Looking to BLM Seeds of Success as a Model and Partner to Secure Native Crop Wild Relatives

SEEDS OF SUCCESS

USDA United States Department of Agriculture
Agricultural Research Service

Stephanie Greene, Colin Khoury, Karen Williams, Chrystian Sosa

National Native Seed Conference, Washington D.C., February 16, 2017

Outline

I. USDA gene bank- conserving & distributing biodiversity to support food security

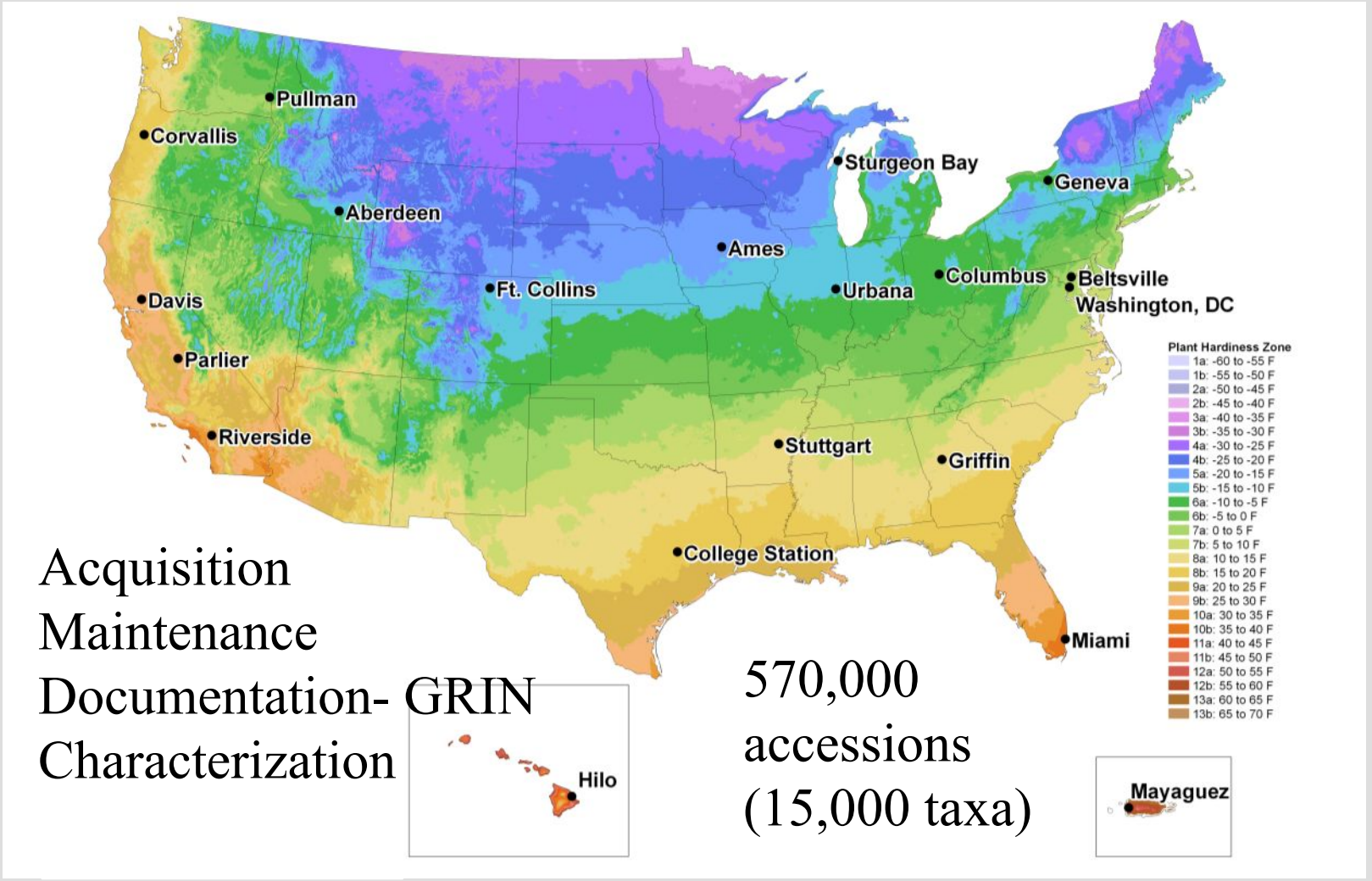
II. Partnering with BLM SOS- supporting restoration

III. Emerging concern- securing crop wild relatives- what are they and why care about them?

IV. Collateral benefit- SOS acquisition of CWR

V. Implementing the National Seed Strategy to support food security

USDA- ARS Gene Bank (National Plant Germplasm System)

