

Managing for Native Pollinators

Grasslands and Meadows Workshop, Dover NH



Jarrold Fowler, The Xerces Society
Don Keirstead, USDA-NRCS

XI

Photo: Don Keirstead USDA-NRCS NH

Presentation Outline

Today:

1. The importance of pollinators
2. Bee ecology
3. Grassland ecology
4. Restoring pollinator habitat



XI

Photos: Bruce Newhouse; Katharina Ullmann, Xerces Society; Eric Lee- Mäder, Xerces Society; Darin O'Brien

Part 1

The Importance of Pollinators

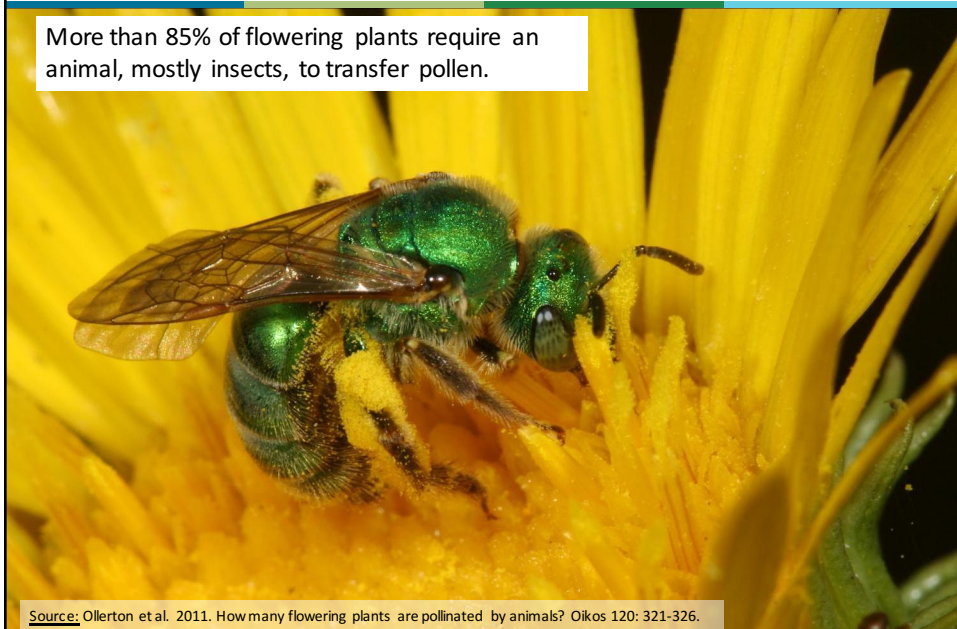


XI

Photo: Dan Mullen, <https://www.flickr.com/photos/8583446@N05/>

Importance of Pollinators

More than 85% of flowering plants require an animal, mostly insects, to transfer pollen.



XI

Source: Ollerton et al. 2011. How many flowering plants are pollinated by animals? *Oikos* 120: 321-326.

Photo: Rollin Coville

Importance of Pollinators

Benefits to Other Wildlife

- 25% of the bird and mammal diets consist of pollinator-produced seeds/fruit
- Pollinators are food for wildlife
 - Bobolink, Eastern meadowlark, Grasshopper sparrow, Horned lark, Upland sandpiper, Vesper sparrow, Whip-poor-will...
 - Blandings turtle, Black racer, Wood turtle
- Pollinator habitat compatible with needs of other wildlife



Source: Losey, JE and M. Vaughan. 2006. The economic value of ecological services provided by insects. Bioscience 56(4) 311-323

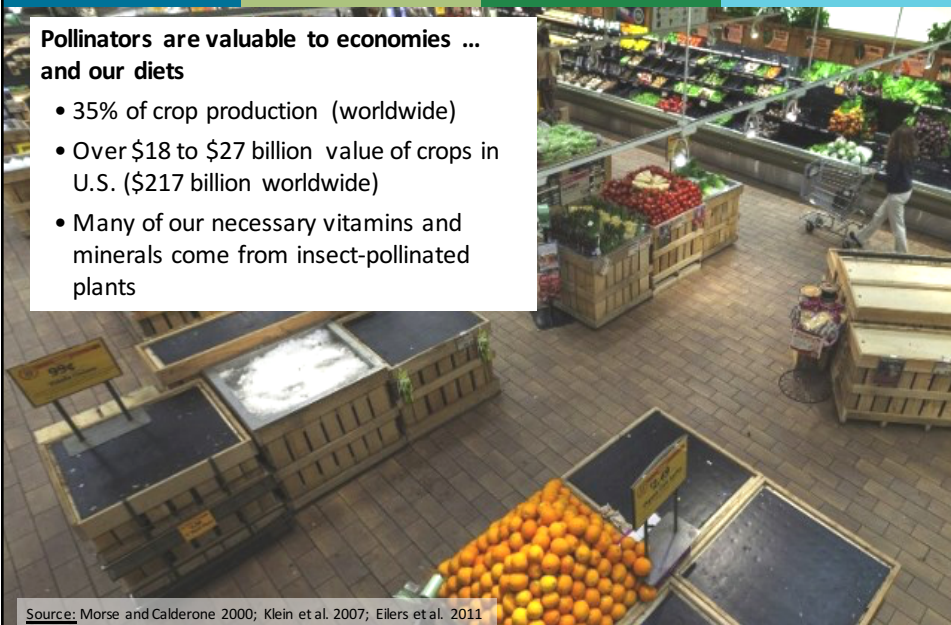


Photo: Rick Bohn

Importance of Pollinators

Pollinators are valuable to economies ... and our diets

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



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



Photo: Whole Foods Market

Importance of Pollinators



XI

Photos: Doug Tallamy; MJ Hatfield; Mace Vaughan, Xerces Society; Rollin Coville; Rich Hatfield, Xerces Society

