Interseeding:
Bringing back flower diversity to your grasslands

Rae Powers, Farm Bill Pollinator Conservation Planner, Nebraska

Mace Vaughan, Pollinator Program Co-Director and NRCS Partner Biologist, WNTSC

Webinar July 19, 2018

Photo: Sarah Foltz Jordan

© 2018 The Xerces Society, Inc. All rights reserved.
Introduction to Xerces Society

Conservation planning, education, research, restoration, and advocacy to protect invertebrates and habitat

- Ten joint Xerces / USDA-NRCS positions
- Diverse staff background and expertise

Staff in Nebraska, Iowa, Minnesota, Wisconsin, Oklahoma, North Carolina, New Jersey, North Dakota, Connecticut, California, Oregon, Washington, Maine

Photos: Ann Avervill/University of Massachusetts; Xerces Society; Sarah Greenleaf
Today’s webinar…

• Importance and decline of pollinators
• Importance of maintaining diverse wildflower stands

• Interseeding process
• Where to go for more information
More than 85% of flowering plants require an animal, mostly insects, to move pollen.

Ollerton et al. 2011

Photo: Rollin Coville
Pollinators and human nutrition

Pollinators are valuable to our economy and our nutrition.

• 35% of crop production, worldwide
• Over $18 to $27 billion value of crops in U.S. ($235-$577 billion worldwide)
• Many of our vitamins and minerals are from insect-pollinated plants

Morse and Calderone 2000; Klein et al. 2007; Eilers et al. 2011; IPBES, 2016
## Importance of Pollinators: Valuable for Wildlife

| Fruits and seeds are a major part of the diet of many birds and mammals | Pollinators and other insects are food for wildlife, including 89% of birds!! | Pollinator habitat supports the needs of other wildlife |

Photos: Wildreturn, Flickr; Ron Nichols, NRCS; Xerces Society / Matthew Shepherd; Karen Ward, NPS.
Meet the pollinators

Photos: Bryan E. Reynolds (2); Sarah Foltz Jordan; David Inouye; Bruce Newhouse; Mace Vaughan
Bees: The most efficient pollinators

- Bees actively collect and transport pollen
- Bees exhibit flower constancy
- Forage in area around nest

Photo: Rollin Coville
Status of Pollinators

Evidence of managed and wild pollinators in decline

Parallel Declines in Pollinators and Insect-Pollinated Plants in Britain and the Netherlands


While widespread concern about declines in pollinator numbers is less intense about the patterns of change in managed pollinator assemblages, by studying bee and butterfly abundance trends, we found evidence of declines in various plant species and plant communities. These trends were observed for both managed and wild pollinators in both the United States and the Netherlands. In both countries, however, observed trends were congruent in behaviour. Dependent on the landscape and location, pollinator declines were most evident in habitat and flower species, but not for all species. In contrast, wild pollinators have shown evidence of decline. Overall, these findings strongly suggest a crucial role of pollinators in the sustainability of managed and wild plant species.

Patterns of widespread decline in North American bumble bees

Sydney A. Cameron, Jeffrey D. Layens, James P. Strange, Jonathan B. Koch, Nile Cordei, Leeellen E. Settele, and Terry L. Griswold

Bumble bees (Bombyliidae) are widely important pollinators of wild and agricultural crops worldwide. Prioritizing observations, however, have suggested population declines in several North American species. Despite ongoing concerns over these observations in the United States, highlighted in a recent National Academy of Sciences report, a number of new reports on geographic and population level declines have appeared. These new reports have increased the urgency for further investigation in both managed and wild pollinators.

SPECIAL COLLECTION: LONG-TERM TRENDS IN EASTERN NORTH AMERICAN MONARCH BUTTERFLIES

Long-Term Trends in Eastern North American Monarch Butterflies: A Collection of Studies Focusing on Spring, Summer, and Fall Dynamics

Andrew K. Davis* and Lee A. Dyner

This collection presents a comprehensive summary of long-term studies on the population dynamics of Monarch butterflies in North America. The studies span over 50 years and cover various aspects of Monarch biology, including larval host plant use, adult migration, and population fluctuations. The collection highlights the importance of monitoring these butterflies for conservation purposes.