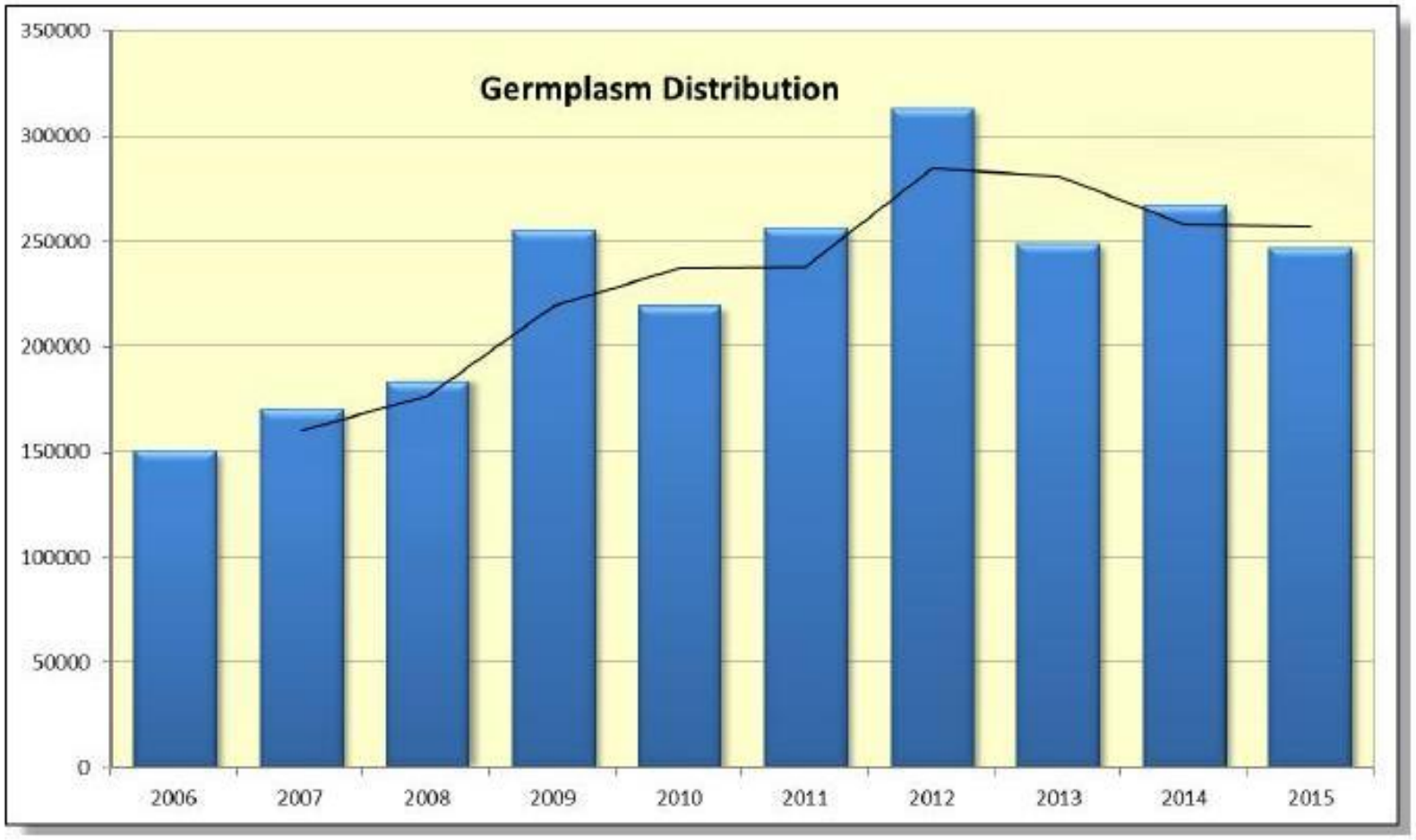


Acquisition
Maintenance
Documentation- GRIN
Characterization

570,000 accessions (15,000 taxa)

Demand for NPGS Germplasm

2006-2015



Research ~ Education ~ Breeding

Flow of SOS Germplasm into NPGS

Login for returning member. Don't have an online profile? Register Now

No items in cart

U.S. National Plant Germplasm System

About NPGS | Contact Us

Accessions | Descriptors | GRIN Taxonomy | View Cart | Reports | My Profile | About GRIN-Global | Help

Ames 31328

Fraxinus anomala Torr. ex S. Watson

>2005
14,000 accessions

Status:	Available
Amt Distributed:	50 count
Type Distributed:	Seed

Add to My Favorites

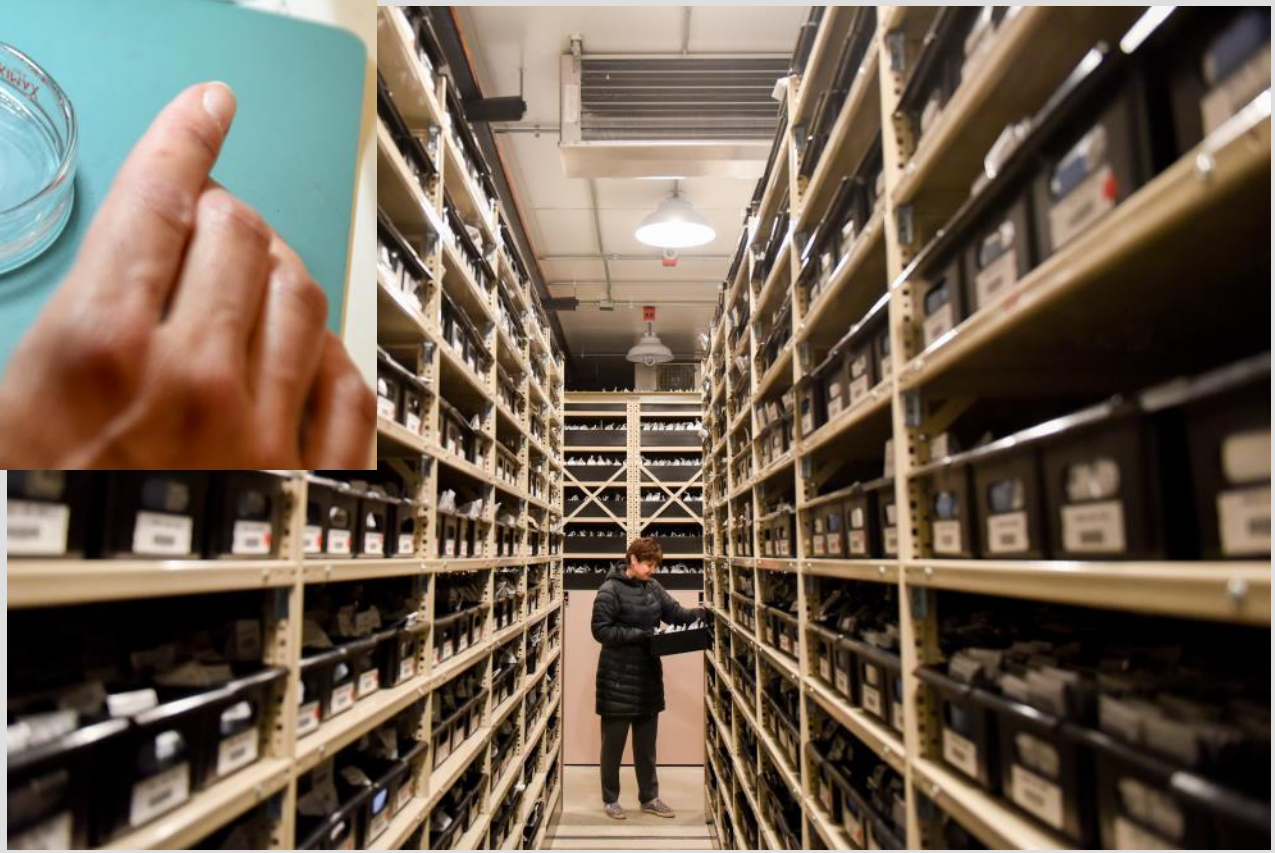
Add to Order

Collected from:	United States
Maintained by:	North Central Regional PI Station
NPGS received:	26-Oct-2007
Backup location:	National Center for Genetic Resources Preservation
Life form:	Tree
Pedigree:	
Improvement status:	Wild material
Reproductive uniformity:	
Form received:	Seed

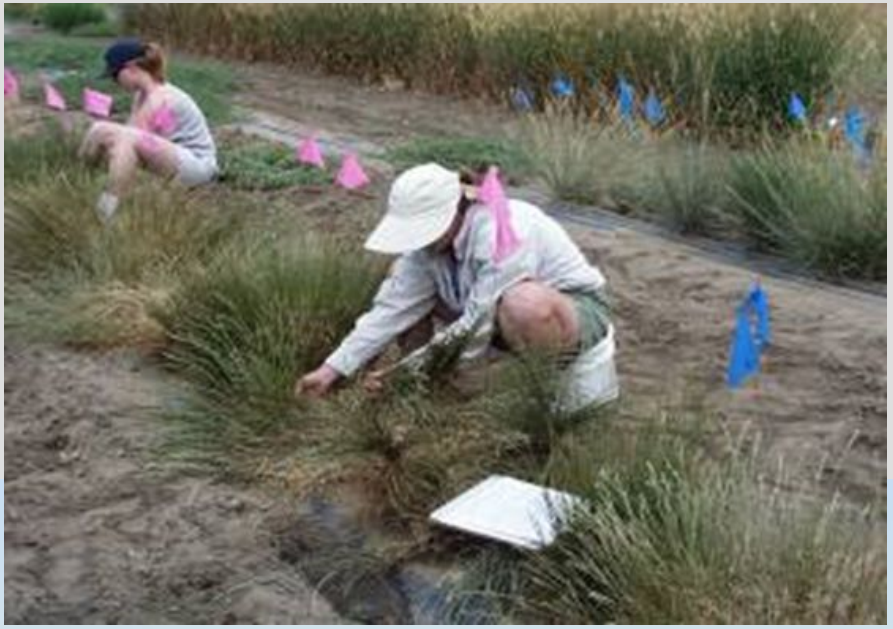
Pullman, WA clearinghouse
(Vicki.Bradley@ars.usda.gov)