Part 2

Bee Ecology



XI

Photo credit: Nancy Lee Adamson, The Xerces Society

Native Bee Diversity

>5,000 species of bees in N. America

- New Hampshire = ~380 species
- U.S. = 3,587 species
- U.S. & Canada = 3,613 spp.
- U.S., Canada, Mexico = 4,522 spp.
- N. A. (20 countries) = 5,180 spp.
- Wide range of forms and functions
- E.g. *Perdita* Vs. *Xylocopa*

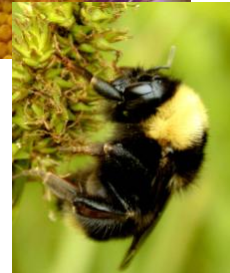


XI

Photo: Stephen L. Buchmann

Native Bee Nesting Organizations

Solitary Gregarious Communal Semi-Social Social



XI

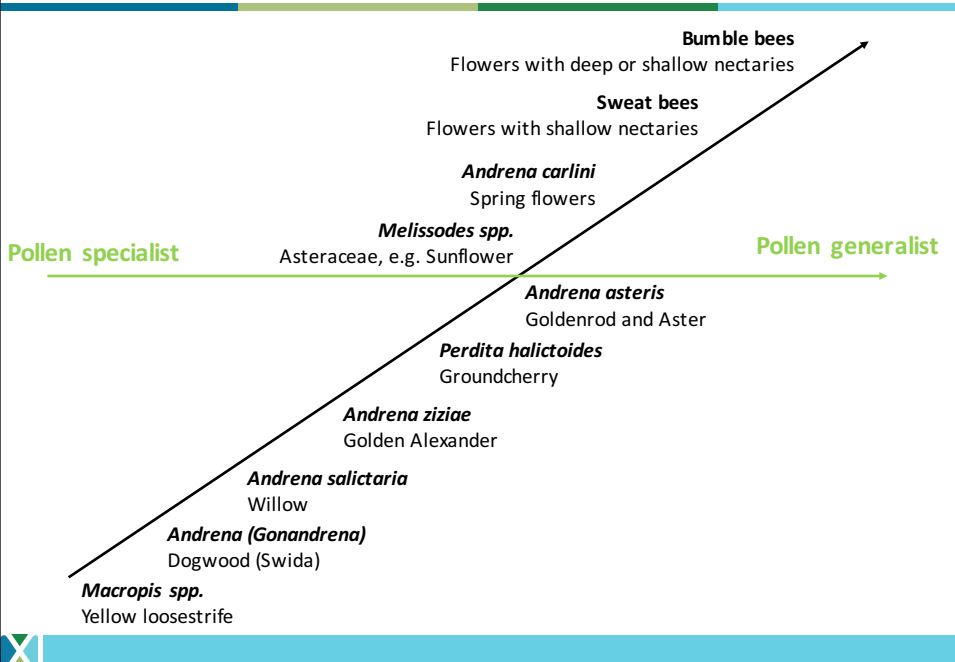
Photos: Jennifer Hopwood (Xerces), Eric Lee-Mader (Xerces), Eileen Miller, MJ Hatfield, Bruce Newhouse

Solitary Bee Life Cycle

Mining bee (*Andrena* sp.):
 One year in its underground nest as egg, larva, and pupa before emerging to spend a few weeks as an adult.

Photos: Dennis Briggs

Native Bee Host Plants



Bee Nests

70% of native bees nest underground

- Resemble ant-nests above-ground
- Often in sites with low plant cover
- Sandy to loam soils are preferred
- Nests maybe cm to m deep

30% of native bees nest in cavities

- Hollow or pithy stems, beetle holes, man-made cavities, ...
- Nest tunnel partitions constructed of mud, foliage, or fibers
- Conserve snags, brush piles

XI

Photos: : Jim Cane, Matthew Shepherd (Xerces), and Jennifer Hopwood (Xerces)

