On-Farm Habitat Restoration Using Transplants

Practical Farmers of Iowa
Jan 17-19, 2019

Jon Judson
Diversity Farms

Sarah Foltz Jordan
Xerces Society

Photo: Sarah Foltz Jordan

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Earth has lost >50% of its wild animal populations in the past 40 years

- 39% TERRESTRIAL SPECIES DECLINED BY 39 PER CENT BETWEEN 1970 AND 2010
- 76% THE LPI FRESHWATER SPECIES SHOWS AN AVERAGE DECLINE OF 76 PER CENT
- 39% MARINE SPECIES DECLINED 39 PER CENT BETWEEN 1970 AND 2010

Largest global analysis of thousands of animal species (birds, mammals, fish, reptiles, etc.)

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Ecosystems are degrading at a rate unprecedented in human history

World wildlife populations halved in 40 years - report

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Insect populations are plummeting, even in natural areas

New Research: Published October 2017

Between 1986 and 2016, insect biomass declined by 76% in German nature reserves


Photo: Alex Wild

The Washington Post

‘This is very alarming!’: Flying insects vanish from nature preserves

By Ben Guarino October 18

The white tent of a maltase trap in a nature reserve shutting farmland. (Vincent Keefield, entomologist)

Not long ago, a lengthy drive on a hot day wouldn’t be complete without scraping bug guts off a windshield. But splattered insects have gone the way of the Chevy Nova — you just don’t see them on the road like you used to.
Bumble Bees

25% of North American Bumble Bee Species At-Risk of Extinction

- Including 6+ species in the Upper Midwest
- Among the most important wild pollinators of crops and native plants


Cameron et al. 2011. Patterns of widespread decline in North American bumble bees. PNAS
Butterflies are also in serious decline

- According to NatureServe, at least 141 N. American butterfly species are considered at risk of extinction (18%)
- Historically rare, specialist butterflies are at risk but we are also seeing declines in many once wide ranging and common butterflies.
Monarch Status

Monarch Butterflies Decline >80% Since 1990s

1990s: 400 million monarchs
2016-17: ~60 million monarchs
Pollinators are critical to our economy... and our diets!

• 2/3 of crop plants (worldwide)
• 35% of crop production (worldwide)
• Many of our necessary vitamins and minerals come from insect-pollinated plants
• Over $18 to $27 billion value of crops in U.S. ($217 billion worldwide)

Morse and Calderone 2000; Klein et al. 2007; Eilers et al. 2011

The Xerces Society; www.xerces.org
Pollinators are Critical to Ecosystem Health

• More than 85% (~240,000 spp.) of flowering plants require an animal, mostly insects, to move pollen

• Diversity and longevity of our wild plant communities depends on pollination


The Xerces Society; www.xerces.org

Photo: Sarah Foltz Jordan
Native habitat is multifunctional
There are lots of habitat restoration options for farms:

- Field Border Plantings; Conversion of Fallow Areas
- Pollinator / Insectary Strips
- Beetle Banks
- Cover crops
- Flowering hedgerows
- Filter Strips, Contour Strips
- Understory Plantings
- Pasture Plantings
- Drift Protection (non-flowering hedgerows)

Farm Bill Programs, etc.
## Native Habitat Restoration

<table>
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<tr>
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<td>More Control &amp; Design Opportunities (desired plants can be selected, clustered, evenly distributed, etc.)</td>
</tr>
<tr>
<td>Better for large areas</td>
<td>Better for small areas (1/10 acre = 4K plants)</td>
</tr>
<tr>
<td>Doesn’t need irrigation</td>
<td>May require irrigation or water at time of transplant</td>
</tr>
</tbody>
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Example: Open Hands Farm: ½ acre Native Habitat Restoration *From Seed*
Example: Prairie Drifter Farm: 1000 ft. Native Habitat Strips

- Native plants propagated in greenhouse
- Integrated into vegetable fields with same bed width as vegetables
- Year 1: Irrigated & Cultivated like vegetable crop
- Year 2: cultivated once in spring; spot weeded in Sept.
- Year 3: spot weeded in Sept.

Photos: Sarah Foltz Jordan
Rapid Restoration!