Plant-Pollinator Interactions over 120 Years: Loss of Species, Co-Occurrence, and Function

Laura A. Yust, John T. Kurtz, and Jennifer K. Wing

Using long-term data sets, we examined the degree to which global climate change has affected plant-pollinator interactions in a temperate forest understory community. We found significant changes in the types of species interacting over time, with a shift towards more generalist pollinators. These changes have implications for the functioning of ecosystem processes such as pollination and seed dispersal.
Status of Pollinators

Large scale loss of pollinator diversity

• >40% of global invertebrate pollinator species facing extinction, particularly bees and butterflies

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)
Bumble Bees in Decline

Bumble bees
• Critical pollinators of crops and wildflowers
• Important example of relatively well studied group of native bees

Cameron et al. 2011; Hatfield et al. 2014 Xerces Society-IUCN status review; Cameron et al. 2016

Photo: Bombus fratermus, by Jennifer Hopwood
Bumble Bees in Decline

Used a database of 250,000+ specimen records to evaluate changes between recent and historic populations.

28% of bumble bees in Canada, the United States, and Mexico are in an IUCN Threatened Category.

Source: Hatfield et al. 2015
Butterflies in decline

More than 17% of North American butterfly species at risk

This includes both habitat specialists and formerly common and widespread species

Source: NatureServe
Butterflies in Decline: Monarchs

- Monitored in hectares of forest occupied
- 84% decline from population high in 1996
Honey Bee Hive Loss

The European honey Bee: our most familiar commercial crop pollinator

• Before 1995:
  • Less than 15% per year

• 1995-2006 (Before CCD):
  • 15% - 22% per year

• 2006-today (After CCD):
  • 22% - 45% per year

National Research Council, 2007; Bee Informed Partnership 2018
Honey Bees

Forb-rich CRP Important for Beekeepers

• The Great Plains are a critical honey bee resting ground and honey-producing area for beekeepers

• Significant loss of CRP acres means that remaining CRP needs to be even more nectar- and pollen-rich.

Map: Otto et al, 2018
(http://www.pnas.org/content/115/29/7629)
What we can do to help

Photo: Jennifer Hopwood
Conservation Across Landscapes

We must actively work to protect, manage, enhance, and restore resilient habitats where plants and pollinators can survive and thrive.
Protect and manage existing habitat

Protect and manage areas of high-quality or potential habitat

- Land enrolled in CRP or other conservation programs
- Native range
- Prairie pockets
- Old fields
- Pivot corners and field margins

Photo: Jennifer Hopwood
Protect and manage existing habitat

Often there are opportunities to better manage existing habitat for the benefit of pollinators.

Photos: Heritage Seedlings, Inc.; NYSDOT; Xerces Society / Anne Stine; Yamhill County Council
Habitat management with pollinators in mind

Management as the first consideration in increasing wildflower abundance and pollinator quality

- In some circumstances, management alone can restore or increase wildflower diversity and should be the first course of action
- Time management for when most effective against target grasses or weeds, or during dormant season for wildflowers
- Allow for sufficient recovery times
- When managing high quality habitat, ideally disturb no more than 1/3 of area each year to allow for pollinator refuge
If management isn’t going to do the job…

- No viable wildflower seed bank
- Previously cropped or CRP ground now dominated by grasses

…Now we start to think about interseeding.
Interseeding
What is interseeding?

• Adding diversity to existing vegetation
• Overseeding
• Litter removal before interseeding
• Process of vegetation suppression before and after interseeding
• Careful selection of wildflower species

Kremen et al. 2004; Winfree et al., 2008; Morandin and Winston 2006; Garibaldi et al 2011; Blauuw and Isaacs 2014
When to start over

• High noxious weed pressure
• Aggressive non-native cool season grasses are very dominant (reed canary grass, smooth brome, crested wheatgrass, tall fescue)
Bringing Back Flower Diversity to Grasslands

FSA-funded guidelines and brochure in development

- Review of published restoration research primarily from Great Plains and Midwest states
- Survey responses from and follow up conversations with land managers, researchers, and landowners
  - Experience with interseeding
  - Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, and North Dakota
Bringing Back Flower Diversity to Grasslands

Key Considerations

Interseeding Process

Strategies from the field

Ongoing management

- NRCS Opportunities
- Additional Resources
Key Considerations

What is already there?