Bee Identification: Common New Hampshire Bees

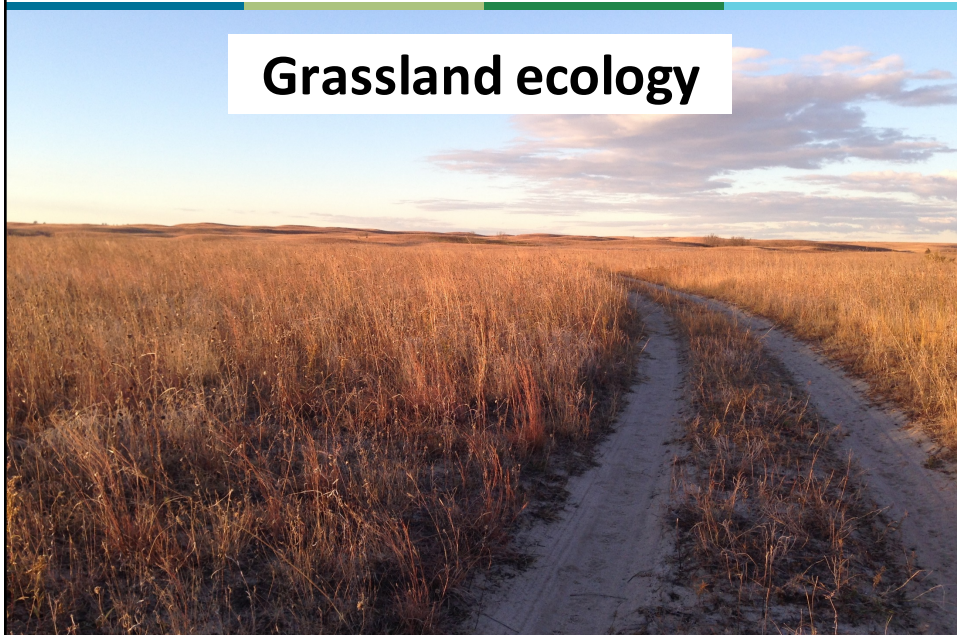


XI

Photos: Sam Droege, USGS BLM

Part 3

Grassland ecology



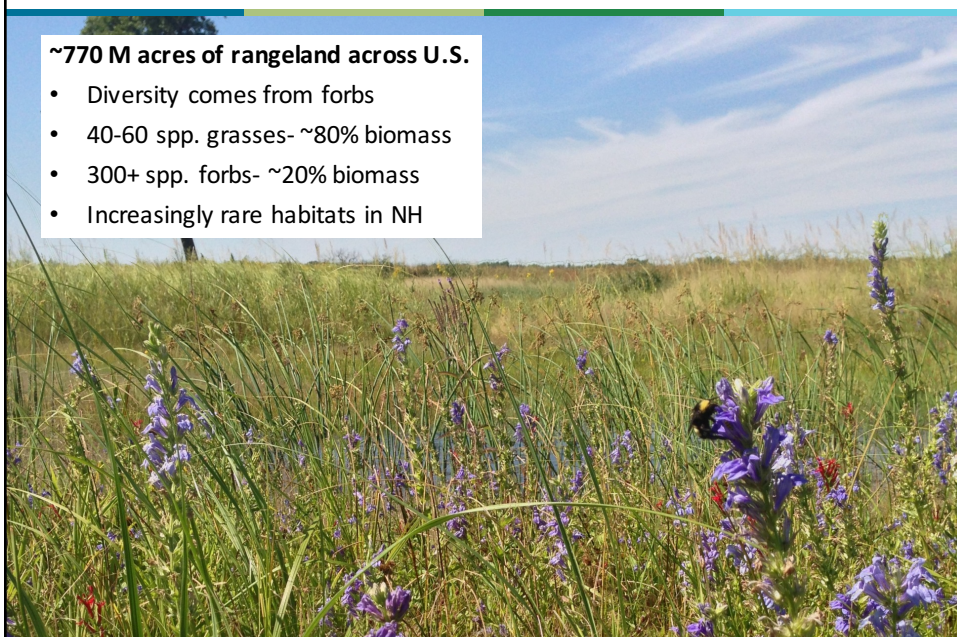
XI

Photo credit: Anne Stine, The Xerces Society

Grassland Ecology

~770 M acres of rangeland across U.S.

- Diversity comes from forbs
- 40-60 spp. grasses- ~80% biomass
- 300+ spp. forbs- ~20% biomass
- Increasingly rare habitats in NH

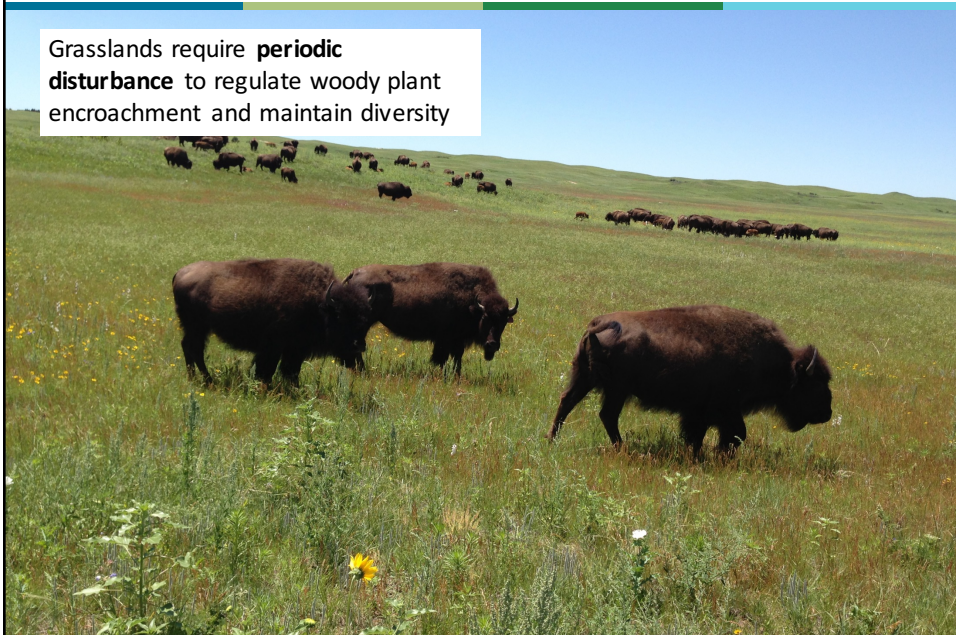


XI

Photos: Anne Stine, The Xerces Society

Grazing and Biodiversity

Grasslands require **periodic disturbance** to regulate woody plant encroachment and maintain diversity

