

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

Sarah Baker

Tallgrass Prairie

What is it?

- Diverse ecosystem
 - Plants
 - Tall grasses (up to 8ft.)
 - Flowers, legumes
 - Few trees
 - Vertebrates
 - Insects

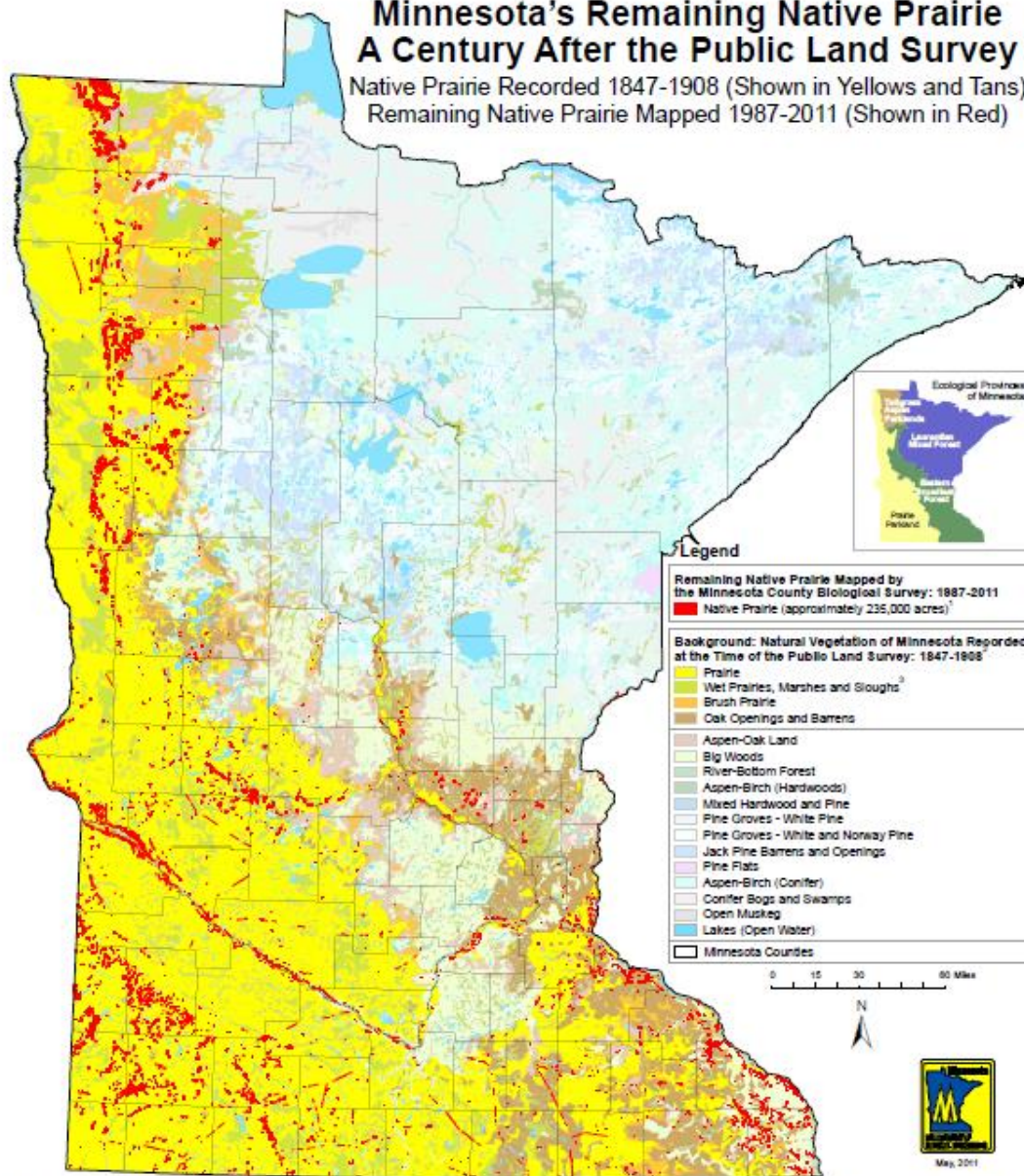


Why is it important?

- Species uncommon elsewhere
- **<1% left as scattered fragments (remnants)**
(Wagenius and Lyon 2010)

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)



¹ 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.

² 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.

³ 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

Causes of decline



<http://www.newspressnow.com>



<http://echinaceaproject.org/>

- **Human influence**

- Before European settlement

- Bison trampling/grazing;
Drought; Fires

- After European settlement

- Roads cut off fires; cattle;
Land used for agriculture,
Intro. of invasive species

- **Climate change puts pressure on various ecosystems**

- Leads to earlier development and flowering (Levin 2006; Bertin 2008)

Tallgrass prairie – What can we do?



- **Conservation and restoration**
 - Conserve what prairie is left
 - Restore unused fields
- **Management**
 - Prescribed burns
- **Research**

The Echinacea Project



- Long-term project, study Minnesota tallgrass prairie remnants
 - Consequences of prairie fragmentation
- *Echinacea angustifolia*: model org.



Research Question

- How do prairie plants respond to climate change?
- Annual and inter-annual weather patterns?

Hypothesis

- We hypothesized that flowering phenology would differ among populations due to variations in temperature and precipitation.

