The How and Why of On-Farm Pollinator Habitat

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The Xerces Society for Invertebrate Conservation

Re-wilding agriculture for biodiversity conservation

Xerces blue butterfly (Glaucopsyche xerces), the first U.S. butterfly to go extinct due to human activities

Headquarters: Portland, Oregon
Regional Offices: Iowa, Minnesota, Indiana, Nebraska, Wisconsin, North Dakota, Oklahoma, Oregon, Washington, California, Connecticut, Maine, New Jersey, New York, North Carolina

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Scattergood Friends School Farm

Scattergood Friends School:
Day and Boarding High School near Iowa City, Iowa
25+ acres of restored prairie
8 acres of IDALS certified organic fruit and vegetable production
Grass-based livestock program supplies meat to the cafeteria
Small classes, experiential learning and intentional community
NRCS Iowa Conservation Innovation Grant: Habitat + Field Days

Scattergood Farm 290th St

A. Plug vs. seed side-by-side comparison. 4 ft of each?

B. Native plants for tea garden (some room will be reserved for non-native annual and perennial tea plants)

C. 1 row of plugs to extend existing row of big bluestem plugged last year
Habitat is key for pollination & natural pest control

Photos: Sarah Foltz Jordan, Thelma Heidel-Baker, Adam Varenhorst, Jennifer Hopwood

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Landscape complexity enhances natural beneficial insect populations in 74% of cases (Bianchi et al. 2011)


Photos: Matthew Roth, Sarah Foltz Jordan
Pollinator habitat: there’s something for everyone!

This talk will focus on:

• Pollinator Habitat Options
• Habitat Restoration Process
  • Site Prep, Planting, Weeding & Management
• Lessons learned at Scattergood Farm!

Photo: Karin Jokela / Xerces Society
Habitat Opportunities in Ag Landscapes

- Field Borders
- Retired Crop Land, Fallow Areas
- Pollinator / Insectary Strips
- Beetle Banks
- Cover Crops & Intercrops
- Flowering Hedgerows
- Filter Strips, Wetlands, Buffers
- Flowering Pasture
- Orchard Understory Plantings
- Drift Protection (non-flowering hedgerows)
On-Farm Pollinator Habitat Opportunities: Native Prairie Plantings

Field Borders, Conservation Cover, CRP Plantings, etc.

- Larger footprint prairie restorations
- Intended to be permanent native vegetation

Photo: Sarah Foltz Jordan

Roger Larson Farm, Princeton, MN
Scattergood Farm: Pollinator Pallooza Planting

Photos: Sarah Foltz Jordan, Xerces Society
On-Farm Pollinator Habitat Opportunities: Native Insectary Strips

- Native wildflowers between row crops
- Dispersed throughout fields
Scattergood Farm: Insectary Strips
On-Farm Pollinator Habitat Opportunities: Beetle Banks

Permanent native grass strips intercropped with vegetables or row crops

**Beetle banks enhance biocontrol:**

- Beetles feed on aphids, flies, snails, slugs, mites, insect eggs, grasshoppers
- Several species will consume up to 40 weed seeds per square foot/day

Grinnell Heritage Farm, Grinnell, IA

Photo: Grinnell Heritage Farm; Bugwood

**Pasimachus ground beetle**

**Firefly beetle**
On-Farm Pollinator Habitat Opportunities: **Annual Insectary Strips**

- Temporary mass wildflower plantings between row crops
- Low cost
- Rapidly blooming species
- Minimal site preparation
- Can provide multiple benefits (Cut flowers, Nitrogen-fixing; Weed control...)

Open Hands Farm, Northfield, MN

Photo: Sarah Foltz Jordan
Scattergood Farm: Annual Plantings

Photos: Practical Farmers of Iowa (left), Sarah Foltz Jordan / Xerces Society (right)
On-Farm Pollinator Habitat Opportunities: Annual Insectary Strips

- Partridge pea
- Plains coreopsis
- Annual blanket flower
- Buckwheat
- Dill
- Cilantro
- Sunflower
- Allysum
- Phacelia
- Holy Basil
- Red clover
- Bachelor’s button
- Cosmos
On-Farm Pollinator Habitat Opportunities: **Cover Cropping**

**To benefit pollinators:** Allow cover crop to bloom before incorporating or mowing

**Maintain healthy soils and crops with cover crops**
- Improve soil health and prevent erosion
- Increase water filtration
- Increase farm biodiversity
- Suppress weeds
- Support natural enemies and pollinators

Photo: Toby Alexander, NRCS
Lots of options for cover crops that support beneficial insects!

