



**Change in a native bee
assemblage on two Missouri
prairie remnants after 22
years of management**



Thanks...

Missouri Prairie Foundation (Owen Sexton, Bruce Schuette)

The Nature Conservancy Chapter of Missouri (Doug Ladd)

**University of Missouri Enns Entomology Museum
(Bob Sites, Kris Simpson)**

**Jane Stevens, Jim Hunt, George Diehl, Danny Brown, Steve Cooper
Missouri Department of Conservation**







Examples of pollen specialization by bees on TGP

Monolecty

Augochlorella
aurata
(everything)

Ceratina
calcarata
(almost everything)

Halictus ligatus
(strongly favors Asteraceae)

Perdita ignota
(Asteraceae)

Svastra obliqua
(summer Helianthae)

Extreme polylecty

Colletes robertsonii
(Amorpha. Dalea)

Melissodes denticulata
(Vernonia spp.)

Osmia distincta
(Penstemon spp.)

Andrena helianthiformis
(Echinacea pallida, E. angustifolia)

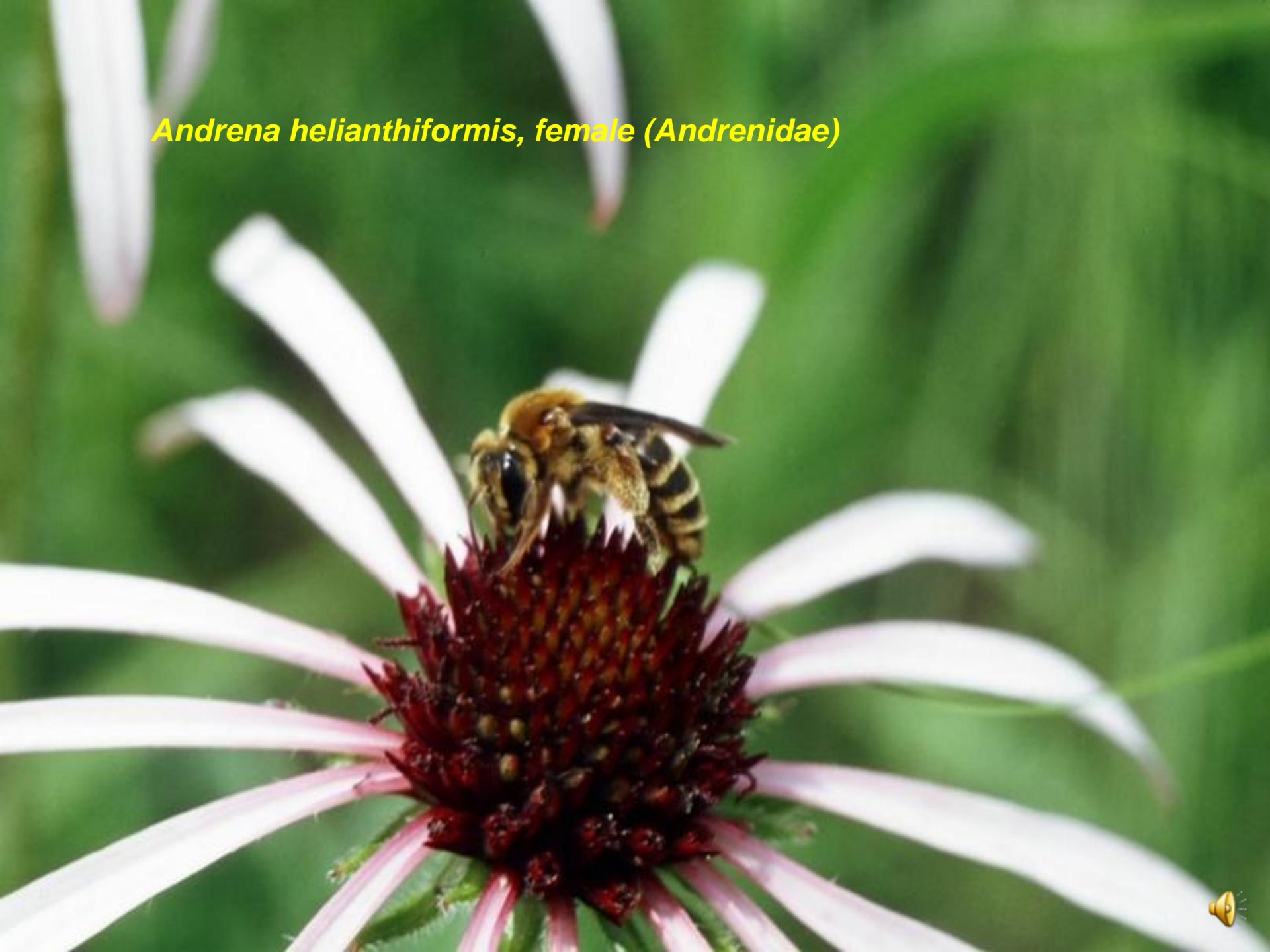
Tetraloniella
cressoniana
(Salvia azurea)



Tetraloniella cressoniana, female (Apidae)



Andrena helianthiformis, female (Andrenidae)



Augochlorella aurata, female (Halictidae)



Plant families and genera supporting oligolectic bees on midwestern prairies

Anacardiaceae (*Rhus*)

Apiaceae (*Lomatium, Perideridia, Polytaenia, Taenidia, Thaspium, Zizia*)

Asteraceae (*Aster, Bidens, Cirsium, Chrysopsis/Heterotheca, Coreopsis, Echinacea, Helianthus, Liatris, Pyrrhopappus, Ratibida, Rudbeckia, Senecio, Silphium, Solidago, Vernonia*)

Cactaceae (*Opuntia*)

Campanulaceae (*Triodanis*)

Convolvulaceae (*Ipomoea*)

Cornaceae (*Cornus*)

Fabaceae (*Amorpha, Astragalus, Dalea, Lespedeza, Oxytropis, Psoralea s.l., Strophostyles, Tephrosia*)

Labiatae (*Monarda, Salvia*)

Liliaceae (*Erythronium, Nothoscordum*)

Malvaceae (*Hibiscus*)

Onagraceae (*Oenothera*)

Portulacaceae (*Claytonia*)

Rhamnaceae (*Ceanothus*)

Salicaceae (*Salix*)

Scrophulariaceae (*Penstemon*)

Solanaceae (*Physalis*)

Verbenaceae (*Verbena*)

Violaceae (*Viola*)

