

Monarch Wings Across The Eastern Broadleaf Forest



An **Ecoregional** approach to developing rapid increases in available seed and plant materials to support monarch habitat

A presentation by Tom Van Arsdall

**POLLINATOR
PARTNERSHIP**

Increase Monarch Habitat



- Engage public land managers and private land stewards
- Multiple monarch habitat enhancing efforts
- Establish 4,688 acres of monarch habitat

Build on success of Monarch Wings Across Ohio



NFWF Grant



Budget

\$450K → **\$300K** match + **\$150K** NFWF cash over 2 years

- Administered by Pollinator Partnership and Core Group of Partners

Core Group



- US Fish and Wildlife Service's Partners for Fish and Wildlife Program (IL, IN, OH)
- Illinois Department of Natural Resources - Mason State Nursery
- Ohio Department of Natural Resources
- Ohio Pollinator Habitat Initiative
- Pheasants Forever
- Pollinator Partnership

1. Establish ecoregional seed collecting program



- ❖ Cooperation with existing collection programs to support their capacity

2. Provide technical assistance and training for seed collection and planting



Plant Profiles

MWAEBF - PLANT PROFILE

Pycnanthemum tenuifolium

(Narrowleaf Mountainmint)

Other common names include: Slender mountain mint and Common horsemint



Bloom Period:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
					X	X	X	X			

Plant Characteristics:

Duration: Perennial

Type: Forb

Size: 2-3' tall

Leaf: Opposite; up to 3" long and 1/4" across. Leaves have no petiole (leaf stem), are linear, and hairless, with a prominent central vein and smooth edges. Leaves smell minty when crushed.

Stem: Stiff, smooth, slender, square stem, with no hairs.

Flower: The short tubular flowers are white, often with scattered purple dots, and individually about 1/4" long.

The flower petals have an upper lip, and three-lobed lower lip.

Seed collection**: Late September-Late October [2]

What it can be confused with:

This plant has a delicate, somewhat airy appearance. *P. tenuifolium* closely resembles *Pycnanthemum virginianum* (Common mountainmint), except that the *P. tenuifolium* has hairless stems and leaves that never exceed 1/4" across. *P. virginianum*, on the other hand, has lines of white hairs on its stems, and some of the larger leaves will exceed 1/4" across. *P. virginianum* tends to be taller, stouter, and less branched in appearance; it also blooms a little later in the year. [3]

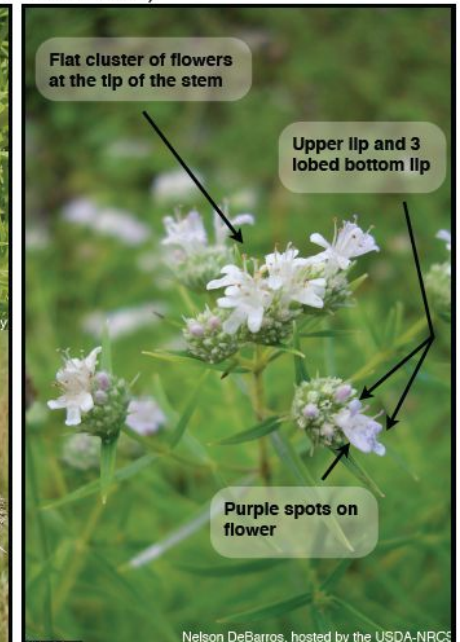
Known Pollinators:

Honey bees, native bees, flies, wasps, butterflies, skippers, and beetles. [3]

** Seed collection times will vary due to location and weather conditions during the growing season. This is a general time seed may be ready; locations will need to be scouted to get a more accurate timetable for each location.
 [1] USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1918. *An illustrated flora of the northern United States, Canada and the British Possessions*. 3 vols. Charles Scribner's Sons, New York. Vol. 3: 142.
 [2] http://plants.usda.gov/plantguide/pdf/pg_pyte.pdf
 [3] http://www.illinoiswildflowers.info/prairie/plantb/elm_mintx.htm

Pycnanthemum tenuifolium

(Narrowleaf Mountainmint)