- Dense & diverse wildflowers just ONE YEAR after planting
- Very little weed management needed

Prairie Drifter Farm, Litchfield MN

Photos: Sarah Foltz Jordan
Example: Prairie Drifter Farm: Native Habitat Strips *From Transplants*

*Uproot Farm, Princeton, MN*

*June 2017*

*July 2018*

*By Sarah Foltz Jordan*
Ground beetles in numbers commonly found in Midwestern crop fields can remove:

- Up to 4000 cutworms/acre/day
- Up to 40 weed seeds/square ft/day

(Menalled and Landis 1997)
The combination of seeds and plugs

Example: Start with plugs, mulch and get them going well, add in seed later, after mulch has broken down. Sprinkle in purple prairie clover and black eyed susan, blue grama.
Example: Combining Seeds and Transplants: Del’s Orchard

- Smother Crop Site Prep
- Planted native seed
- Included plugs of Lupin and New Jersey Tea
Example: Combining Seeds and Transplants: Heidel Family Farm

- Solarization Site Prep
- Planted native seed
- Included Liatris as a bare root plant
- Mowed around the Liatris when possible
Propagation Considerations: Germination

- Different species have different requirements to break dormancy
- Prairie Moon Cultural Catalog Germination Codes
  - A is the easiest (no treatment)
  - B needs hot water
  - C needs cold-moist stratification for a few days to a few months
  - H needs scarification
  - Etc.
Propagation Considerations: Stratification

- Count backwards number of days required for stratification plus growing time.
  - e.g., C(30) requires 30 days of stratification, plus greenhouse growing time, before transplant will be ready to plant outdoors.
- Stratification Media: Moist Sand; Vermiculite; Moist Paper Towel (may depend on if you need to singulate seed after stratification)
- Scarification required for certain species
- Heat treatment required for some species
- Check on Seed Weekly
- Plant seeds when stratification time is up, or sooner if significant sprouting has occurred
Easy Wildflowers to Start With:

- Agastache spp. (hyssop)
- Asclepias incarnata (swamp milkweed) (*Germinate well but don’t transplant well—sow directly)
- Aster novae-angliae and other spp. (New England aster and others) some*
- Coreopsis spp. (coreopsis)
- Dalea spp. (prairie clover)*
- Desmodium canadense (Canada tick trefoil)*
- Echinacea pallida (echinacea)*
- Eryngium yuccifolium (rattlesnake master)
- Eupatorium spp. (boneset, Joe Pye weed, etc)
- Helianthus spp. (native sunflowers)
- Helenium autumnale (sneezeweed)*
- Monarda spp. (bee balm, spotted bee balm)*
- Pycanthemum spp. (mountain mint)*
- Penstemon spp. (penstemon) (damp off issues)
- Solidago speciosa (showy goldenrod and others)
- Silphium spp. (compass plant, cup plant, etc)
- Verbena spp. ( vervain)
- Vernonia spp. (iron weed)

* no stratification needed
Easy Grasses/Sedges to Start With:

- Andropogon gerardii (big bluestem)*
- Bouteloua curtipendula (side-oats grama)*
- Bouteloua hirsuta (hairy grama) *
- Bromus kalmii (prairie brome*
- Carex brevior (plains oval sedge)
- Sporabolis sp. (prairie dropseed and others)
- Elymus spp. (wild rye & bottlebrush grass)*
- Schizachyrium scoparium (little bluestem)*
- Koeleria macrantha (june grass)*
- Panicum virgatum (Switch grass)*
- Sorghastrum nutans (Indian grass) *
- Stipa sp. (porcupine grass) *

* no stratification needed
Other Considerations for Species Selection

- **Soil Type**: Match the species habitat preferences to soil moisture conditions
- **Diversity**! Include representatives from as many plant families as possible
- Include species with **high pollinator value**
- Plan for **bloom succession** (pollinators need bloom all season long). Aggressive species as needed for resisting weed invasion
- **Locally adapted** species/ genotypes

<table>
<thead>
<tr>
<th>NRCS</th>
<th>Nurseries / Seed Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessively drained</td>
<td>Dry</td>
</tr>
<tr>
<td>Somewhat excessively drained</td>
<td>Dry Mesic</td>
</tr>
<tr>
<td>Moderately well drained</td>
<td>Mesic</td>
</tr>
<tr>
<td>Well drained</td>
<td>Mesic</td>
</tr>
<tr>
<td>Somewhat poorly drained</td>
<td>Wet Mesic</td>
</tr>
<tr>
<td>Poorly drained</td>
<td>Wet Mesic</td>
</tr>
<tr>
<td>Very poorly drained</td>
<td>Wet</td>
</tr>
</tbody>
</table>

