureServe global conservation ranks (G1-G5)

Generated an incredible amount of data

- Obtained 601 species lists (46% of the total no. of vendors)
- 109,572 species total
  - 16,584 unique species
- 413 (32%) vendors were without websites (small local businesses)
  - Received emailed lists from 48 vendors

Results

Species Richness:

- Only 23% of native species found in the USDA PLANTS database are commercially available
  - 5,942 of 25,414

Taxonomy:

- 46% of the plant families are represented
  - 250 of 548

Illustration by Jeremie Fant

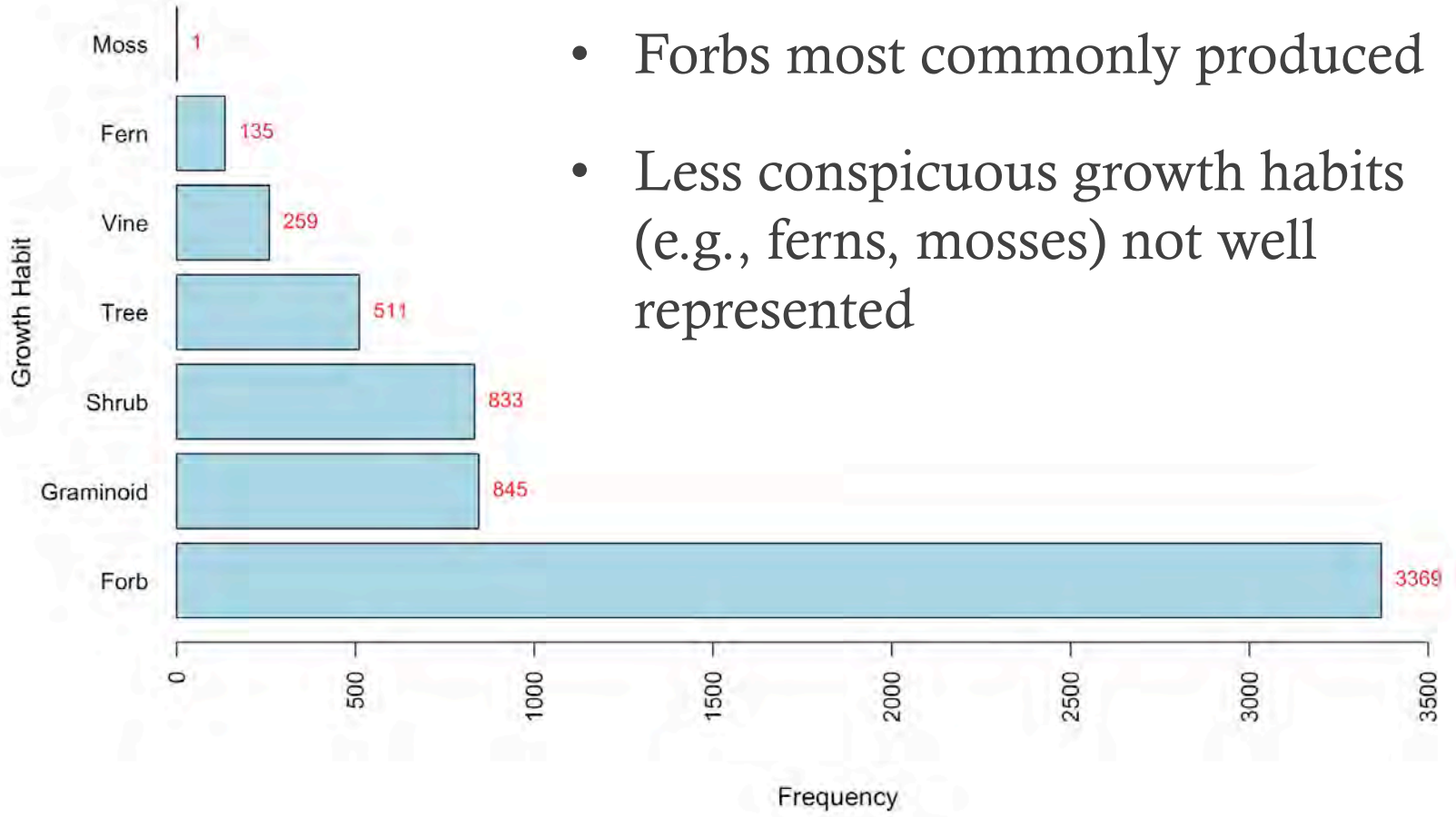
Thistles and Milkweeds

http://www.kansasnativeplants.com/

- 7 species of *Cirsium*
