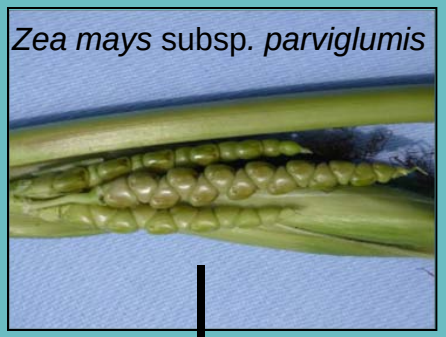
USFS and ARS Collaboration on the Conservation of Crop Wild Relatives

Karen A. Williams
USDA-ARS
Beltsville, Maryland
Karen.Williams@ars.usda.gov

Crop Wild Relatives (CWR) are wild plants that are closely related to crops.

They are either the ancestors of crops or other plants that are closely related to crops.

	Apple	Maize	Chile pepper
Wild ancestor	 *Malus sieversii*	 *Zea mays* subsp. *parviglumis*	 *Capsicum annuum* var. *glabriusculum*
Crop			

Crop Centers of Origin

Note: The pointer locations indicate general regions where crops are believed to have first been domesticated. In some cases, the center of origin is uncertain. Other geographic regions also harbor important genetic diversity for these crops.

Source: This map was developed by the General Accounting Office using data provided by the National Plant Germplasm System's Plant Exchange Office.

Why are CWR important?

- Part of natural ecosystems

- Vital resources for providing food security, enhancing agricultural production, and sustaining productivity

- Sources of genetic diversity for crop breeding:
  - Resistant to pests and diseases
  - Adaptation to abiotic stresses – drought, saline soils, climatic variability
  - Productivity
  - Flavor and color

Sclerotinia stalk rot in sunflower

Some wild relatives of sunflower

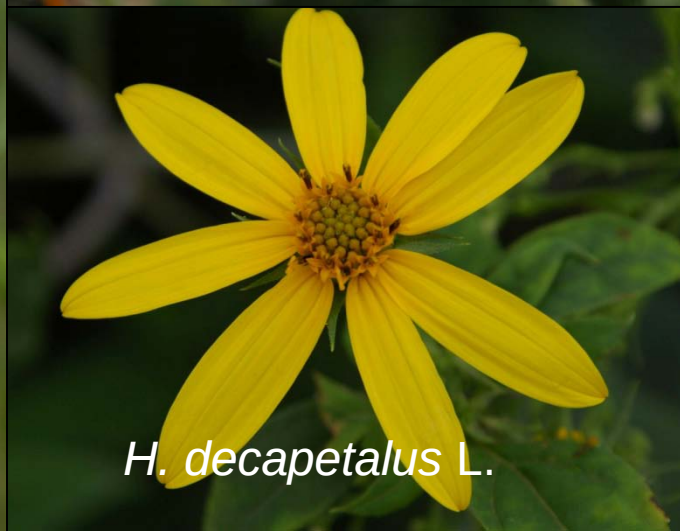
H. maximiliani Schrad.

