

# Flowering Phenology of *Echinacea angustifolia* in Minnesota Tallgrass Prairie Remnants Over Three Years

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# The Echinacea Project



- Long-term project studying Minnesota tallgrass prairie remnants
- Effects of prairie fragmentation



# Narrow-leaved Purple Coneflower

## *(Echinacea angustifolia)*

- Model organism
  - Common prairie plant
  - Common plant family (sunflower)
  - Taproot system
  - Long-lived
  - Many pollinators (bees)



# Narrow-leaved Purple Coneflower

*(Echinacea angustifolia)*

- Self-incompatible
  - Cannot fertilize own flowers
  - Relies on pollinators for pollen dispersal between plants



# Tallgrass Prairie



# Tallgrass Prairie

Flowers



Grasses



**<1% left as scattered fragments (remnants)**

(Wagenius and Lyon 2010)

Vertebrates

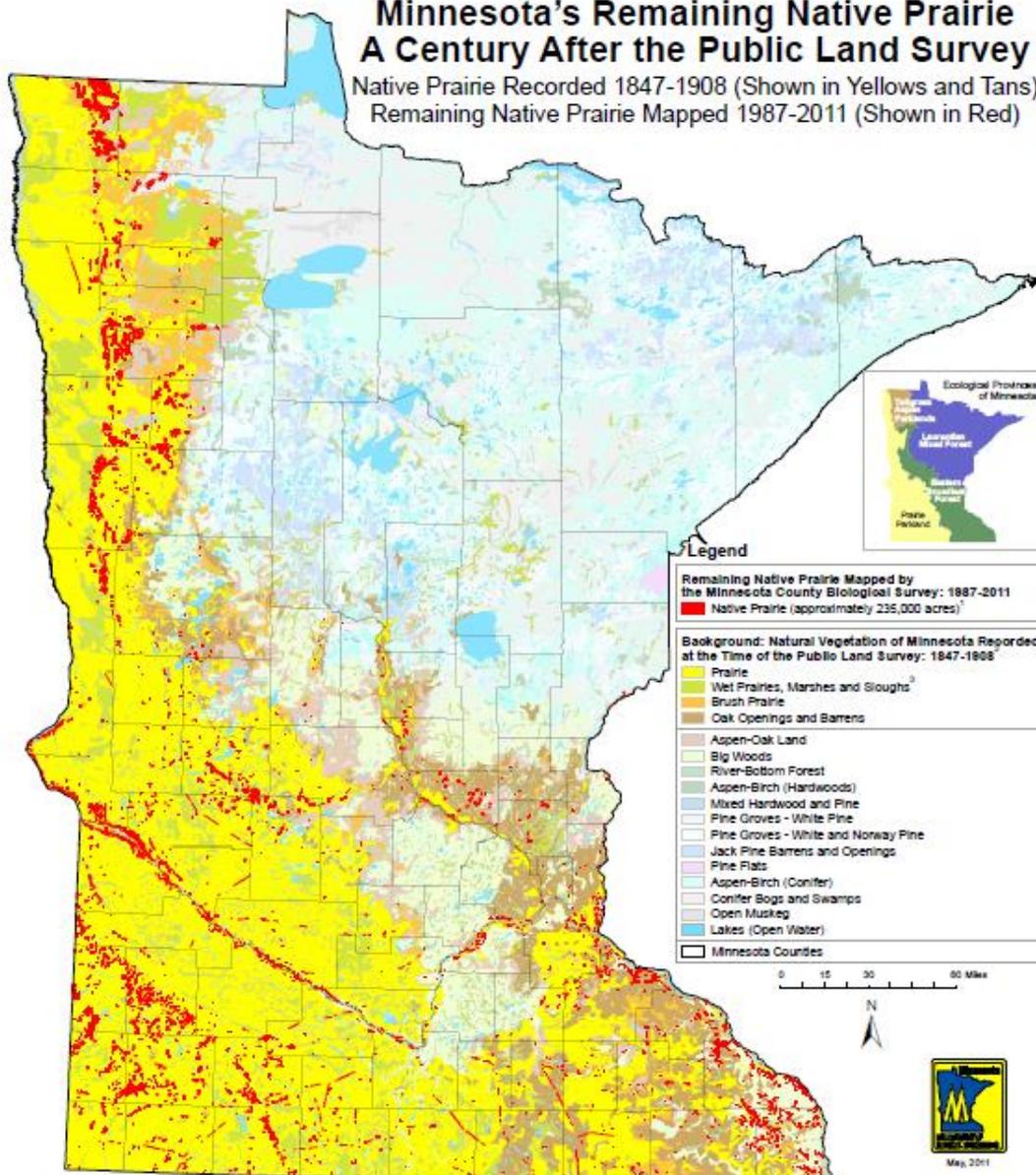


Insects



# Minnesota's Remaining Native Prairie A Century After the Public Land Survey

Native Prairie Recorded 1847-1908 (Shown in Yellows and Tans)  
Remaining Native Prairie Mapped 1987-2011 (Shown in Red)



<sup>1</sup> Prairies mapped by the Minnesota County Biological Survey (MCBS) as of May, 2011. Some of the prairies represented on this map may have been destroyed since the time of their documentation by MCBS.

<sup>2</sup> Adapted from Marschner, F.J. 1974. The original vegetation of Minnesota, compiled from U.S. General Land Office Survey notes [map]. 1:500,000. Redrafted from the 1930 original by F.J. Burwell and S.J. Haas under the direction of M.L. Heinzelman. St. Paul: North Central Forest Experiment Station, United States Department of Agriculture.

<sup>3</sup> In the Laurentian Mixed Forest Province, this category mainly comprises marshes and sloughs. If wet prairies were present in the province, they were uncommon and likely restricted to western and southern regions bordering the Tallgrass Aspen Parklands and Eastern Broadleaf Forest provinces.