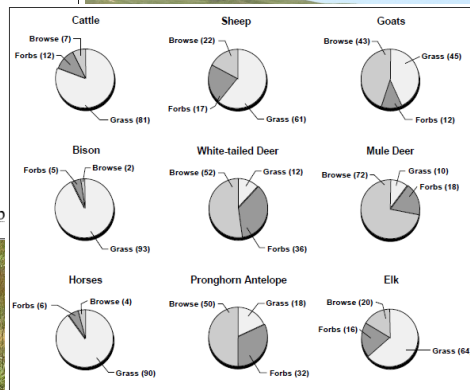


XI

Photos: Anne Stine, The Xerces Society

Grazing and Biodiversity

Browsers	Intermediate Feeders	Grazers
White-tailed deer	Goat	Mouflon
	Axis deer	Sheep
Mule deer	Nilgai	Bighorn sheep
	Sika deer	
Roe deer	Elk	
	Red deer	
Giraffe	Fallow deer	
	Eland	Blackbuck
	Pronghorn antelope	
Kudu	Aoudad	Oryx
	Thompson's gazelle	
	Impala	Wildeb



Source: Lyons, R. K., Forbes, T. D. A., & Machen, R. V. (1999). What Range Herbivores Eat--and Why. Texas A & M Extension.

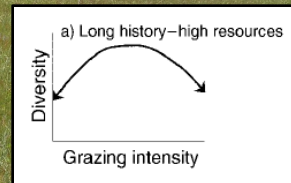
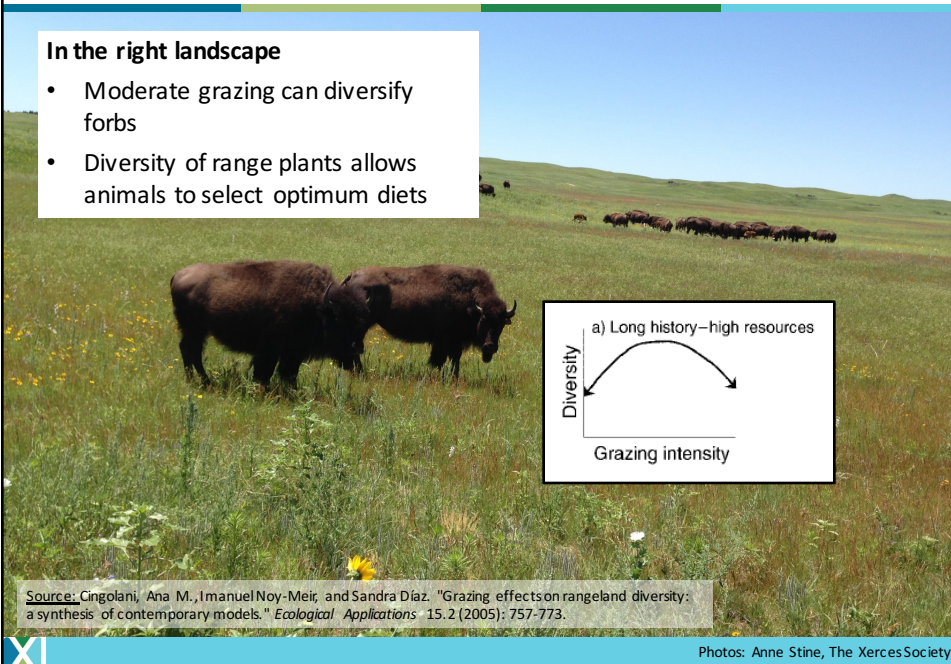
XI

Photos: Anne Stine, The Xerces Society

Grazing and Biodiversity

In the right landscape

- Moderate grazing can diversify forbs
- Diversity of range plants allows animals to select optimum diets



Source: Cingolani, Ana M., Immanuel Noy-Meir, and Sandra Diaz. "Grazing effects on rangeland diversity: a synthesis of contemporary models." *Ecological Applications* 15.2 (2005): 757-773.