- Grass Phenology
- Soil type, Drainage Class, and Landscape Position
- Species Selection
- Invasive Weeds
- Litter Management
- Precipitation
Cool Season Grasses

- Active growth in spring and fall
- Introduced species are of primary concern
- Pasture or turf grasses
- Sod forming
- May require more grass suppression

- Smooth brome (*Bromus inermis*)
- Kentucky bluegrass (*Poa pratensis*)

- Reed Canary Grass (*Phalaris arundinacea*)
- Tall Fescue (*Schedonorus arundinaceus*)

Photo: Dave Williams, Karin Jokela
Warm Season Grasses

- Active growth entire growing season
- Native species and non-native
- Remnant or planted
- Typically bunchgrasses
- May require some grass suppression

- Switchgrass *(Panicum virgatum)*
- Little Bluestem *(Schizachyrium scoparium)*

- Big Bluestem *(Andropogon gerardii)*
- Indian Grass *(Sorghastrum nutans)*

Photo: Dave Williams, Karin Jokela
Mixed Season Grass Stands

- Active growth throughout growing season
- Native species and introduced species
- Remnant or planted
- Bunchgrasses and sod formers
- May require some grass suppression, but less than stands dominated by introduced cool season

Photo: Chris Helzer, Rae Powers
Invasive weeds

- Invasive broadleaf weeds need control before interseeding
- Grass suppressing techniques can stimulate invasive weeds
- May outcompete interseeded wildflowers
- When invasive weed pressure is high, complete restoration may be more efficient and cost effective
Litter Management

- Seed–soil contact!
- Sunlight to seedlings
- Burning, Haying, Grazing
- More important with broadcast seeding

Photo: Karin Jokela
Soil type, Drainage Class and Landscape Position

- May have more success in sandy, gravelly, low fertility soils
- Saturated, nutrient rich soils can be difficult to interseed
Species Selection

- Plant native species that thrive in similar environments
- Choose wildflowers that bloom in different seasons
- Consider interseeding grasses or sedges if missing from plant community
- USDA Plants, Biota of North America (BONAP), nearby diverse restored or remnants
Precipitation

- Average or above average precipitation increases success
- Longer establishment time in drought conditions
Bringing Back Flower Diversity to your Grasslands

Key Considerations

Interseeding Process

Strategies from the field

Ongoing management

- NRCS Opportunities
- Additional Resources

© 2018 The Xerces Society, Inc. All rights reserved.
The Interseeding Process

• **Prior to Interseeding**: Suppressing highly competitive vegetation and litter management

• **Interseeding**: Seeding methods, seeding rates, and timing

• **Seedling establishment management**
# Before Interseeding

Grass Suppression and Litter Management

<table>
<thead>
<tr>
<th>Disturbance</th>
<th>Grass Suppression and Weed Control</th>
<th>Litter Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbicide</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Grazing</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Burning</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Haying</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Mowing</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>
Before Interseeding-Herbicides

- Non-selective
- Grass selective
- Cool season grasses – 2+ applications
- Warm season grasses – 1 application
- Invasive weed species control
- Litter management needed

Grass selective
- Clethodim
  - Select, Envoy
- Sethoxydim*
  - Poast
- Fluazifop-P-butyl
  - Fusilade

Non-selective
- Glyphosate
  - Round-up

Somewhat selective
- Imazapic
  - Plateau
Before Interseeding: Grazing

- Time to target dominant grass
- Moderate-intense grazing removes litter

Photo: Chris Helzer
Before Interseeding: Burning, Haying, Mowing

- Time to suppress dominant grass
- Often used in tandem with herbicide, grazing or both
- One time disturbance