H. atrorubens L

H. mollis Lam.

H. hirsutus Raf.

H. nuttalii subsp. nuttallii

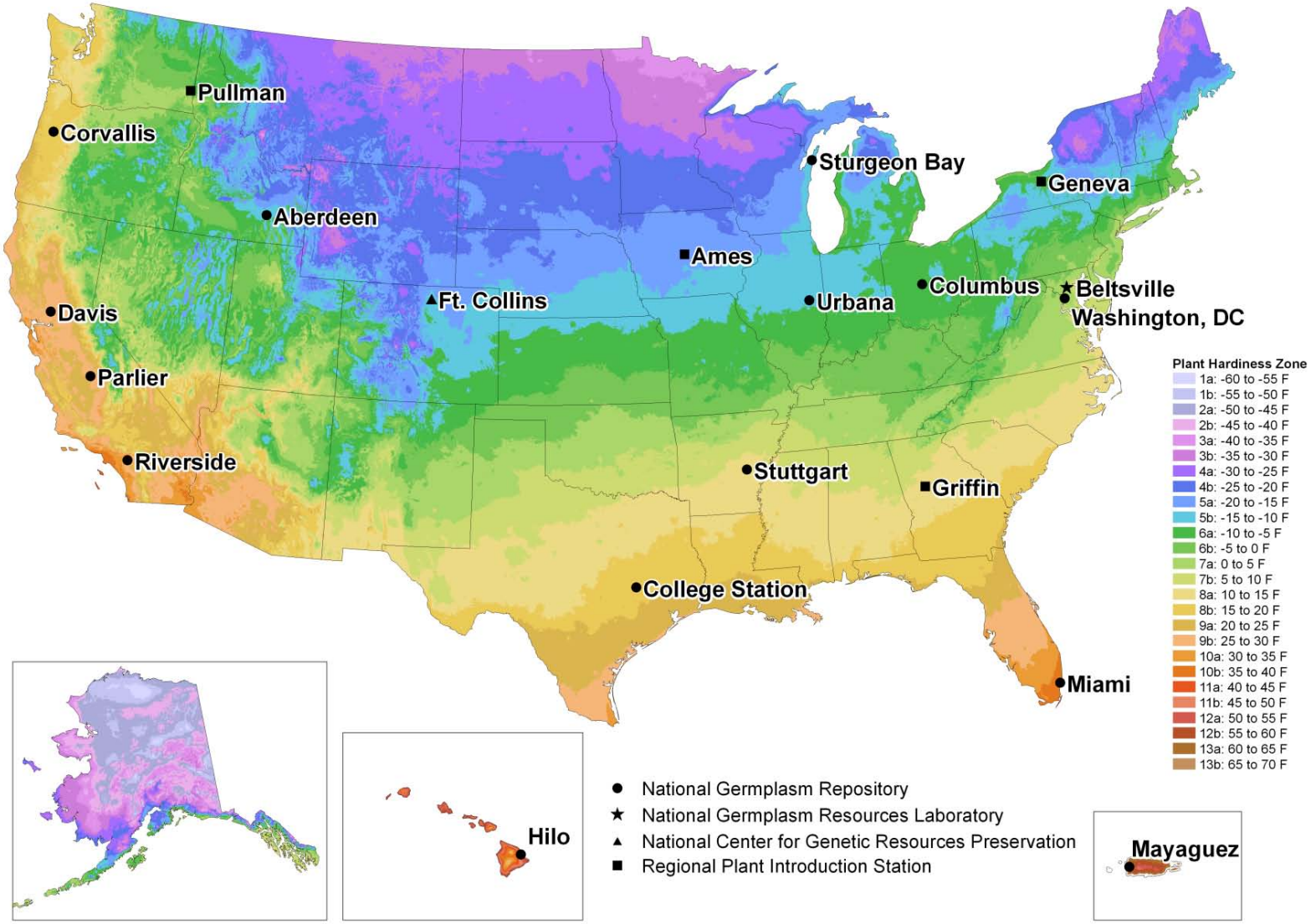


H. decapetalus L.

US National Plant Germplasm System (NPGS)

- managed by USDA\ARS
- *ex situ* conservation
- > 568,000 accessions
- 14,848 species
- seeds, tubers, cuttings, pollen, plants, *in vitro* cultures

National Plant Germplasm System



Complementary Conservation of CWR

Ex situ – conservation outside the natural habitat (genebanks, botanical gardens)
– easily accessible for use, secure

In situ – conservation in the natural habitat
– more variation conserved, less costly, evolution continues

2011 – USFS\ARS MOU on complementary conservation of native plants

2014 – USFS\ARS framework for cooperation on CWR

ARS\FS Framework for Cooperation on CWR

In situ (two approaches):

Specific crop approach – populations of the CWR of one crop are designated as *In Situ* Genetic Resource Reserves (**IGRR**s)

Protected area approach – all CWR within one area in a National Forest are identified and the area is designated as an IGRR

Ex situ component for both approaches:

- conserve germplasm *ex situ* in the NPGS

What are the CWR in the U.S.?

