

# Distributions and collecting priorities for crop wild relatives in the United States

Colin K. Khoury, Stephanie L. Greene, Karen A. Williams, & Chrystian C. Sosa



2017 National Native Seed Conference

14 February 2017

Washington, D.C.



# Crop wild relatives are wild and weedy cousins



# Crop wild relatives are in the news



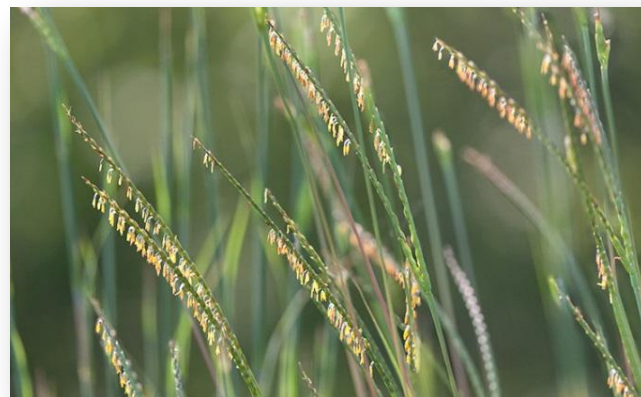
# Crop wild relatives are valuable genetic resources



Salinity tolerance from Pecos sunflower  
(*Helianthus paradoxus*)



Eastern filbert blight resistance from  
American filbert (*Corylus americana*)



Western corn rootworm resistance from  
eastern gama grass (*Tripsacum dactyloides*)



Rootstock from northern California  
walnut (*Juglans hindsii*)

# Crop wild relatives are threatened wild plants



Listing Status: **Endangered**  
Where Listed: **WHEREVER FOUND**

Okeechobee gourd (*Cucurbita okeechobeensis* subsp. *okeechobeensis*)



Listing Status: **Threatened**  
Where Listed: **WHEREVER FOUND**

Pecos sunflower (*Helianthus paradoxus*)



Listing Status: **Endangered**  
Where Listed: **WHEREVER FOUND**

Texas wild rice (*Zizania texana*)



Listing Status: **Endangered**  
Where Listed: **WHEREVER FOUND**

Scrub plum (*Prunus geniculata*)

# Inventory of crop wild relatives of the U.S.

RESEARCH

## 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.

C.K. Khoury and A. Jarvis, International Center for Tropical Agriculture (CIAT), Km 17, Recta Cali-Palmira, Apartado Aéreo 6713, Cali, Colombia; C.K. Khoury and P.C. Struik, Centre for Crop Systems Analysis, Wageningen Univ., Droeendaalsesteeg 1, 6708 PB Wageningen, The Netherlands; S. Greene, United States Dep. of Agriculture, Agricultural Research Service, Plant Germplasm Introduction and Testing, 24106 North Bunn Rd., Prosser, WA 99350; J. Wiersema, United States Dep. of Agriculture, Agricultural Research Service, National Germplasm Research Laboratory, Building 003, BARC-West, Beltsville, MD 20705-2350; N. Maxted, School of Biosciences, Univ. of Birmingham, Edgbaston, Birmingham, B15 2TT, UK; A. Jarvis, CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Km 17, Recta Cali-Palmira, Apartado Aéreo 6713, Cali, Colombia. Received 11 Oct. 2012. \*Corresponding author (c.khoury@cgiar.org).

**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.

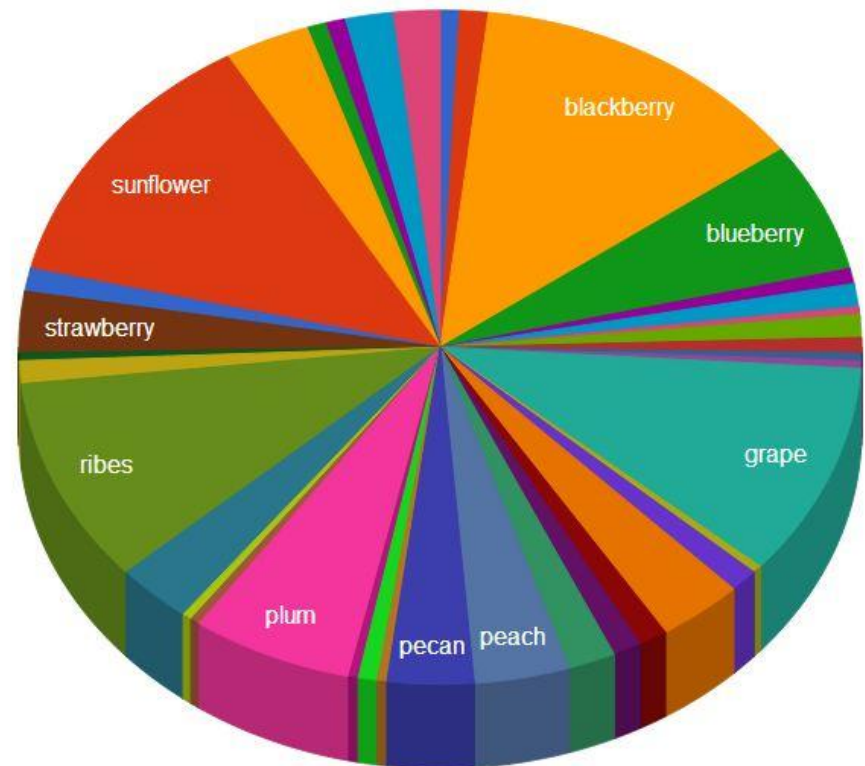
N EARLY 40 yr ago Jack Harlan outlined the major factors explaining the extent of use of crop wild relatives (CWRs) in plant breeding. His list included the degree of domestication of the crop, the perceived genetic vulnerability of the crop, the availability of CWRs for use, the degree of difficulty 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

Published in *Crop Sci.* 53:1–13 (2013).  
doi: 10.2135/cropsci2012.10.0585

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# Gap analysis

Choose species and area



Make conservation recommendations

Gather occurrence data

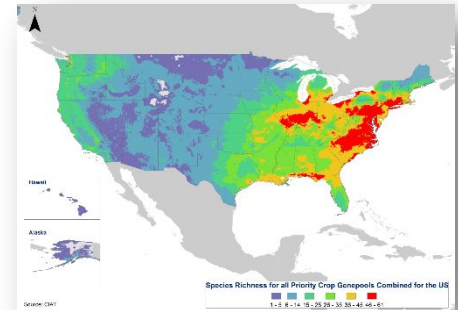
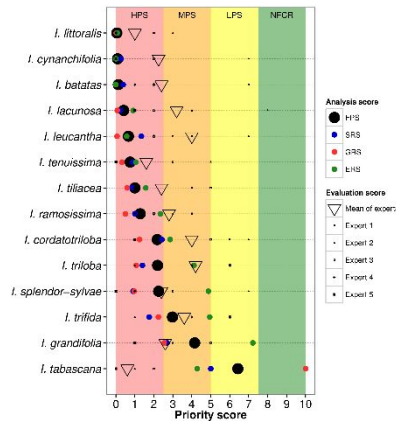
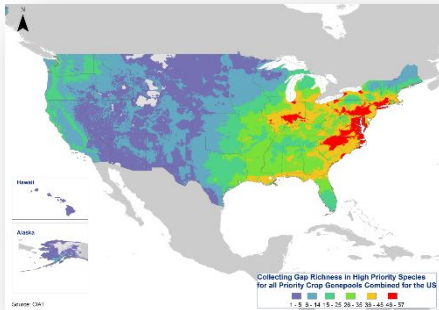