- Buckwheat (*Fagopyrum esculentum*)
- Lacy phacelia (*Phacelia tanacetifolia*)
- Partridge pea (*Chamaecrista fasciculata*)
- Brassica spp.
Tillman 2013: Flowering cover crops near soybeans (buckwheat for nectar) increased wasp parasitism of stink bug eggs by 2 ½ times.
On-Farm Pollinator Habitat Opportunities: Native Flowering Hedgerows

Little Hill Berry Farm, Northfield, MN

Photos: Sarah Foltz Jordan, Nancy Adamson

- **Early Spring Forage** (hawthorne, wild plum, juneberry, willows, maples)
- **Nesting resources for stem nesting insects** (elderberry, sumac)
- **Screening, wind and dust reduction, living snow fences**
- **Harvestable fruit, tea** (elderberry, juneberry, NJ tea, aronia, highbush cranberry, currants)
- **Seed/berries for birds** (Vibernums, juneberry, hawthorne…)

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Key Native Flowering Shrubs

- **Elderberry** (black and red) (*Sambucus* spp.)
- **Juneberry** (*Amelanchier* spp.)
- **Highbush cranberry** (*Viburnum trilobum*)
- **Nannyberry** (*Viburnum lentago*)
- **Cockspur Hawthorn** (*Crataegus crus galli*)
- **Wild plum** (*Prunus americana*)
- **Currants** (*Ribes* spp.)
- **New Jersey Tea** (*Ceanothus americanus*)
- **Aronia** (*Aronia melanocarpa*)
- **Dogwood** (*Cornus* spp.)
- **Willow** (*Salix* spp.)
- **Lead plant** (*Amorpha canescens*)

*Plants in blue provide edible product*
On-Farm Pollinator Habitat Opportunities: Native Flowering Hedgerows

Native elderberry & currant hedgerow

Diverse native hedgerow with forb component

Photos: Sarah Foltz Jordan, Xerces Society

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On-Farm Pollinator Habitat Opportunities: Native Tea Garden

Photos: Practical Farmers of Iowa
On-Farm Pollinator Habitat: Drift Protection Buffers

- Place habitat away from sites of application (e.g. crops), 40 ft. for ground applications, 125 ft. for neonic treated fields
- Work with farmers/applicators to establish buffers or setbacks: Unsprayed area (30’ – 60’)
- Pesticide drift barriers: ‘Non-habitat’ vegetative barriers (eg. conifers)
On-Farm Pollinator Habitat: **Drift Protection Buffers**

- Spruce, fir, juniper are better than pine
- Multiple rows of low porosity vegetation are better than a single row of dense vegetation
- Aim for ~60% density


Photo: Sarah Foltz Jordan

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Interseeding Wildflowers into Grasslands

### Interseeding Wildflowers to Diversify Grasslands for Pollinators

#### Management Timelines & Techniques

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>Spring</th>
<th>Summer</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
<th>Full</th>
<th>Spring</th>
<th>Summer</th>
<th>Full</th>
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<td><strong>First Year (Preparation for Interseeding)</strong></td>
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<tr>
<td><strong>Years 3+ (Ongoing Management)</strong></td>
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#### Disturbance & Management Techniques

- **Grazing**: Grazing intensively during the growing season of dominant grasses. Grazing also may help remove litter. Aggressive grasses may require multiple years of grazing during the appropriate season.
- **Burning**: Burns to suppress grasses and remove litter. Target dominant grasses or weeds during their growth periods. Aggressive species may require multiple years of burning during the appropriate season.
- **Haying/Mowing**: Haying can help suppress grasses and remove litter. Be sure to follow haying/mowing at the best times to avoid damage to wildflower seedlings.
- **Herbicides**: Multiple applications may be necessary. If cool season grasses are dominant, use a GRASS-SELECTIVE HERBICIDE if possible.
- **Grass-Selective Herbicides**: Apply GRASS-SELECTIVE HERBICIDES during seedling establishment. Spot-spray invasive weeds as needed.
- **Interseeding**: Do not interseed site without adequate preparation.
- **Disking (PLOW)**: Not recommended. Disking can be used to suppress grasses but can also increase soil erosion, promote weed growth, and disturb soil biology. Though it may be appropriate under some circumstances on previously cropped land, disking should NEVER be used on sites with such conditions.