Priority list developed by ARS and FS:

- 386 native taxa related to over 35 crops
- mainly relatives of food crops
- a few wild utilized species

Sources:

- GRIN database (www.ars-grin.gov)
- Khoury et al. (2013). An Inventory of Crop Wild Relatives of the United States. *Crop Sci. 53(4): 1496.*

Main Crops with Wild Relatives in the US

Cranberry
Blueberries
Sunflower
Wild rice
Pecan
Pumpkin\Squash
Blackberries
Raspberries
Quinoa

Currants
Gooseberry
Plum
Cherry
Grape
Walnut
Pawpaw
Amaranth
Beans
Forages and turf grasses

Conservation of Cranberry CWR

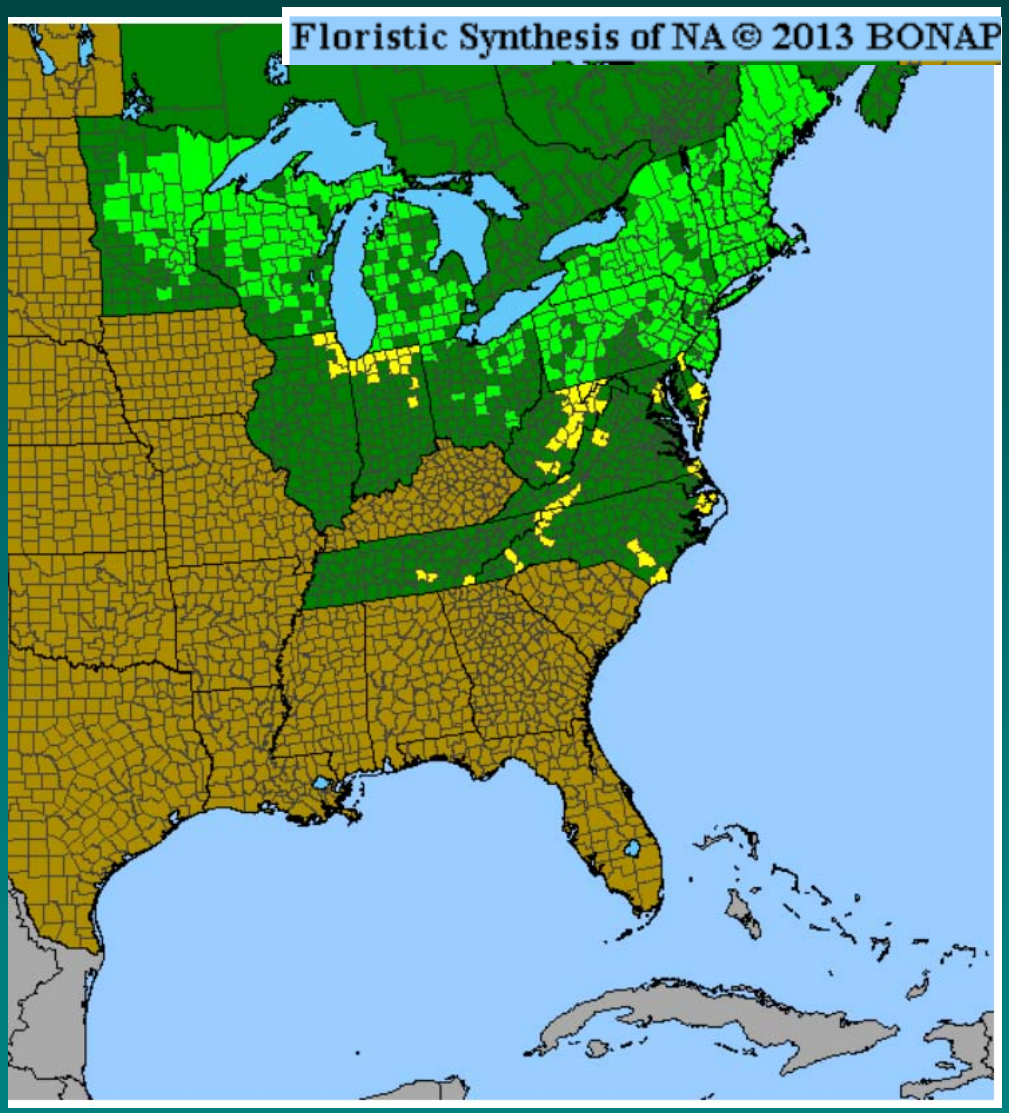
Large cranberry

Vaccinium macrocarpon Ait.