XI

Photos: Anne Stine, The Xerces Society

Grazing and Biodiversity

Over-grazing VS Under-grazing

- Do not try to overcome natural grazing preferences of cattle
- Cattle preferentially select grasses
- Forbs gain competitive advantage



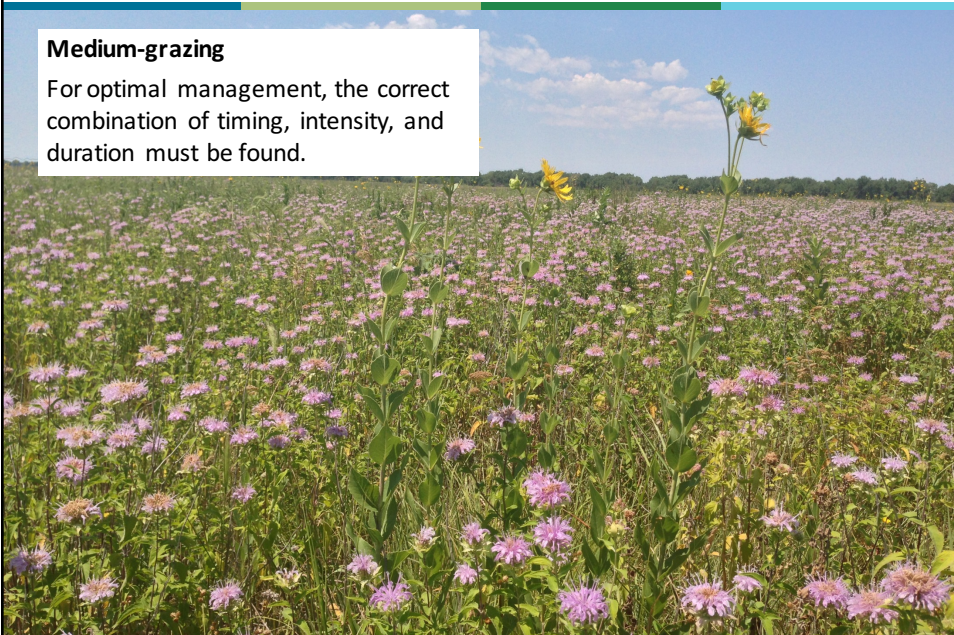
XI

Photos: Anne Stine, The Xerces Society

Grazing and Biodiversity

Medium-grazing

For optimal management, the correct combination of timing, intensity, and duration must be found.



XI

Photos: Anne Stine, The Xerces Society

Part 4

Restoring Pollinator Habitat

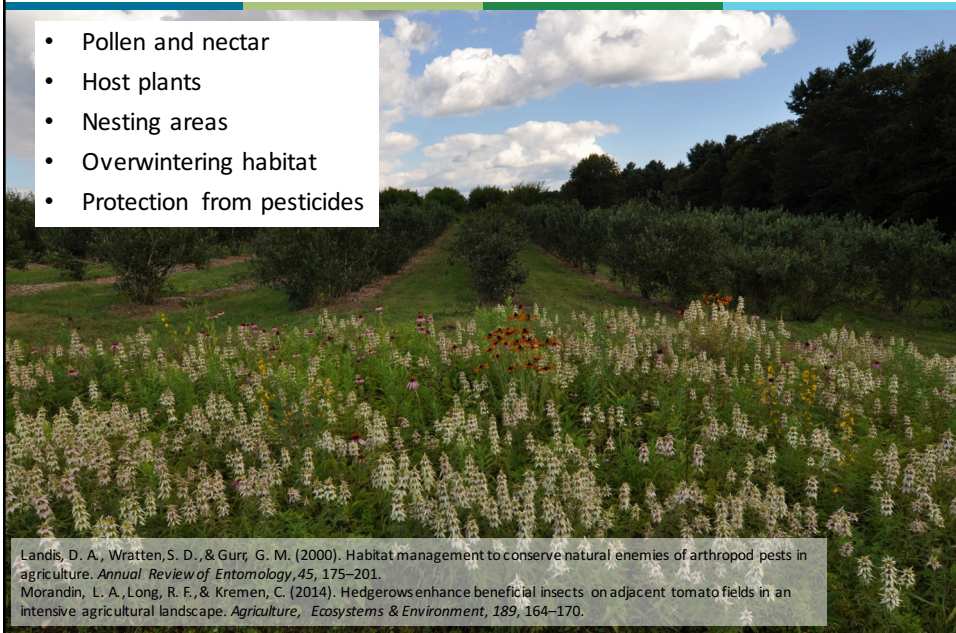


XI

Photo credit: Don Keirstead, USDA-NRCS NH

Habitat is key

- Pollen and nectar
- Host plants
- Nesting areas
- Overwintering habitat
- Protection from pesticides



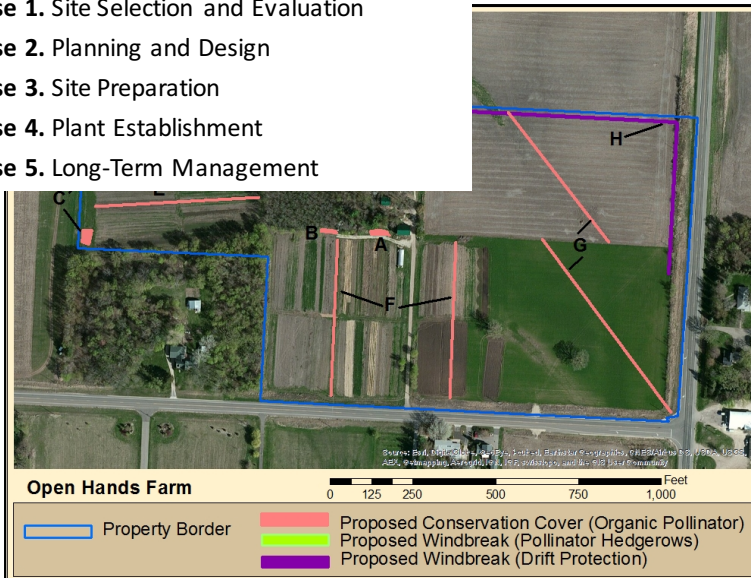
Landis, D. A., Wratten, S. D., & Gurr, G. M. (2000). Habitat management to conserve natural enemies of arthropod pests in agriculture. *Annual Review of Entomology*, 45, 175–201.
 Morandin, L. A., Long, R. F., & Kremen, C. (2014). Hedgerows enhance beneficial insects on adjacent tomato fields in an intensive agricultural landscape. *Agriculture, Ecosystems & Environment*, 189, 164–170.