Long term secure storage

National Lab Genetic Resources Preservation, Fort Collins, CO

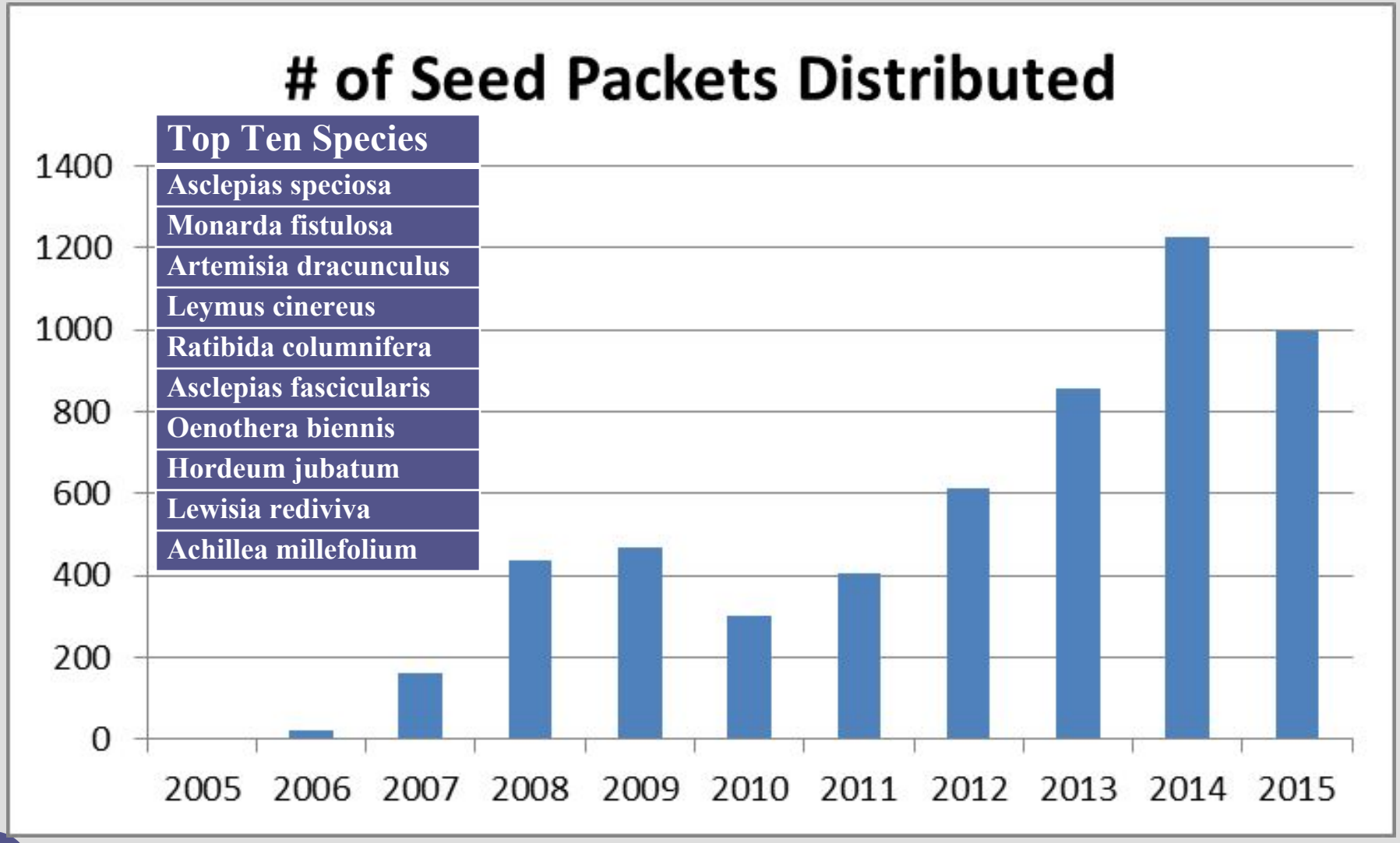


Increase and Characterization

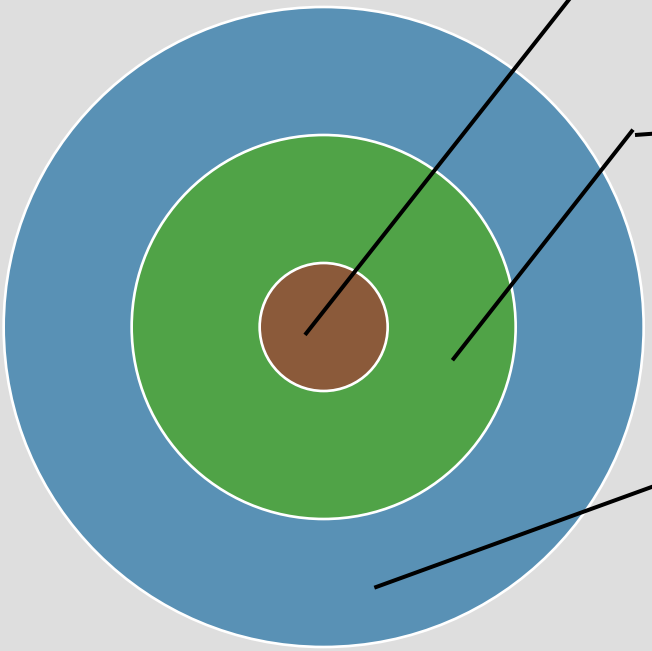


Various NPGS sites around U.S.