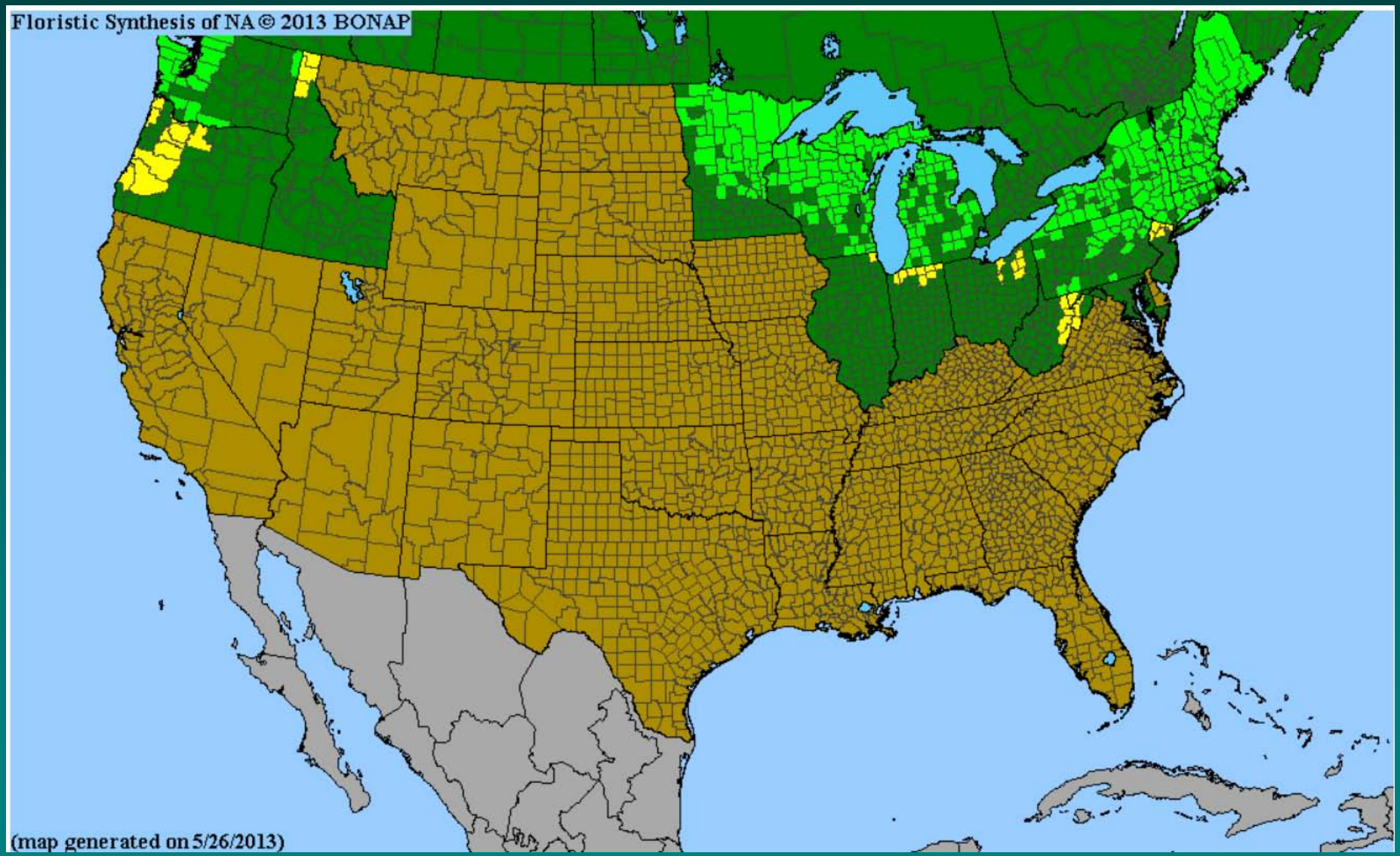
Small cranberry

Vaccinium oxycoccos L.

Vaccinium macrocarpon Ait.



Vaccinium oxycoccos L.



Selection of *In Situ* Genetic Reserves (IGRRs) for Cranberry CWR

- Location, climate, ecology
- Sustainability
- Adequate population size
- Genetic profile (uniqueness, allelic diversity, etc.)
- Ease of access for monitoring and germplasm collection
- Presence of both species of cranberry
- Cultural significance to Native Americans or others


Vaccinium macrocarpon and *V. oxycoccos*
Red Run Bog, Monongahela National Forest, WV