  - Cirsium discolor
  - Cirsium undulatum
  - Cirsium nuttallii
  - Cirsium texanum
  - Cirsium occidentale var. venustum
  - Cirsium horridulum var. horridulum
  - Cirsium hordilulum var. vittatum
- Only represented 20 times in the dataset…

- 34 species of *Asclepias*
  - Asclepias syriaca
  - Asclepias incarnata
  - Asclepias hallii
  - Asclepias lanuginosa*
  - Asclepias fascicularis (weed)
- Represented >1,000 times in the dataset

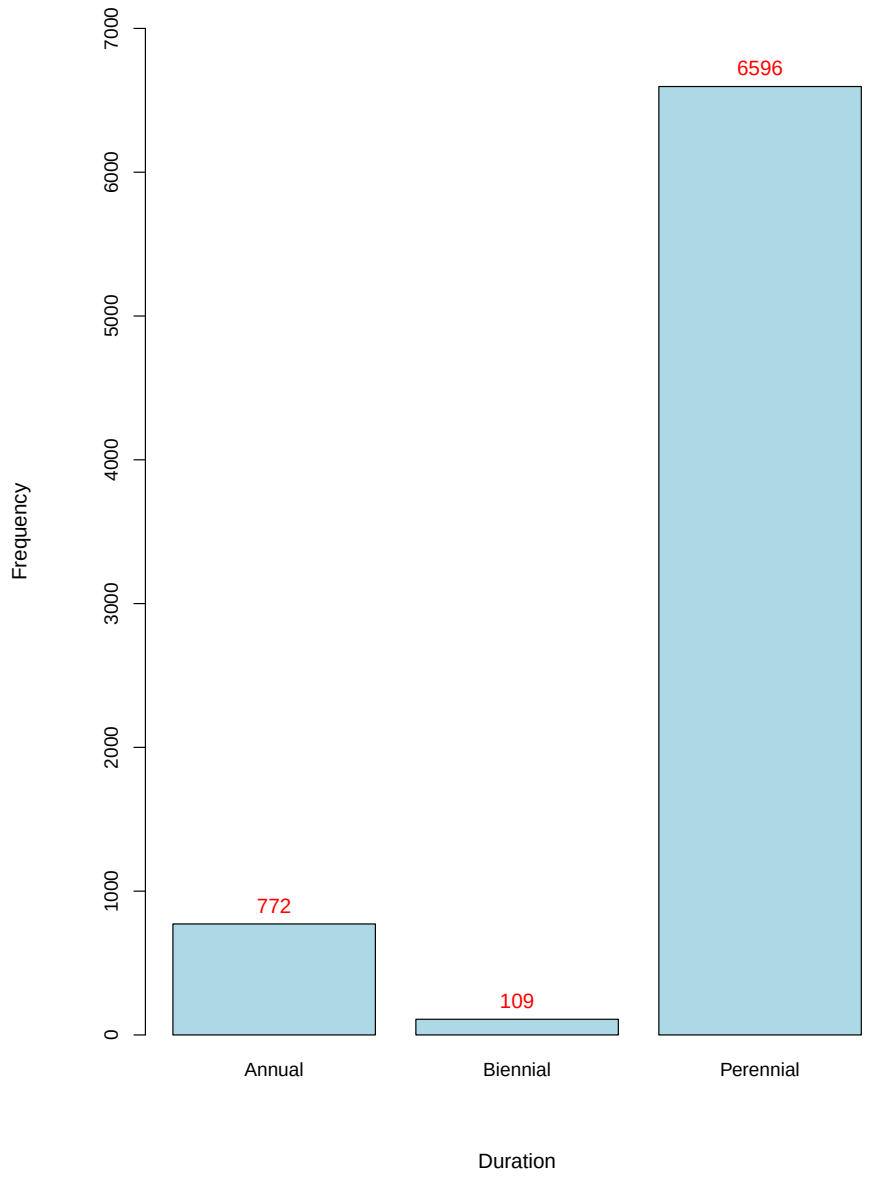
Growth Habits



- Forbs most commonly produced
- Less conspicuous growth habits (e.g., ferns, mosses) not well represented

Figure 1. Frequencies of commercially available growth habits (actual values in red).