3. Long-term habitat establishment



Scientific support



The Willamette Valley Seed Increase Program

Developing genetically diverse germplasm using an ecoregion approach

Kimora Ward, Melanie Gaiser, Rob Hegener, and Amy Young

ABSTRACT

The goal of the Institute for Applied Ecology's Willamette Valley Seed Increase Program is to develop a supply of ecologically appropriate, genetically diverse native plant material for restoration of prairie ecosystems in the Willamette Valley. In creating restoration germplasm we seek to maximize genetic diversity while simultaneously protecting genetic integrity of extant native populations. In the absence of genetic data to guide appropriate movement of native seeds, we are testing the use of an ecoregion approach using a variety of research techniques. We collected seeds, defined preliminary seed transfer zones, and planted seed increase fields for each of 21 historically widespread, common species. We captured spatial and temporal genetic diversity by sampling from many populations per species over a 3-y period. Seed zone boundaries for each species were drawn at the scale of the ecoregion or smaller, depending on life history characteristics and potential for adverse genetic effects of translocation. To minimize loss of diversity through domestication selection, we planted increase fields using a novel design, the Diversity Enhancement Block. Seedlots from populations with different phenology or from different areas within the ecoregion were planted in separate adjacent blocks. This design allows harvest of each block separately as seeds mature, while still permitting plants from different regions of the valley to cross-pollinate and to produce crop seeds with maximum genetic diversity. All of our production fields have been entered into the Oregon Seed Certification Service Pro-Variety Germplasm program. We are looking for partners to participate in a buyer's cooperative.

Ward K, Gaiser M, Hegener R, Young A. 2008. The Willamette Valley seed increase program: developing genetically diverse germplasm using an ecoregion approach. *Native Plants Journal* 9(2):334-349.

KEY WORDS
native plant material development, prairies, restoration genetics, seed transfer zones, domestication selection, Diversity Enhancement Block design

NOMENCLATURE
USDA NRCS (2008)

Successful habitat restoration includes sufficient species diversity to create plant communities representative of the original habitat, resilient to environmental fluctuations, and capable of supporting a diverse assemblage of wildlife (Bradshaw 1987; Ehrenfeld 2001; Meninger and Palmer 2006). Within those species, the genetic quality of germplasm can be equally important in achieving success (Falk and others 2006). Restoration germplasm should be both locally adapted and genetically diverse (McKay and others 2005).

The use of locally adapted germplasm improves the chance of establishment and persistence on restoration sites (Ostafson and others 2005), while protecting genetic integrity of indigenous plant populations by preventing swamping of ecologically inappropriate genes (Lesica and Allendorf 1999;

Asclepias speciosa Torr. (Asclepiadaceae) in the Willamette Valley, Oregon. Photo by Kimora Ward.

A Collaborative Program to Provide Native Plant Materials for the Great Basin

By Nancy Shaw, Mike Pellant, Matthew Fisk, and Erin Denney

The Great Basin as defined on a floristic basis¹ includes the hydrographic Great Basin plus the Owyhee Uplands and Snake River Plain of southern Idaho (Fig. 1). The region encompasses about 60 million ha, of which more than two-thirds are publicly owned. Vegetation ranges from salt desert and sagebrush shrublands in the basins to conifer forests in the more than 200 mountain ranges. Historic land management opened the environment to invasion by exotic annual grasses, primarily cheatgrass (*Bromus arvensis*). Resulting changes in the regimes and more recent human disturbances such as energy development, mining, and recreation have combined to increase the spread of annual and perennial exotics, deplete native seed banks, simplify community structure and species associations, and reduce landscape patchiness. Ecosystem resilience declines with disruption of ecological functions such as snow or water catchment, reduction of wind velocity, and nutrient cycling. West and Young² described in detail the plant communities and management issues in the Great Basin and suggested that development of more effective and economical revegetation techniques should be a research priority for the more arid regions.

The status of fire-intolerant sagebrush and its communities, which covers more than 43 million ha in the western United States, is threatened not only by the incursion of exotic species and altered wildfire regimes, but also by the encroachment of piñon and juniper woodlands as a result of overgrazing, fire exclusion, and climate change. Nielsen et al.³ simulated potential climate change impacts on the future distribution of the sagebrush ecosystem. The greatest warming scenario reduced the system to 20% of its current area within the 21st century. As a result of these threats, the sagebrush ecosystem now includes about 350 species of conservation concern,⁴ and 20% of the systems flora and fauna are considered imperiled.⁵ Major species losses can be expected if current trends continue.

The decline in greater sage-grouse (*Centrocercus urophasianus*) in the Great Basin illustrates the complexity of manage-

ing a keystone wildlife species threatened by a loss of habitat due in large part to wildfires (Fig. 1), invasive plants, and human development. Habitat restoration has been identified as a high priority to conserve greater sage-grouse, but limitations in native seed and seedling equipment often thwart these efforts.⁶ Native birds are an important component of growing-season habitats for greater sage-grouse and are often in short supply.⁷ A strategic and adaptive program to provide and successfully establish native plants can help conserve greater sage-grouse and other resources and human values in the Great Basin. Given the scale of issues and the land mass of the Great Basin, collaborative efforts are essential to successfully meet these challenges.