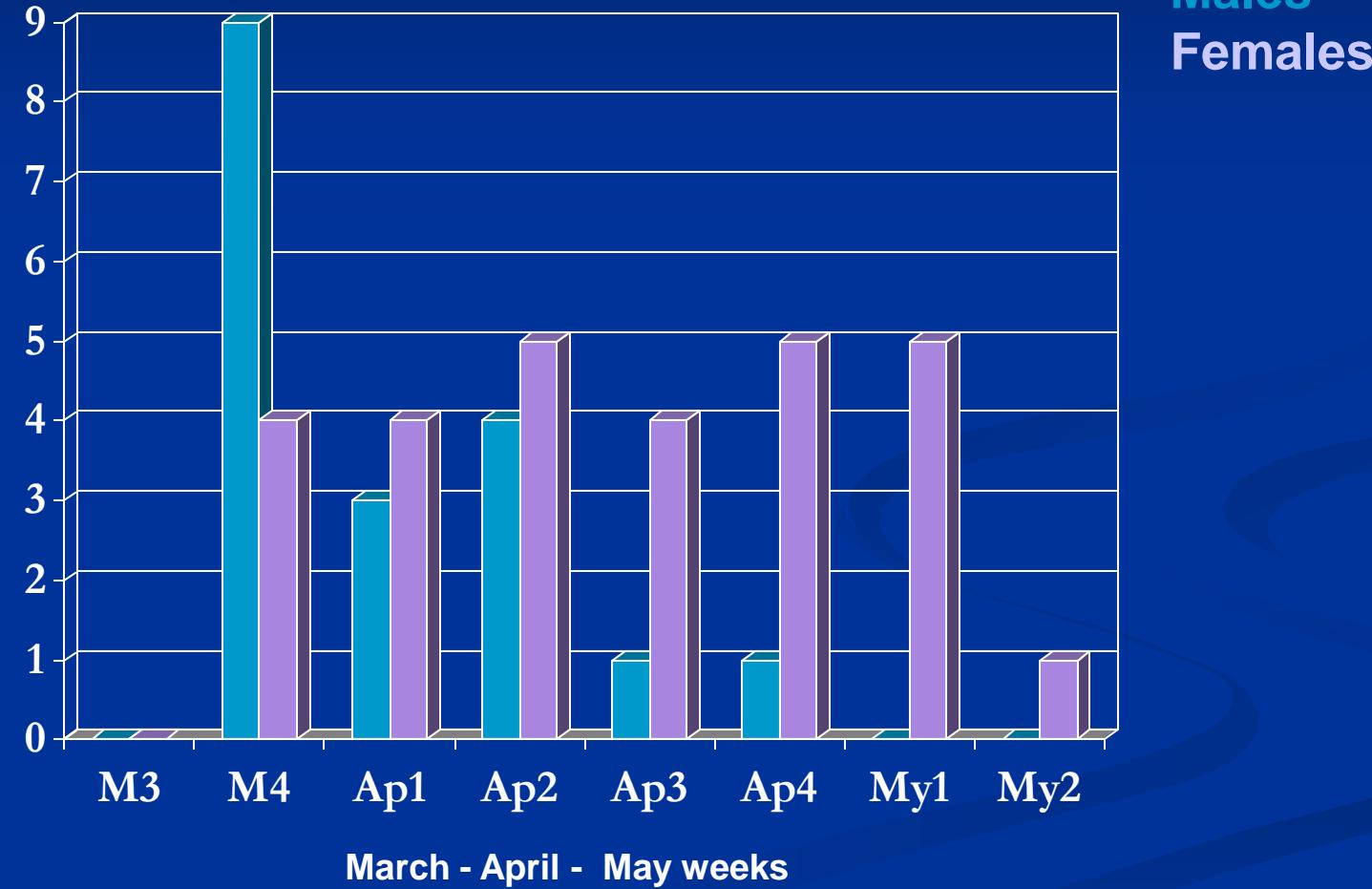


native bee nesting biology



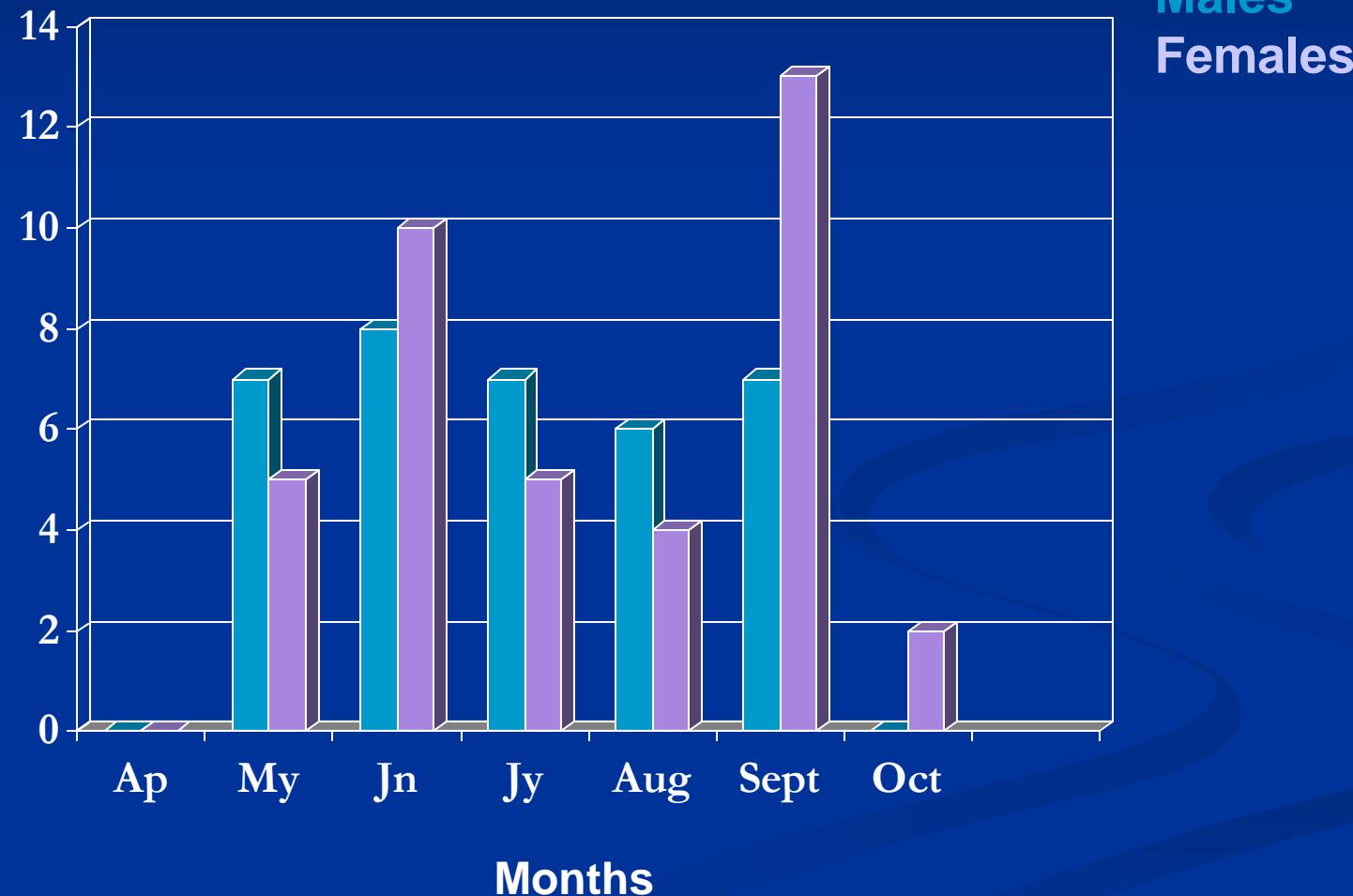
MO collection dates of *Colletes inaequalis*, a vernal solitary univoltine polylectic