#### Xerces Society

Xerces Society for Invertebrate Conservation
Farm Planning: Cover Crops (yellow) & Native Prairie Habitat (pink)

Uproot Farm: Isanti Co., MN; 30 acres Organic Vegetables

Photos: Uproot Farm
Spring Winds Farm: Northfield, MN

Farm Planning: Native Ground Cover for Apple Orchard + Native Strips + Hedgerows
Native Habitat Installation Process

- Habitat Evaluation
- Site Selection
- Pesticide Risk Mitigation
- Planting Design / Seed Mix
- Pre-planting Weed Control
- Habitat Installation
- Ongoing Weed Management
Organic Site Preparation for Wildflower Establishment

- Smother Cropping
- Solarization
- Repeat Cultivation
- Soil inversion
- Organic Herbicides
- Sheet Mulching
- Sod Removal
- Weed barriers
- Livestock Rooting
- Burning/Grazing
Smother Cropping: high density cover crop to outcompete weeds

- Duration: 1 or more growing seasons
- Timing is essential;
- Requires attentive management to be effective
- Species selection varies based on soils & weeds
- Termination methods vary (mowing; winter kill; cultivation)

Photos: Kelly Gill, Sarah Foltz Jordan
Smother Cropping: Buckwheat
Del’s Orchard, Leonard, MN
Smother Cropping

Lots of Options

- Buckwheat
- Millet spp.
- Sorghum sudan
- Alfalfa
- Crimson Clover
- Oats, Peas, Red Clover
- Diverse species blends

Partridge Pea
(Chamaecrista fasciculata)

Lacy Phacelia
(Phacelia tanacetifolia)

Oats, Peas, Clover Blend
Smother Cropping: Oats & Proso Millet
York Farm, Hutchinson, MN

July 2016
Starting conditions: mostly quack grass

Photos: Sarah Foltz Jordan

Spring 2017:
Oat Smother Crop

Summer 2017:
Proso Millet Smother Crop

Oct. 2017
Light drag; Broadcast Seeding; Cultipacking

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Smother Cropping: Japanese Millet & Sorgum Sudangrass
Waxwing Farm, Webster, MN

Summer 2016
Starting conditions: wet weedy crop field (quack grass, water smart weed, annual weeds)

Summer 2017
50:50 Sorghum Sudan: Japanese Millet Smother

Summer 2018
Sorghum Sudan Smother

Oct-Nov. 2018
Controlled Burn & Seeding

Photos: Karin Jokela; Waxwing Farm
Red clover…fuel for monarch migration?

250 monarchs nectaring in field of red clover Sumpter, Minnesota Aug. 29, 2015
Solarization: smothering weeds; heating soil to kill weed seeds

- Duration- 1 growing season
- 4 or 6 mil UV stabilized, *clear* high tunnel plastic (USED is great)
- Ideally no airflow, repair rips throughout season (may need deer fence)
- DO NOT TILL after removing plastic
- Not effective against some weeds
- Costly; plastic disposal issues

1. Cultivate or mow to create a seed bed (spring)
2. Dig trench around perimeter (spring)
3. Lay solarization plastic (spring)
4. Remove plastic (fall)
5. Broadcast seed (fall)

Photos: Sarah Foltz Jordan; Eric Mader
Used Plastic

Photo: Sarah Foltz Jordan, Xerces Society
Piecing it together

Clean seams! That’s better

Photo: Sarah Foltz Jordan, Xerces Society
Moving a piece of plastic through an area over multiple years

Heidel Family Dairy Farm, Random Lake, WI

Photos: Sarah Foltz Jordan
Solarization- Dry Soils
Keepsake Farm, Princeton MN

June 2015

June 2018
Solarization - Dry Soils
Keepsake Farm, Princeton MN

Photos: Sarah Foltz Jordan

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Solarization Case Study: Wet Basin with Reed Canary
Open Hands Farm, Northfield, MN

Sept. 2014: regularly mowed weedy basin (reed canary, narrow-leaf cattail, some CA thistles)

Solarized 2015 (full growing season)

Seeded March 2016

Photos: Sarah Foltz Jordan

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August 2018: cardinal flower, great blue lobelia, swamp milkweed, blue vervain, false aster, monkey flower, meadow rue, bur marigold, bottle gentian, brown-eyed susan…

Photos: Sarah Foltz Jordan
Weeds Differ in their Response to Solarization

In my experience in the Upper Midwest....

Solarization Works Well
- Quack
- Smooth Brome
- Reed Canary
- Kentucky Bluegrass
- CA Goldenrod
- Burnet Saxifrage (carrot family)
- Yellow Bedstraw

Solarization Hasn’t Worked Well
- Canada Thistle
- Yellow Nutsedge
- Purslane
Repeat Cultivation: mechanical disturbance to reduce weeds & seed bank

- Use implements with shallow depth
- Repeated throughout season
- Timing is critical
- Results variable
- Best success when weed pressure is low

Photos: Eric Mader, Alex Stone (OSU)
Repeat Cultivation: Open Hands Farm, Northfield, MN