Determine gaps in conservation

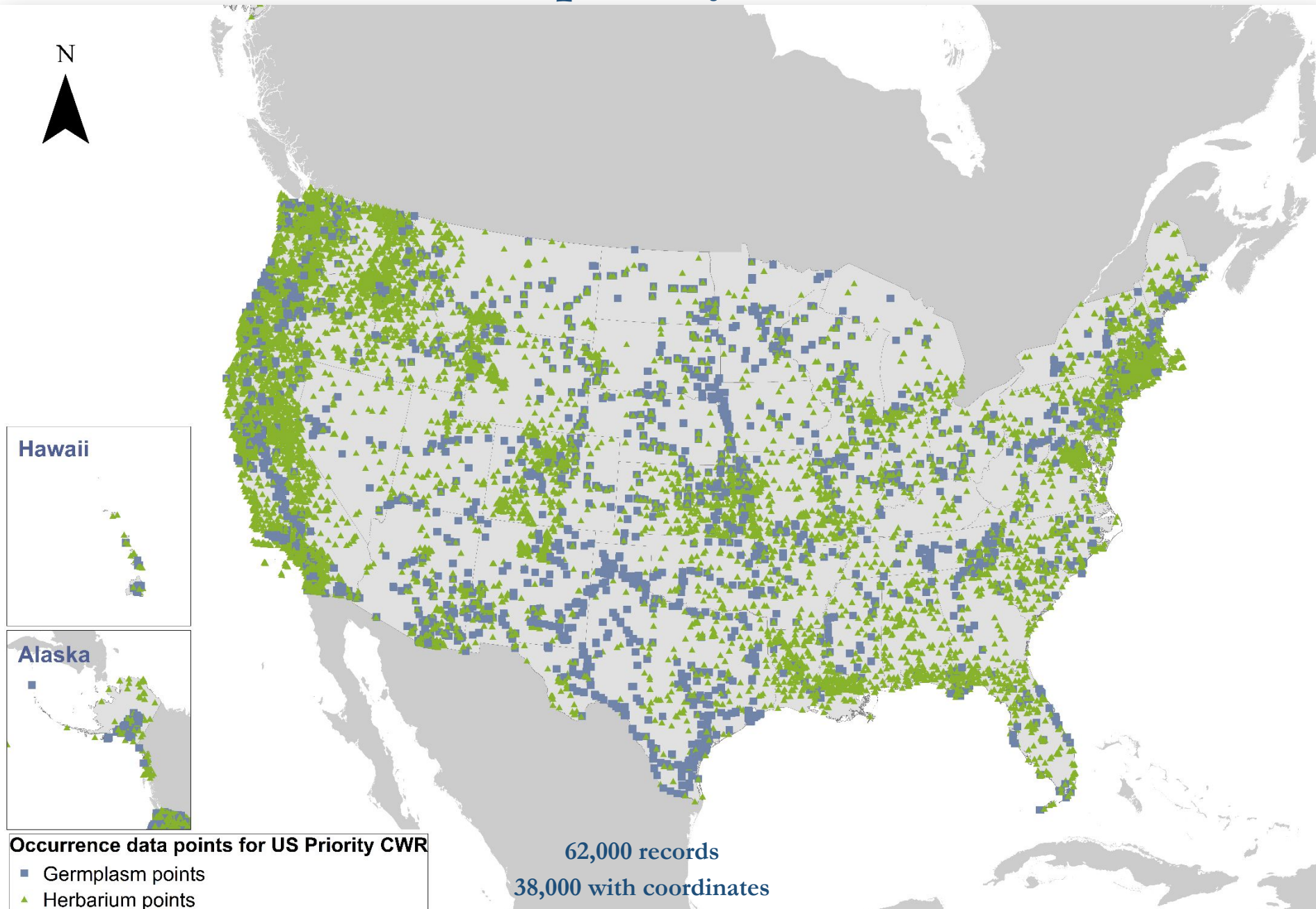
Process data



Model distributions

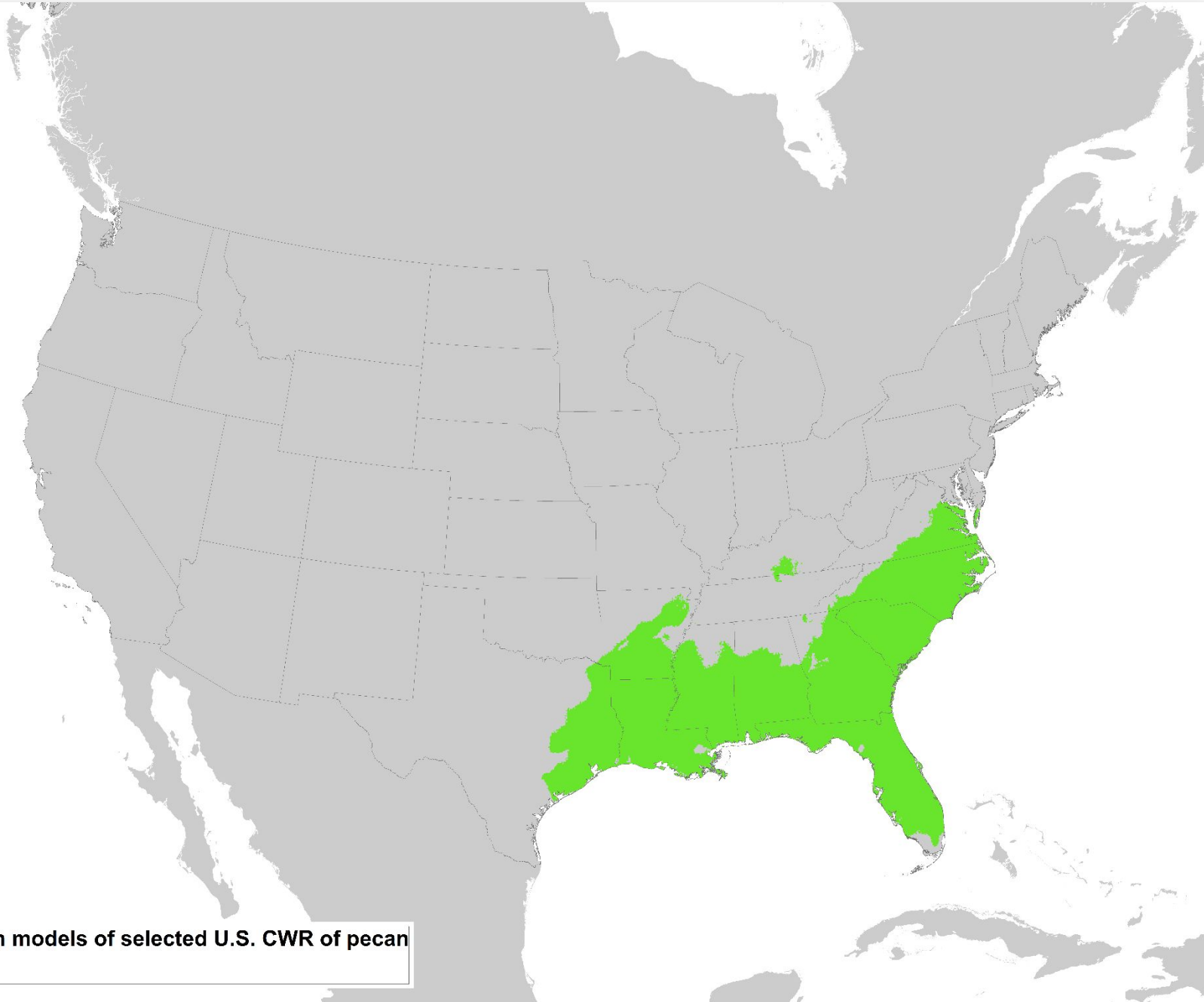


# Distributions of priority CWR in the U.S.





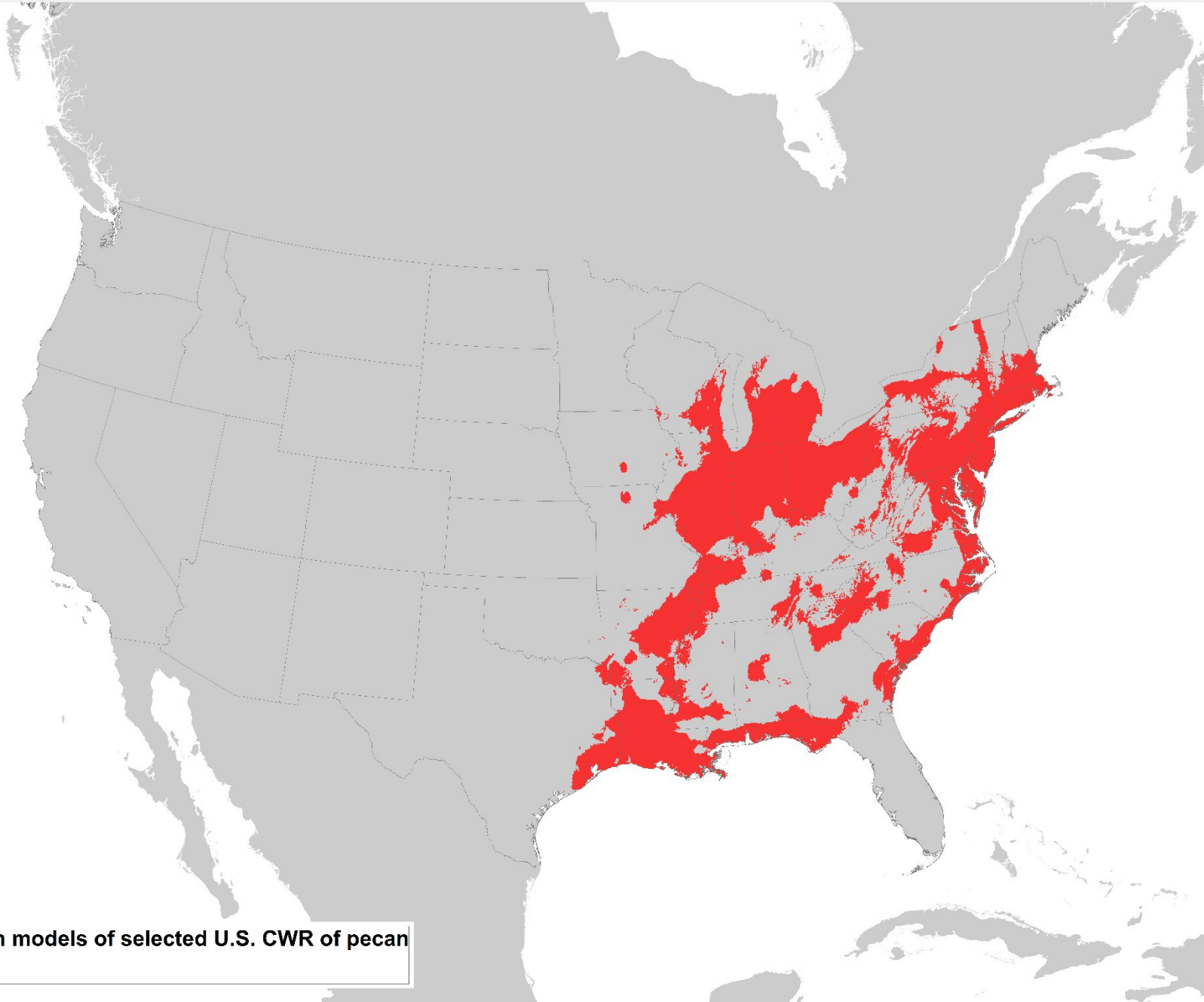