Photos: Sarah Foltz Jordan; Karin Jokela
Propagation Considerations: Seeding

- Potting Medium
  - Soil-less media ideal (light, well-drained, some fertility)
  - Example Recipe from Tallgrass Prairie Center:

  **Soil-less Mix Recipe**

  This recipe makes about 1 cubic yard of potting medium:

  - Peat moss (4 cu. ft/bag) 2 bags (8 cu. ft)
  - Vermiculite (medium 4 cu. ft/bag) 1/2 bag (2 cu. ft)
  - Perlite (4 cu. ft/bag) 1/2 bag (2 cu. ft)
  - Sterile soil two 5-gal buckets
  - Composted (sterile) manure 40-lb bag
  - Osmocote® Plus fertilizer 15-9-12 (180 days) 8 lb

Photo: Jon Judson
Propagation Considerations: Seeding

Lots of Options

- Start in Open Flat (10 x 20) → transplant to individual cells

- Start in 128 → transplant to larger cells (leave in 128)
Propagation Considerations: Seeding

- Sowing Depth
  - Small seeds are often surface sown; see “D” in Prairie Moon Cultural Catalog

- Legumes may benefit from inoculant

Black eyed Susan (*Rudbeckia hirta*)
92,000 seeds/oz

Partridge pea (*Chamaecrista fasciculata*)
2,700 seeds/oz
Even if you do everything right, germination is often poor and uneven... and plant growth is slow. PLAN FOR THIS
Design Considerations: Site Selection

- Larger is better, but any size is better than none!
- Place plantings where pollination / pest control services are most needed
- Place plantings away from crop fields with pesticide use
- Minimize edges where weeds can encroach

Perennial Insectary Strips

- Permanent mass wildflower plantings integrated into crop fields
- Promote movement of pollinators and beneficial insects in the INTERIOR of the farm

Photo: Jennifer Hopwood
Outplanting your Transplants:

- Different species will be ready to outplant at different times (but can “hold” well in their containers until everything is ready)

- **Spring planting** – allows for growth and possible bloom before winter
- **Fall planting** – more consistent moisture
- Summer planting – ok if irrigation is possible

- Water thoroughly before bringing into the field

- Spacing: plant on 8 to 12 inch centers (or closer/farther depending on species)

- Water-wheel transplanter; by hand; etc.
Outplanting your Transplants:  Example: 1.5 days, 17K plants, 30 people!
Planting Considerations: Design

• Clustering Species vs. Spreading Evenly

• Integrate plenty of native grasses (50:50 can really help with weedy grass invasion)
Weed Control at Planting Time

Straw Mulch

Biodegradable Weed Guard

Photos: Xerces Society, Sarah Foltz Jordan
Ongoing Weed Control

- Cultivate edges
- Mow edges
- Controlled Burn
Crop-Related Concerns:

Spread of Natives into Crops?
- Mostly not an issue; Tillage keeps most things in check
- Partridge pea (annual legume) can spread

Shading of Adjacent Crops? Flopping?
- Mostly not an issue, but if that’s a concern, select shorter stature plants
Crop-Related Concerns:

Strips may capture snow drift, adding moisture to adjacent fields → slower drying, slower warming in spring.
1. Seed collecting from tallgrass prairies
2. Drying, cleaning and storing prairie seed
3. Propagating native plants
4. Recognizing and appreciating tallgrass prairie remnants
5. Native seed source and quality
6. Designing seed mixes
7. Site preparation
8. Seeding
9. Initial post seeding and early reconstruction management
10. Evaluating stand establishment

Additional Resources: Tallgrass Prairie Center Technical Guides

https://tallgrassprairiecenter.org/technical-guides
Additional Resources: Prairie Moon Cultural Catalog
Additional Resources: Xerces Society: Harvesting & Using Your Own Seed

Collecting and Using Your Own Wildflower Seed
To Expand Pollinator Habitat on Farms

James Eckberg, Jenifer Hopwood, and Eric Lee-Mader

Native wildflowers are the backbone of pollinator habitat on the farm. Field borders, filter strips, pastures, hedgerows, and other places where wildflowers (and grasses) grow also provide on with natural pest control by consuming populations of crop pests. Additionally, these plants help filter nutrient losses, and protect soil from erosion. Despite the benefits that native wildflowers and grasses provide, the cost of seed can be daunting. Fortunately, if you have native plant areas already established, they can provide you with a ready supply source for additional seed.