No. of collection dates



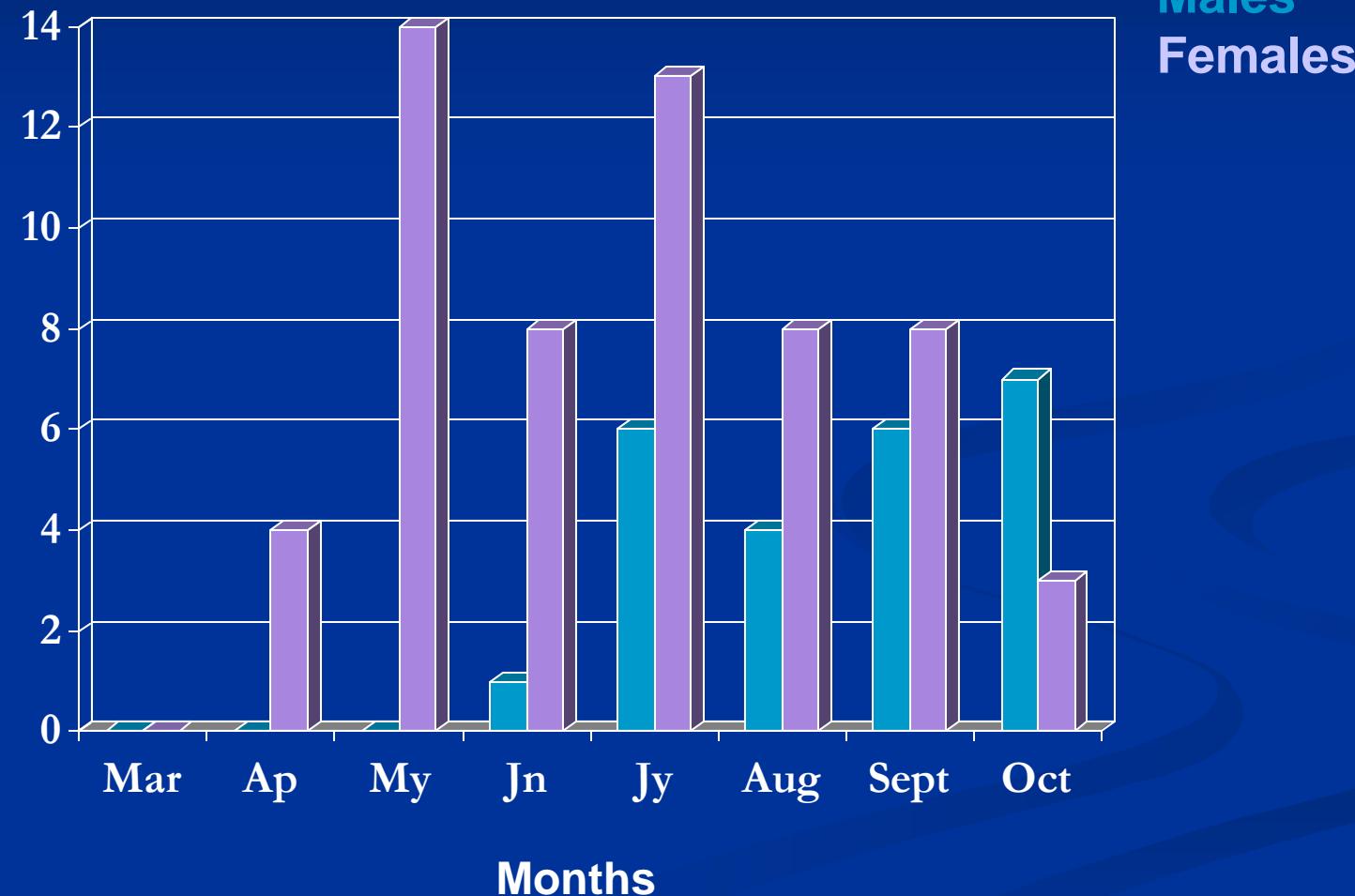
MO collection dates of *Megachile brevis*, a solitary multivoltine polylege

No. of collection dates



MO collection dates of *Halictus ligatus*, a social polylectic Halictine

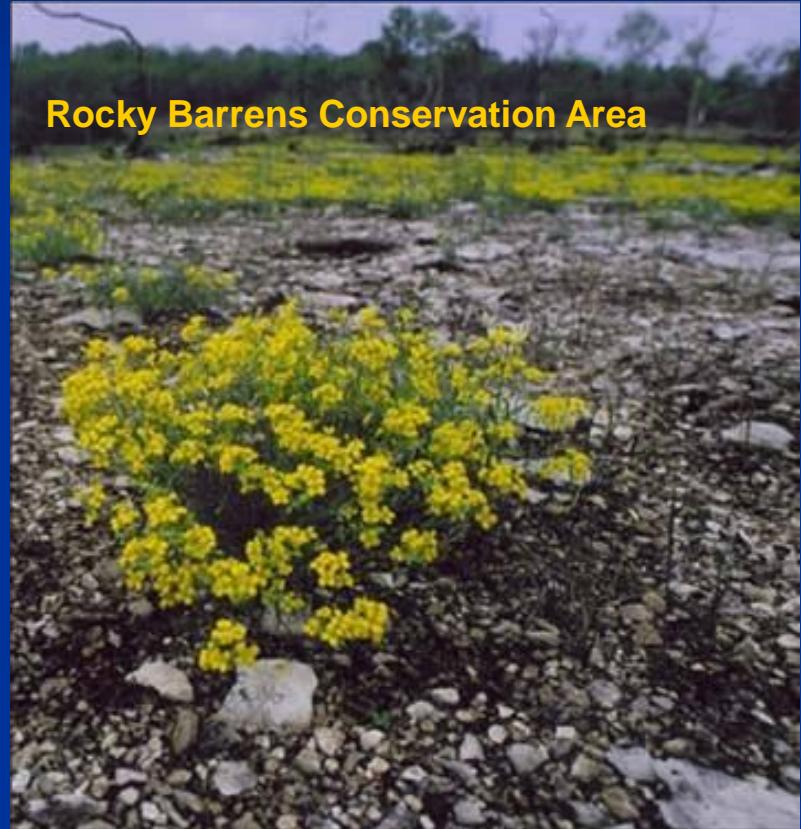
No. of collection dates



Natural Community Dependency

...the degree to which a species is dependent on natural communities

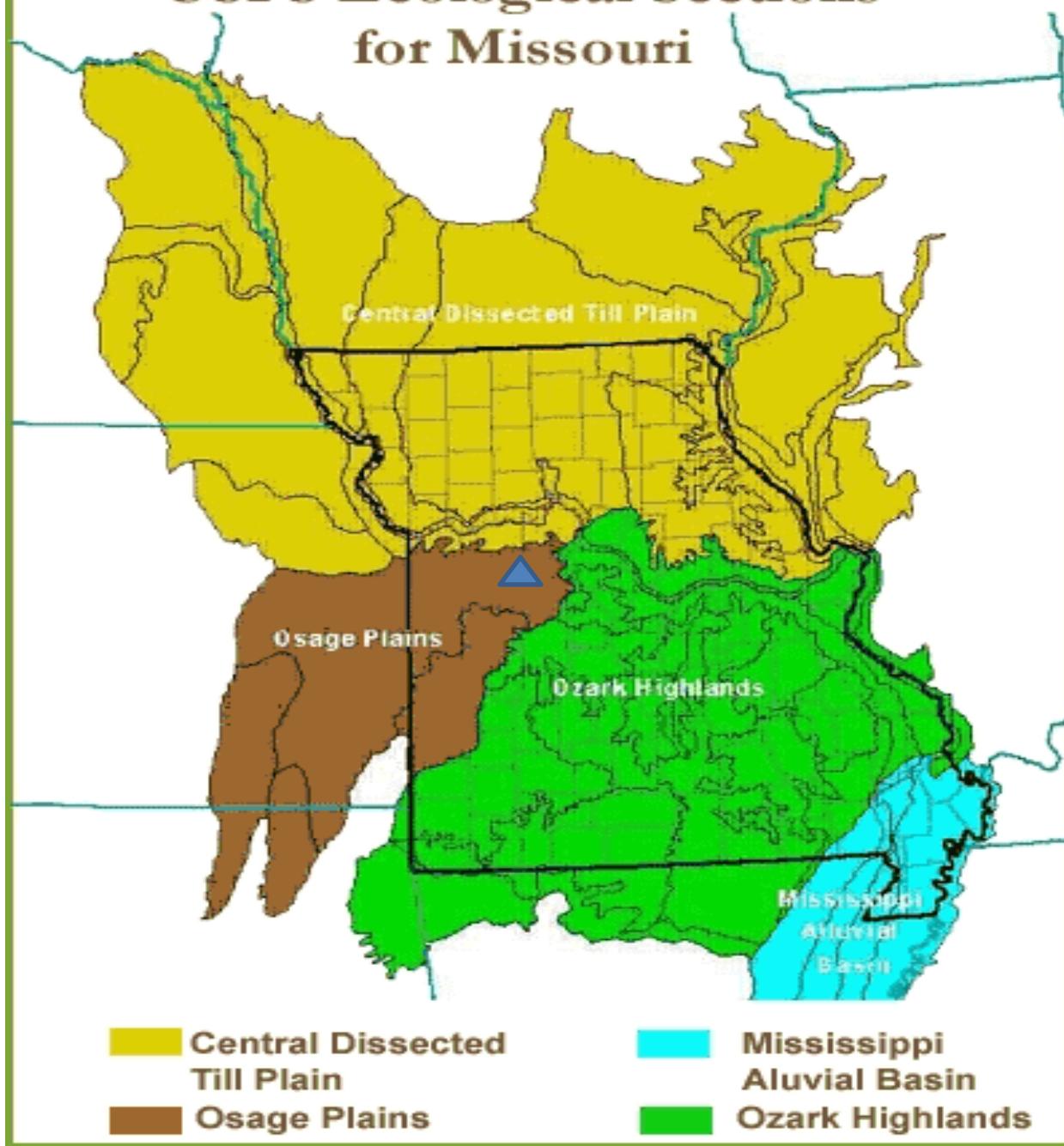
- **Obligate:** restricted to natural communities
- **High:** rarely found outside of natural communities
- **Moderate:** occasionally found outside of natural communities
- **Low:** commonly found outside of natural communities
- **None:** rarely (or never) found in natural communities