# Potential distributions of priority CWR in the U.S.




Potential distribution models of selected U.S. CWR of pecan

 *Carya aquatica*

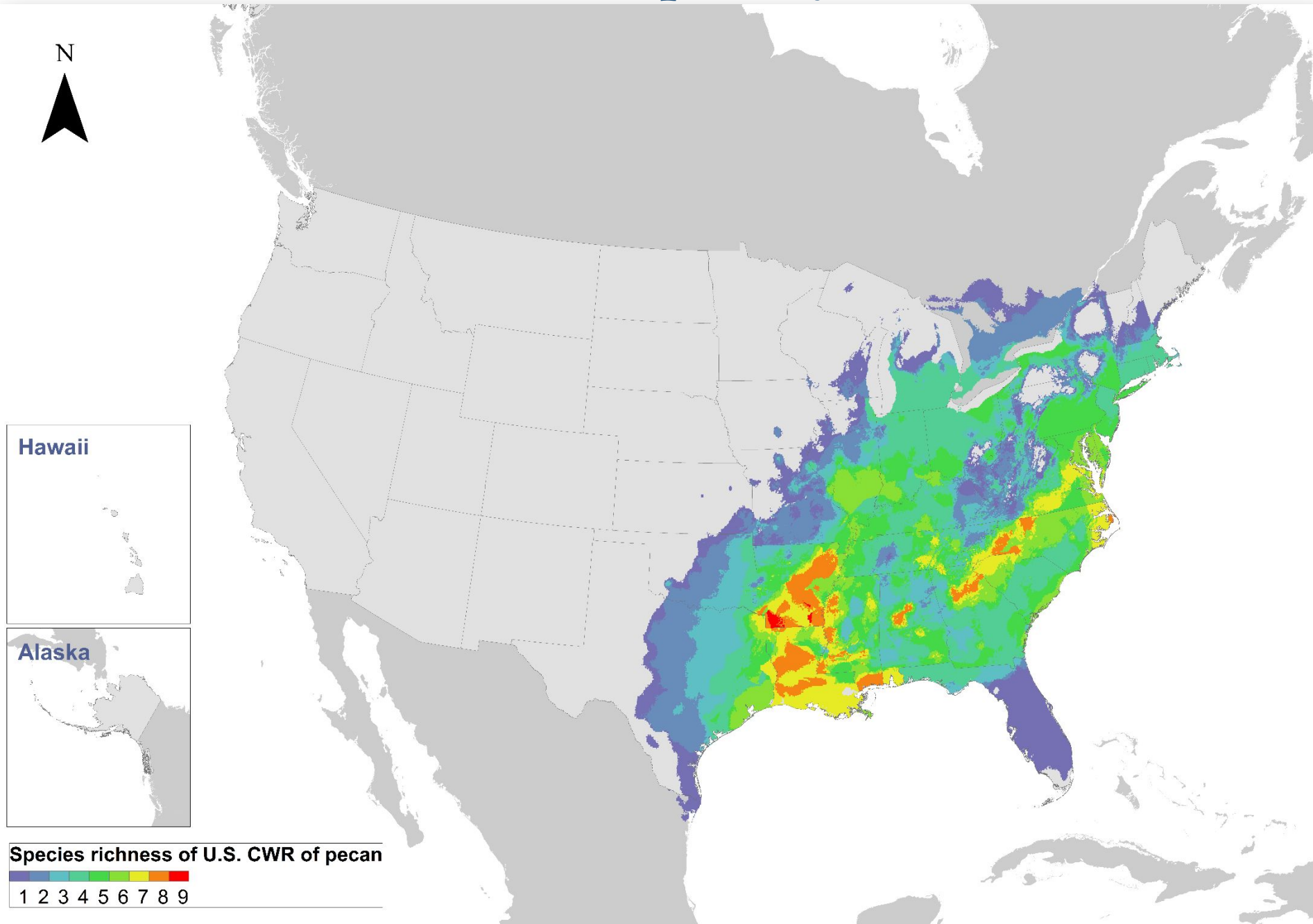
# Potential distributions of priority CWR in the U.S.