Spring 2015

Summer 2016
Starting conditions: mostly non-native cool season grasses & Canada goldenrod
Solarization vs. Repeat Tillage
Stonecreek Farm, Taylor’s Falls, MN

Photo: Sarah Foltz Jordan
Adaptive Weed Management

PRE-PLANTING weed control (site prep):
• Tailor approach to best target weeds on site
• Focus on invasive, persistent perennial weeds
• May require multiple seasons, multiple methods

PLANTING
• Choose aggressive species
• Fill as many niches as possible
• Use a high seeding rate
• Consider container plants/ bare root plants if needed

POST-SEEDING weed control:
• Regular mowing for at least one growing season
• Ongoing, rapid spot-treatment of any problematic weeds

Photos  Sarah Foltz Jordan
Mowing for Weed Management During Establishment

Planting in Year 2 of Growth  Planting in Year 1 of Growth

Heidel Family Dairy Farm, Random Lake, WI

Photo: Thelma Heidel-Baker
Insectary Strips: Side-by-Side Comparison Plugs vs. Seeds
Scattergood Farm, West Branch, Iowa

A. Plug vs. seed side-by-side comparison. 4 ft of each?

B. Native plants for tea garden. (some room will be reserved for non-native annual and perennial tea plants)

C. 1 row of plugs to extend existing row of big bluestem plugged last year
Insectary Strips: Side-by-Side Comparison Plugs vs. Seeds

Scattergood Farm, West Branch, Iowa
Insectary Strips with Plugs (rather than seed)
Prairie Drifter Farm, Litchfield, MN; Uproot Farm, Princeton, MN; Melon Patch Herbs, Princeton, MN

Photos: Sarah Foltz Jordan

June 2016
Insectary Strips with Plugs (rather than seed)
Prairie Drifter Farm, Litchfield, MN

Rapid Restoration!

• Dense & diverse wildflowers just ONE YEAR after planting
• Very little weed management needed
• Low Cost if growers propagate some of the natives

August 2017

Photo: Sarah Foltz Jordan / Xerces Society

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Insectary Strips with Plugs (rather than seed)

June 2016

Uproot Farm, Princeton, MN

July 2017

Photos: Sarah Foltz Jordan
Insectary Strips with Plugs (rather than seed)
Scattergood Farm, West Branch, IA

Rapid Restoration!

September 2019

Photo: Sarah Foltz Jordan / Xerces Society

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Insectary Strips with Plugs (rather than seed)
River Root Farm, Decorah, IA
Native Perennial Insectary Strip Sample Seed Mix

- Species are native to your county
- Species are appropriate for your soils
- Mix provides bloom spring through fall
- Includes diverse, high-quality bee plants
- Includes shallow-nectary flowers
- Includes milkweeds
- Includes bunch grasses & sedges
- Forb to grass ratio  40:60, 50:50, 60:40
- Seeds per Square Foot: 45+
- Cost: ~$800/acre+

<table>
<thead>
<tr>
<th>Species/Varity</th>
<th>Bloom (Early Mid Late)</th>
<th>Percent of mix by seed count</th>
<th>Total number seed/ft²</th>
<th>Target bulk seed/ft²</th>
<th>number seeds/lb</th>
<th>number seeds/oz</th>
<th>Baseline seeding rate (lbs/seed/ac)</th>
<th>Number acres</th>
<th>Total pounds seed</th>
<th>Price per lb</th>
<th>Price per seed</th>
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</thead>
</table>
The Habitat Restoration Process: Seeding

• Timing: Dormant season is best
• Mix the seed with an inert carrier
  • Sawdust
  • Peat moss

Photos: Sarah Foltz Jordan, Xerces Society
The Habitat Restoration Process: Seeding Methods
The Habitat Restoration Process

Post-broadcast seeding: roll with cultipacker (less important if Fall seeding compared to Spring Seeding)

Photo: Sarah Foltz Jordan, Xerces Society
Xerces-NRCS Conservation Partnership

- Xerces-NRCS Farm Bill Biologists
- Technical assistance for Farm Bill programs
- Developing / enhancing on-farm pollinator habitat
- Financial support for conservation
- Find out more at: www.nrcs.usda.gov
Special thanks to PFI, our farm partners, Xerces members, and supporters

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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
Johnson County Historic Farm
Melon Patch Herbs
Nelson Family Farm
Open Hands Farm
Prairie Drifter Farm
Paul Mugge Farm
Rabinowitz Farms
Scattergood Farm
Stone Creek Farm
Sogn Valley Farm
Spring Winds Farm
Taproot Farm
Uproot Farm
Vilicus Farms
Waxwing Farm
York Farm
AND MANY MORE…..

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Photo: Sarah Foltz Jordan