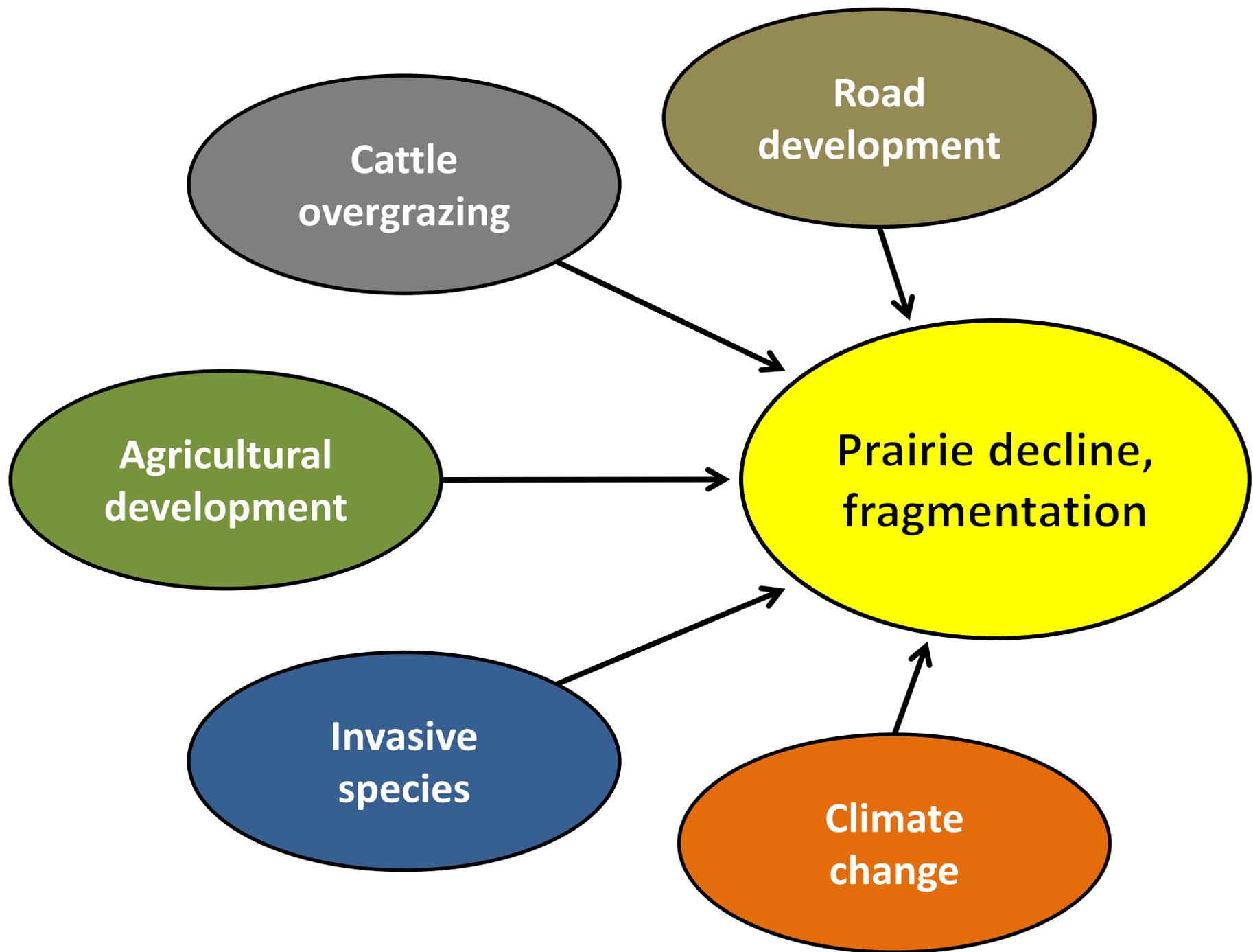
GIS data for many of the native prairies depicted on this map are available in shapefile format as "MCBS Native Plant Communities" and "MCBS Railroad Rights-of-Way Prairies" on the DNR's data del at <http://del.dnr.state.mn.us/index.html>. Information on MCBS procedures for mapping Minnesota's prairies and other native plant communities is available at [http://files.dnr.state.mn.us/eco/mcbs/prairie\\_map.pdf](http://files.dnr.state.mn.us/eco/mcbs/prairie_map.pdf)