Study sites



USFS Ecological Sections for Missouri



Osage Plains biodiversity..



Prairie management on the Osage Plains:

fire

haying/mowing

mechanical brush control

herbicidal control

grazing

fertilizing

rest



Presettlement prairie



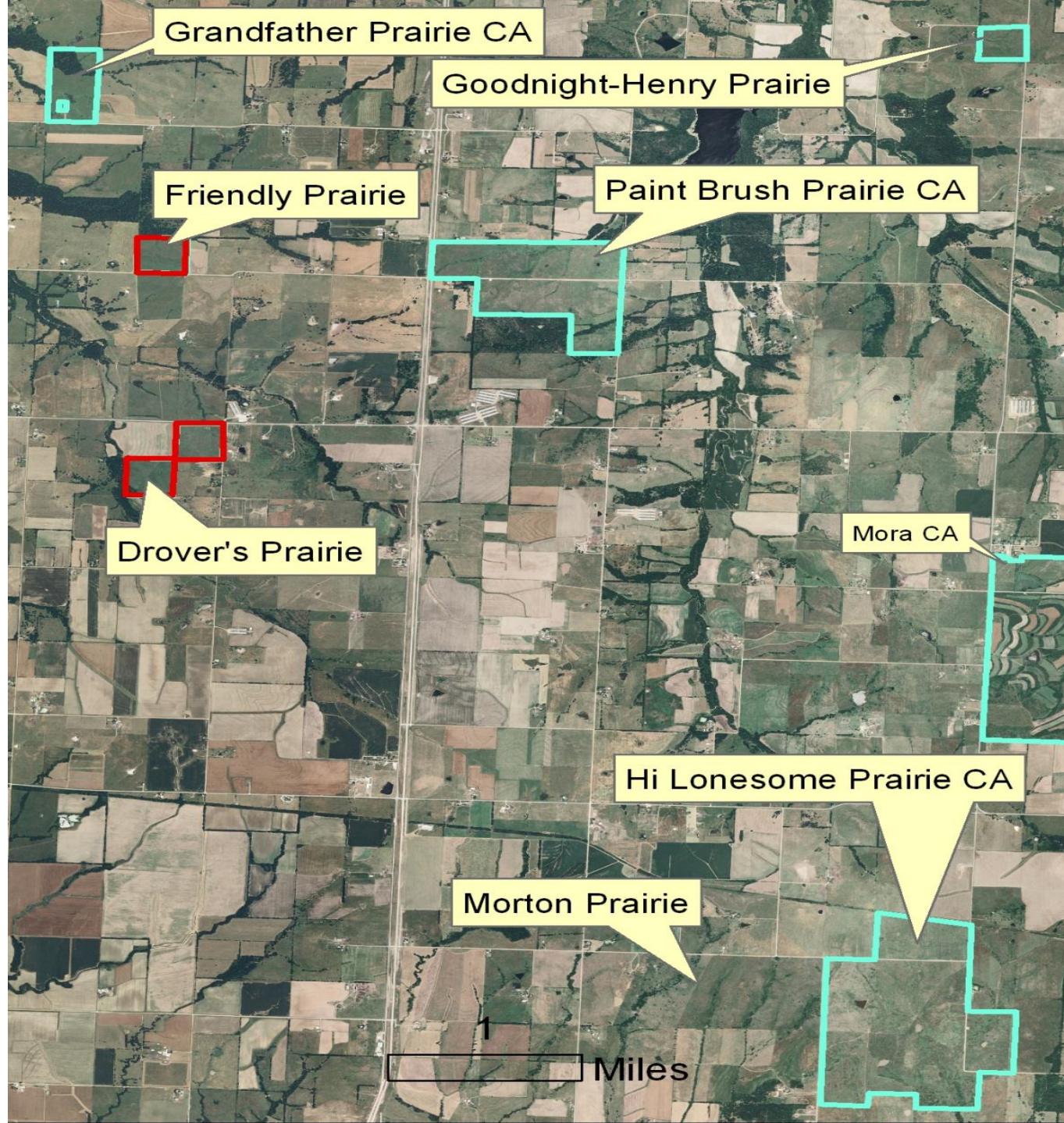
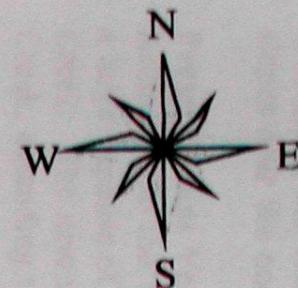
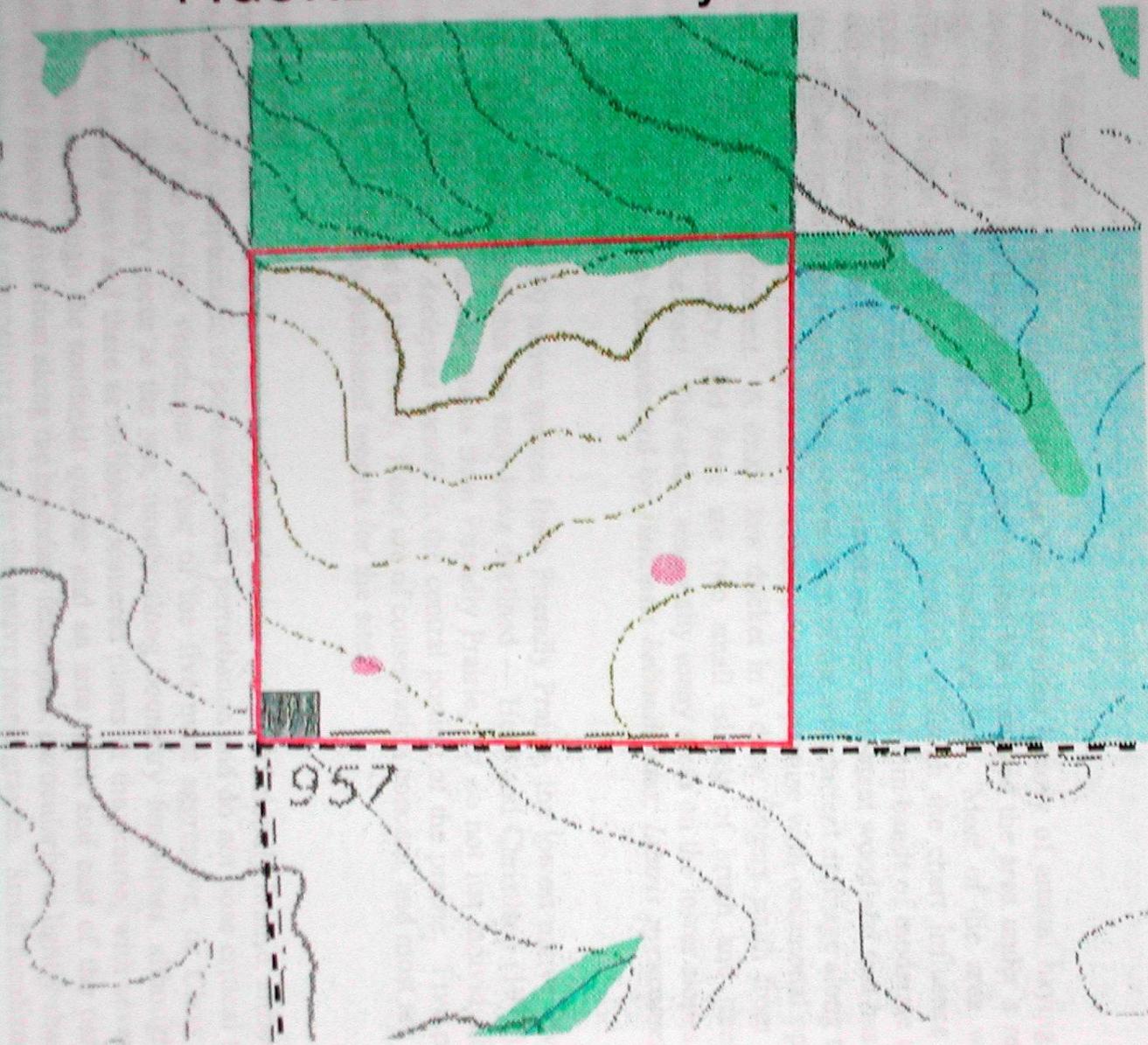