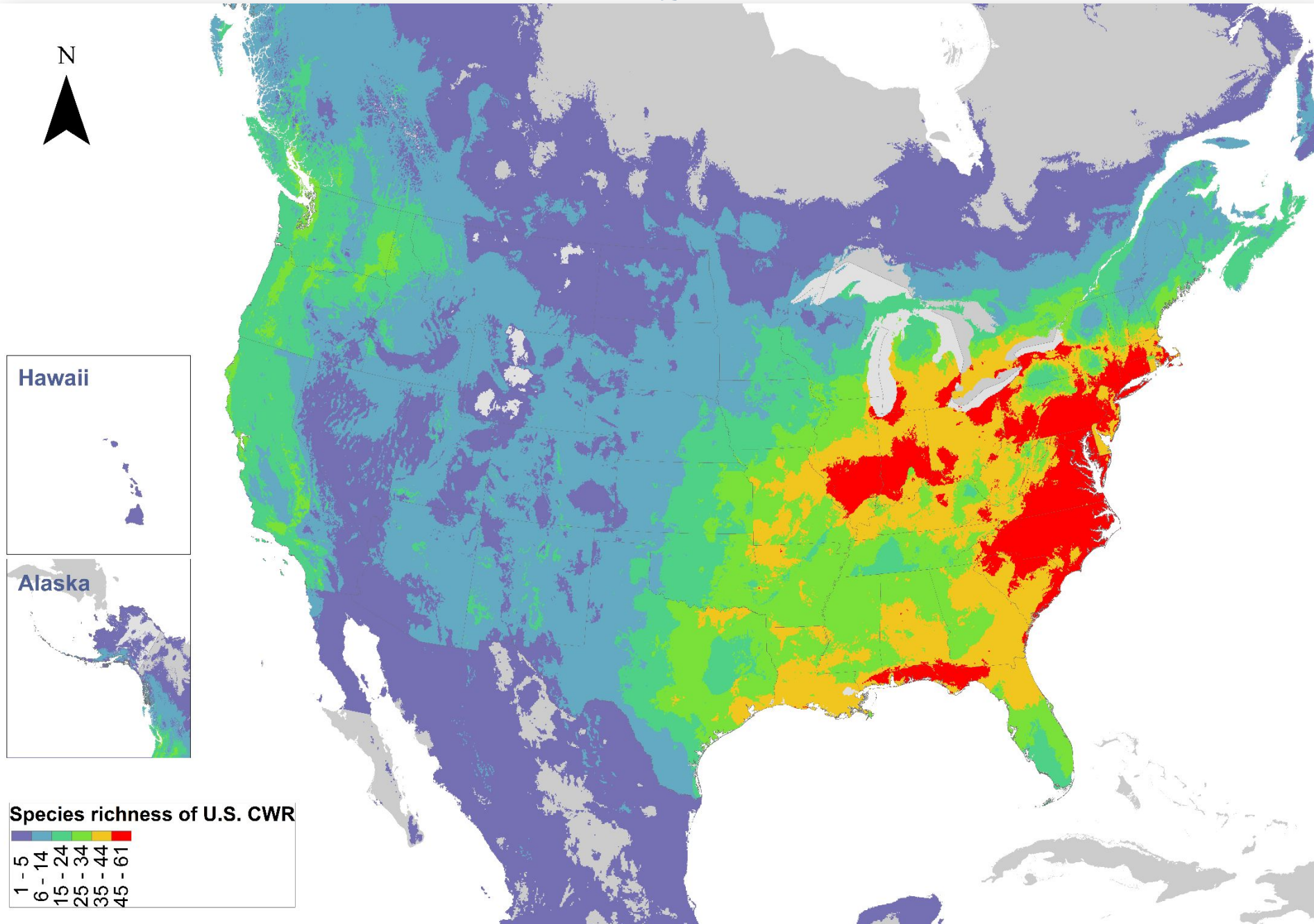
Potential distribution models of selected U.S. CWR of pecan

 *Carya cordiformis*

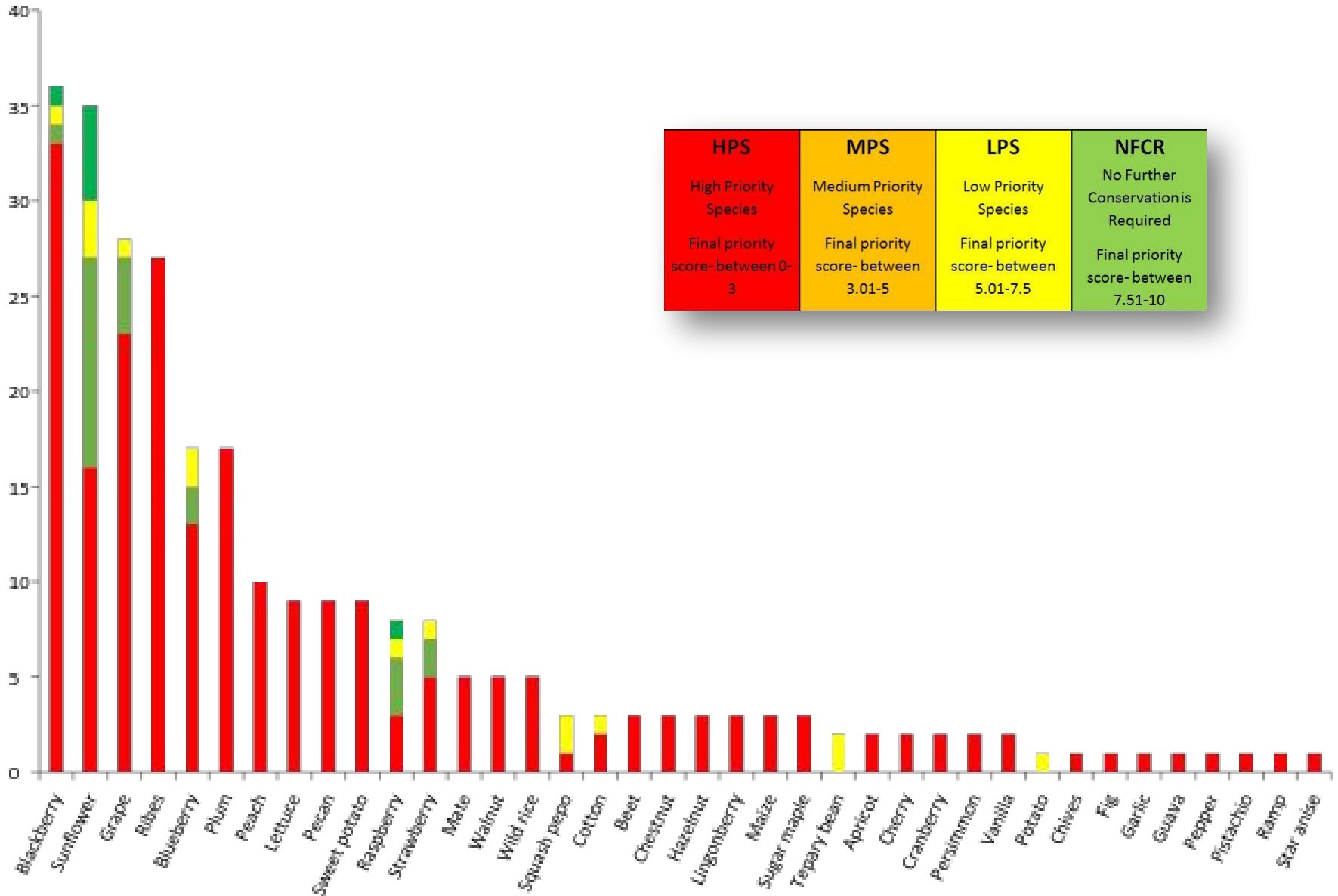
# Potential distributions of priority CWR in the U.S.