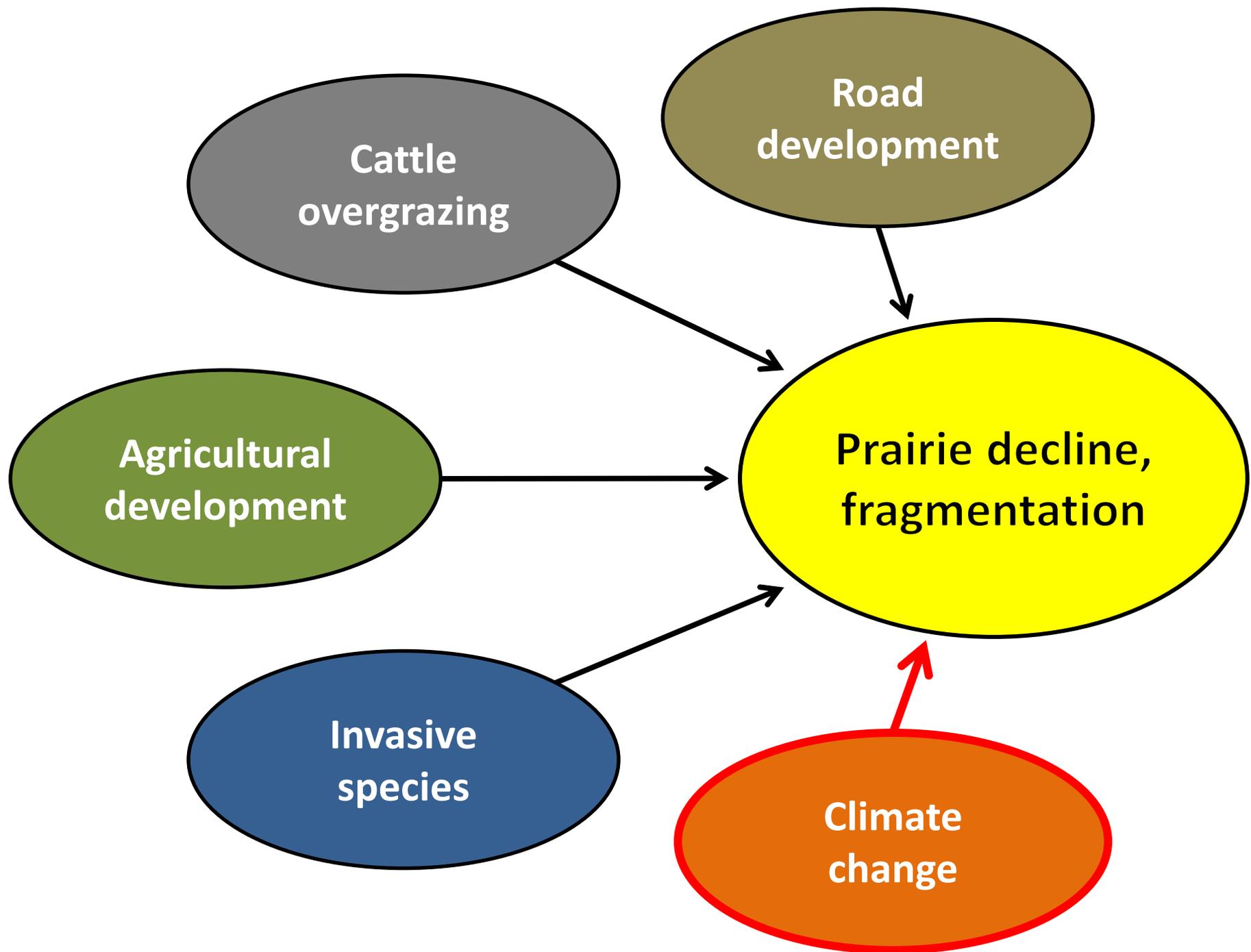
# Natural Processes Needed by Prairie: Fire