- Can create bare soil for seeding
- Remove litter if mowing

Photo: Jeff Vanuga, Dave Williams, David O'Shields, Chris Helzer
Interseeding

Broadcast
• Hand broadcast, fertilizer spreader, drop seeder
• Bare soil essential!
• Cultipacking recommended
• Mid-contract management seed rate requirements

Drill
• Native seed drill essential
• Can plant into light stubble layer
• Plant ¼” or shallower, target depth to seed size
• Check calibration frequently

Photo: Sarah Foltz Jordan, Dave Williams
After Interseeding: Establishment management

- First and second growing season after planting
- New seedlings need light, moisture, and space above and below ground
- May need to continue grass suppression
- Don’t damage new seedlings

- Herbicide (grass selective only)
- Grazing
- Invasive weed control
- Haying/mowing

Photo: Chris Helzer, Dave Williams, David O’Shields
Bringing Back Flower Diversity to your Grasslands

- Key Considerations
- Interseeding Process
- Strategies from the field
- Ongoing management

- NRCS Opportunities
- Additional Resources
Cool Season Grass Scenarios

- Late-Summer Mow → Fall Spray → Dormant Interseed → Consider Spring Spray
- Fall Burn → Dormant Interseed → Spring Spray
- Fall Graze → Fall Spray → Spring Interseed → Late-Spring Graze → Early-Fall Graze
- Multiple Late-Spring Mowing or Burning → Late-Spring Interseed → Multiple Late-Spring Disturbances
Warm Season Grass Scenarios

Fall Burn → Fall Interseed → Summer High Mow or Hay

Summer Burn → Dormant Interseed → Summer Graze

Late-Summer Mow or Hay → Dormant Interseed → Late-Spring Spray → Summer Mow
Mixed Season Grass Scenarios

Graze all seasons → Dormant Interseed → Graze or Hay Multiple Seasons

Spring Burn → Spring Interseed → Graze or Hay Multiple Seasons

Fall Burn → Dormant Interseed → Mow or Hay Multiple Times or Graze

Late Summer/Fall Burn → Fall Spray → Dormant Interseed → Spray Grass
Selective Multiple Seasons or Hay Once per Year, Multiple Years and Varied Seasons
Bringing Back Flower Diversity to your Grasslands

- Key Considerations
- Interseeding Process
- Strategies from the field
- Ongoing management

NRCS Opportunities
Additional Resources
Ongoing Management

• Disturbance is key!

• Leave undisturbed refuges (disturb only 1/3-1/5 of site each year)

• Adaptive management

• Vary management type, timing and location
FSA and NRCS Opportunities for Interseeding

Programs
- CRP – Conservation Reserve Program
  - Mid-contract management
  - Re-enrollments
- EQIP – Environmental Quality Incentives Program
- CSP – Conservation Stewardship Program

Practices
- Range Planting
- Conservation Cover
- Upland Wildlife Habitat Management
- Herbaceous Weed Control
- Prescribed Grazing
- Prescribed Fire
- Forage Harvest Management
Conservation Technical Assistance (CTA)

Farmers, ranchers, and other landowners can visit an NRCS field office to get technical support, including the development of a farm- or ranch-specific pollinator conservation plan.
Additional Resources

• Interseeding guidelines and brochure are in final stages of development

• Placeholder on the Xerces Society website
  • https://xerces.org/interseeding-grasslands-for-pollinators/
Additional Resources

• The Xerces Society website (www.Xerces.org)
  • Pollinator Conservation Resource Center
  • Guides to establish and maintain pollinator habitat
  • Plant lists
  • Regional seed and plant vendors

• NRCS local service centers
  • nrcs.usda.gov
  • Field Office Technical Guide
  • Regional information on interseeding
Acknowledgments

Thanks and Questions

• Funding from FSA (grant award number CCC-DAFP-6-059)
• Sarah Cline and Rich Iovanna (FSA) for helping to organize this webinar
• Thanks also to the dozens of practitioners who agreed to be interviewed and consulted as we developed these guidelines.