Origin of the Great Basin Native Plant Selection and Increase Project
Rehabilitation and restoration efforts following the wildfires of 1999 and 2000 that burned more than 1 million ha in the Great Basin were limited by inadequate supplies of appropriate plant materials, especially seed of native species. To address this issue, the House of Representatives' Department of the Interior and Related Agencies Appropriations Act, FY2001 directed the Secretaries of Interior and Agriculture to prepare a plan to "supply native plant materials for emergency stabilization and longer-term rehabilitation and restoration efforts."⁸ The resulting Report to Congress outlined recommendations and strategies for development of an Intergovernmental Native Plant Materials Development Program to "ensure a stable and economical supply of native plant materials" for public lands.⁹ Key emphasis areas for program success were support for federal, state, and Tribal native plant materials research, development, and production; expanded seed storage facilities; public and private sector partnerships; and education and outreach to the general public.

The 1999 and 2000 wildfires also provided the impetus for the formation of the Great Basin Restoration Initiative, an effort led by the USDA-Bureau of Land Management (BLM) to proactively address invasive species spread and

Proceedings from the Wild Compatibility Initiative Workshop, number 1A

COMPATIBILITY OF BREEDING FOR INCREASED WOOD PRODUCTION AND LONG-TERM SUSTAINABILITY: THE GENETIC VARIATION OF SEED ORCHARD SEED AND ASSOCIATED RISKS

Randy Johnson¹ and Sara Lipow²

ABSTRACT

Because breeding imposes strong artificial selection for a narrow suite of economically important traits, genetic variation is reduced in seedlings derived from operational seed orchards. Both quantitative genetics theory and studies of all-yrone variation show that seed orchards contain most of the genetic diversity found in natural populations, although low-frequency alleles are often absent from seed orchard populations. Because plantations established with seed orchard seed are frequently maintained for only a single generation, they do not need to preserve the low-frequency alleles that are maintained in the breeding and gene resource populations. Moreover, in the Pacific Northwest, low-frequency alleles are typically maintained in the breeding population and in *in situ* reserves that serve as gene resource populations. Our analysis of theoretical and empirical data indicates that seed orchards with 20 or more selections should provide the same level of risks as seed collected from the natural population.

KEY WORDS: Genetic diversity, tree breeding, seed orchards, risks.

INTRODUCTION

Genetic variation is essential for populations to be able to adapt to new stresses such as disease and climate change. The amount of genetic variation required for population viability is dependent on many factors, including the expected life of the population (e.g., rotation age), the number of future generations the population is expected to produce, the environmental variation (over time and space) to which the population must adapt, and the rate that mutation and migration adds genetic variation in the future. On one extreme are agonomic crops that are planted for a single generation, lasting less than a year in a relatively uniform environment. On the other extreme are natural populations of forest species that are long-lived and are expected to adapt to changes in climate and environment for many centuries. Forest plantations tend to be somewhere in the middle of this continuum; they must survive for only a single generation, but generation intervals tend to be measured in decades, during which time they experience a variety of environments.

Many forest tree species have active, ongoing tree improvement programs. Breeding activities involve selection for heritable traits such as growth and yield, crown form, and wood quality. Tree improvement enables genetic gain but also may result in undesirable erosion of genetic variation that hinders adaptation and evolutionary success (Nasinkov et al. 1988). Genetic variation may be lost at several steps in the tree improvement process including during the breeding cycle and establishment of production populations (i.e., seed orchards or clonal stool beds). Therefore, a question that cost users to arise with all breeding programs is: Will the use of improved varieties result in a significant loss of natural genetic variation, hence reducing the long-term sustainability of species and ecosystems that depend on them? An additional question for forest trees concerns the viability of stand products from seed orchards: Does the stand have sufficient genetic diversity to buffer short-term environmental pressures that it will encounter throughout a typical rotation cycle?