Methods

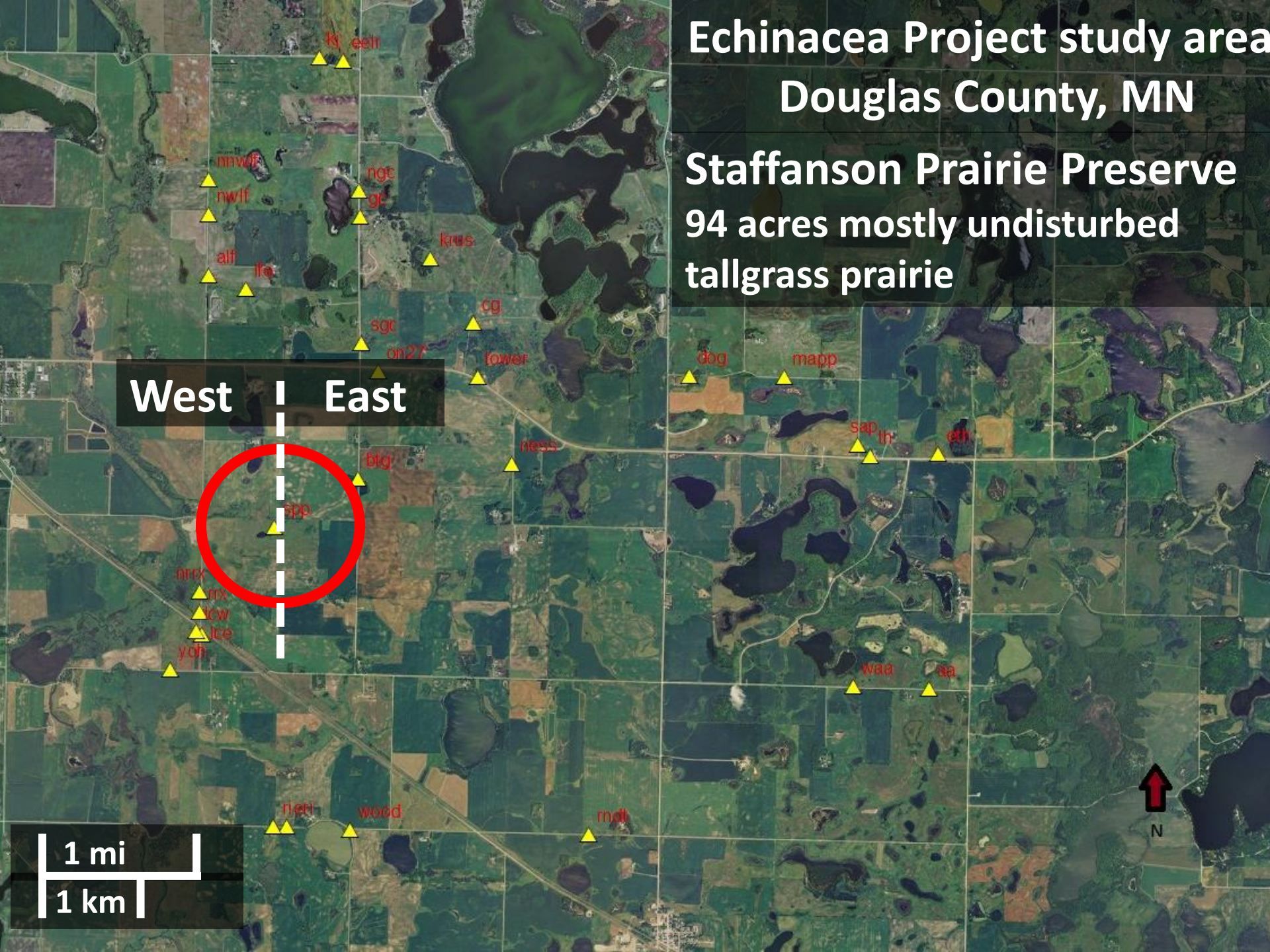
- Tracked flowering phenology of *E. angustifolia* in six remnants
 - Timing and duration of flowering, start to end
 - Calculated peak flowering date – date of highest overlap in flowering plants



- Compared 2013 with existing data from 2011 and 2012 for 3 remnants (n=3)

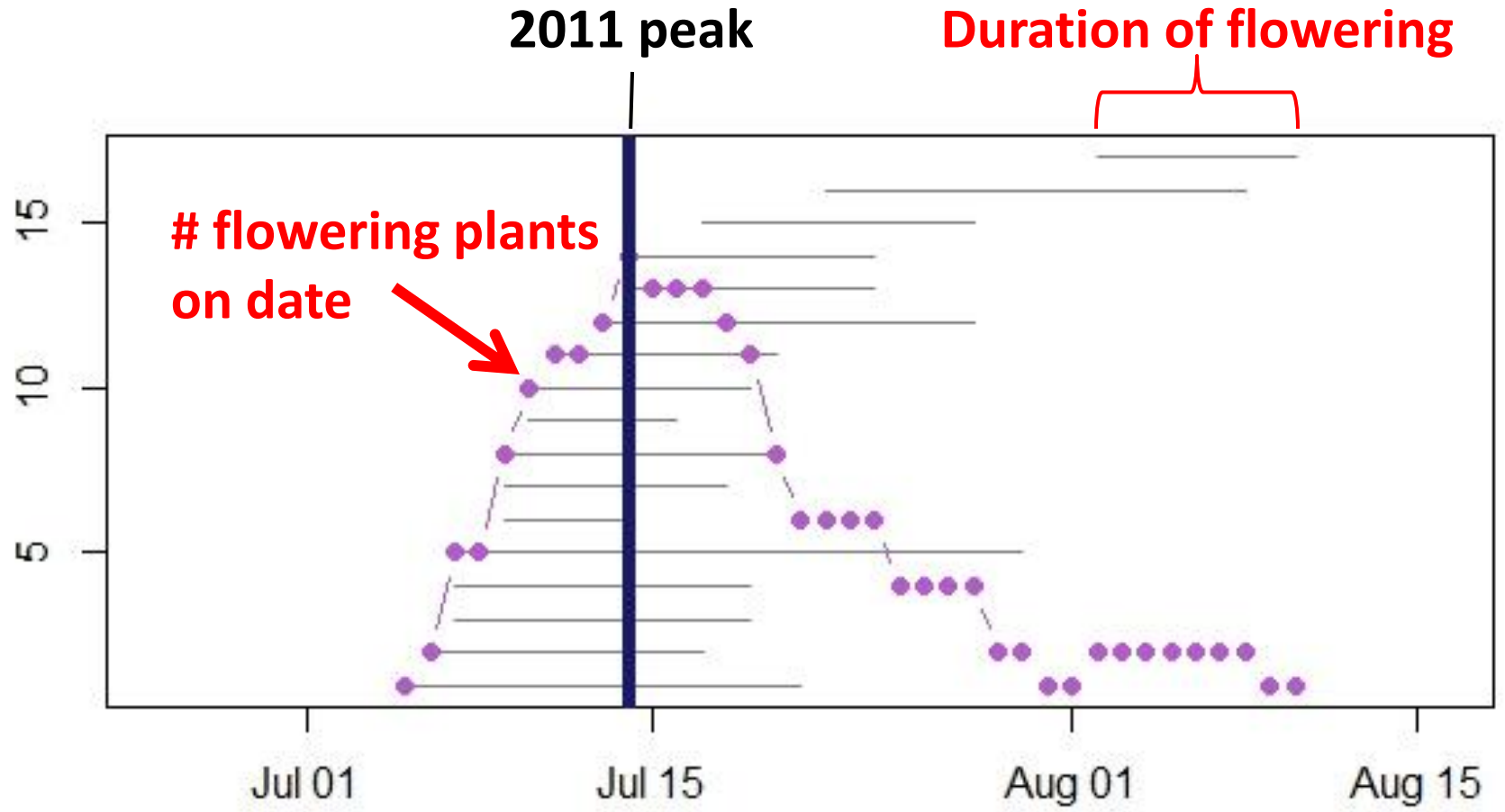
Echinacea Project study area Douglas County, MN