Distribution of SOS Seed



Crop wild relative= wild taxon that is genetically close to a crop



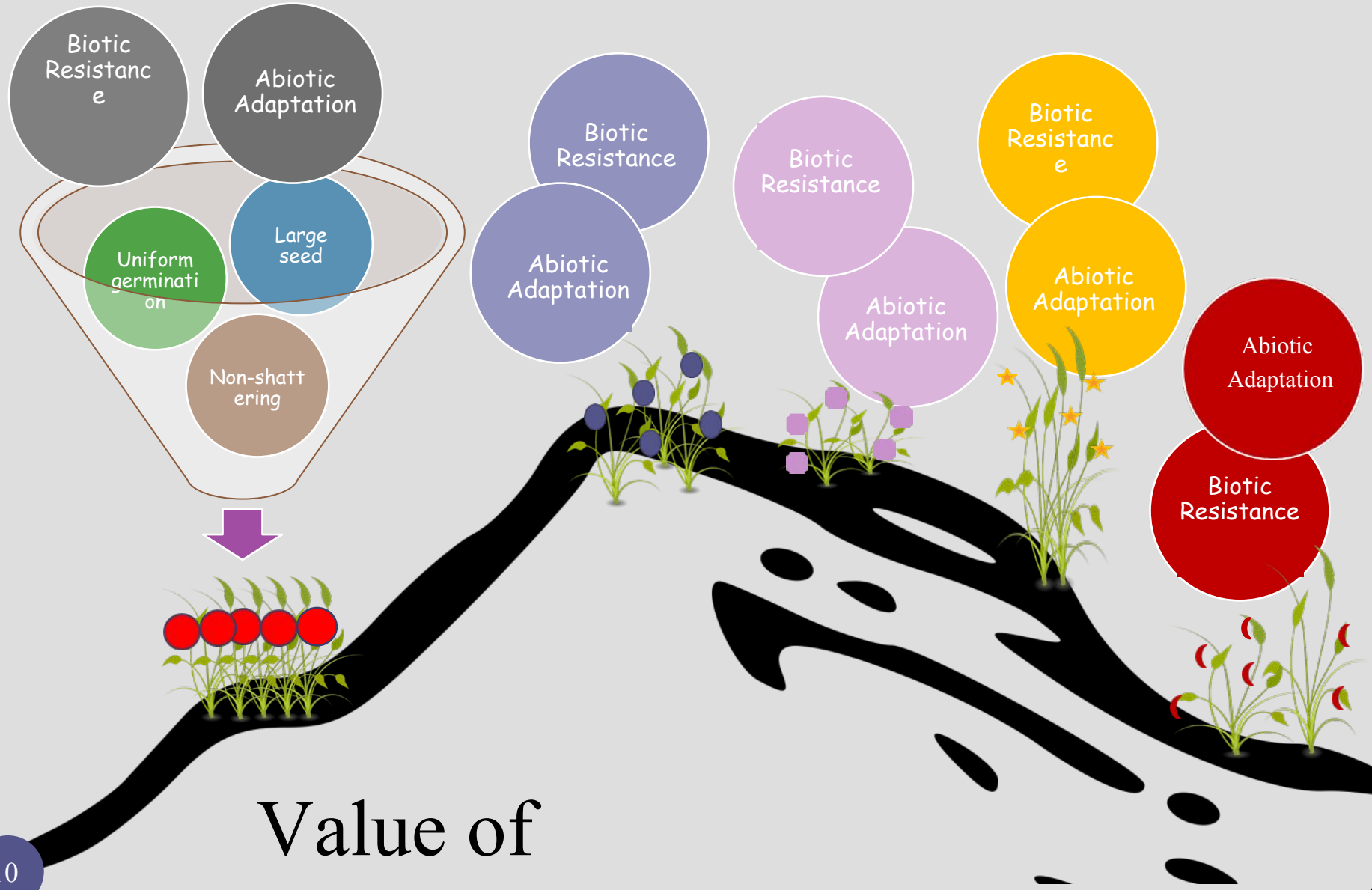
1°-easy to cross wild species with crop species

2°- crossing occurs, but barriers need to be overcome

3°- crossing only occurs with heroic effort

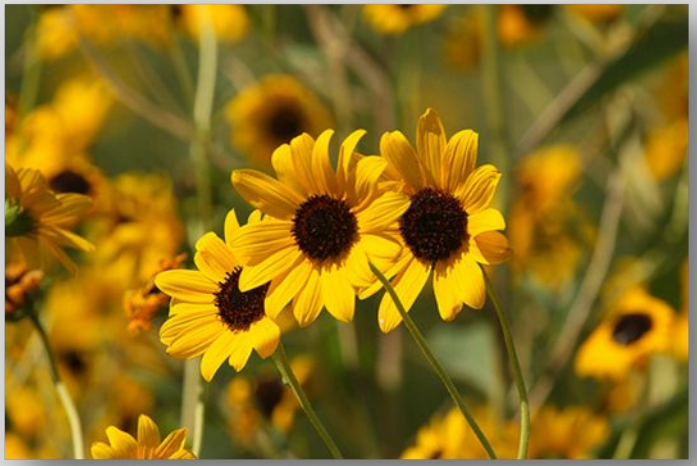
Crop Gene Pool Concept (Harlan and DeWet 1973)