FIGURE 11. Friendly Prairie



- MPF Land
- Ponds
- Parking Area
- Road
- Streams
- Agriculture
- Sericea Lespedeza
- Pasture
- Prairie
- Woods/Brush

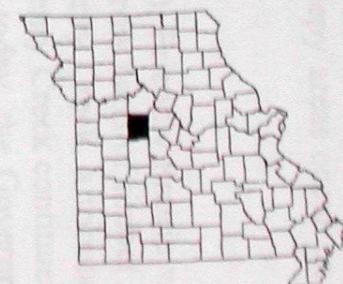
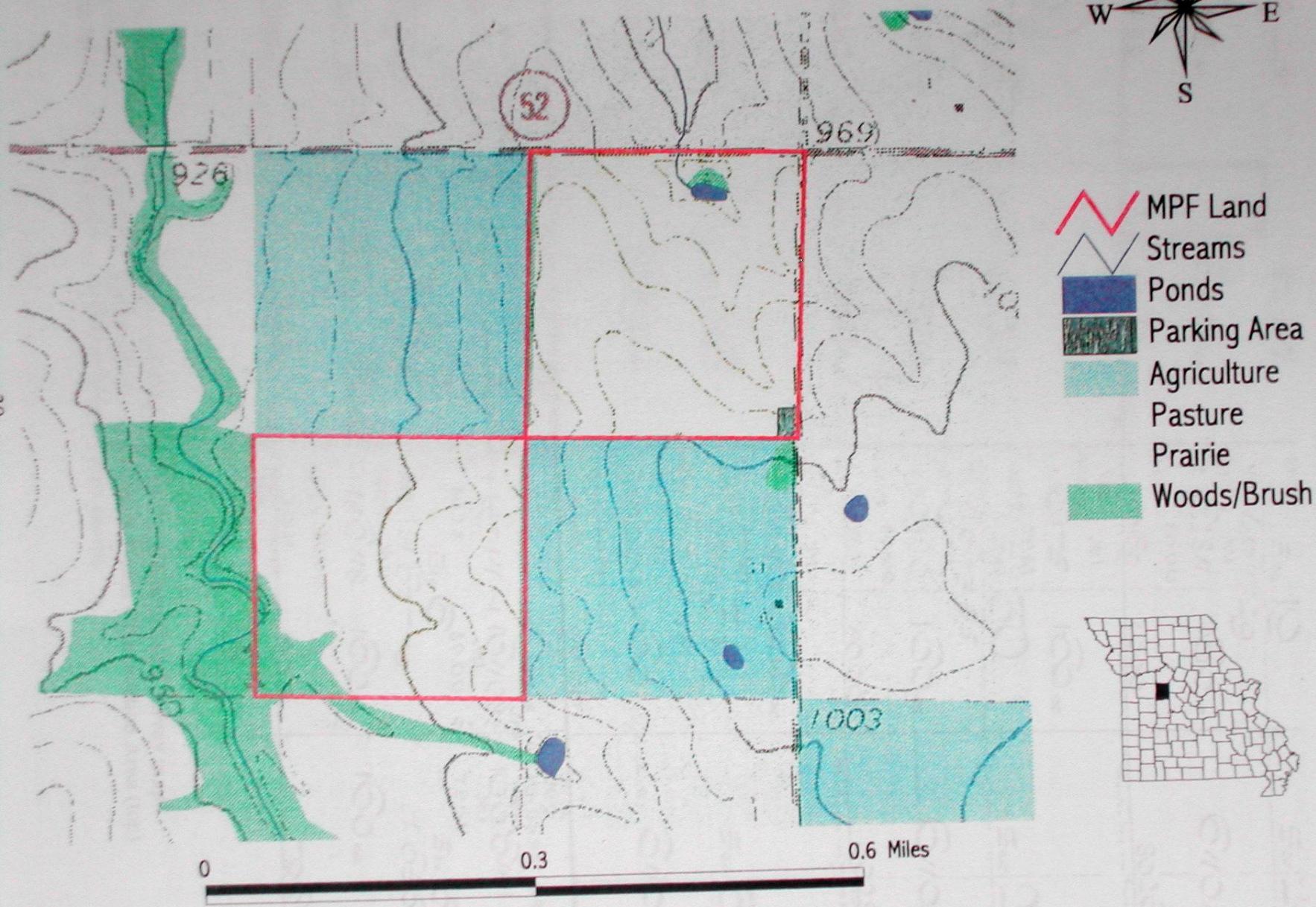


FIGURE 9. Drovers Prairie



RESEARCH/MONITORING HISTORY

FRIENDLY

- 1969: purchased by Missouri Prairie Foundation (hay prairie)
- 1971-1973: ecological study of Friendly Prairie (Hurd and Christiansen, 1975).
- 1988: native bee survey of Friendly Prairie (Arduser et. al., unpublished)
- 1999: floristic survey of Friendly Prairie (Ladd and Churchwell, 1999)
- 2010: bee survey of Friendly Prairie (prairie was rested)