Staffanson Prairie Preserve
94 acres mostly undisturbed
tallgrass prairie



Flowering phenology over 2011 season: Staffanson Prairie Preserve east

Number of Flowering Plants



Flowering Season 2011

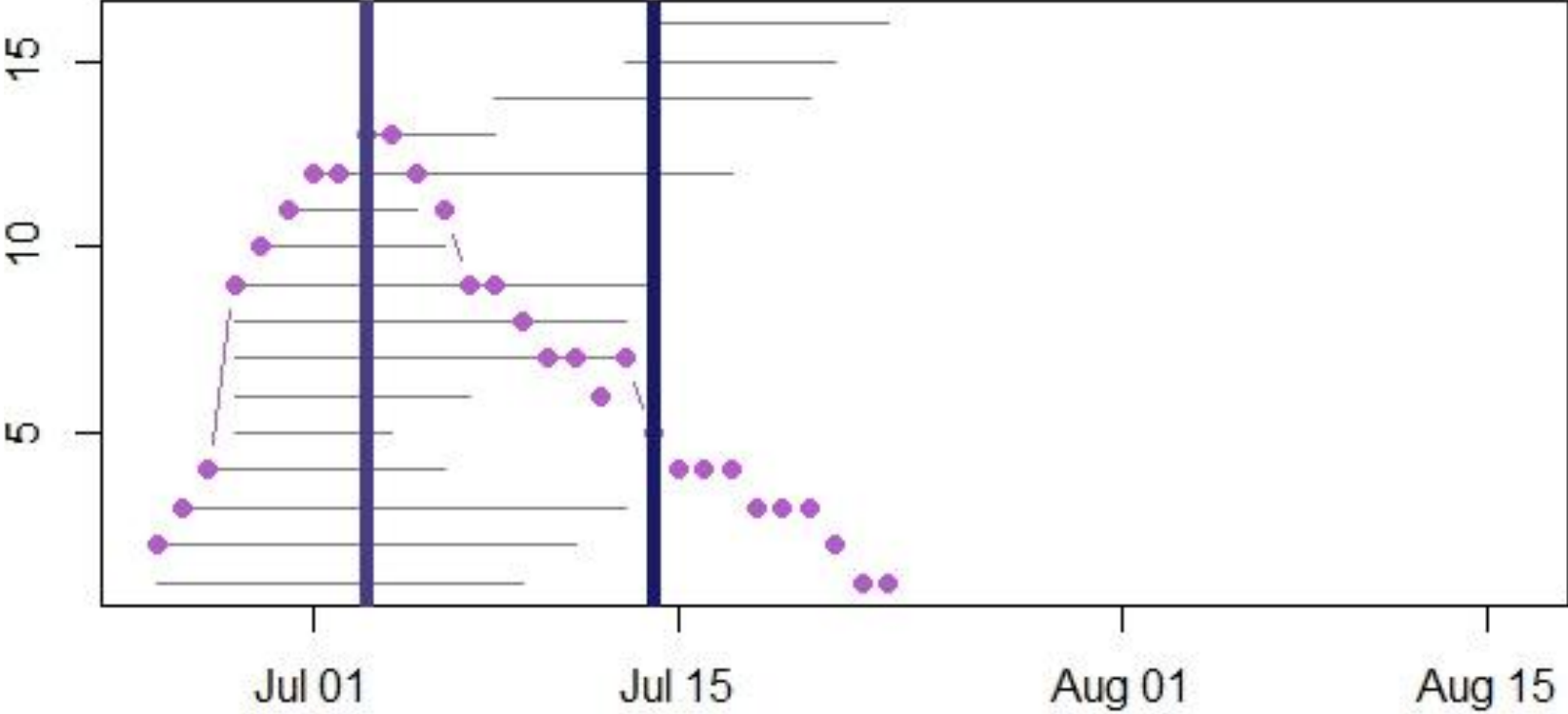
Earlier spring = earlier peak flowering in 2012