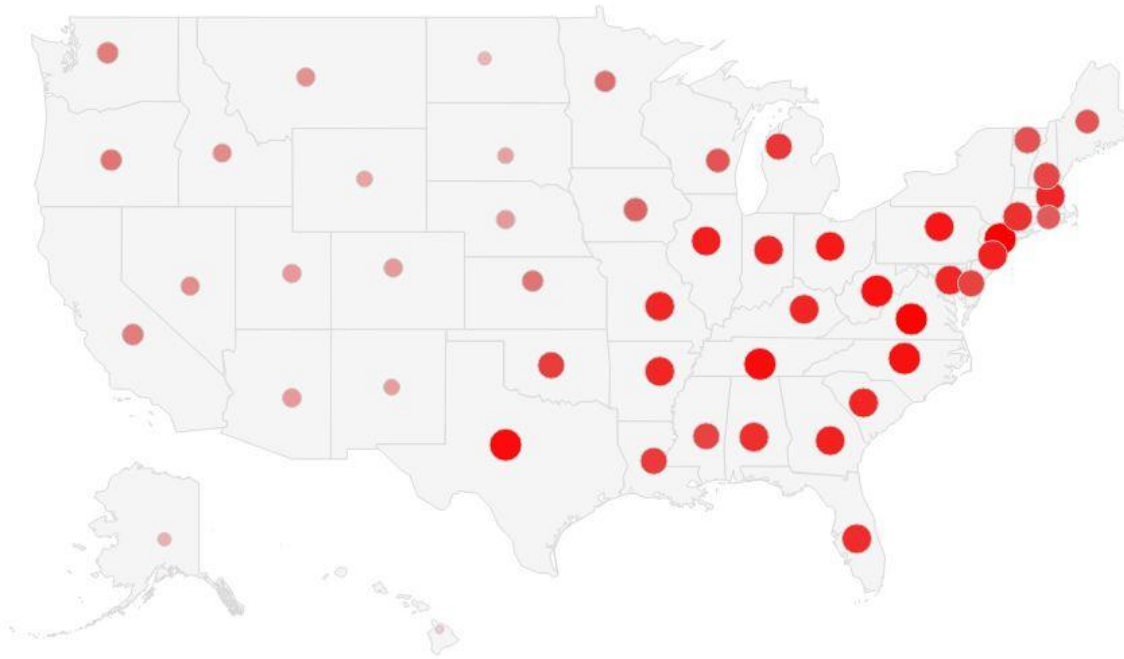
# Potential distributions of priority CWR in the U.S.



# Further collecting priorities for priority CWR



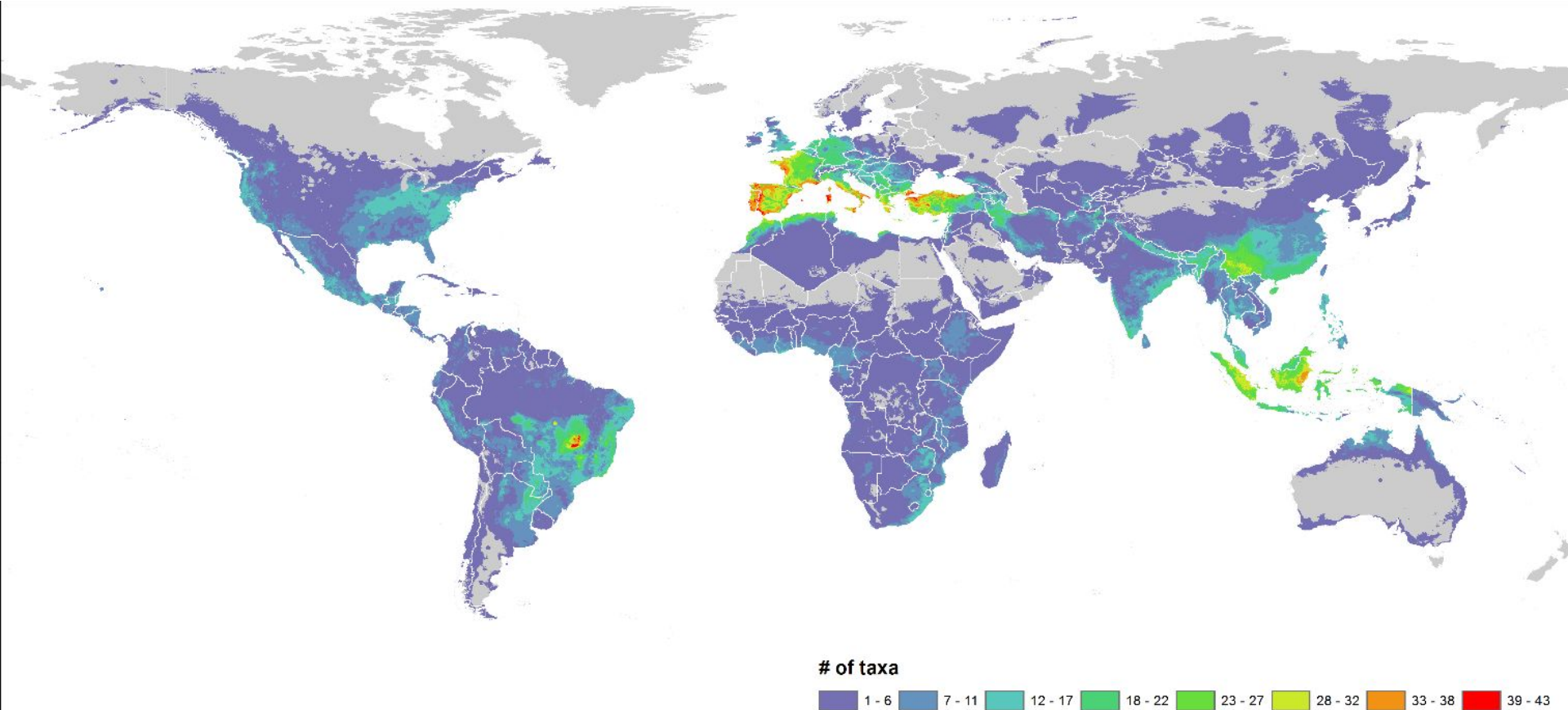
# Further collecting priorities for priority CWR