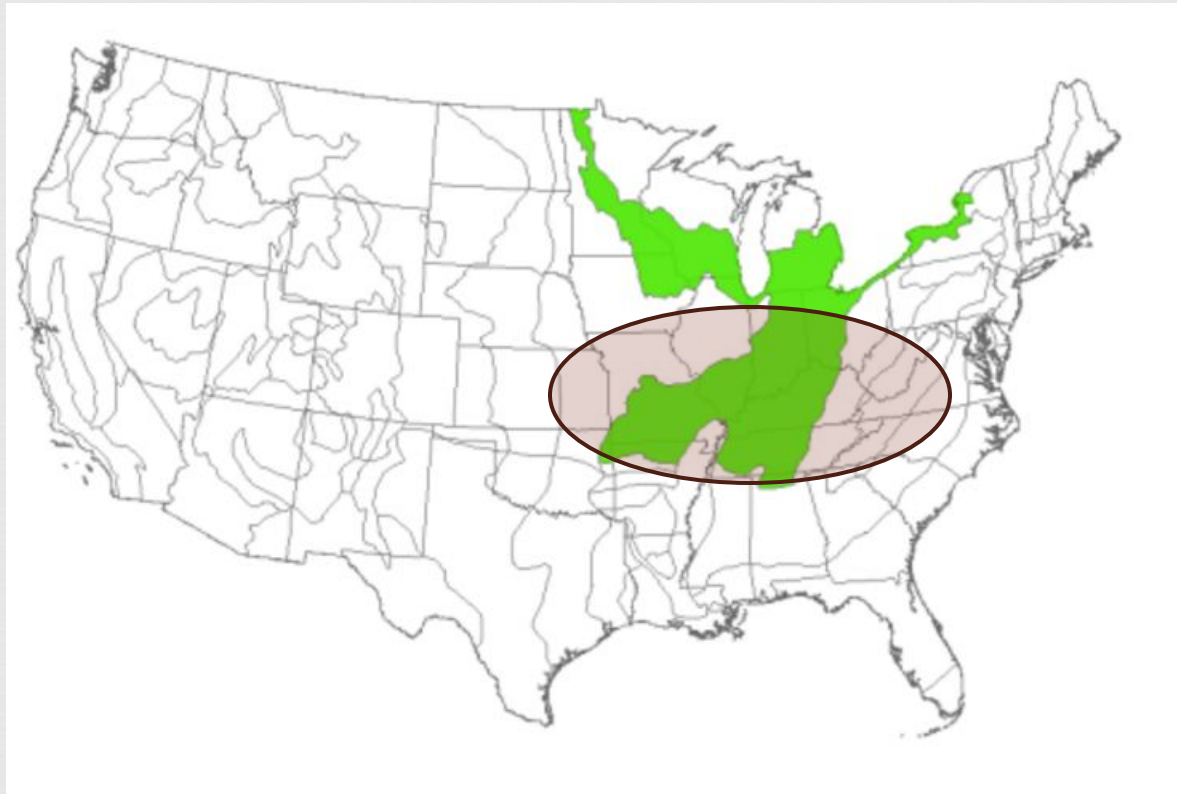
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² Forest geneticist, Oregon Department of Forestry, 2600 State Street, Salem, OR 97310

Eastern Broadleaf Forest Continental Province



For this reason, an ecoregional approach to seed collection is being taken across the project's five target states; Ohio, Indiana, Illinois, Missouri and Arkansas.



The goal of Monarch Wings Across the Eastern Broadleaf Forest is to make 300 seed collections of milkweed and monarch nectar species, or approximately 60 collections per state over two years.



MWAEBF seeks to target common, native species that are either monarch larval hosts (milkweed) or nectar resources.



Target List of Common Species

Botanical Name	Common Name	Bloom Period											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Zizia aurea</i>	Golden Alexander				X	X	X						
<i>Tradescantia ohiensis</i>	Ohio Spiderwort				X	X	X	X					
<i>Penstemon digitalis</i>	Foxglove beardtongue					X	X	X					
<i>Asclepias syriaca</i>	Common milkweed						X	X	X				
<i>Asclepias verticillata</i>	Whorled milkweed						X	X	X	X			
<i>Ratibida pinnata</i>	Yellow coneflower						X	X	X	X			
<i>Pycnanthemum tenuifolium</i>	Narrowleaf mountainmint						X	X	X	X			
<i>Heliopsis helianthoides</i>	Ox eye Sunflower						X	X	X	X			
<i>Asclepias incarnata</i>	Swamp milkweed						X	X	X	X			
<i>Rudbeckia hirta</i>	Black eyed susan						X	X	X	X			
<i>Chamaecrista fasciculata</i>	Partridge pea						X	X	X	X			
<i>Verbena urticifolia</i>	White vervain						X	X	X	X	X		
<i>Monarda fistulosa</i>	Wild bergamot							X	X	X			
<i>Eupatorium perfoliatum</i>	Common boneset							X	X	X			
<i>Coreopsis tripteris</i>	Tall coreopsis							X	X	X	X		
<i>Symphotrichum pilosum</i>	Frost Aster							X	X	X	X		
<i>Vernonia gigantea</i>	Giant ironweed							X	X	X	X		
<i>Eupatorium serotinum</i>	Late boneset							X	X	X	X		
<i>Symphotrichum novae-angliae</i>	New England aster								X	X	X		
<i>Symphotrichum laeve</i>	Smooth blue aster								X	X	X		

How'd we get there?