2012 peak

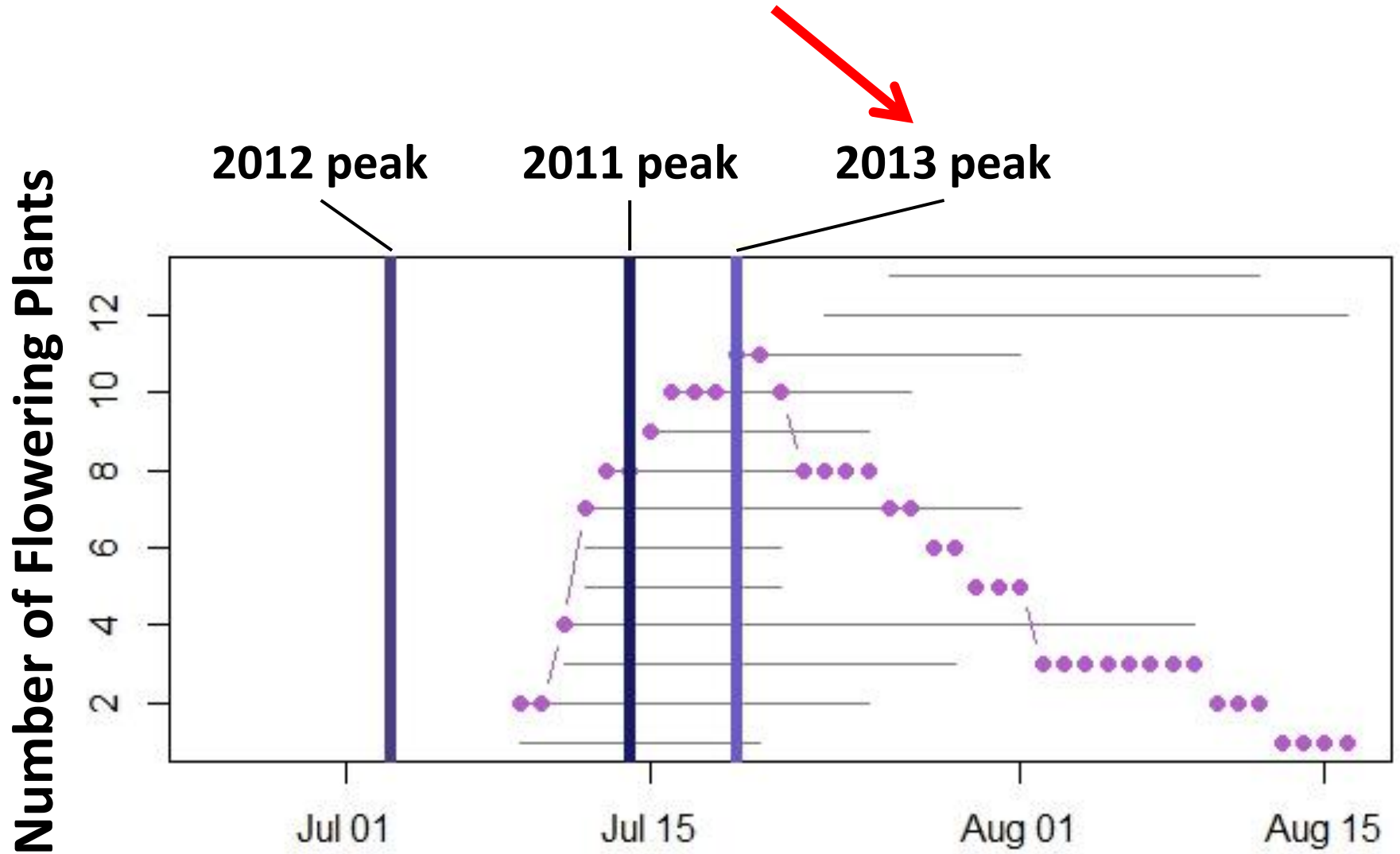
2011 peak

Number of Flowering Plants



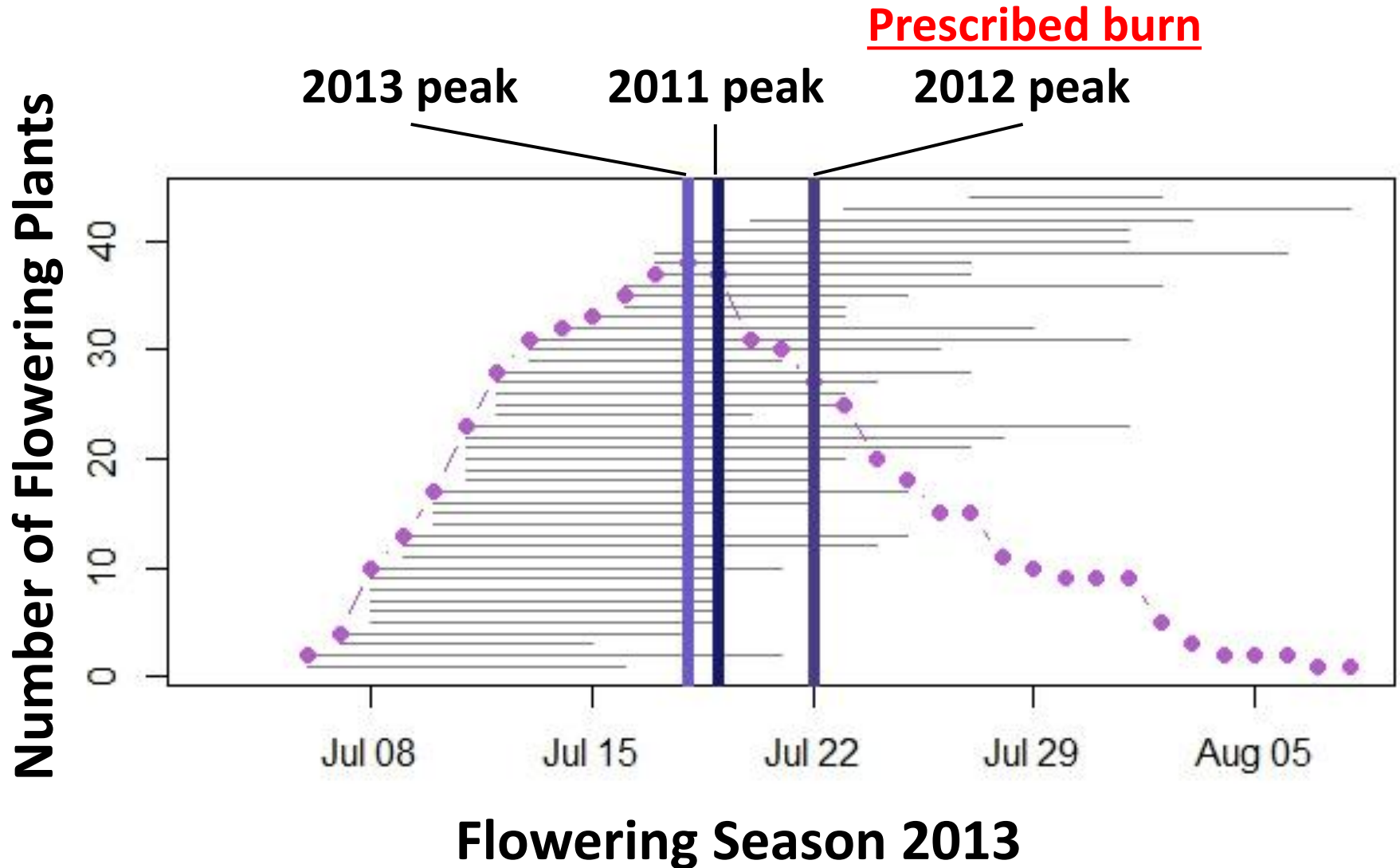
Flowering Season 2012

Later spring = later peak flowering (similar to 2011)



Timing of start of spring affects peak flowering dates

Staffanson Prairie Preserve west: 2011 and 2013 still close, but why is 2012 later?