While harvesting seed from existing wildflowers around the farm may yield huge volumes, it can provide you with the raw material to gradually create more habitat on the farm. By collecting seed from plants already growing on your land, you are also focusing your efforts on species that are known to perform well on your soils. In this document we outline the basic steps of collecting native plant seed using readily available, non-specialized equipment. While we focus primarily on wildflowers, many of these same techniques can be useful for collecting native grasses as well as seeds from trees and shrubs.

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### Additional Resources: Xerces Site Preparation / Weed Control

- **Solarization**
- **Smother Cropping**
- **Repeat Cultivation**
- **Soil Inversion**
- **Organic Herbicides**
- **Sheet Mulching**
- **Sod Removal**
- **Weed Barriers**
- **Burning**
- **Livestock Rooting**

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#### Organic Site Preparation

**For Wildflower Establishment**

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<th>Method</th>
<th>When to Use</th>
<th>When not to Use</th>
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<tr>
<td><strong>Solarization</strong></td>
<td>- Flat or gently sloping sites with low-tide of nutrition</td>
<td>- Steep slopes or areas with microtopography</td>
</tr>
<tr>
<td></td>
<td>- Sunny sites</td>
<td>- Shady or wet sites</td>
</tr>
<tr>
<td></td>
<td>- Small areas, up to 15 sq. ft.</td>
<td>- Large sites (15+ ac.)</td>
</tr>
<tr>
<td></td>
<td>- Cultivation equipment is available</td>
<td>- Regions where average summer temperatures are low</td>
</tr>
<tr>
<td></td>
<td>- Use clear, 70-01 plastic available or new is affordable</td>
<td>- Clear 70-01 plastic is unavailable or unaffordable</td>
</tr>
<tr>
<td></td>
<td>- Minimal maintenance of the site during summer is delayed</td>
<td>- Sites where deep pressure is high, as clear can easily puncture plastic</td>
</tr>
<tr>
<td><strong>Smother Cropping</strong></td>
<td>- Flat or gently sloping, sunny, and well-drained sites</td>
<td>- Steep topography with high spring potential poor drainage</td>
</tr>
<tr>
<td></td>
<td>- Cover crop rotations are already started early in summer</td>
<td>- Cover crop rotations are not used or do not fit into this plan</td>
</tr>
<tr>
<td></td>
<td>- Weed pressure is low to moderate</td>
<td>- Tillage pressure is high (e.g., fall field)</td>
</tr>
<tr>
<td></td>
<td>- Tillers can be set off throughout entire site prep process</td>
<td>- Tillers cannot be set off (e.g., fall field)</td>
</tr>
<tr>
<td></td>
<td>- Proper equipment for planting and termination are not available</td>
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<td></td>
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<td></td>
<td>- In designated weedy or area withently drained soil</td>
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<td>- Where planting non-native plants is probable and native plants may be threatened by the intentional exclusion of non-native cultivated species</td>
<td></td>
</tr>
<tr>
<td><strong>Repeated Shallow Cultivation</strong></td>
<td>- Flat or gently sloping, sunny or shady sites</td>
<td>- Same slopes</td>
</tr>
<tr>
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<td>- Transplanting is feasible and sites with low weed pressure</td>
<td>- Where experience is low concern</td>
</tr>
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<td>- Proper equipment is available and can be used for this purpose</td>
<td>- Site is sufficiently weed pressure is medium to high</td>
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<td>- Tillage equipment is available (see Appendix B)</td>
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<td><strong>Sheet Mulching</strong></td>
<td>- Flat or gently sloping, sunny or shady, and backyards</td>
<td>- Designated wetlands or areas with poorly drained or fragile soil</td>
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<td>- Small areas, up to 15 sq. ft.</td>
<td>- Large areas (15+ ac.)</td>
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<td>- Cultivation is practical, e.g., rocky conditions, weed pressure</td>
<td>- And/or semi-arid climates without access to irrigation</td>
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<td>- Minimal maintenance of the site during cultivation</td>
<td>- Site contains aggressive or persistent deep rooted, perennial, non-native, woody weeds</td>
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<td></td>
<td>- Mulching materials are available or affordable</td>
<td>- Mulching materials are available or unsuitable (low cost)</td>
</tr>
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<td><strong>Sod Removal</strong></td>
<td>- Flat or gently sloping, sunny or shady sites</td>
<td>- Slow slopes</td>
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<td>- Sites where sod removal is not a concern</td>
<td>- Simple concerns are very high</td>
</tr>
<tr>
<td></td>
<td>- Sites with medium to high weed pressure or dense grass soil</td>
<td>- Multisite control is available or unsuitable or unaffordable (low cost)</td>
</tr>
<tr>
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<td>- Site can be sprayed or sprayed sites</td>
<td>- Overall deep rooted perennial weeds (that susceptible to herbicide)</td>
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<td>- Weed pressure is low and other methods can be used</td>
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<tr>
<td><strong>Organic Herbicide Applications</strong></td>
<td>- Flat or gently sloping, sunny or shady sites</td>
<td>- Application equipment is available or unaffordable or unaffordable</td>
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<tr>
<td></td>
<td>- Cultivation is practical, e.g., rocky conditions, conservation</td>
<td>- Targeted weeds are non-native, perennial, or herbicides</td>
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<tr>
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<td>- Targeted weeds are annual or biennial species (see text)</td>
<td>- Targeted weeds are native and perennial (pre-emergent)</td>
</tr>
<tr>
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<td>- Targeted weeds are at seedling stage</td>
<td>- Water pollution concerns are high</td>
</tr>
<tr>
<td><strong>Sod Removal</strong></td>
<td>- Sites composed of dense sod, regularly moved for several years</td>
<td>- Large sites, where sod removal would be impractical</td>
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**Photos** Sarah Foltz Jordan
Special thanks to PFI, our farm partners, Xerces members, and supporters