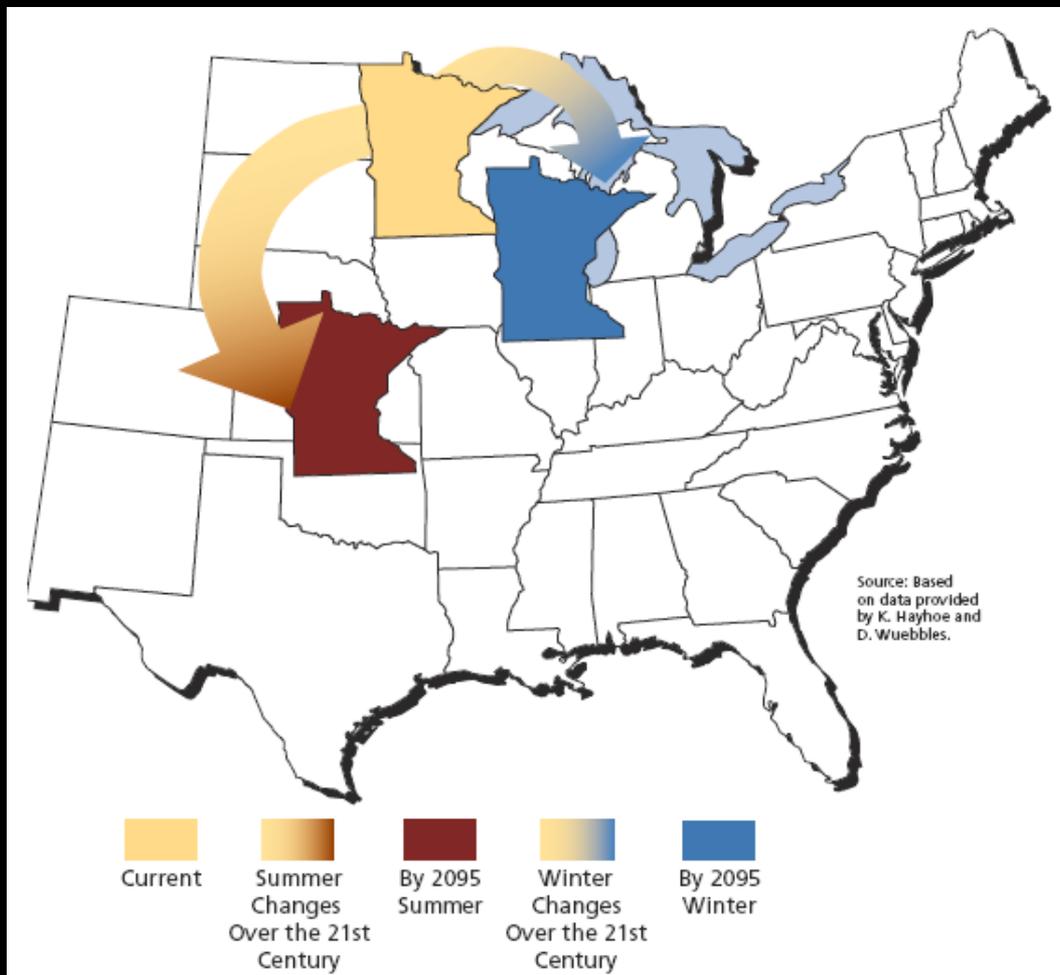
# Natural Processes Needed by Prairie: Bison







# Climate Change



**CONFRONTING CLIMATE CHANGE IN THE GREAT LAKES REGION**

*Union of Concerned Scientists • The Ecological Society of America*

2003

# Research Questions & Hypothesis

- How do prairie plants respond to:
  - climate change?
  - weather patterns among years?
- I hypothesized that flowering phenology differs among populations due to variations in temperature among years.

**Warmer Temp → Earlier flowering**

**Cooler Temp → Later flowering**

# Methods

- Tracked flowering phenology of *E. angustifolia* in six prairie remnants
  - Timing and duration of flowering, start to end
  - Calculated peak flowering date
    - date of highest overlap in flowering plants