Conclusion

- Flowering phenology likely strongly coupled to weather
- Timing of spring affects timing of flowering
- Prescribed burning may offset shifts in flowering caused by weather, climate change

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



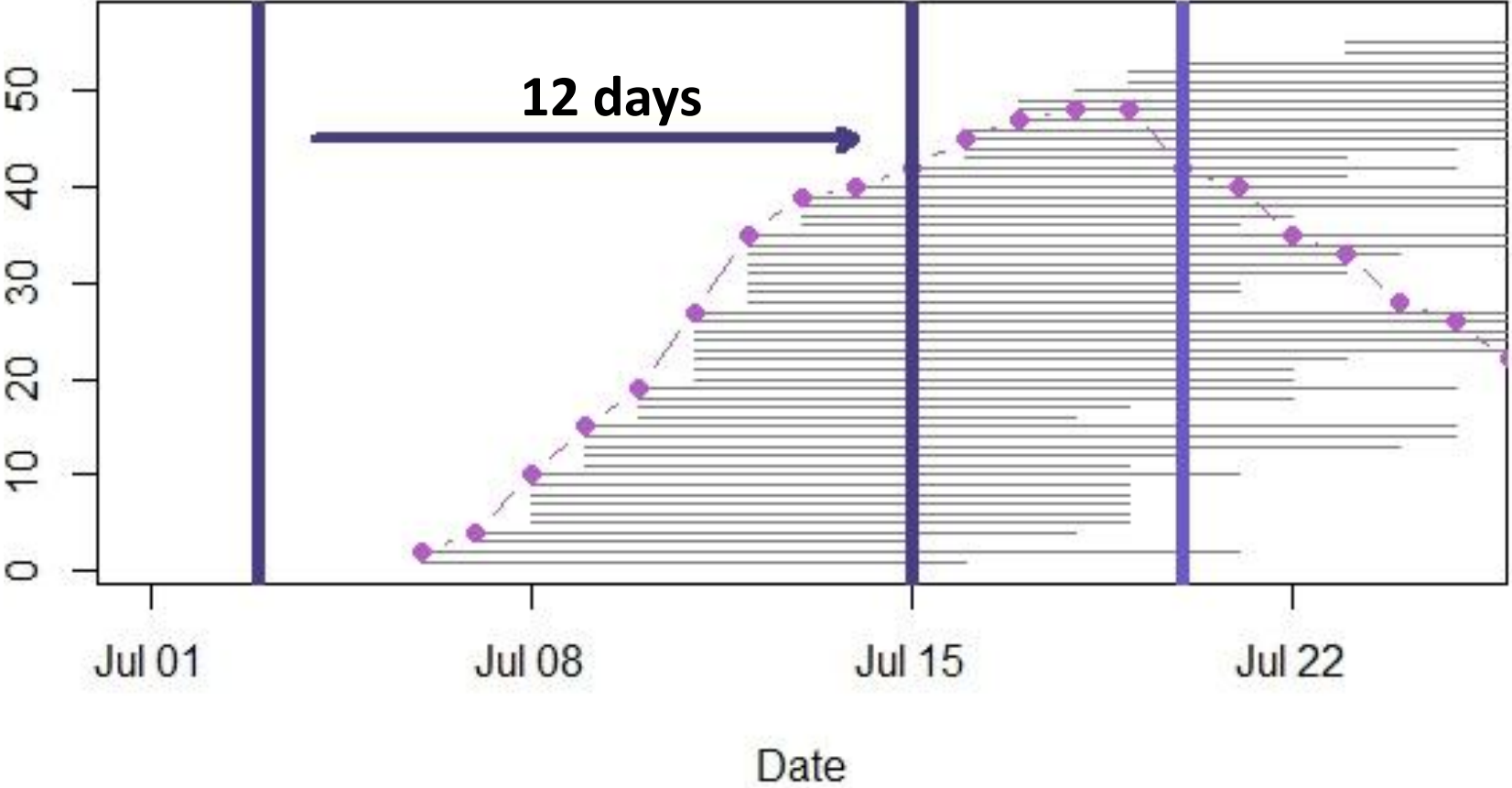
Total 2012 avg. peak w/o SPP

Total 2011 & 2013
avg. peaks

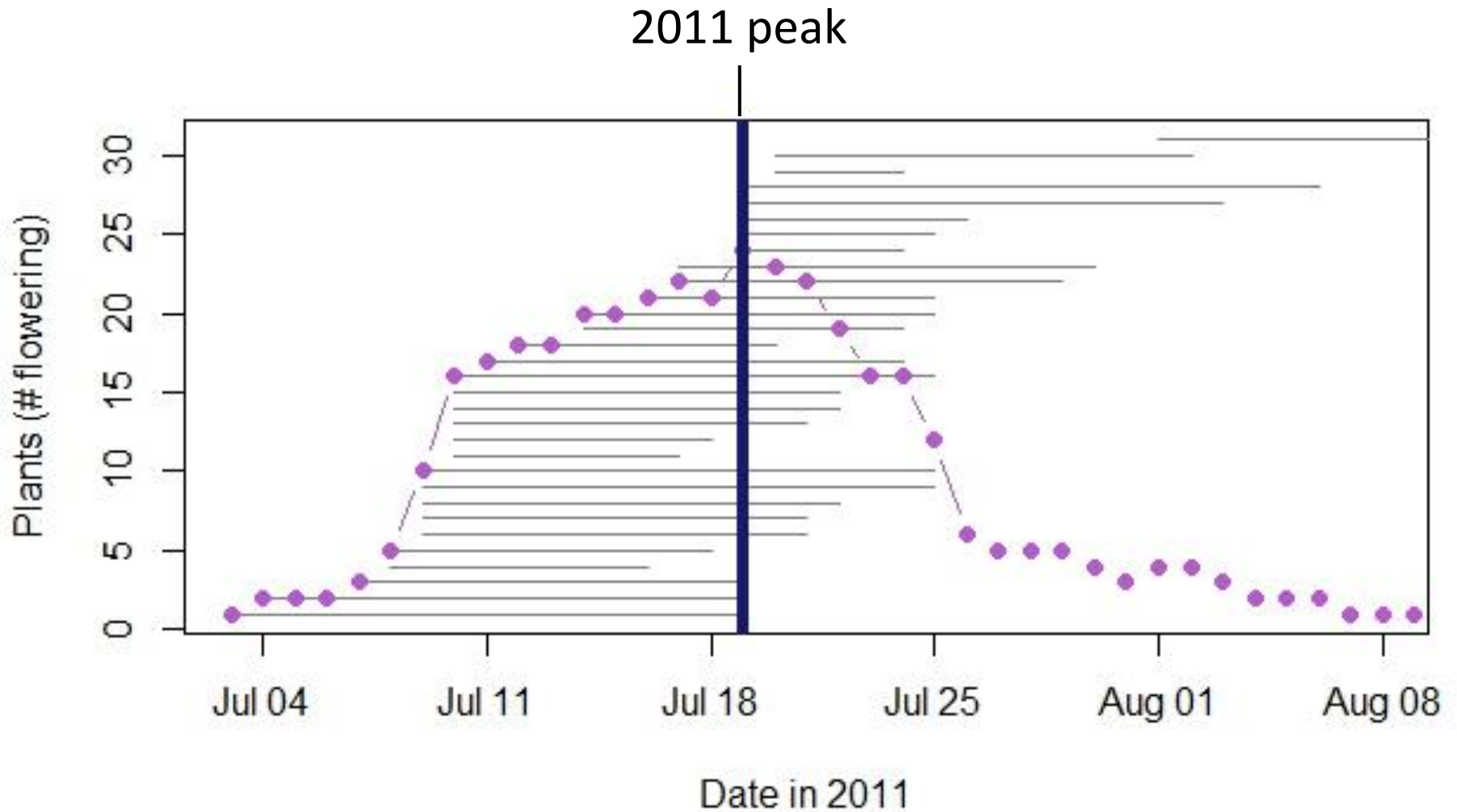