XI

Photo: Don Keirstead, USDA-NRCS NH

The Habitat Restoration Process

- Phase 1. Site Selection and Evaluation
- Phase 2. Planning and Design
- Phase 3. Site Preparation
- Phase 4. Plant Establishment
- Phase 5. Long-Term Management



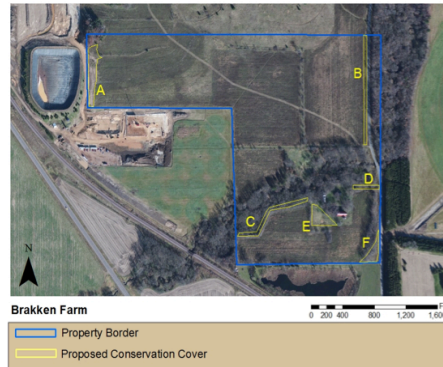
XI

Map: Sarah Foltz Jordan, Xerces Society

The Habitat Restoration Process

Phase 1. Site Selection and Evaluation

- Define project goals
- Document existing conditions:
 - Soil type
 - Weed presence
 - Land use
 - Risk of pesticide drift
- Delineate size/location of restoration area(s)



Brakken Farm
 0 200 400 800 1,200 1,600 Feet
 Property Border
 Proposed Conservation Cover

Photos: Don Keirstead; Map: Sarah Foltz Jordan, Xerces Society



The Habitat Restoration Process

Phase 2. Planning and Design

- Timeline
- Plant selection

January	February	March	April	May	June	July	August	September	October	November	December
		Site evaluation									
			Site preparation								
								Planting			



Photos: Don Keirstea USDA-NRCS NH; Eric Lee-Mäder, Xerces Society



Plant Selection: Key Principles

Phase 2. Planning and Design

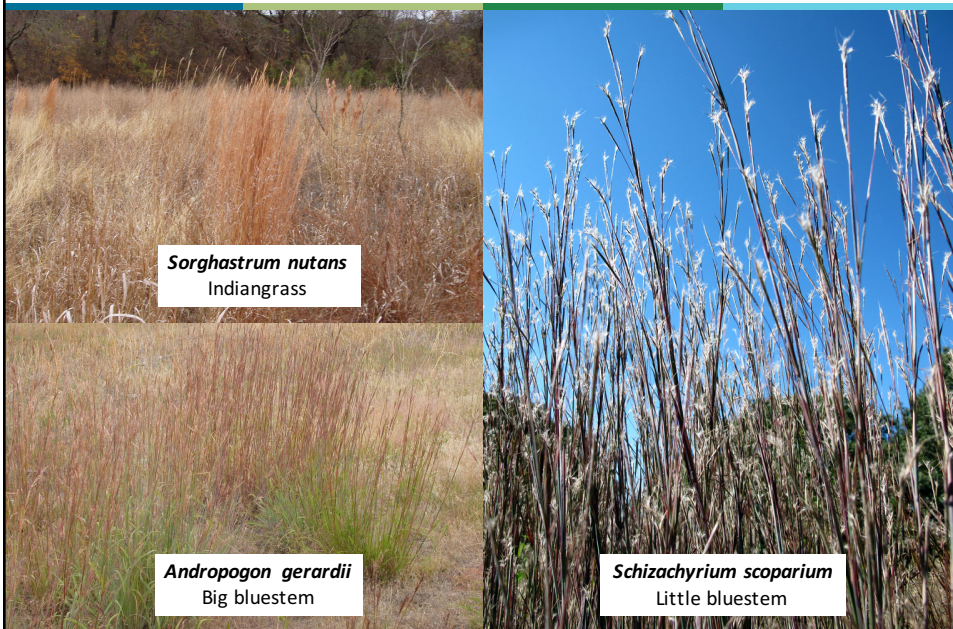
- Local adaptation, site-specific
 - >85% native plants
 - ~10% warm-season bunch grasses
- Bloom time: >3 spp. / season
- Availability and Cost: \$-\$\$\$
- Target seeds per ft² = 60-80...
- Xerces Seed Mix Calculator:
xerces.org/pollinator-resource-center



