

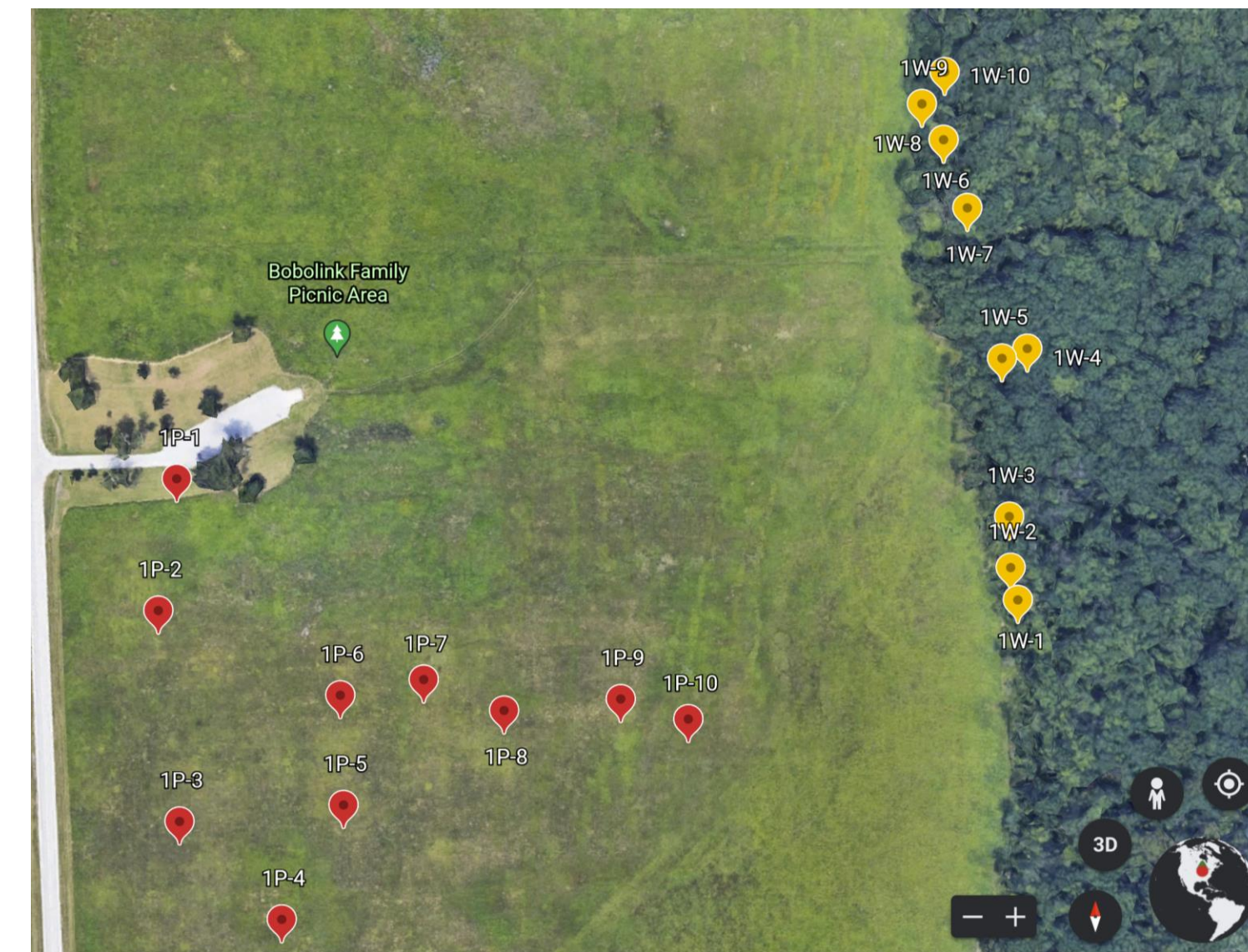
# Understanding Ploidy Variation in *Solidago altissima* to Inform Prairie Restoration and Management

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## Introduction

- Studying polyploidy is extremely beneficial to help understand climate change and phenotypic plasticity regarding climate change
- Research has shown that chromosome variation can be important for species to tolerate different climates. Understanding intraspecific ploidy variation (IPV) is important for managing species in areas where they compete and overtake other native species (1/3 of restoration species have IPV)
- Previous studies suggests that different landscapes on a regional scale have diploid populations of *Solidago altissima* tends to be more drought tolerant than polyploids
- Polyploids could have mutated due to the difference in conditions at each location. The woods have less light and higher competition from woody species. The prairie locations are more open, have higher sunlight, and the competition of mostly herbaceous plants



A map of the Bobolink Family Area on Google Earth showing where samples were collected. Not shown is the Bartel Grasslands site



*Solidago altissima*

## Project Limitations

- Limited sample sizes
- Solidago altissima* is difficult to work with on flow cytometer
- Time constraints did not allow for chromosome squashes

## Discussion

- Tall Goldenrod is an aggressive native species that will never be used in restoration, but many other Asteraceae could have varying ploidy levels so this information benefits restoration projects
- Differences in ploidy are present as expected. Future research could be done to see how ploidy affects management and restoration. Do disturbances lead to polyploidy?
- Questions remain about variation within a site. Future research could be done to help understand what this means for managing species with differing ploidy levels
- Future research can be done to get the exact ploidy levels. Chromosome squashes would need to be done on those with higher relative genome sizes to know for sure if the plant is a triploid, hexaploid, or tetraploid