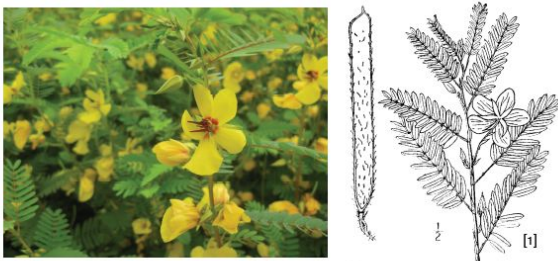
- ❧ Species widely distributed across ecoregion by county
- ❧ Species cover broad bloom period
- ❧ Cross-referenced regional weedy/invasive lists
- ❧ 7 rounds of vetting from partners and advisors
- ❧ Ground-truthed via local experts
- ❧ Considered species tolerance and Coefficient of Conservation



Plant Profiles for All 20 Plants

- ☛ Applicable across the full ecoregion
- ☛ Contact us at info@pollinator.org if you want copies

MWAEBF - PLANT PROFILE
Chamaecrista fasciculata
 Partridge pea
 Other common names include: Showy Partridge Pea, Sleepingplant, or Sensitive Plant



Bloom Period:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
					X	X	X	X			

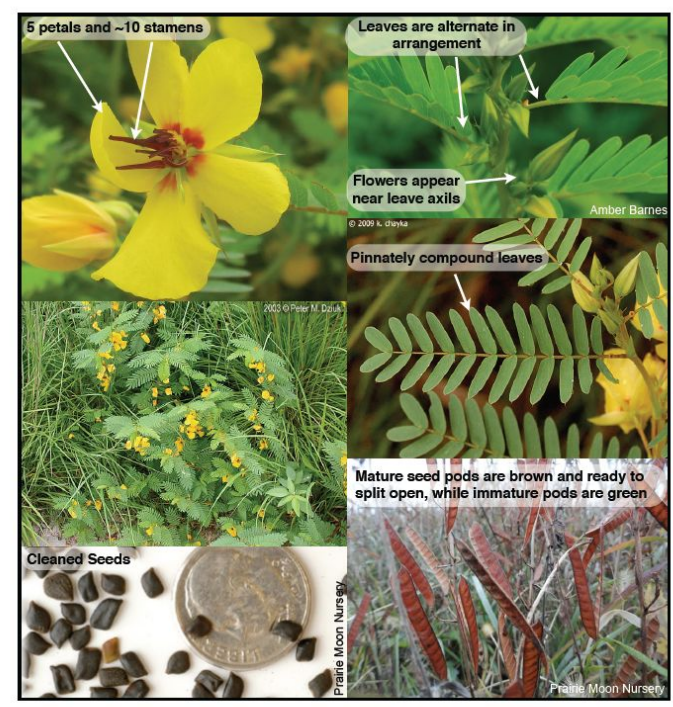
Plant Characteristics:
 Duration: Annual
 Type: Forb
 Size: 1-3' tall
 Leaf: Alternate, pinnately compound. Medium to dark green. Petioles with nectaries. Each compound leaf has up to 20 leaflets, which are hairless, oblong, and roughly 2/3" long and 1/3" wide.
 Stem: Shorter plants are erect while larger plants tend to sprawl. Stems are slender and hairless, and are light green at first but become reddish brown.
 Flower: Flowers are bright yellow and irregular, appearing on 1/3" flower stalks along major stems near leaf axils. Flowers are 1" wide with 5 rounded petals and approximately 10 ruddy stamens. No scent. [3]
 Seed collection**: Early September [2].