Number of CWR of high priority for further collecting per state

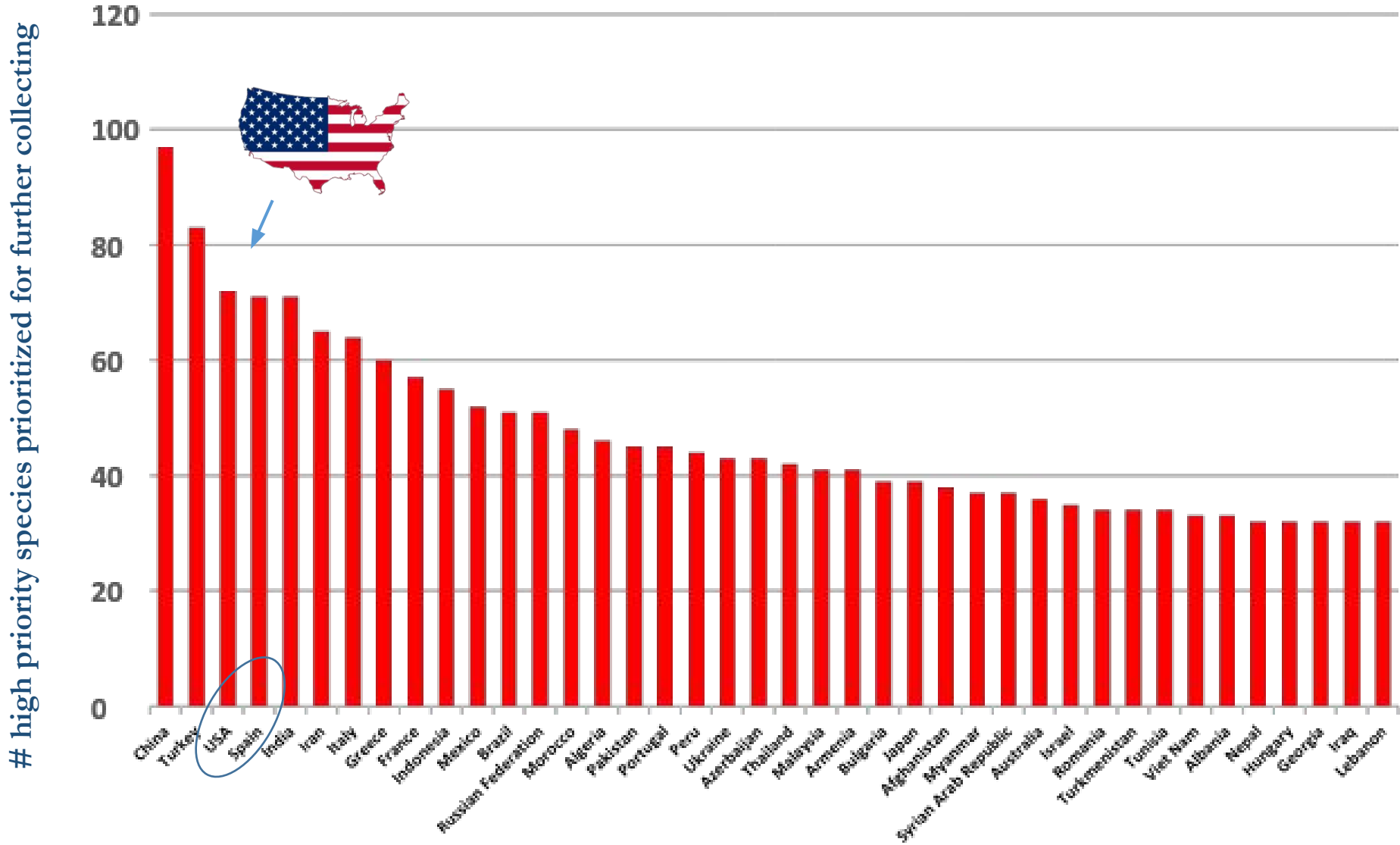
State	# of CWR of high priority for further collecting
New York	87
Virginia	85
Tennessee	82
Texas	82
North Carolina	80
West Virginia	80
Pennsylvania	78
Ohio	77
Illinois	75
Georgia	74
New Jersey	74
Indiana	73
Arkansas	72
Kentucky	72
Maryland	72
Massachusetts	72
Missouri	72
South Carolina	72
Florida	69
Alabama	68

# Global hotspots for under-represented CWR



Distributions of wild relatives of important food crops of high priority for further collecting