XI

Photo: Jennifer Hopwood, Xerces Society

Plant Selection: Warm-season bunch-grasses



Sorghastrum nutans
Indiangrass

Andropogon gerardii
Big bluestem

Schizachyrium scoparium
Little bluestem

XI

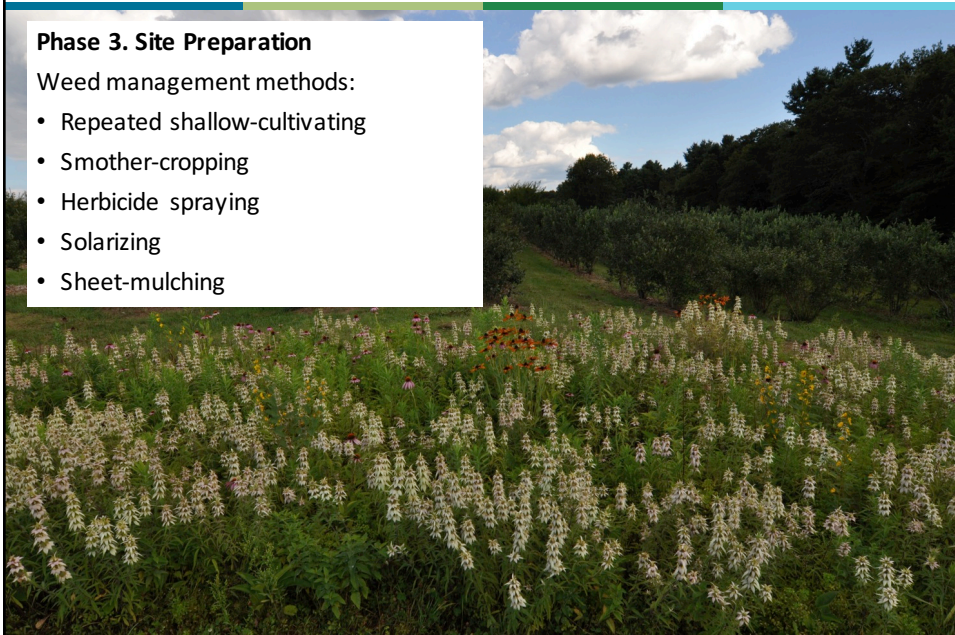
Photos: Matt Lavin, Kristine Paulus

The Habitat Restoration Process

Phase 3. Site Preparation

Weed management methods:

- Repeated shallow-cultivating
- Smother-cropping
- Herbicide spraying
- Solarizing
- Sheet-mulching



XI

Photo: Don Keirstead, USDA-NRCS NH

The Habitat Restoration Process

Repeated Shallow Cultivation

- Timing: Late spring/early fall
- Duration: 6+ months
- Cultivation performed monthly
- May diminish soil health



XI

Photo: Don Keirstead, USDA-NRCS NH

The Habitat Restoration Process

Smother Crop

Buckwheat example:

- Spring: Till, before winter/spring annuals flower
- Two weeks later: Shallow cultivation
- Two weeks later: Repeat shallow cultivation, prepare seedbed
- IMMEDIATELY seed crop: 70 lb/ac broadcast, 50 lb/acre drill
- Six weeks later: Mow, remove debris, and seed second crop
- Six weeks later: Mow or crimp and leave debris on surface

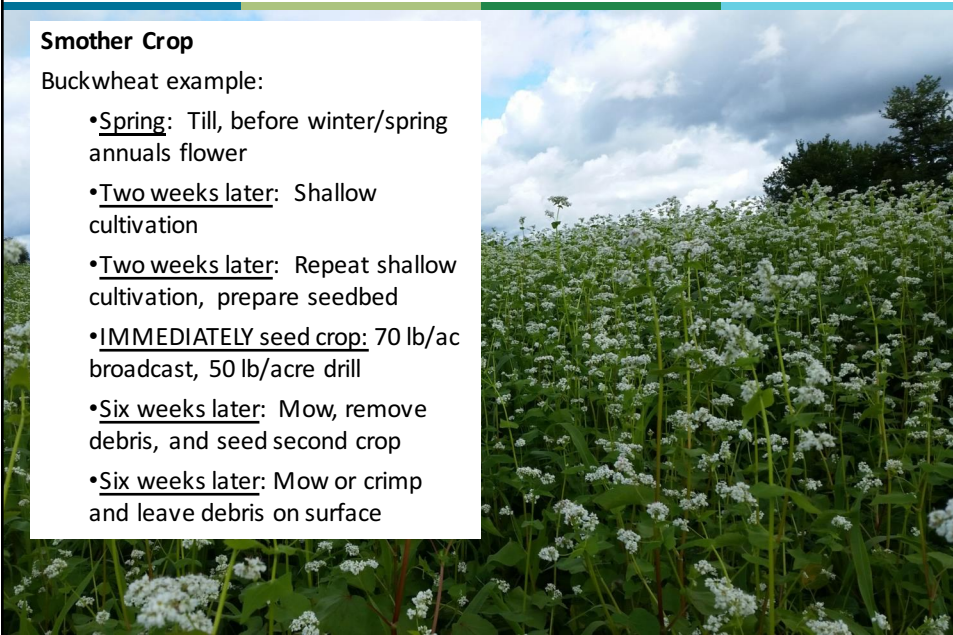


Photo: Kelly Gil, Xerces Society

The Habitat Restoration Process

Herbicide Treatment

- Non-selective and non-persistent
- Conventional or organic herbicide
- Timing: 6 to 12 months
- Early spring – fall, weeds 4-6 inches
- Avoid tillage



Photos: Jessa Kay Cruz, Xerces Society

The Habitat Restoration Process

Soil Solarization

- Timing: Late spring/early summer
- Duration: 6 months
- Mow, irrigate, trench
- Use 4 or 6 mil UV stabilized, *clear* high tunnel plastic
- NO airflow, must repair rips

Photos: Sarah Foltz Jordan, Xerces Society; Jessa Kay Cruz., Xerces Society

The Habitat Restoration Process

Cultivating to create a seed bed (spring)

Solarization plastic (summer)

Removing the plastic (fall)

Broadcast seeding (fall)

Flowering habitat (next spring!)