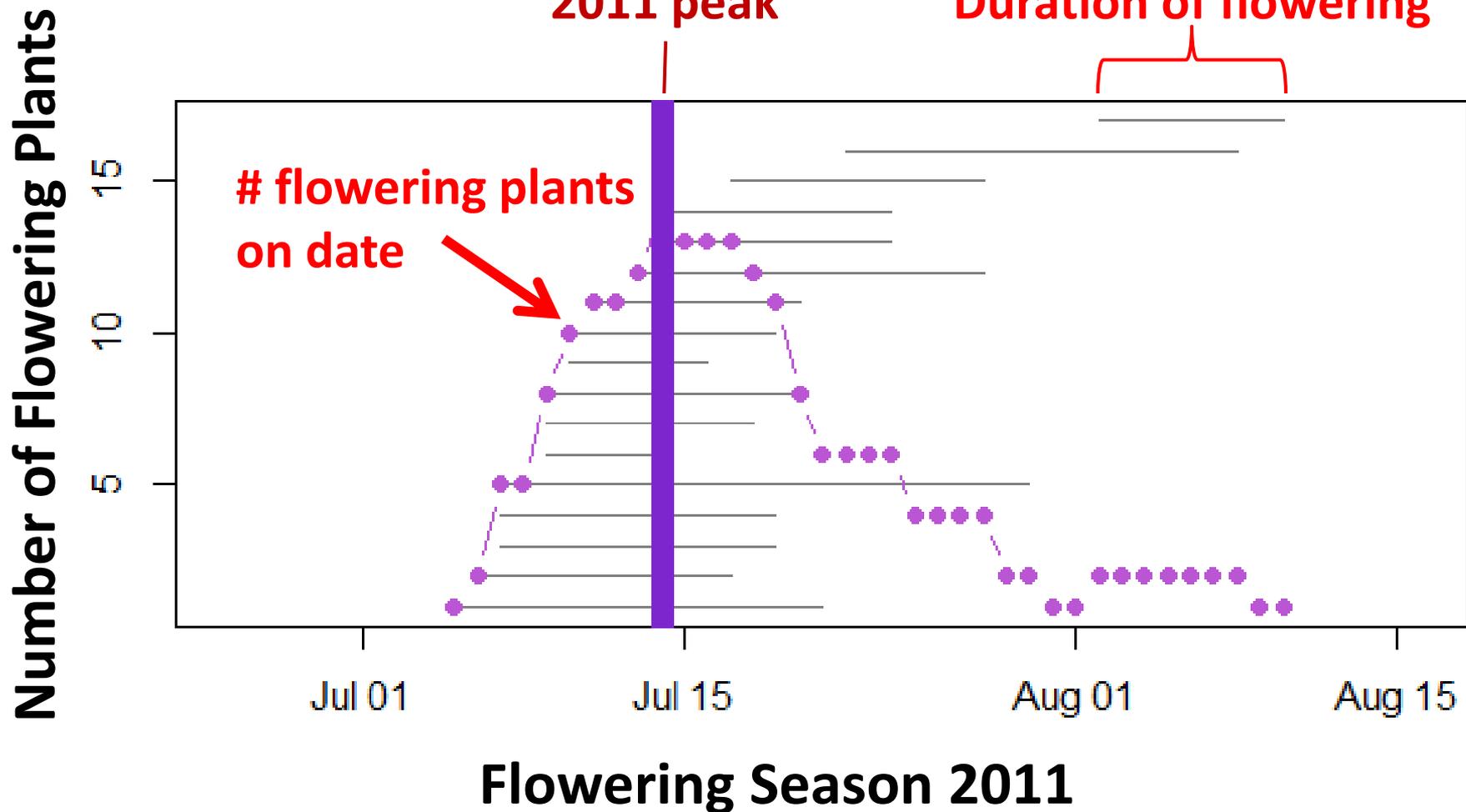
- Compared 2013 with existing data from 2011 (Amber Zahler) and 2012 (Kelly Kapsar)