Domestication Reduces Diversity



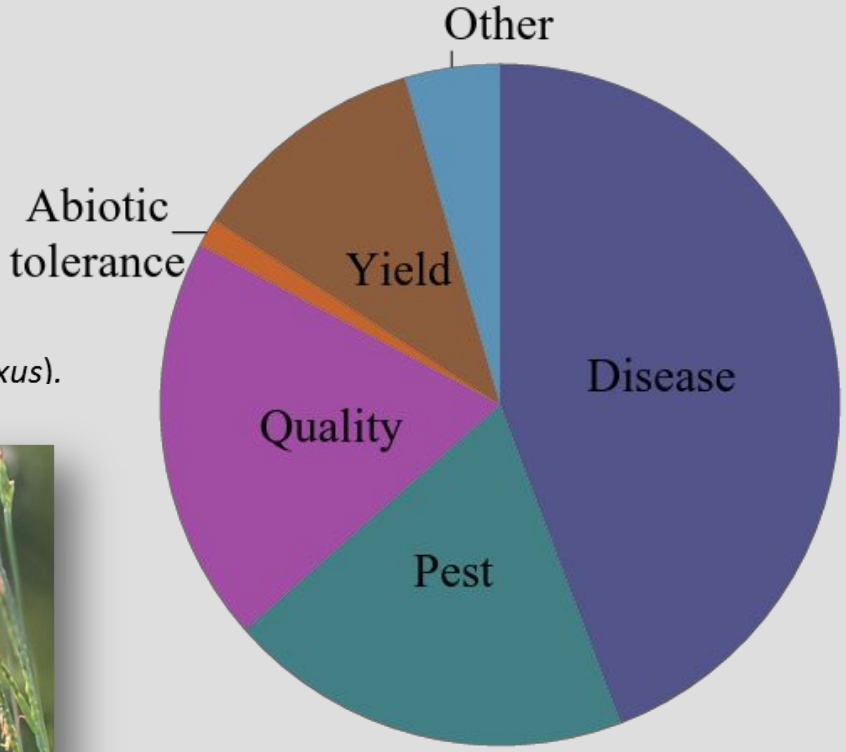
Value of CRW

CWR are Important to Agriculture

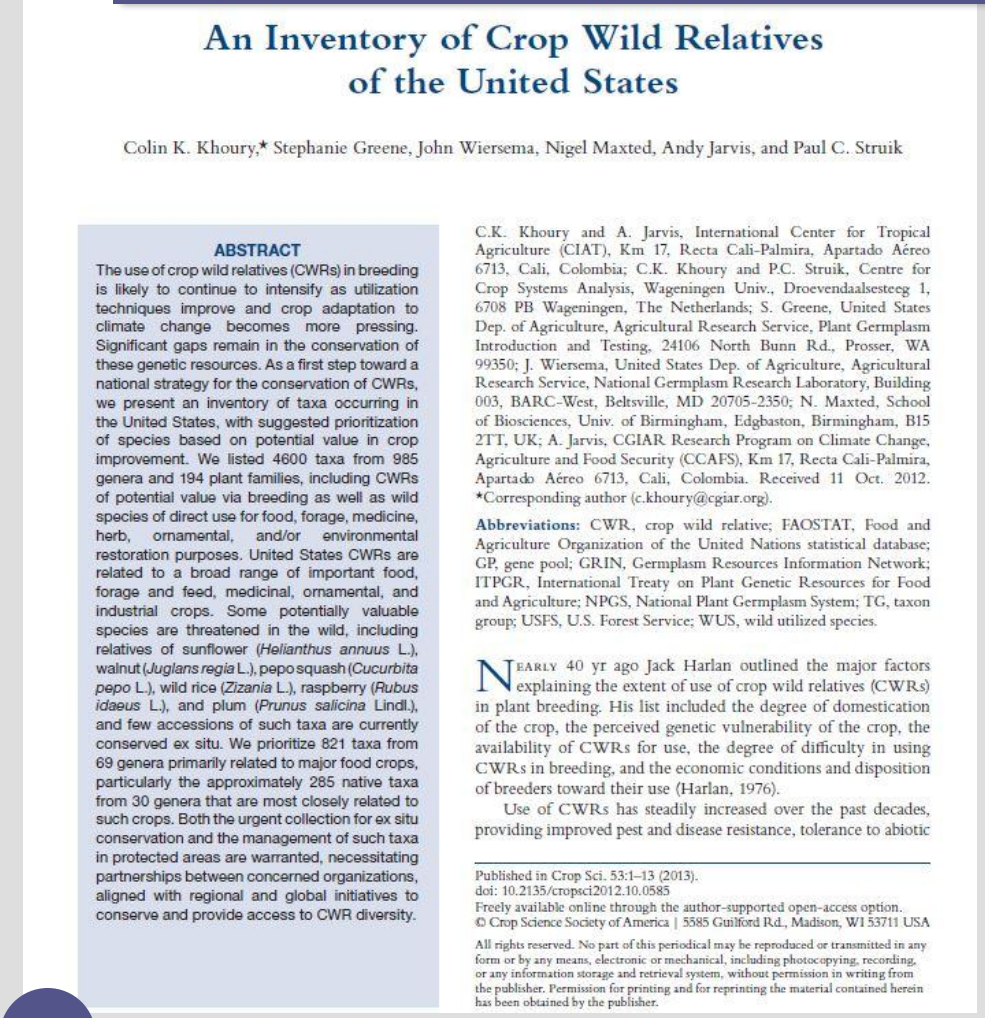


Salinity tolerance from Pecos sunflower (*Helianthus paradoxus*).

Western corn rootworm resistance from Eastern gamagrass (*Tripsacum dactyloides*).



Inventory of Crop Wild Relatives of the U.S.



An Inventory of Crop Wild Relatives of the United States

Colin K. Khoury,* Stephanie Greene, John Wiersema, Nigel Maxted, Andy Jarvis, and Paul C. Struik

ABSTRACT

The use of crop wild relatives (CWRs) in breeding is likely to continue to intensify as utilization techniques improve and crop adaptation to climate change becomes more pressing. Significant gaps remain in the conservation of these genetic resources. As a first step toward a national strategy for the conservation of CWRs, we present an inventory of taxa occurring in the United States, with suggested prioritization of species based on potential value in crop improvement. We listed 4600 taxa from 985 genera and 194 plant families, including CWRs of potential value via breeding as well as wild species of direct use for food, forage, medicine, herb, ornamental, and/or environmental restoration purposes. United States CWRs are related to a broad range of important food, forage and feed, medicinal, ornamental, and industrial crops. Some potentially valuable species are threatened in the wild, including relatives of sunflower (*Helianthus annuus* L.), walnut (*Juglans regia* L.), pepo squash (*Cucurbita pepo* L.), wild rice (*Zizania* L.), raspberry (*Rubus idaeus* L.), and plum (*Prunus salicina* Lindl.), and few accessions of such taxa are currently conserved ex situ. We prioritize 821 taxa from 69 genera primarily related to major food crops, particularly the approximately 285 native taxa from 30 genera that are most closely related to such crops. Both the urgent collection for ex situ conservation and the management of such taxa in protected areas are warranted, necessitating partnerships between concerned organizations, aligned with regional and global initiatives to conserve and provide access to CWR diversity.

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Abbreviations: CWR, crop wild relative; FAOSTAT, Food and Agriculture Organization of the United Nations statistical database; GP, gene pool; GRIN, Germplasm Resources Information Network; ITPGR, International Treaty on Plant Genetic Resources for Food and Agriculture; NPGS, National Plant Germplasm System; TG, taxon group; USFS, U.S. Forest Service; WUS, wild utilized species.

Nearly 40 yr ago Jack Harlan outlined the major factors explaining the extent of use of crop wild relatives (CWRs) in plant breeding. His list included the degree of domestication of the crop, the perceived genetic vulnerability of the crop, the availability of CWRs for use, the degree of difficulty in using CWRs in breeding, and the economic conditions and disposition of breeders toward their use (Harlan, 1976).

Use of CWRs has steadily increased over the past decades, providing improved pest and disease resistance, tolerance to abiotic

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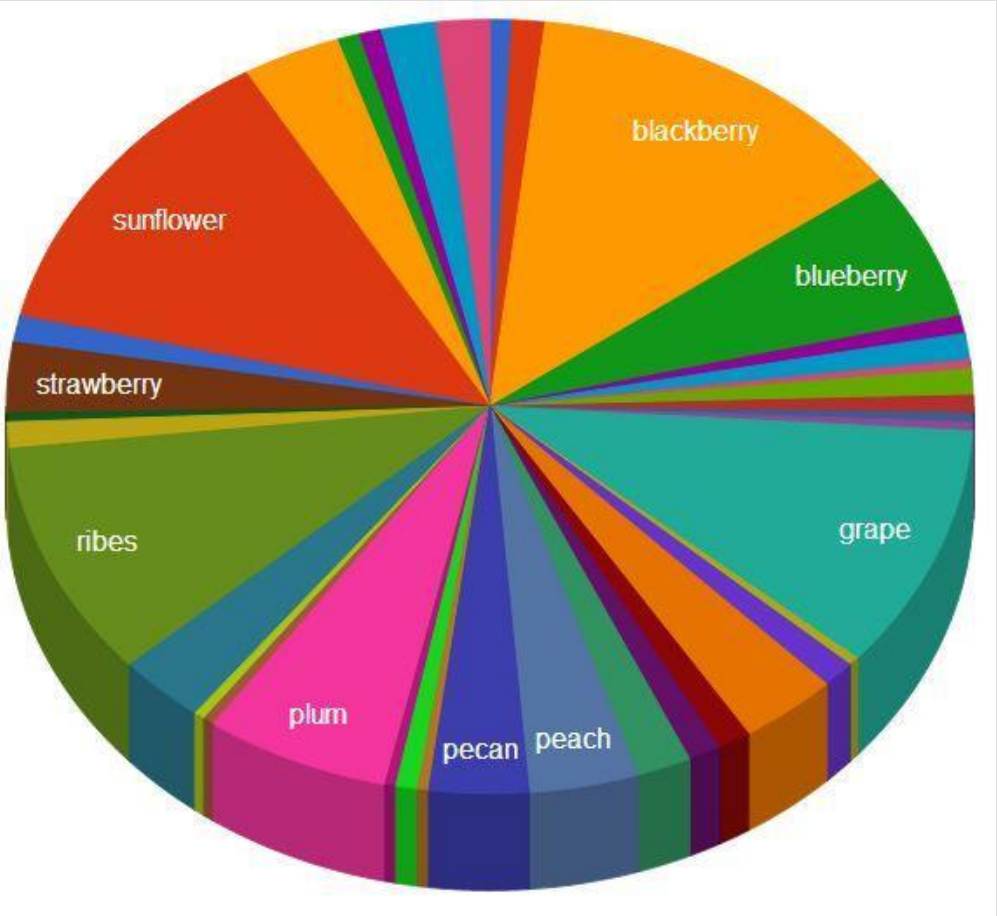
Freely available online through the author-supported open-access option.