1,110 m.


Vaccinium macrocarpon
Green Pond, George Washington National Forest, VA
976 m.


Vaccinium macrocarpon
Johns Bog, Cherokee National Forest, TN
1,029 m.


Vaccinium macrocarpon
Ivestor Gap Seep
Pisgah National Forest, NC
1,748 m.

Protocols to Support Complementary Conservation of Cranberry Species

-- Collecting Leaf Tissue for DNA Analysis

-- Collecting Fruit/Seed for *ex situ* Conservation

-- Collecting Herbarium Specimens

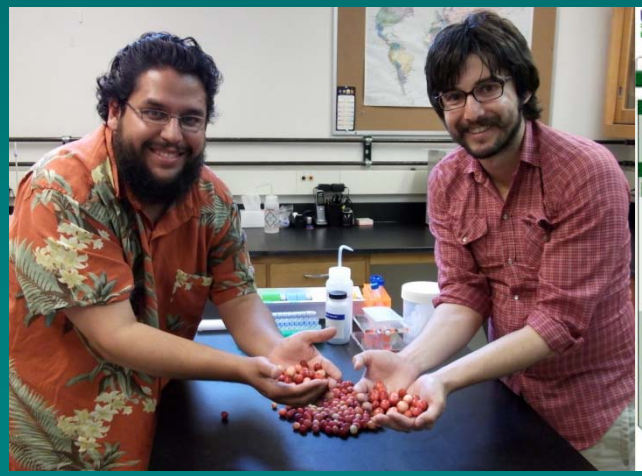
Available at *http://www.fs.fed.us/wildflowers/ethnobotany/cranberry/index.shtml*