What it can be confused with:
 Sometimes confused with *Chamaecrista nictitans* which can be distinguished by its flowers (which are smaller in size - about 1/3" across, have 5 stamens, and appear on 1/10" flower stalks), as well as its leaves, which are sensitive to the touch and will fold when contacted. [5]

Known Pollinators:
 Honey bees, native bees, flies, wasps, ants, butterflies [4, 5]

** Seed collection times will vary due to location and weather conditions during the growing season. This is a general time seed may be ready, locations will need to be scouted to get a more accurate timetable for each location.
 [1] USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vol. Charles Scribner's Sons, New York, Vol. 2: 337.
 [2] <http://research.kewconservatory.org/seedcollectingtimes.html>
 [3] http://www.wildflower.org/plants/result.php?id_plant=CHFA2
 [4] http://www.inlinewildflowers.info/prairie/plants/part_peax.htm
 [5] <https://gobotany.newenglandwild.org/species/chamaecrista/fasciculata/>

Chamaecrista fasciculata
 Partridge pea



5 petals and ~10 stamens

Leaves are alternate in arrangement

Flowers appear near leaf axils

Pinnately compound leaves

Mature seed pods are brown and ready to split open, while immature pods are green

Cleaned Seeds

© 2009 L. Orshka
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 Amber Barnes
 Prairie Moon Nursery

Seed collection by collecting team

Seed is shipped to be cleaned, tested (viability and weed), and placed into temporary storage. Collections are held separately.

Plug grow-out from collections

Direct seeding (from collections)

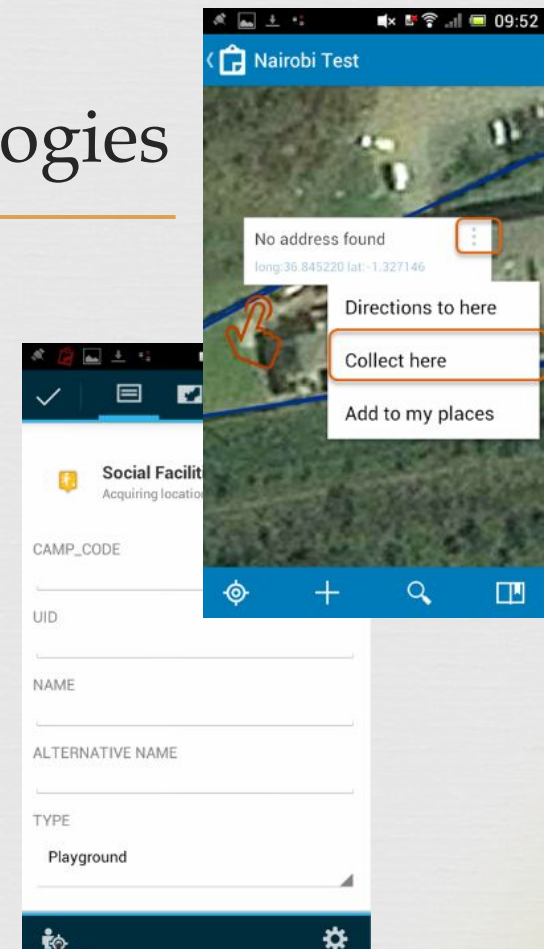
Mapping App



University of Arkansas

Center for Advanced Spatial Technologies

- Smartphone app for volunteers to map collections and store data
- Secure server hosted by U of AR
- Enabled for offline data entry
- Valuable data for model validation
- Future applications...



Opportunities and Challenges



Challenges

- ❧ Fear of contamination and competing seed sources
- ❧ Identifying sites
- ❧ Recruiting volunteers
- ❧ Plant identification
- ❧ Training

Opportunities and Challenges

Opportunities

- ❧ Training will be consistent
- ❧ Jump start for habitat
- ❧ Develops new resources for seed collection in the future
- ❧ Scientifically sound



Next Steps



- ❧ Secure state leads
- ❧ Build plant profiles and training modules
- ❧ Train volunteers
- ❧ Identify and secure sites and make collections
- ❧ Seeds processed, cleaned, checked, and verified
- ❧ Planting/Seed distribution

Rapid increase of much-needed monarch habitat



2017 NAPPC Poster – The Monarch Highway

- ♥ Ongoing project
- ♥ Available Earth Day, April 22nd



Join us!

We need volunteer seed collectors in
Arkansas, Missouri, Illinois, Indiana, and Ohio

Contact info@pollinator.org



Interested in being a State Lead
in Arkansas or Missouri?

Contact Amber Barnes
AB@pollinator.org



Thank You!

Project Coordinators:
Laurie Davies Adams
Evan Cole
Amber Barnes

QUESTIONS?

Please send to:

info@pollinator.org

**POLLINATOR
PARTNERSHIP**



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>