Total 2012 avg. peak

12 days

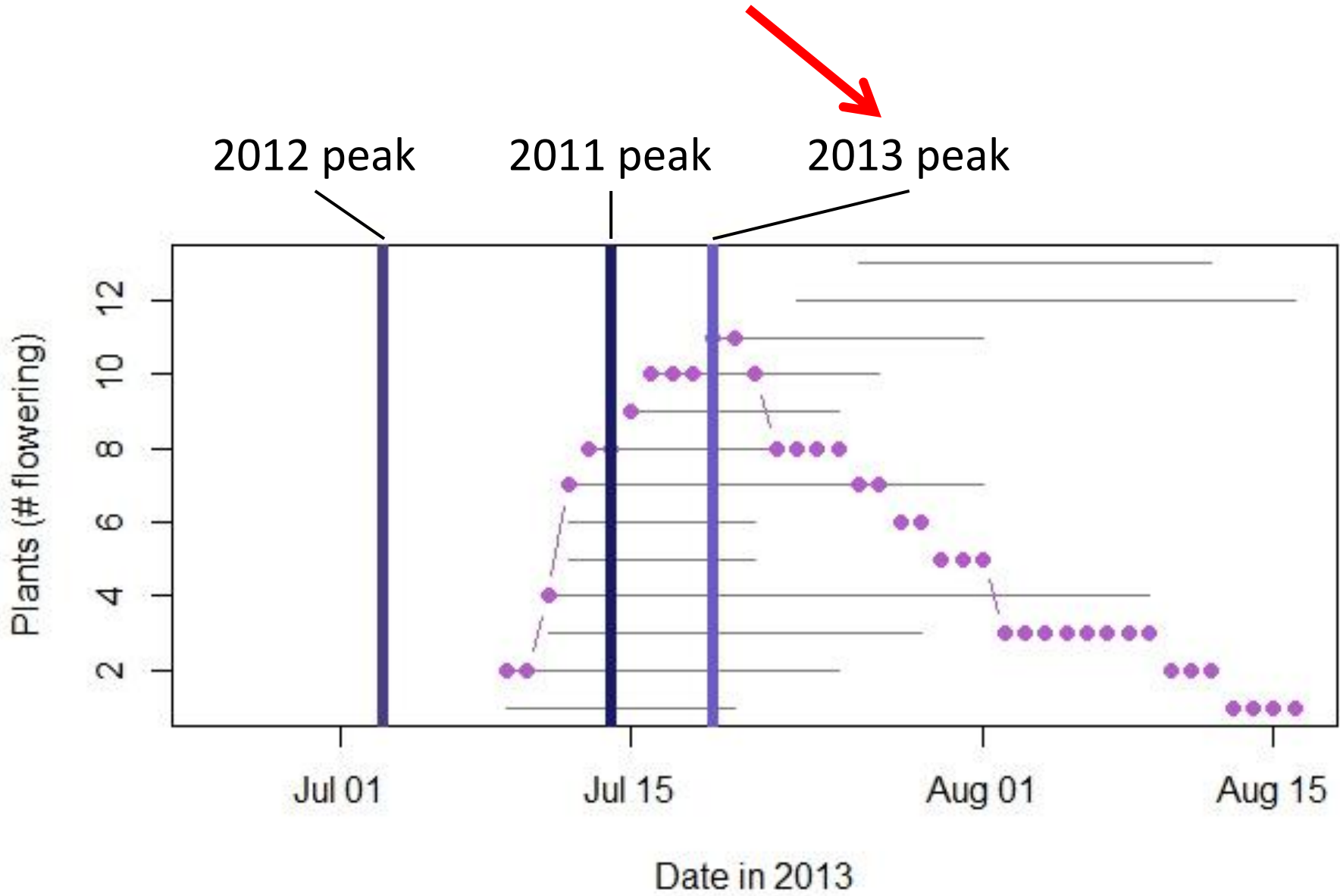
Number of Flowering Plants



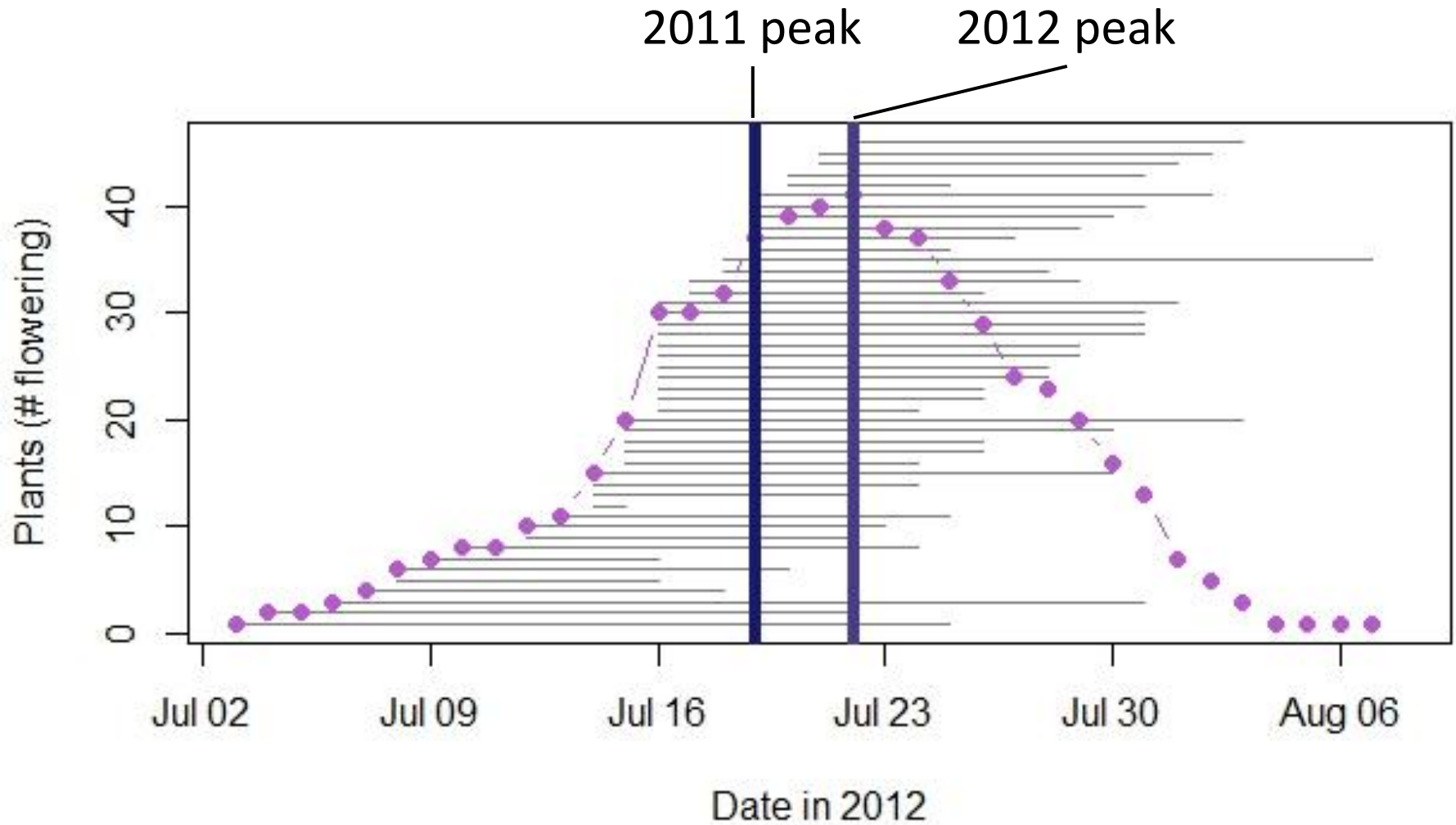
Flowering phenology over 2011 season: Staffanson Prairie Preserve west