- Utilized and potentially useful taxa, native and naturalized
- 4,600 taxa
- Relatives of major food crops + iconic wild food crops (e.g. sugar maple, wild rice, pecan)
- 250 native, close relatives of 38 important food crops = highest priority

Crop Science 53(4): 1496

Highest Priority Crop Wild Relatives

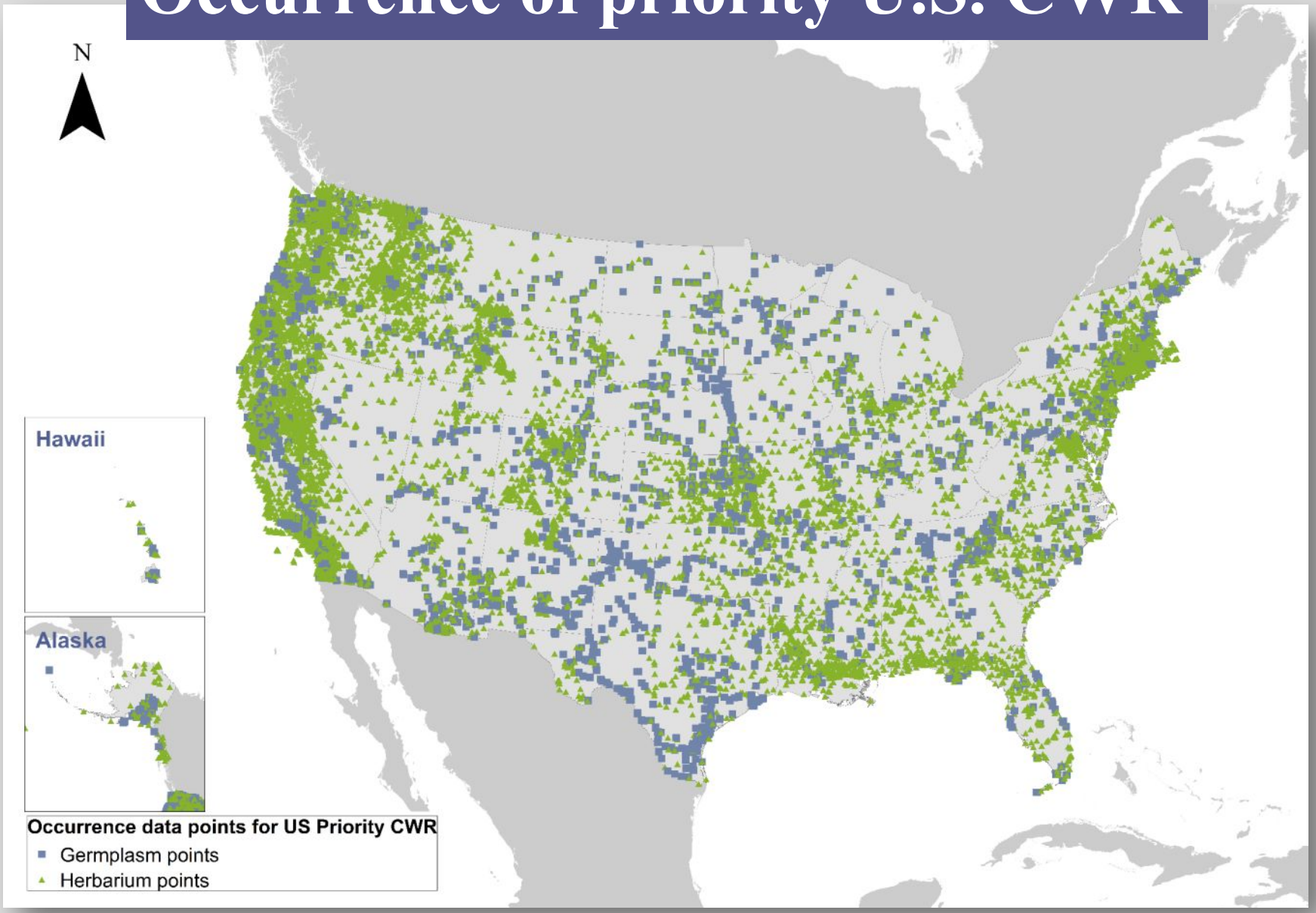
Crop	CWR species
apricot	2
beet	3
blackberry	36
blueberry	17
cherry	2
chestnut	3
chives	1
cotton	3
cranberry	2
fig	1
garlic	1
grape	28
guava	1
hazelnut	3
lettuce	9
lingonberry	3
maize	3
mate	5
peach	10
pecan	9
pepper	1
persimmon	2
pistachio	1
plum	17
potato	1
ramp	1
raspberry	8
ribes	27
squash	3
star anise	1
strawberry	8
sugar maple	3
sunflower	35
sweet potato	9
tepary bean	2
vanilla	2
walnut	5
wild rice	5