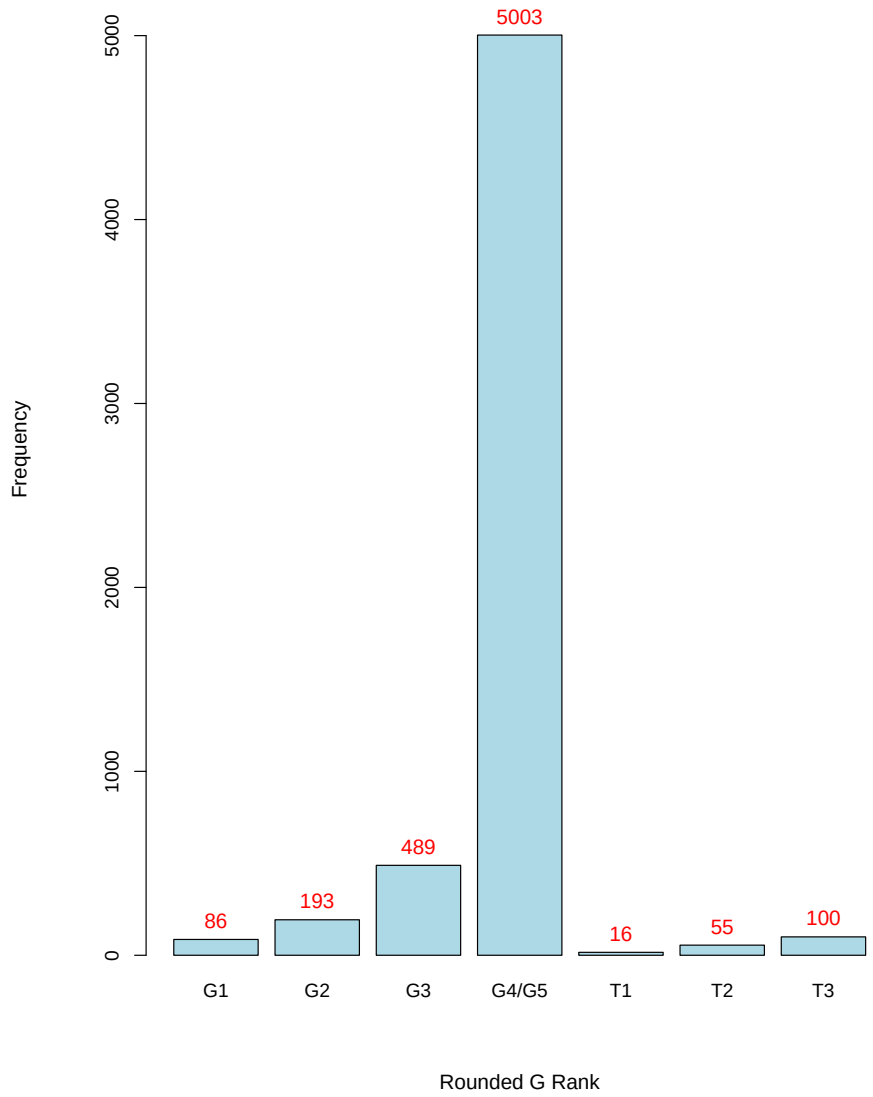
Duration



- Preference for perennial species

Figure 2. Frequencies of commercially available annuals, biennials, and perennials (actual values in red).

Conservation Ranks



- Vulnerable species underrepresented
- More imperiled and critically imperiled species than expected
- Only 5,003 of the 16,584 total species are secure/common native species (G4/G5)

Figure 3. Frequencies of commercially available species by conservation rank (actual values in red).