DROVER'S

- 1981: purchased by Missouri Prairie Foundation (hay prairie)
- 1988: native bee survey of Drover's Prairie (Arduser et. al., unpublished)
- 1999: floristic survey of Drover's Prairie (Ladd and Churchwell, 1999)
- 2010: bee survey of Drover's Prairie (prairie was rested)



Methods

Collecting bees
Estimating flower abundance



Results



Bombus fraternus gyne



Principal resource species

(Francis Evans, 1982)



Plant species visited by bees:

1988: 78

2010: 72

1988: (no. spp. bees visiting)

Pycnanthemum tenuifolium (22)

Silphium integrifolium (21)

Monarda fistulosa (17)

Liatris pycnostachya (16)

Helianthus grosseserratus (14)

Echinacea pallida (12)

Helenium flexulosum (12)

2010:

Verbena hastata (23)

Penstemon digitalis (17)

Lythrum alatum (14)

Rubus sp. (12)

Pycnanthemum tenuifolium (12)

Ceanothus americanus (9)

Rudbeckia hirta (7)



Principal resource species on Friendly and Drover's

1988: (no. spp. bees visiting 1988-2010)

<i>Pycnanthemum tenuifolium</i>	(22, 12)
<i>Silphium integrifolium</i>	(21, 0)
<i>Monarda fistulosa</i>	(17, 9)
<i>Liatris pycnostachya</i>	(16, 5)
<i>Helianthus grosseserratus</i>	(14, 5)
<i>Echinacea pallida</i>	(12, 1)
<i>Rubus</i> sp.	(13, 12)
<i>Helenium flexulosum</i>	(12, 5)

plant estimated abundance

1988	2010
sa	sa
a	few
uc, patchy	c
c	few
uc, patchy	few
c	uc
c	a
c	uc

2010:

<i>Verbena hastata</i>	(1, 23)
<i>Penstemon digitalis</i>	(10, 17)
<i>Lythrum alatum</i>	(5, 14)
<i>Rubus</i> sp.	(13, 12)
<i>Pycnanthemum tenuifolium</i>	(24, 12)
<i>Ceanothus americanus</i>	(0, 9)
<i>Rudbeckia hirta</i>	(9, 7)

1988	2010
few	a
c	a
uc	a
c	a
sa	sa
few	c
c	c



Collecting effort:

1988 = 83 hours (11 sampling days, April-October)

2010 = 41.5 hours (9 sampling days, April-September)

Total bees (individuals) collected:

1988 = 1001

2010 = 568

Total species collected:

1988 = 111

2010 = 77

Mean no. bees collected/hour:

1988 = 12.1 (range 1.4 – 15.4)

2010 = 13.7 (range 4.7 – 24.6)

Mean no. bee species/trip:

1988 = 10.0

2010 = 8.5

Present in both years = 63 (50%)

Present only in 1988 = 48

Present only in 2010 = 15



Bee species relative abundance

1988 (n= 1,001)

Lasioglossum versatum complex (12%)
Augochlorella aurata/persimilis (10%)
Megachile brevis (5%)
Halictus ligatus (5%)
Ceratina dupla/calcarata (5%)
Bombus pensylvanicus (4%)
Agapostemon virescens (3%)
Bombus griseocollis (3%)

= 47%

2010 (n= 568)

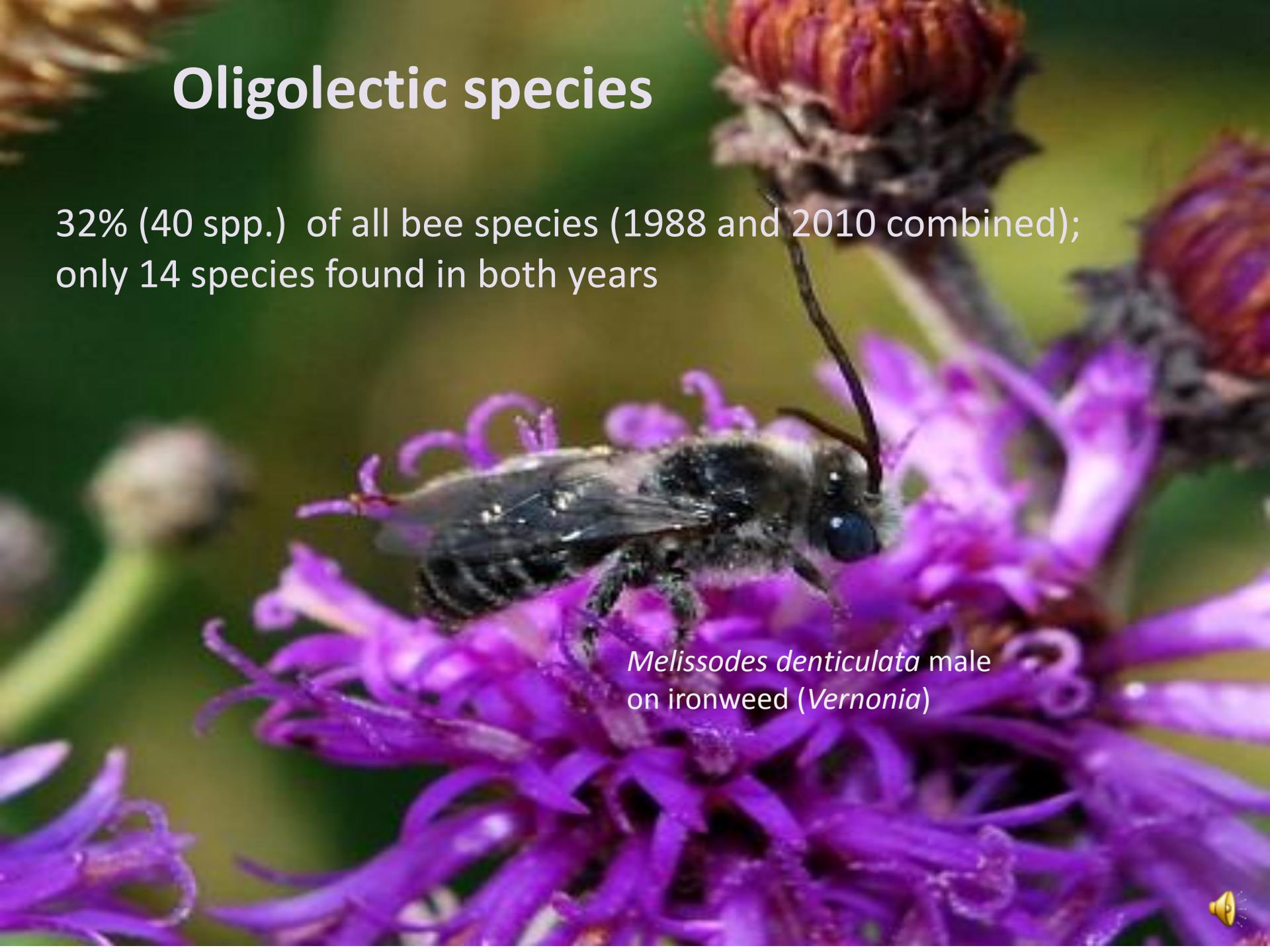
Lasioglossum versatum complex (16%)
Augochlorella aurata/persimilis (11%)
Ceratina strenua (4%)
Halictus ligatus (4%)
Ceratina dupla/calcarata (3%)
Megachile brevis (2%)
Megachile mendica (2%)
Bombus griseocollis (2%)