**OUR FARMERS:**
- Agua Gorda Cooperative
- Blue Gate Farm
- Casey Bailey Farm
- Del's Orchard
- Grinnell Heritage Farm
- Genuine Faux Farm
- Mustard Seed Community Farm
- Helgelson Farm
- Heidel Family Dairy Farm
- Longdale Farm
- Little Hill Berry Farm
- Melon Patch Herbs
- Nelson Family Farm
- Open Hands Farm
- Prairie Drifter Farm
- Paul Mugge Farm
- Rabinowitz Farms
- Stone Creek Farm
- Sogn Valley Farm
- Spring Winds Farm
- Taproot Farm
- Uproot Farm
- Vilicus Farms
- Waxwing Farm
- York Farm
- AND MANY MORE.....

**XERCES SUPPORT FROM:**
- Xerces Society Members
- Annie's
- Bently Foundation
- Cascadian Farm
- Ceres Trust
- Cheerios
- Cinco
- Clif Bar Family Foundation
- CS Fund
- Disney Conservation Fund
- The Dudley Foundation
- Endangered Species Chocolate
- Gaia Fund
- Generals Mills
- Häagen-Dazs
- J. Crew
- Justin's
- Madhava Natural Sweeteners
- Metabolic Studio
- Minnesota Environment and Natural Resources Trust Fund
- The Monarch Joint Venture
- Nature Valley
- Prairie Moon Nursery
- Sustainable Agriculture Research and Education program
- Turner Foundation, Inc.
- USDA Natural Resources Conservation Service
- The White Pine Fund
- Whole Systems Foundation

Photo: Sarah Foltz Jordan
## Contact Information:

<table>
<thead>
<tr>
<th>Jon Judson</th>
<th>Diversity Farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>712 830 4143</td>
<td></td>
</tr>
<tr>
<td><a href="mailto:diversityfarms@iowatelecom.net">diversityfarms@iowatelecom.net</a></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sarah Foltz Jordan</th>
<th>Xerces Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>612 845 4531</td>
<td></td>
</tr>
<tr>
<td><a href="mailto:sarah.foltz@xerces.org">sarah.foltz@xerces.org</a></td>
<td></td>
</tr>
</tbody>
</table>