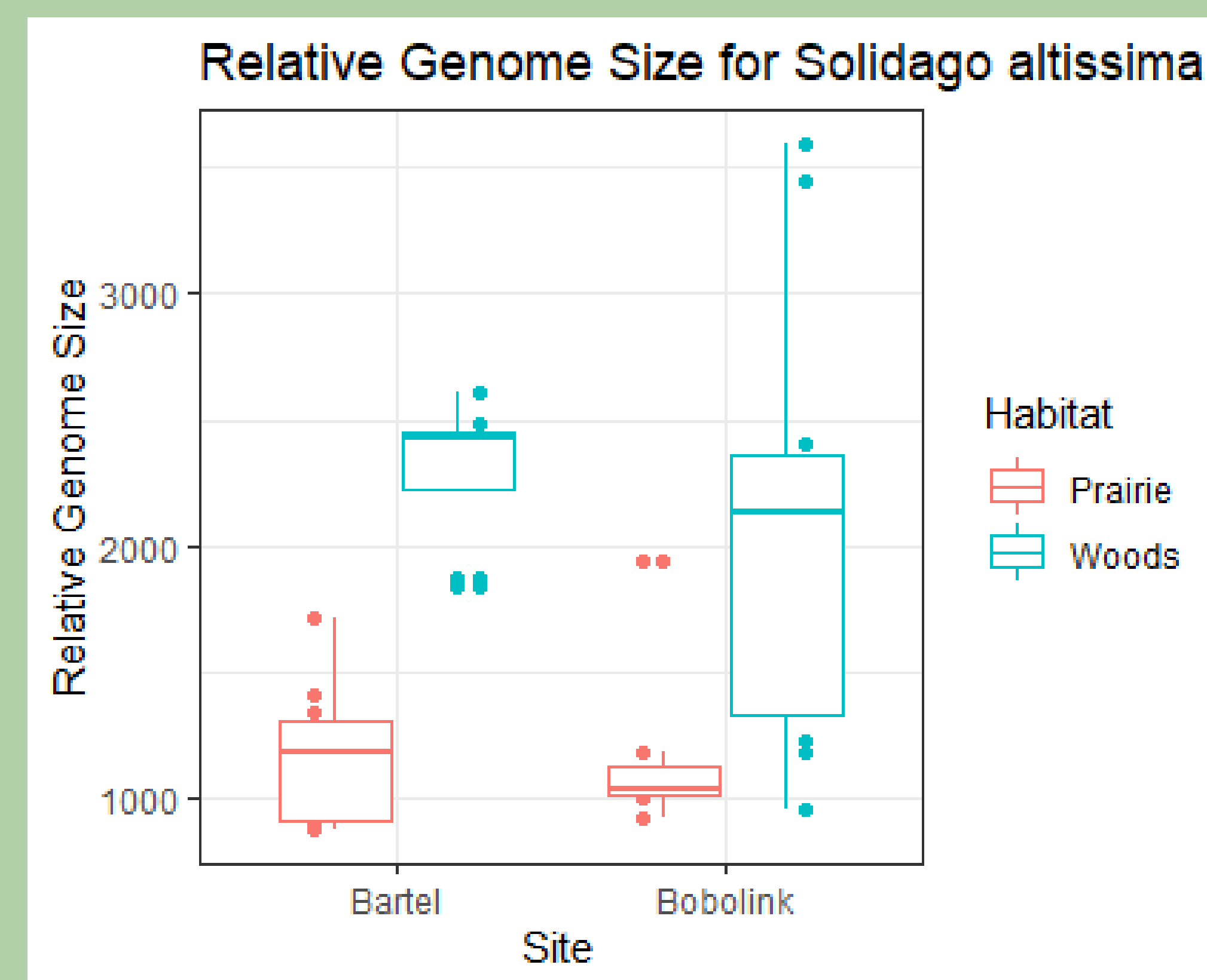
## Hypothesis

There will be variation in ploidy within a site and it will be related to the habitat. Due to the drier nature of the prairie the samples from the prairie would tend to be made up of more diploids than polyploids

## Methods

- 10 *S. altissima* samples haphazardly collected from woods and prairie at two SW Cook County sites (40 total samples)
- Quantified relative genome size of all samples using the flow cytometer and the Pea as a standard
- We used a linear model to model Genome size as a factor (predicted by) habitat, site, and the interaction between habitat and site
- We evaluated the model using type 3 ANOVA

## Results



- My research shows that both sites have intraspecific ploidy variation
- Overall, the average relative genome size was higher in the woods compared to the prairie samples at both sites. We estimate that the polyploids have much higher relative genome sizes compared to the diploids
- It is estimated that almost all of the woods samples were polyploids, with a few polyploids being in the prairies
- This is telling us that Genome size was significantly influenced by habitat type ( $F=19.21$ ,  $p<0.001$ ), but not by site or the interaction



Alexis B. (L) and Lauryn C. (R) at Bobolink

## Acknowledgments

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## Literature Cited

- Doležel, J., Greilhuber, J., & Suda, J. (2007). Estimation of nuclear dna content in plants using flow cytometry. *Nature Protocols*, 2(9), 2233–2244. <https://doi.org/10.1038/nprot.2007.310>
- Kramer, A. T., Wood, T. E., Frischie, S., & Havens, K. (2017). Considering ploidy when producing and using mixed-source native plant materials for restoration. *Restoration Ecology*, 26(1), 13–19. <https://doi.org/10.1111/rec.12636>
- Etterson, J. R., Toczylowski, R. H., Winkler, K. J., Kirschbaum, J. A., & McAulay, T. S. (2016). *Solidago altissima* differs with respect to ploidy frequency and clinal variation across the PRAIRIE-FOREST biome border in Minnesota. *American Journal of Botany*, 103(1), 22–32. <https://doi.org/10.3732/ajb.1500146>
- Solidago altissima* (TALL GOLDENROD). Minnesota Wildflowers. (n.d.). <https://www.minnesotawildflowers.info/flower/tall-goldenrod>.