# Methods

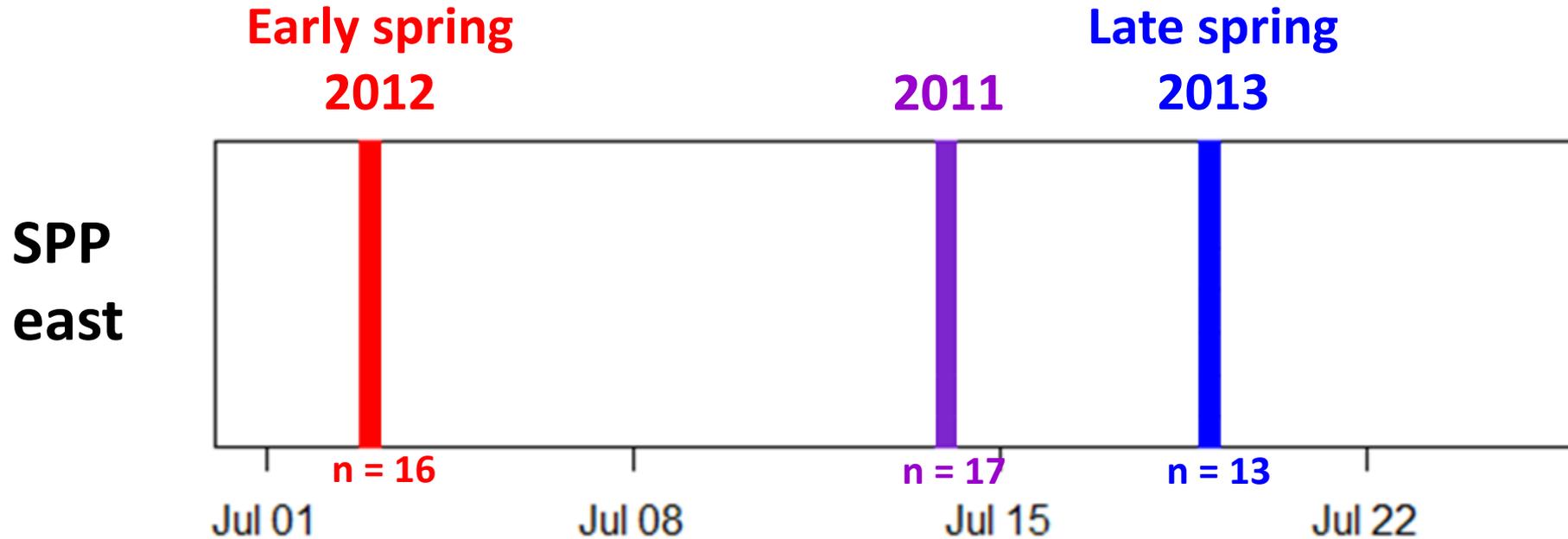




# Flowering phenology over 2011 season: Staffanson Prairie Preserve east (SPP east)



# Peak flowering dates for 3 years



**Observed similar pattern across other remnants**

**Conclusion:**

**Spring conditions affected peak flowering dates**

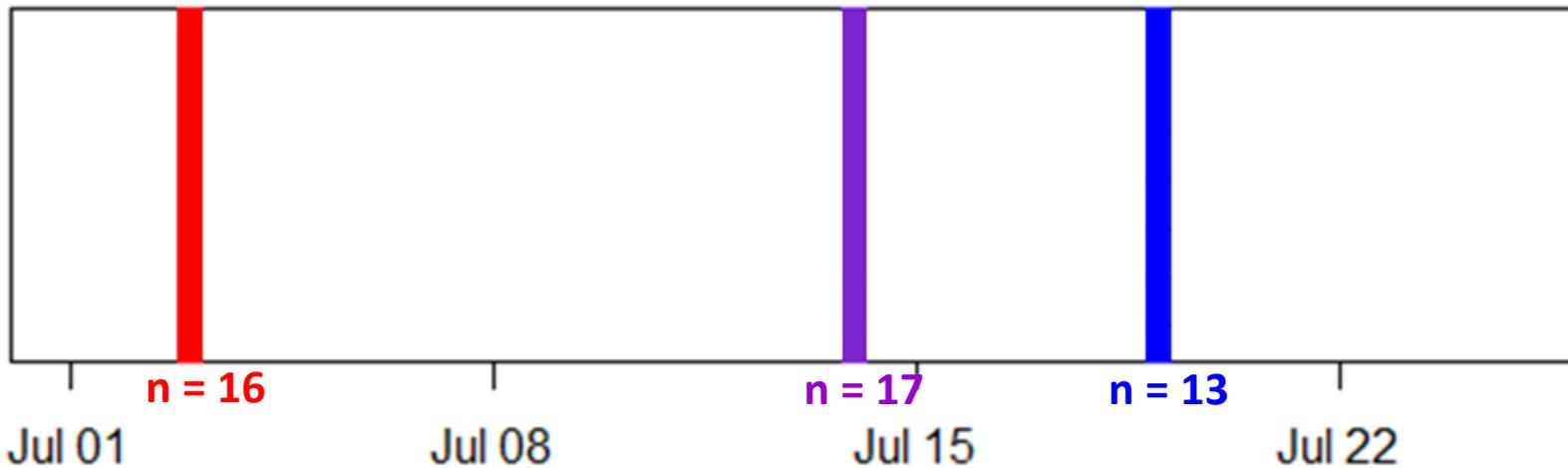
# Peak flowering dates for 3 years

Early spring  
2012

2011

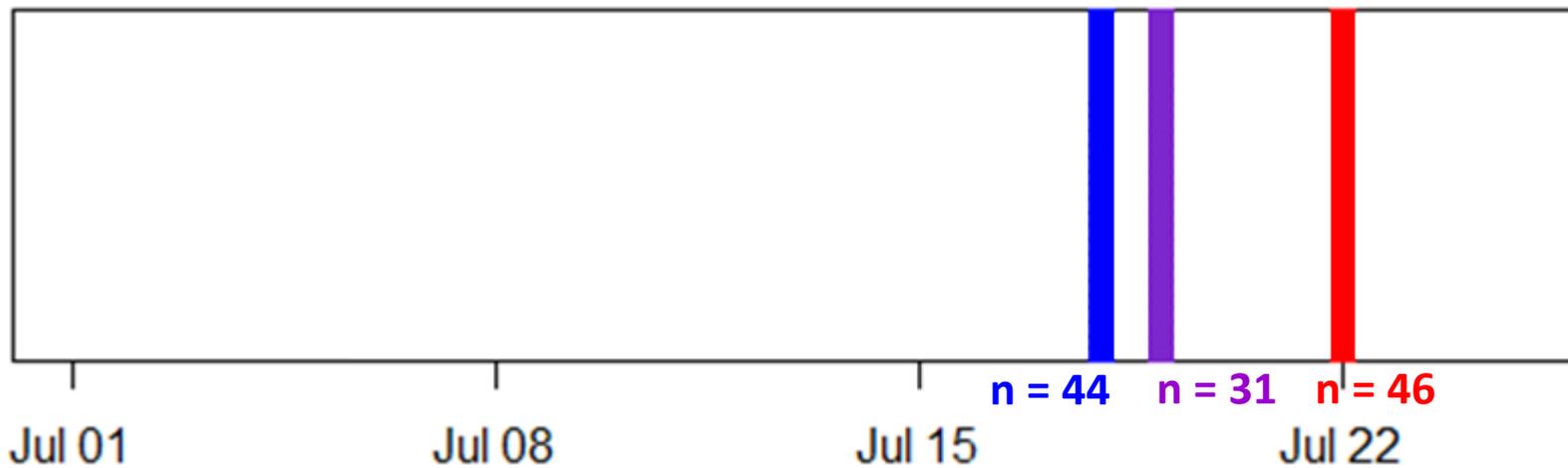
Late spring  
2013

SPP  
east



SPP  
west

Prescribed  
burn



# Conclusion

- Flowering phenology likely coupled to weather, timing of spring

**Warmer Temp → Earlier flowering**

**Cooler Temp → Later flowering**

# Conclusion

- Prescribed fire appears to delay flowering

**Prescribed Fire → Later flowering**

# Management implications



- **Prescribed burning may be a tool to offset shifts in flowering caused by climate change**
- **Counteract plant-pollinator decoupling**

# Acknowledgements



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- Echinacea Project

- Amber Zahler (2011)
- Kelly Kapsar (2012)
- Team 2013

- Participating Institutions

- University of Minnesota
- Chicago Botanic Garden

- Funding Sources

- National Science Foundation:  
Research Experience for Undergraduates







**2012 avg. peak w/o SPP**

**2011 & 2013  
avg. peaks**

**2012 avg. peak w/ SPP**