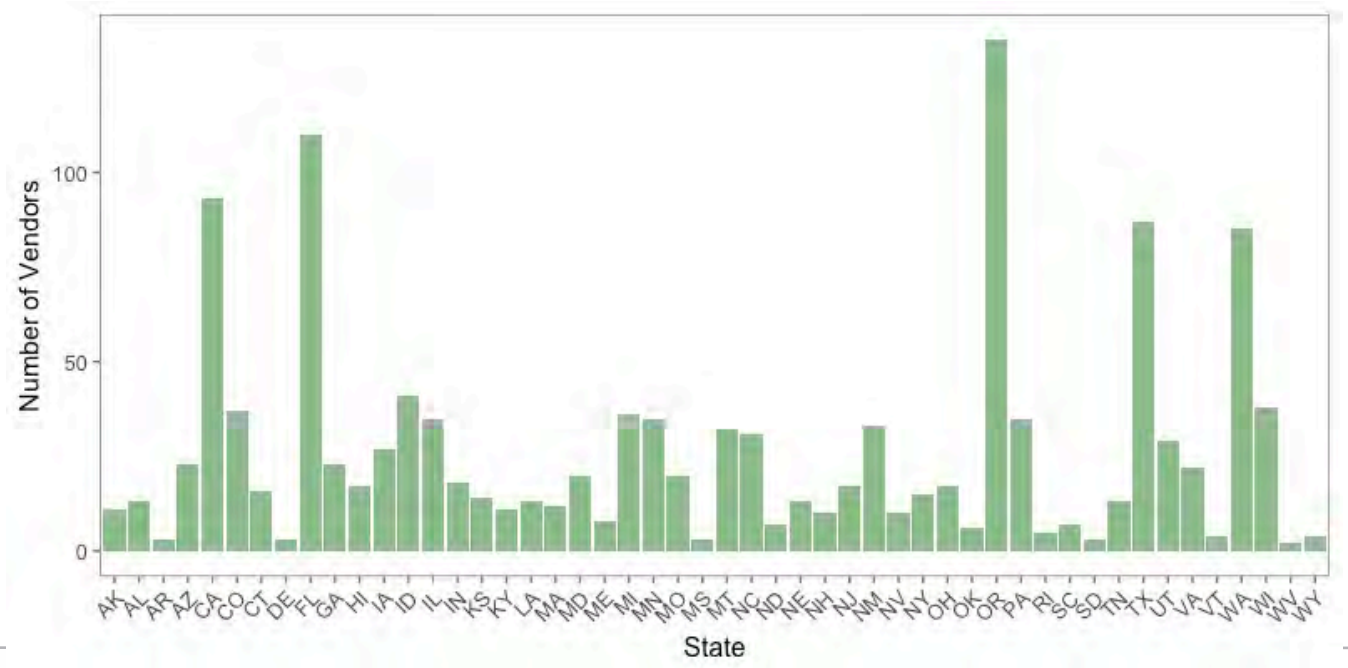
Production Details

Action	No. of Vendors
Continuous nursery propagation	529
Periodic wild collection	97
Purchased elsewhere	28
Local ecotypes	51
Genetic engineering	3

- This is a crude assessment
- Predominately continuous nursery propagation

Geography

Region	Number of Vendors
West	523
Central	411
East	341
Hawaii and Alaska	28



Implications

- On track, but room for growth
- Increase diversity of available species
  - No. of natives, less "popular" growth habits, certain families, vulnerable species
- Research: Best production strategies for new species
  - Species biology
- Local material/genetic diversity

Future Work

- Endless possibilities for ways to look at this data
  - Currently in the beginning stages
  - Analyze by region, ecoregion, etc.
- Distribute the data to make it as useful as possible
- Update directories

Acknowledgements

- Andrea Kramer, Jeremie Fant, and Kay Havens
- Mark Skinner and Matt Horning
- Laura Steger, Grace Guarraia, and Marina Malone
- Members of the Kramer/Havens lab group
- Vendors that sent species lists via email

CHICAGO BOTANIC GARDEN

NORTHWESTERN UNIVERSITY

The preceding presentation was delivered at the

2017 National Native Seed Conference

Washington, D.C. February 13-16, 2017

This and additional presentations available at http://nativeseed.info

NATIVE SEED NETWORK

Institute for Applied Ecology