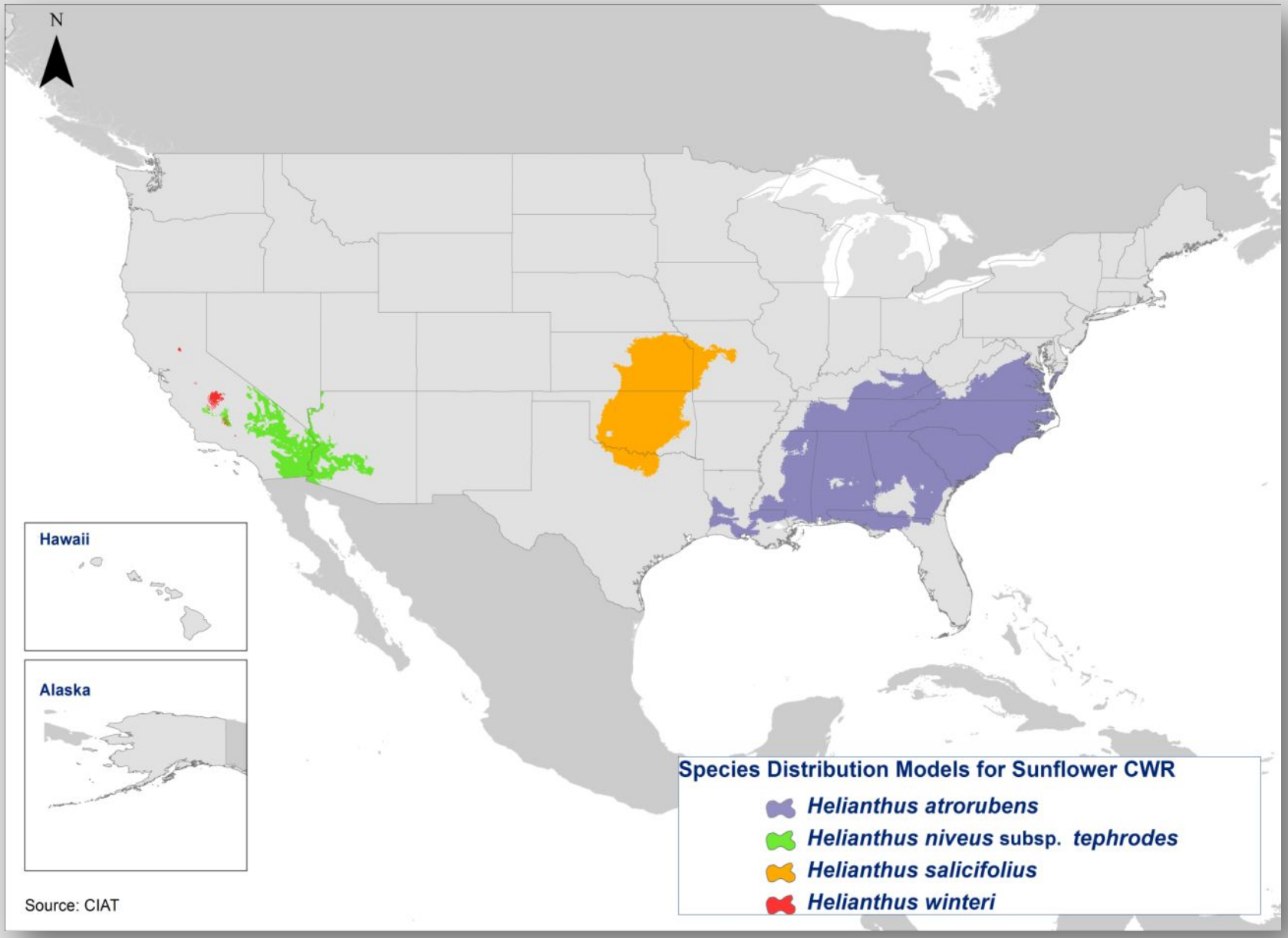
Global hotspots for under-represented CWR