Photos: Eric Lee-Mäder, Xerces Society

The Habitat Restoration Process

Sheet Mulching

- Timing: Late spring/early summer
- Duration: 6 months
- Mow, irrigate, layer
- Layered OMRI approved materials:
 - Wood chips: 1.5 inch
 - Compost: 2 inch
 - Cardboard: ½ inch
 - Grass clippings
 - Soil



XI

Photos: Jarrod Fowler, Xerces Society

The Habitat Restoration Process

Phase 4. Plant Establishment

- | | |
|--|---|
| <ul style="list-style-type: none"> • Seeds <ul style="list-style-type: none"> • Field borders • Insectary strips • Filter strips • Understory plantings | <ul style="list-style-type: none"> • Transplants <ul style="list-style-type: none"> • Beetle banks • Hedgerows • Drift fences • Windbreaks |
|--|---|



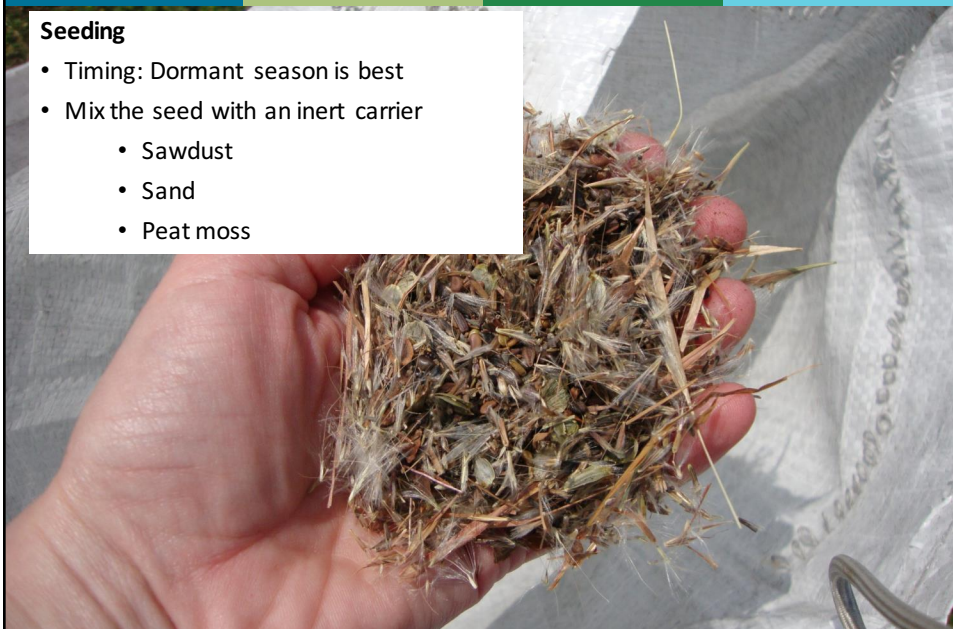
XI

Photos: Hillary Sardiñas, Xerces Society; Jessa Kay Cruz, Xerces Society

The Habitat Restoration Process

Seeding

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



XI

Photo: Kelly Gill, Xerces

The Habitat Restoration Process

Seeding

- Methods:
 - Hand scatter on surface
 - Belly grinder
 - Drop seeder or fertilizer spreader
 - Native seed drill



XI

Photos: Jessa Kay Cruz, Xerces Society; Sarah Foltz Jordan, Xerces Society

The Habitat Restoration Process

Seeding

- Post-seeding: roll with cultipacker



XI

Photo: Sarah Foltz Jordan, Xerces Society

The Habitat Restoration Process

Transplants

When to use:

- Quicker establishment
- Small areas
- Higher weed pressure
- Irrigation is available
- To add plants that establish poorly from seed



XI

Photos: Eric Lee-Mäder, Xerces Society; Mace Vaughan, Xerces Society; Nancy Adamson, Xerces Society

The Habitat Restoration Process

Transplants

Considerations:

- Weed barriers
- Mulch
- Animal guards



XI

Photo: Sarah Foltz Jordan, Xerces Society

The Habitat Restoration Process

Phase 5. Habitat Management

- Goals
 - Maintain plant diversity
 - Maintain seral stage
- Short-term actions (Years 1-3)
 - Hand-weed
 - Mow
 - Spot-treat
 - Deter herbivores
- Long-term actions (Years 3...)
 - Burn
 - Graze
 - Eliminate irrigation
 - Till and re-seed

Before mowing: Weedy mustards about to set seed



After mowing: Wildflower seedlings can grow



XI

Photos: Eric Lee-Mäder, Xerces Society; Brianna Borders, Xerces Society

The Habitat Restoration Process

Phase 5. Long Term Management

- Disturbance to no more than 1/3 of habitat area each year
- Diversify disturbance methods across space and time at varying scales
- Allow for long recovery times after management



XI

Photos; USDA-ARS; Audubon California



Photograph: Don Keirstead, USDA-NRCS, NJ