# The U.S. is a global hotspot for under-represented CWR



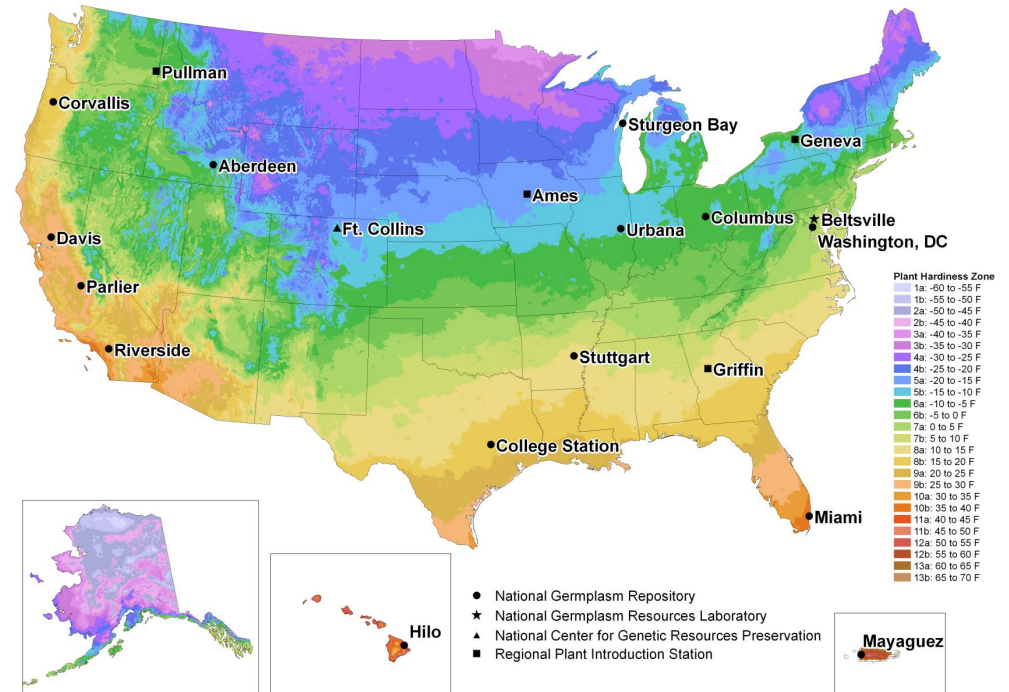


# Ex situ conservation and ongoing collecting



Photo: J. Baraberg

Wild potato, Arizona



**SEEDS  
OF  
SUCCESS**



Photo: E.A. Williams

Wild sunflower, Louisiana

# Complementary conservation of wild cranberry

Large cranberry

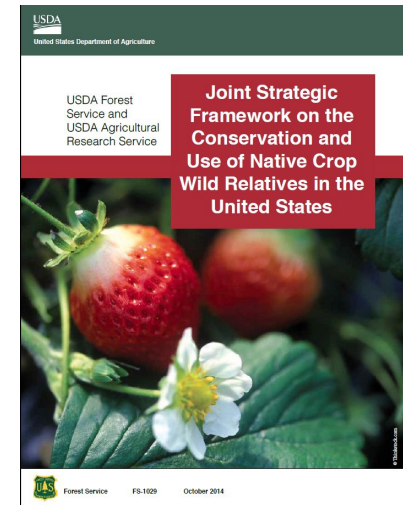
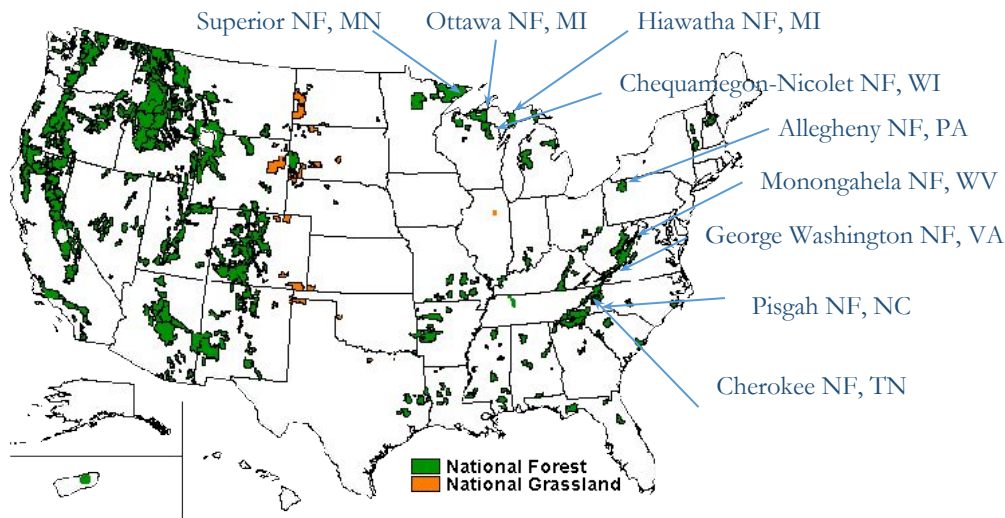


*V. macrocarpon* Ait.

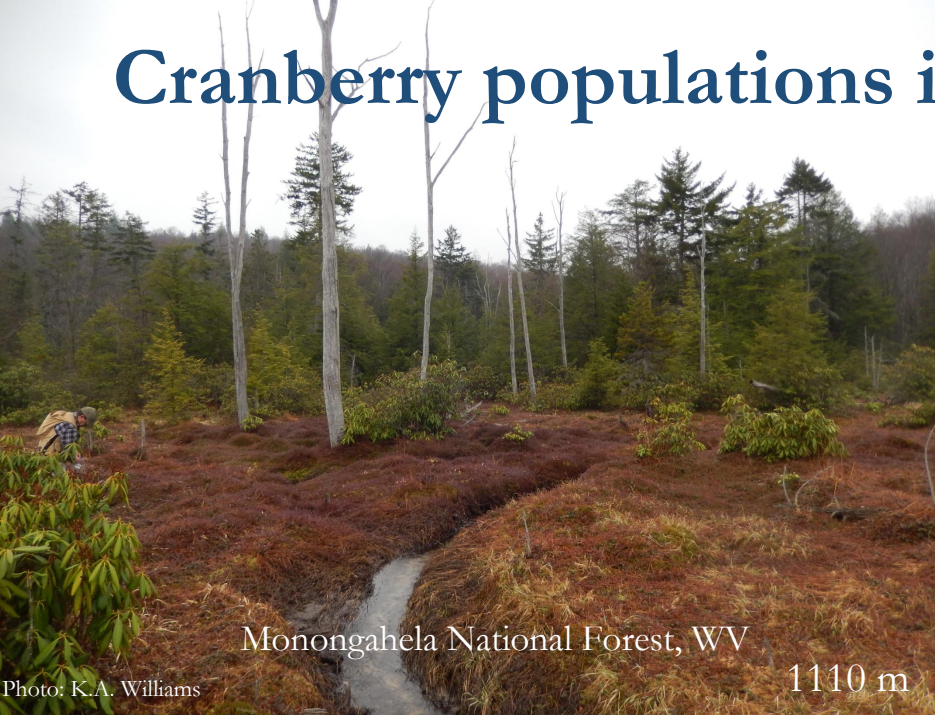
Small cranberry



*V. oxycoccos* L.