=44%



Oligolectic species

32% (40 spp.) of all bee species (1988 and 2010 combined);
only 14 species found in both years



Melissodes denticulata male
on ironweed (*Vernonia*)



Plant families and genera potentially supporting oligoleptic bees on Friendly/Drover's prairies

* = oliloleges found in 1988

! = oligoleges found in 2010

Anacardiaceae (*Rhus*)

* Apiaceae (*Polytaenia, Thaspium, Zizia*)

!* Asteraceae (*Aster, Bidens, Cirsium, Coreopsis, Echinacea, Helianthus, Liatris, Ratibida, Rudbeckia, Senecio, Silphium, Solidago, Vernonia*)

* Campanulaceae (*Triodanis*)

* Cornaceae (*Cornus*)

!* Fabaceae (*Amorpha, Dalea, Lespedeza, Psoralea s.l., Tephrosia*)

!* Liliaceae (*Erythronium, Nothoscordum*)

Onagraceae (*Oenothera*)

* Portulacaceae (*Claytonia*)

Rhamnaceae (*Ceanothus*)

* Salicaceae (*Salix*)

!* Scrophulariaceae (*Penstemon*)

! Solanaceae (*Physalis*)

! Verbenaceae (*Verbena*)

! Violaceae (*Viola*)



Guilds and networks



Svastra obliqua female



Andrena cressonii

1988:

Prunus americana

Salix nigra

Barbarea vulgaris

Thaspium trifoliatum

Cornus drummondii

Chrysanthemum leucanthemum

2010:

Erythronium mesochoreum

Hypoxis hirsuta

Rubus sp.

Fragaria virginiana

Polytaenia nuttallii

Ceanothus americanus



*Nomia
nortoni*, male
(Halictidae)

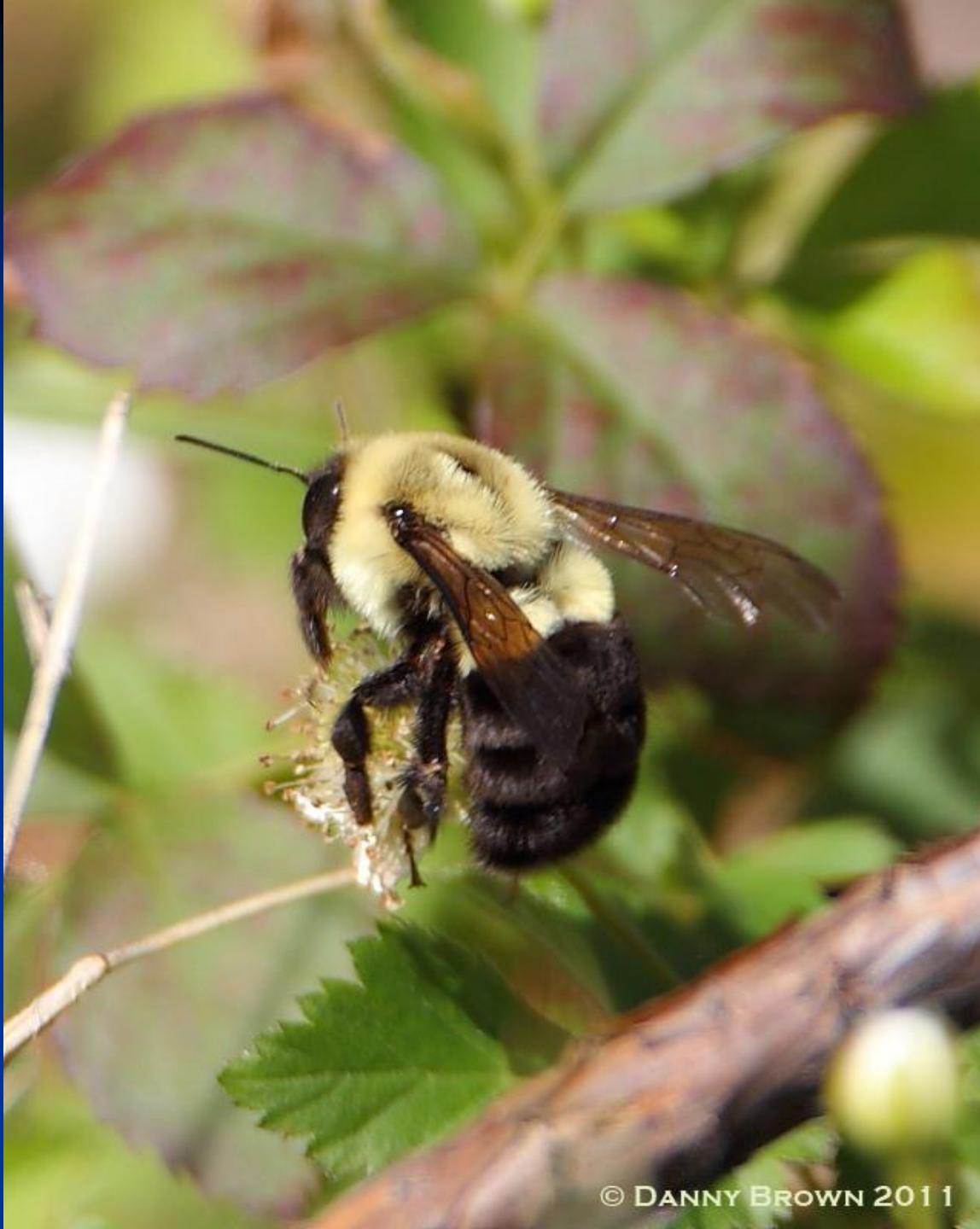




VISITOR
PARKING







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Natural community-dependent species



Andrena helianthiformis
female on *Echinacea pallida*

Plant families and genera potentially supporting oligolectic bees on Friendly/Drover's prairies

yellow – present in 1988 only

red – present in 2010 only

Anacardiaceae (*Rhus*)

Apiaceae (*Polytaenia, Thaspium, Zizia*)

Asteraceae (*Aster, Bidens, Cirsium, Coreopsis, Echinacea, Helianthus, Liatris, Ratibida, Rudbeckia, Senecio, Silphium, Solidago, Vernonia*)

Campanulaceae (*Triodanis*)

Cornaceae (*Cornus*)

Fabaceae (*Amorpha, Dalea, Lespedeza, Psoralea s.l., Tephrosia*)

Liliaceae (*Erythronium, Nothoscordum*)

Onagraceae (*Oenothera*)

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Rhamnaceae (*Ceanothus*)

Salicaceae (*Salix*)

Scrophulariaceae (*Penstemon*)

Solanaceae (*Physalis*)