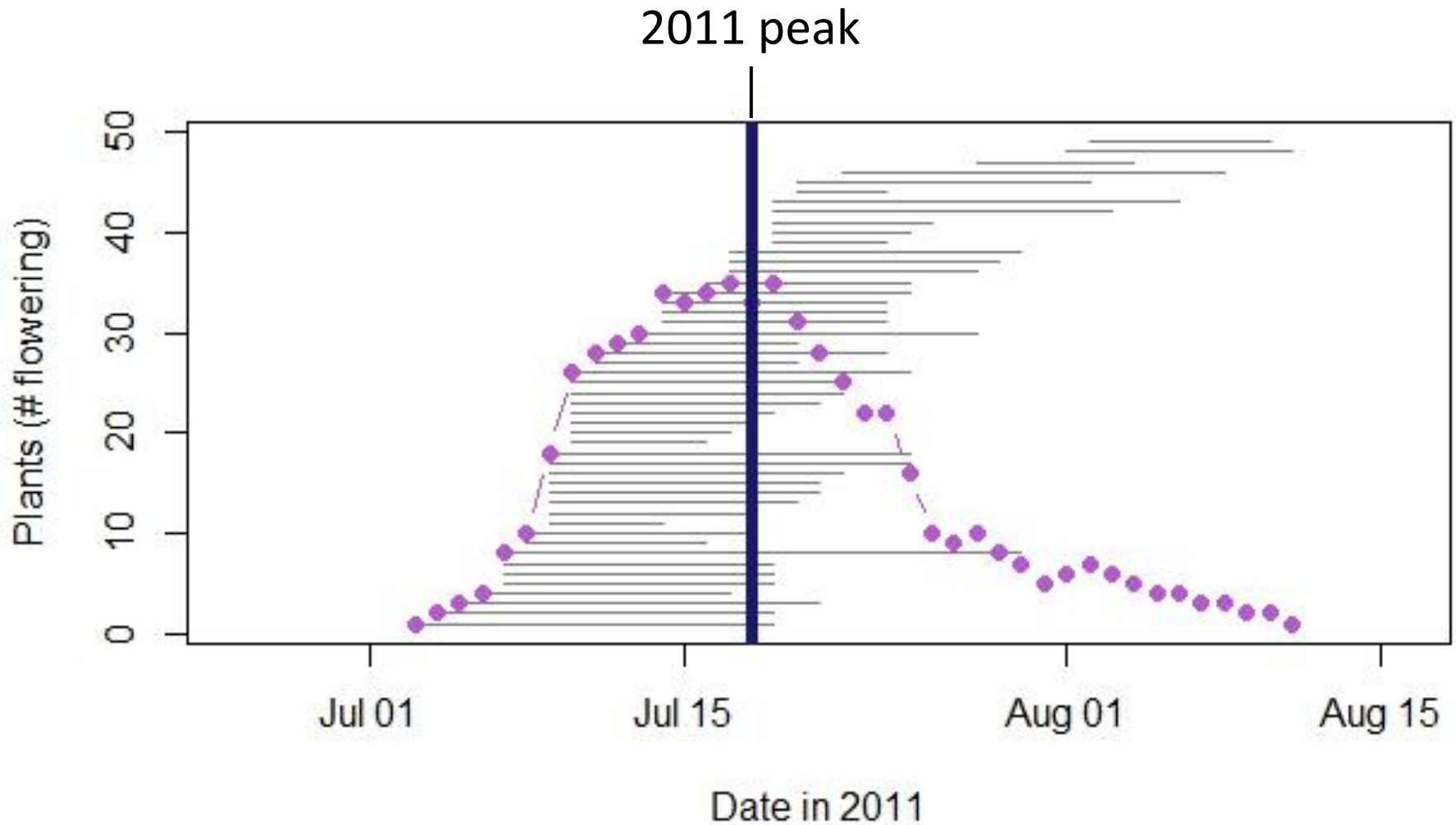
Later spring = later peak flowering in 2013



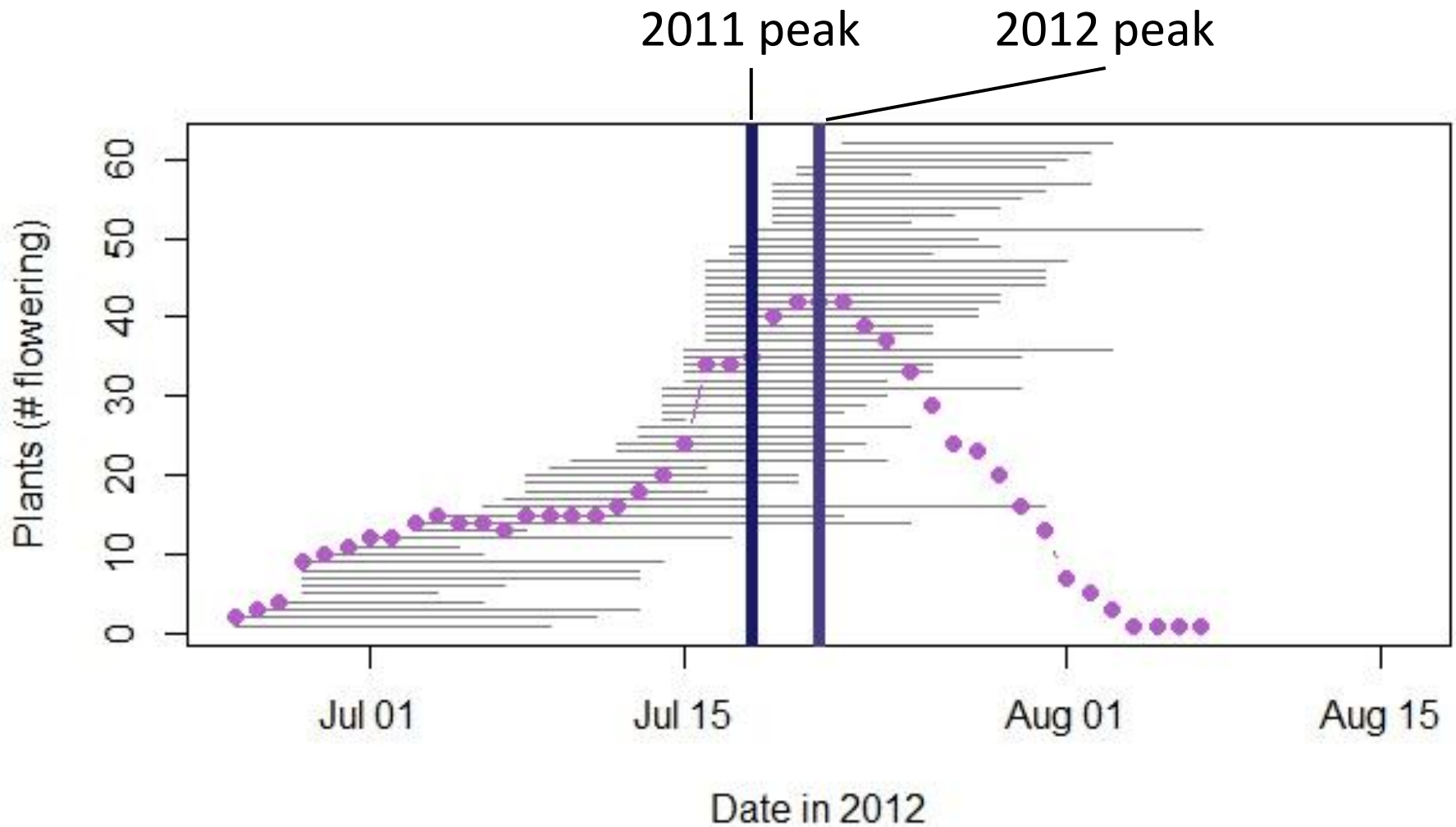
Staffanson Prairie Preserve west



Staffanson Prairie Preserve



Staffanson Prairie Preserve



Staffanson Prairie Preserve