# Cranberry populations in U.S. National Forests



Monongahela National Forest, WV

1110 m

Photo: K.A. Williams



George Washington National Forest, VA

976 m

Photo: K.A. Williams



Chéquamégon - Nicolet National Forest, WI

490 m

Photo: L. Rodriguez-Bonilla, UW



Pisgah National Forest, NC

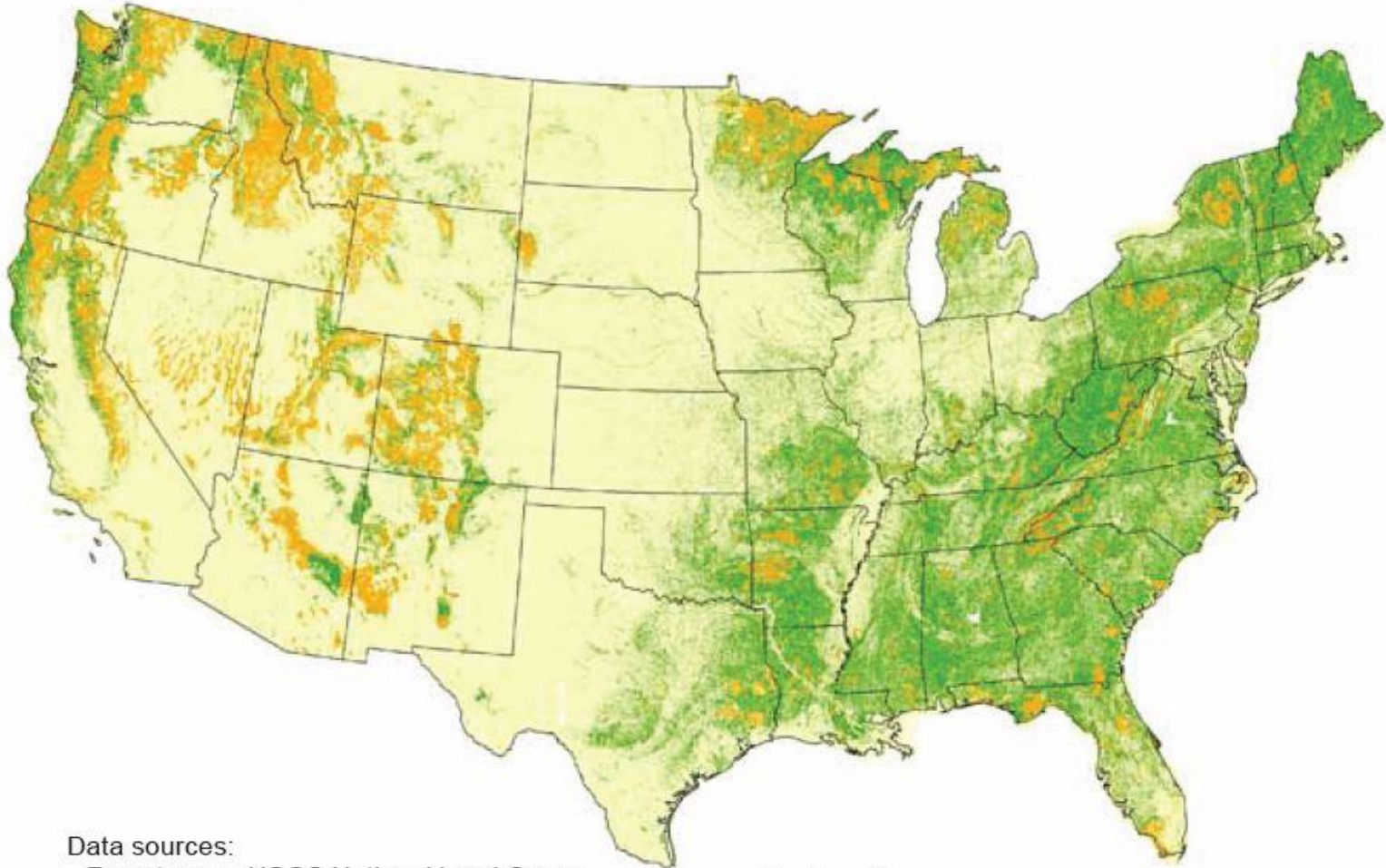
1748 m

Photo: K.A. Williams

# Private conservation lands are important for U.S. CWR

## Forest Ownership in the Coterminous United States, 2006

■ Private forest land ■ Public forest land ■ Nonforest



### Data sources:

Forest area - USGS National Land Cover Database 2001

Ownership - CBI Protected Areas Database, Version 4.0

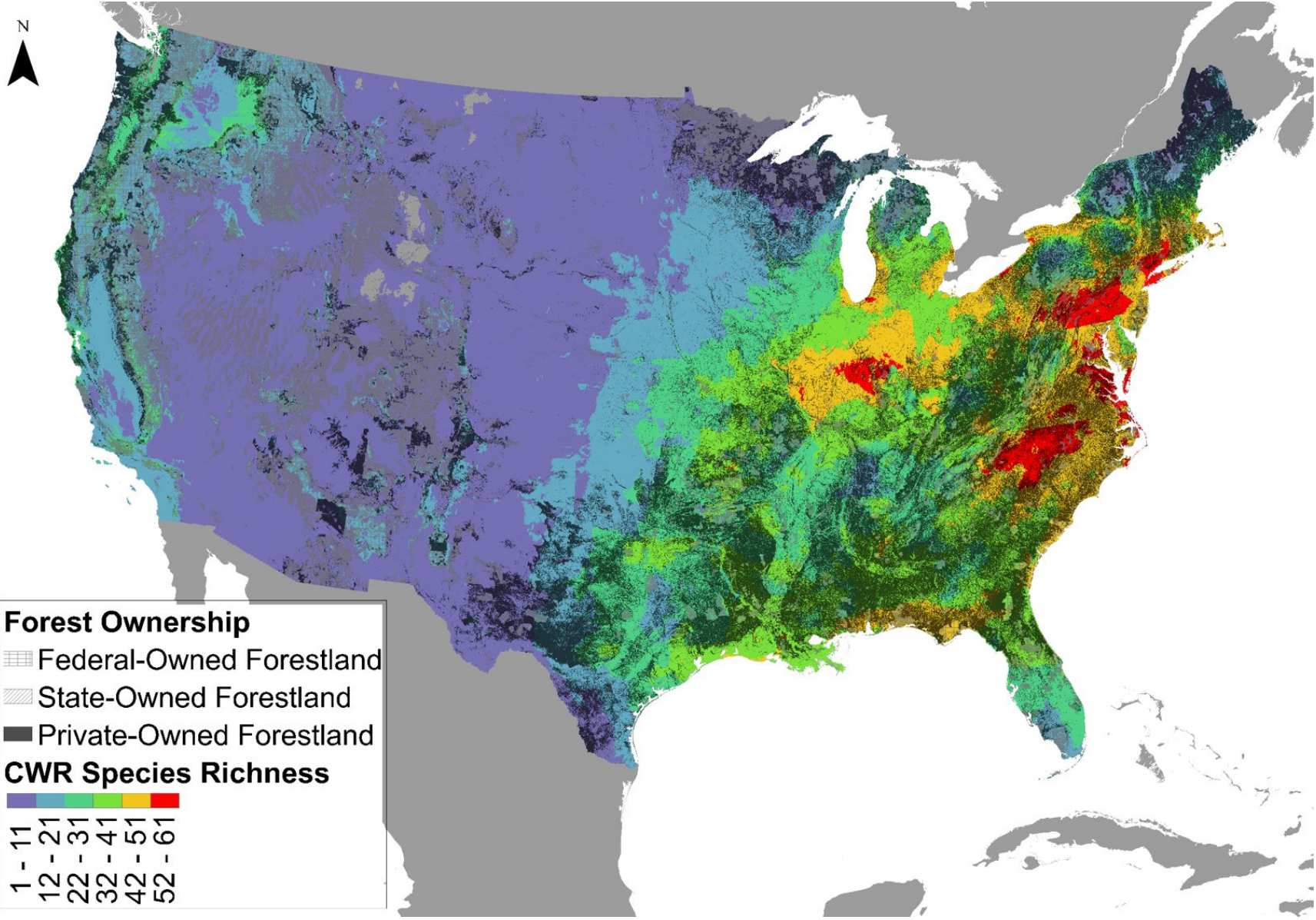
State and countries - ESRI Data & Maps 2006

### Produced by:

US Forest Service, Northern Research Station  
Forest Inventory and Analysis, Family Forest  
Research Center

Brett J. Butler (17-Oct-07)

# Private conservation lands are important for U.S. CWR

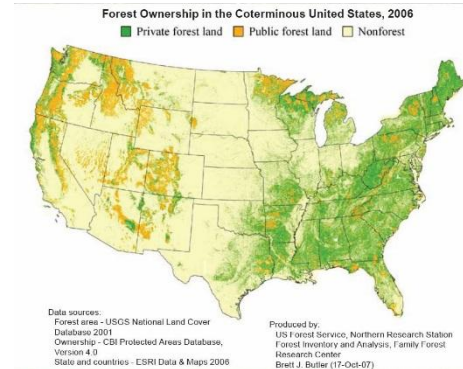
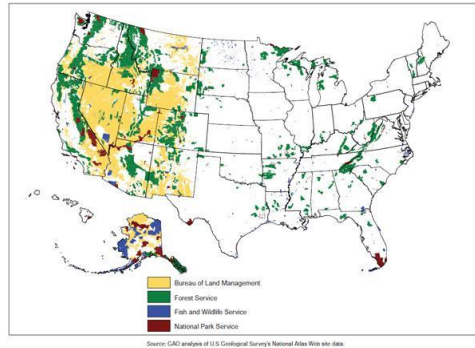


# Comprehensive action on U.S. crop wild relatives

## Information



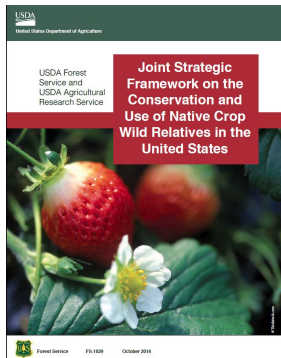
## Conservation



## Access for Use



## Strategy



# Thank you!

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Castañeda-Álvarez *et al.* (2016) Global conservation priorities for crop wild relatives.  
*Nature Plants* 2(4): 16022.

Khoury *et al.* (2013) An inventory of crop wild relatives of the United States.  
*Crop Science* 53(4): 1496.

Khoury *et al.* (2016) *Measuring the state of conservation of crop diversity: a baseline for marking progress toward biodiversity conservation and sustainable development goals.* Crop Wild Relatives project policy brief.

USFS/ARS Strategic Framework:

<http://www.fs.fed.us/wildflowers/ethnobotany/documents/cwr/FrameworkNativeCropWildRelativesOct2014.pdf>

USFS/ARS Cranberry project:

<http://www.fs.fed.us/wildflowers/ethnobotany/cranberry/index.shtml>



The preceding presentation was delivered at the

## **2017 National Native Seed Conference**

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

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