Destination of Samples

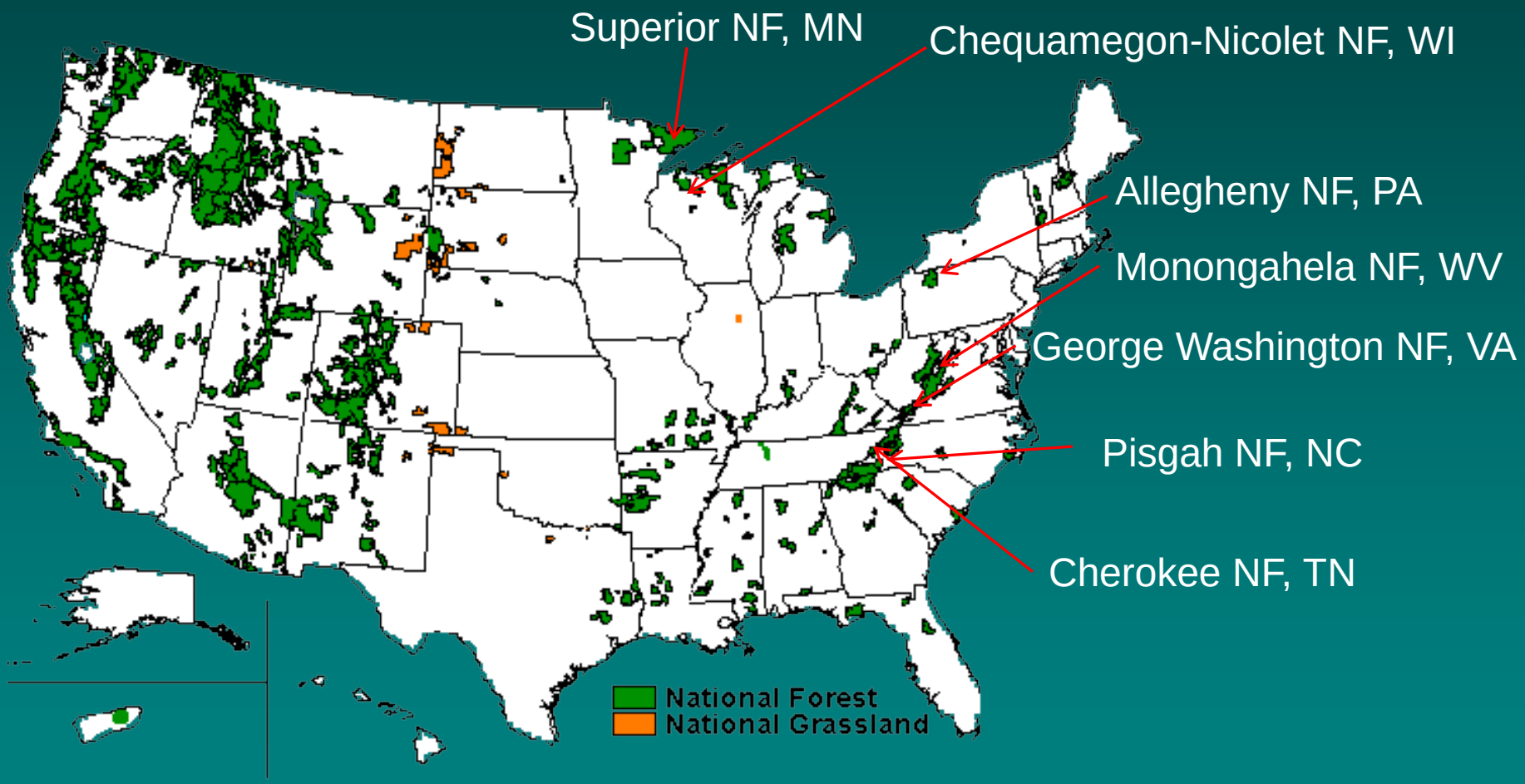
Leaf samples sent to ARS Vegetable Crops Research Unit, Madison, WI

Seed samples sent to the ARS National Clonal Repository, Corvallis, OR

Herbarium samples sent to US National Arboretum, Washington, DC



Leaf Tissue Samples
US National Forests



Future Plans for Cranberry IGRR Project

- Sample at least two populations per NF
- Analyze results of genetic studies
- FS and ARS designate IGRRs
- Involve other partners

Future Plans for Protected Area Approach

- Additional checklists of flora for NF protected areas

- Refinement of criteria for designation of protected areas as IGRRs:
  - number of CWR taxa
  - significance of individual taxa
  - uniqueness of CWR taxa
  - ease of access for monitoring and germplasm collection
  - distance from other IGRRs