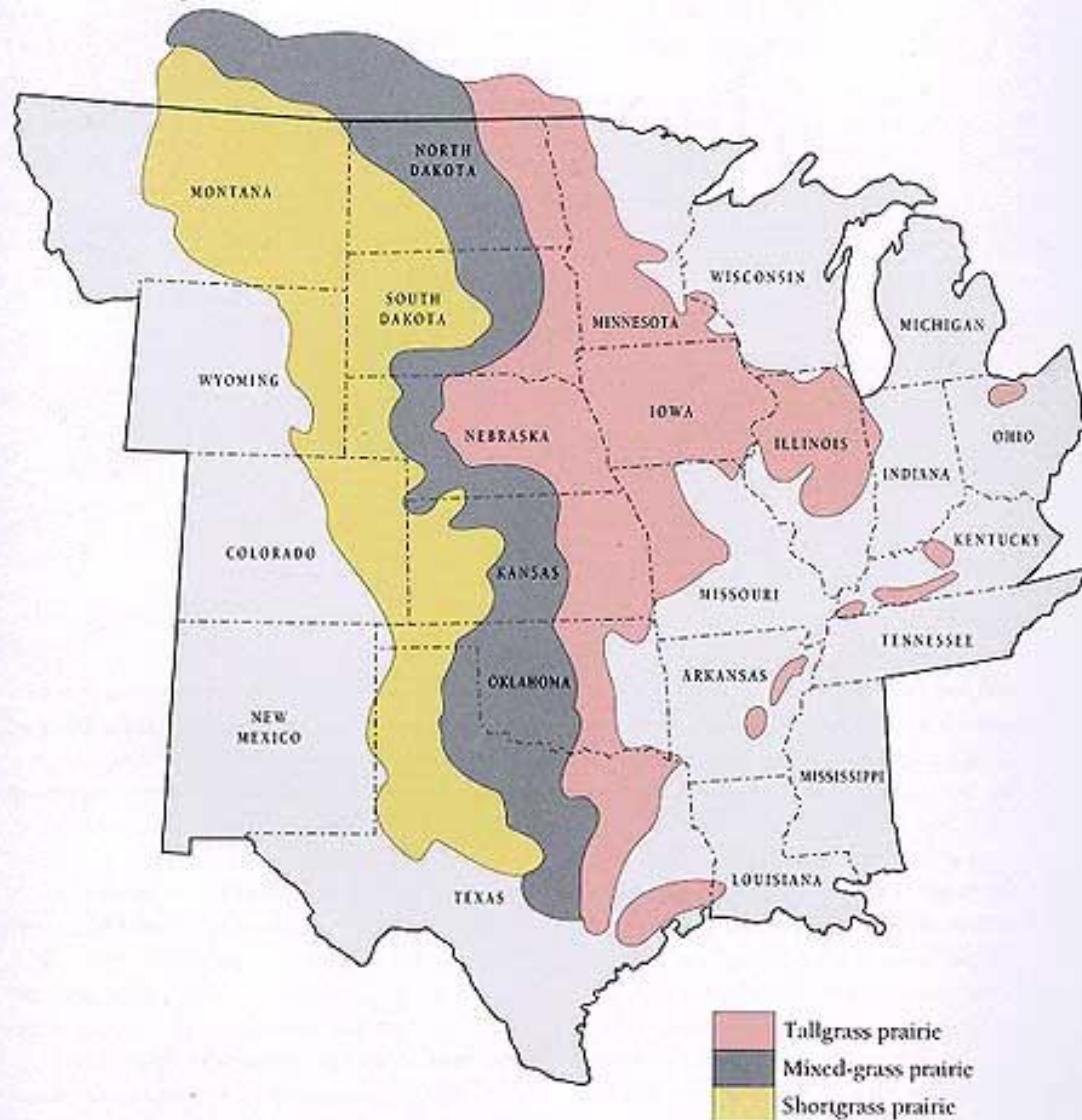
Verbenaceae (*Verbena*)

Violaceae (*Viola*)





TALLGRASS PRAIRIE



This map shows the original boundaries of tallgrass, mixed-grass, and shortgrass prairies that once spanned much of mid-America. Today only small remnants of the tallgrass prairie remain unplowed or undeveloped.



Plant families and genera potentially supporting oligolectic bees on Friendly/Drover's prairies

Anacardiaceae (*Rhus*)

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Salicaceae (*Salix*)

Scrophulariaceae (*Penstemon*)

Solanaceae (*Physalis*)

Verbenaceae (*Verbena*)

Violaceae (*Viola*)

Megachilidae



Halictidae



Apidae

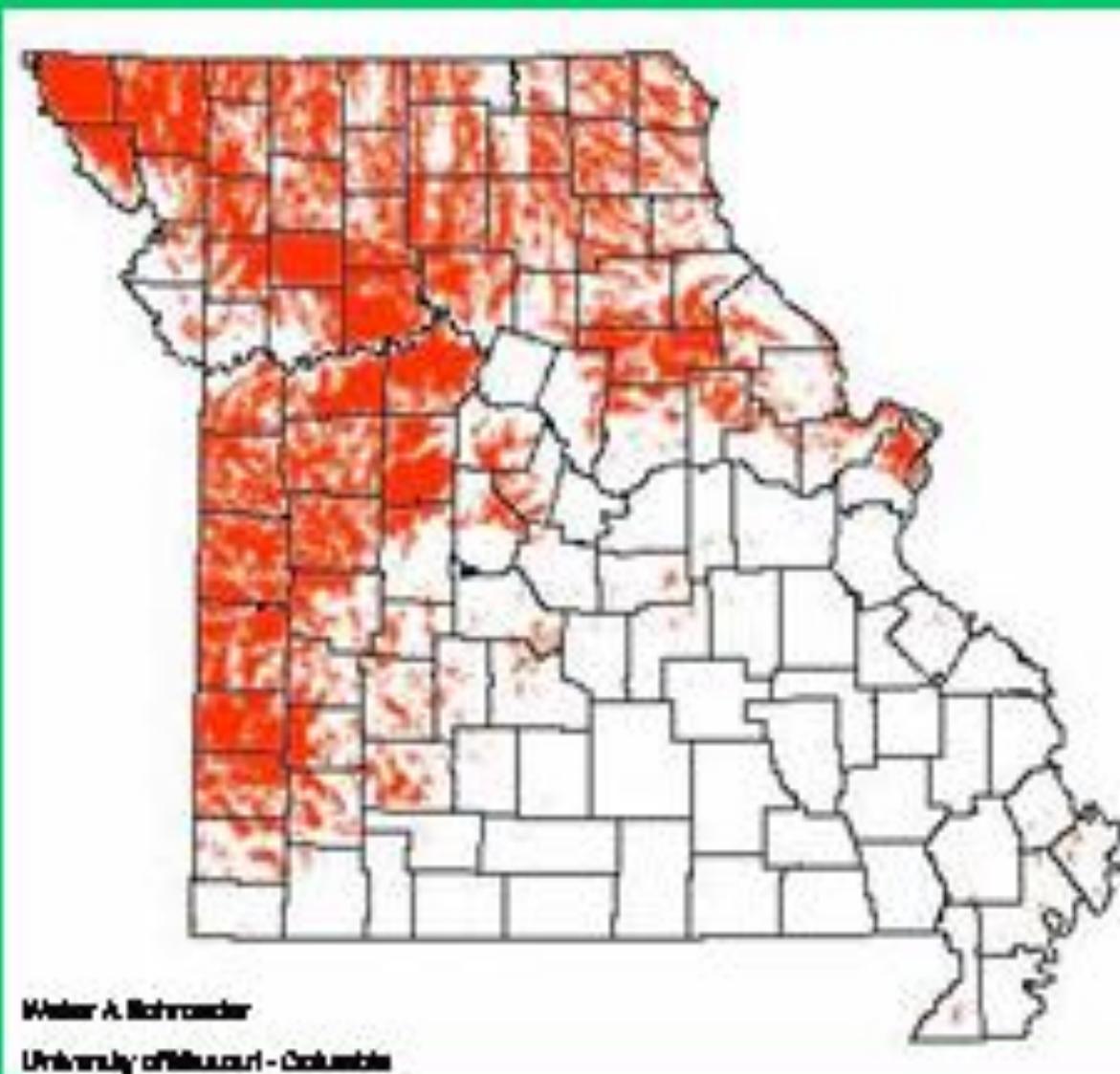


Andrenidae



Colletidae

Map of Pre-settlement Tallgrass Prairies in Missouri



Walter A. Schreiner
University of Missouri - Columbia

Number of bee species active by month (statewide, MO)