Castañeda-Álvarez *et al*. (2016) *Nature Plants* 2(4): 16022

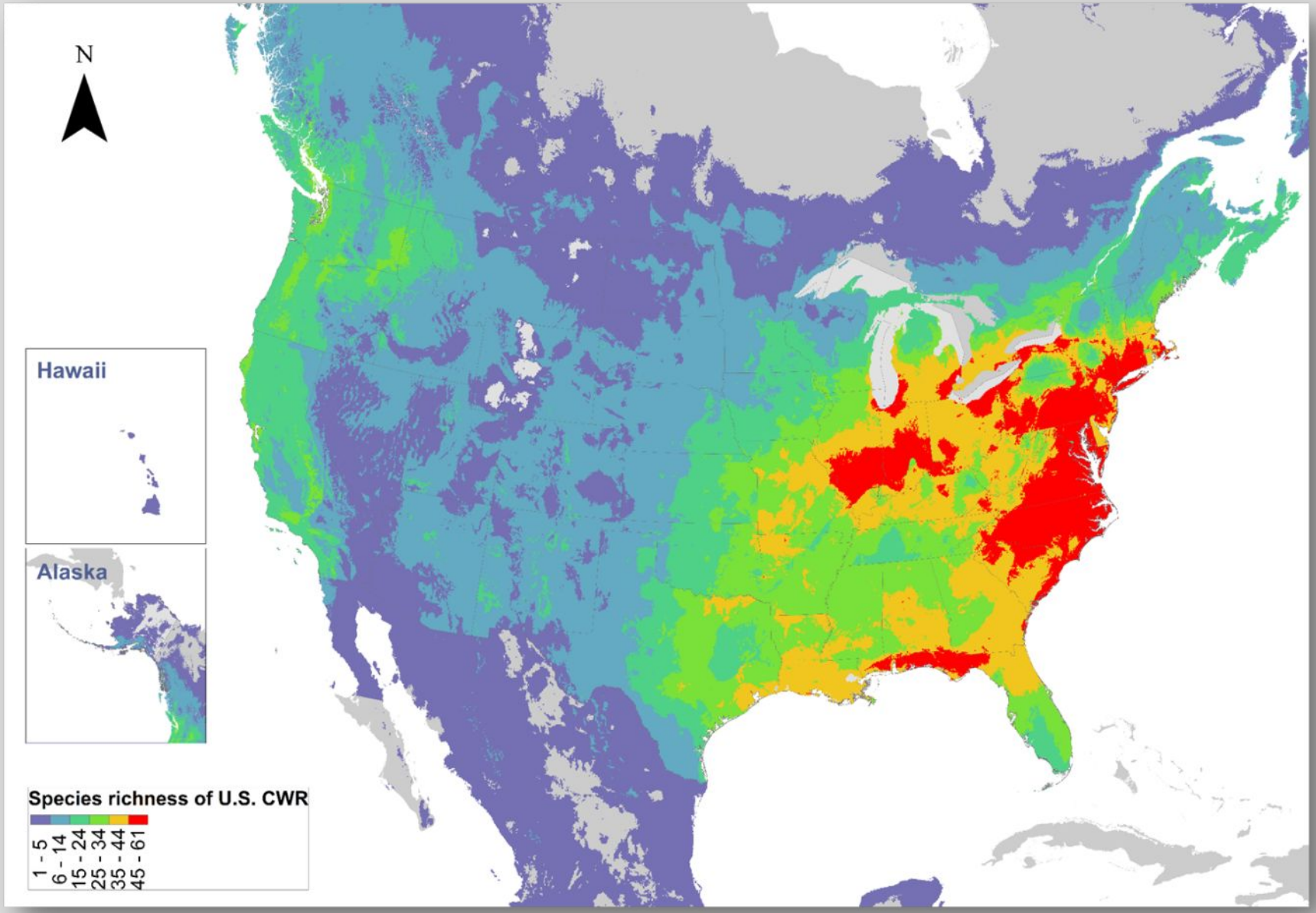
Occurrence of priority U.S. CWR



Modeling CWR species distribution



CWR Hotspots

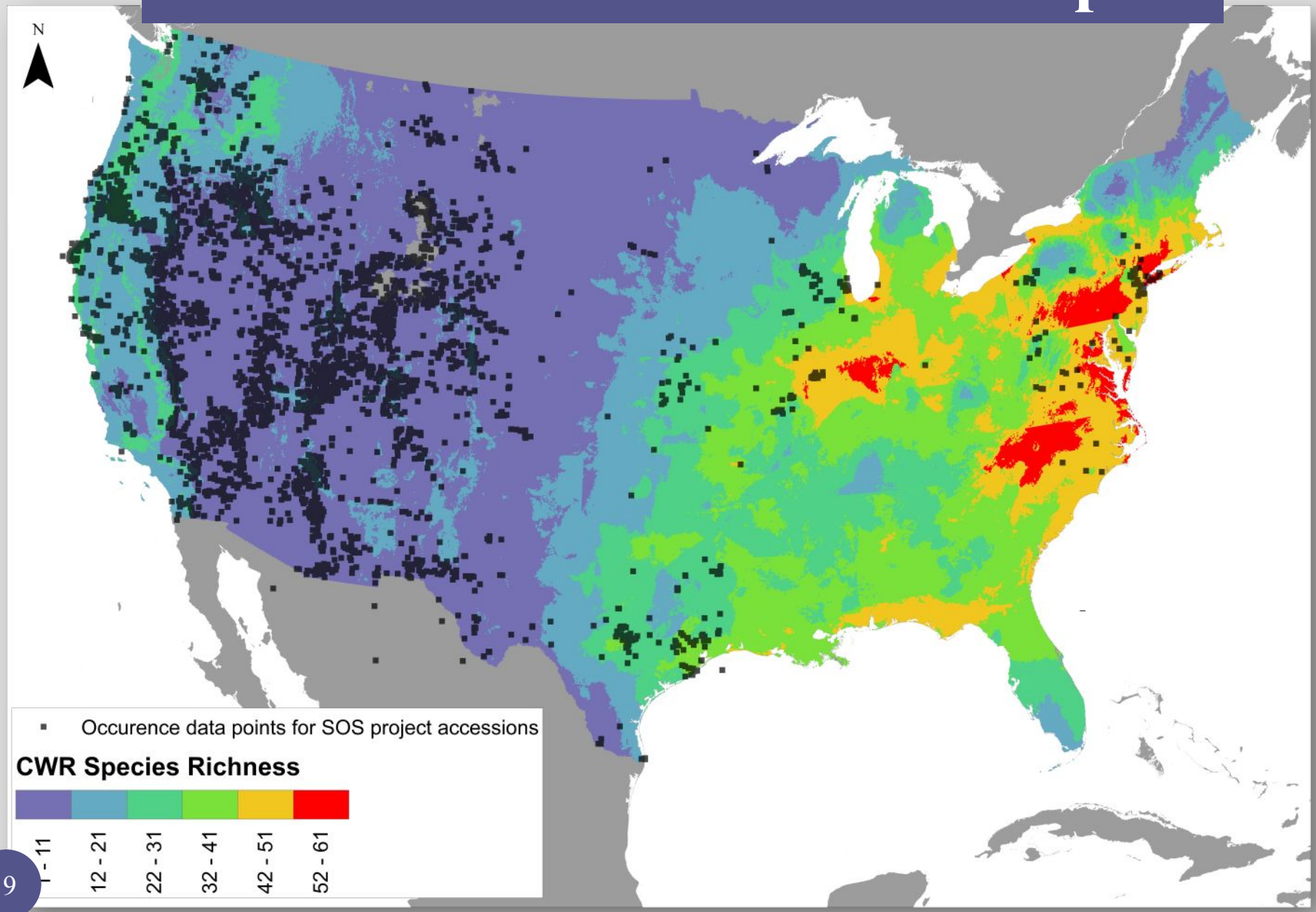


CWR collected by SOS efforts

- 7020 accessions (1336 taxa) listed in the U.S. inventory and used for restoration purposes
- 2357 accessions (486 taxa) are CWR related to food, fiber, forage and industrial crops
  - 706 accessions(146 taxa)- close CWR of major crops
  - 92 accessions (39 taxa)- very close CWR of major crops



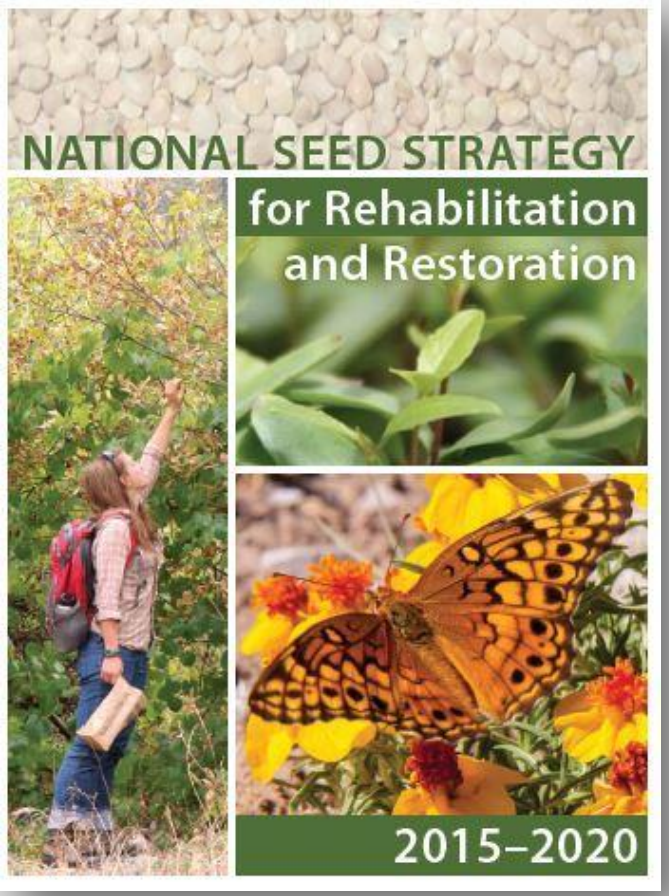
SOS collections and CWR hotspots



Mobilizing Efforts to Secure CWR

- NPGS exploration grants support U.S. CWR collecting
- Forest Service\ARS Framework on Conservation and Use of CWR
    - FS/ARS joint project: conservation of wild cranberry
- BLM SOS- expand acquisition priorities to include CWR- especially in the eastern US


Forest and Kim Star



Action 1.3.4 Expand collection, conservation, and assessment of native plant genetic resources for use now and into the future through Seeds of Success and other complementary efforts.

GUIDING VALUES AND PRINCIPLES

And Food Security!

- Native plants, including crop wild relatives, contain unique properties, and the full benefit of these may not yet be recognized but should be preserved for future generations.

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Unless otherwise noted plant photos from www.plantsystematics.org

The preceding presentation was delivered at the

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

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

NATIVE SEED NETWORK

Institute for Applied Ecology