Yale SCHOOL OF THE ENVIRONMENT

Ucross High Plains Stewardship

FELLOWSHIP BRIEF

# Impact of Climate Change on Plant Community Composition and Implications for Wildlife Migration in Western Wyoming

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## The Need.

As climate change increases temperatures and changes precipitation patterns globally, plant communities around the world will be substantially impacted. This is particularly true and important in water-limited drylands where changes in the timing of precipitation could alter the distribution of soil moisture and ultimately, the composition of plant functional types. In the Upper Green River Basin (UGRB) of western Wyoming, these climatic variables could cause the plant community composition to shift, resulting in less cool season (C3) plant species and more warm season (C4) plant species. These potential alterations to the plant community could impact ungulates that track spring green-up along their annual migration between their overwintering and breeding sites. It is important to consider the potential of a resource-level plant functional type shift that would alter the timing of green vegetation so we can consider options available to protect forage availability along this major wildlife migration route.

## The Project.

To investigate the possibility of a shift in the plant community from cool season (C3) plant species to warm season (C4) species, Rob studied the primary warm-season plant species in the region, blue grama (Bouteloua gracilis). Rob searched areas in the UGRB for blue grama and then created a map to illustrate the distribution of this C4 species. Rob selected areas to search for blue grama based on historical records provided by local conservation groups and results of a model to identify areas with similar environmental characteristics to areas where blue grama exists. Rob also compared the timing of green-up for cool and warm season plants during the spring and summer by tracking

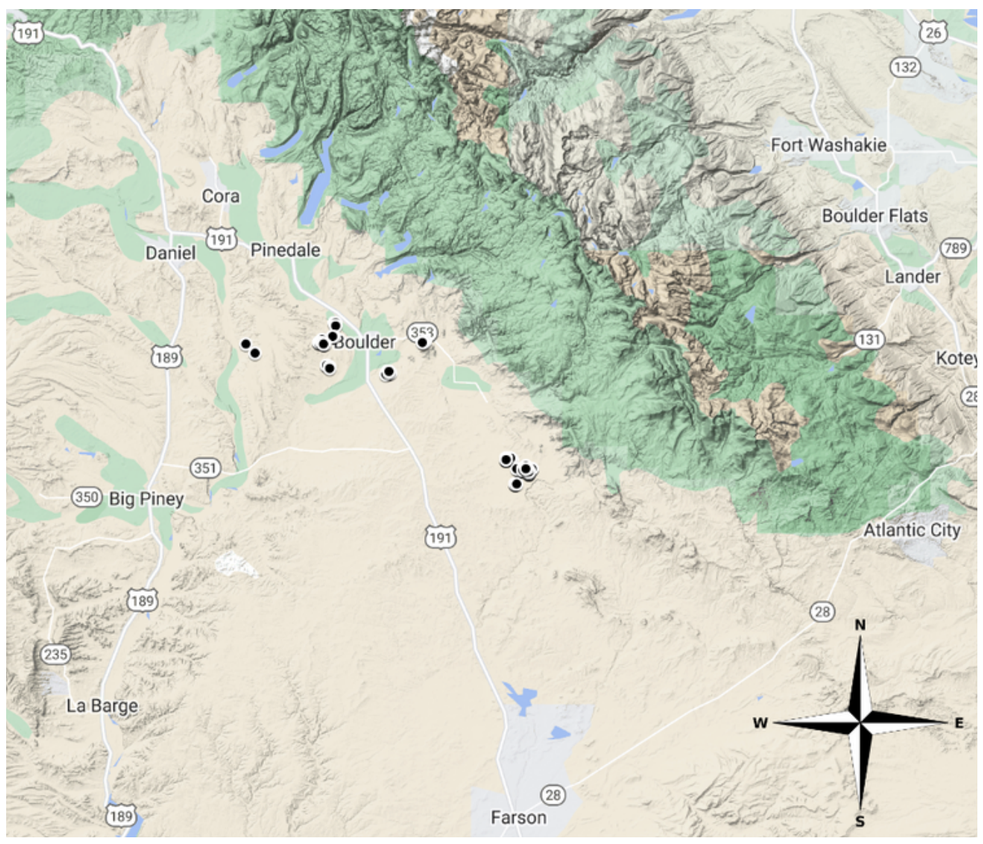


Figure 1. Map of the Upper Green River Basin (UGRB) area and locations where blue grama was found (black dots) during summer 2022.

individuals of various grass and flowering plant species at 8 sites around the UGRB.Individual plants were visited every week during the spring and summer and measured to track the stages of growth of the functional types through the growing season.

## The Findings.

Rob's work has resulted in a map illustrating the distribution of blue grama in the UGRB (Figure 1). Not only is this warm season species present in the region, but Rob found its distribution to be much more extensive than previously documented. These results indicate that it is possible for the plant community composition to shift from C3 plants to C4 plant species. Rob is still in the process of analyzing data to compare green-up between functional groups, but through his field work he noted a stark difference in the timing of certain phenological stages. While the C3 species were becoming increasingly green throughout April, the blue grama individuals did not reach the same level of greenness until well into June. The month of June was the peak month for C3 species to be entering their reproductive stage, and by July many C3 species were in the process of senescence. Meanwhile, the last week of field work in July marked the first time reproductive structures were seen on most blue grama individuals.

## The Impact.

Some locations where blue grama was found are either nearby or overlapping with primary migratory routes for mule deer, making these findings valuable to conservation organizations and land managers. More analysis is needed to better understand the potential implications of climate change on this migration route, but initial research indicates it is possible for green forage availability during the ungulate migratory time period to change if there is a plant functional group shift. Rob will collaborate with conservation groups so they can utilize this information to create protected areas that would ensure wildlife, such as mule deer, continue to have access to lands that will provide forage during migration. These results may also benefit ranchers and land managers designing grazing strategies by providing additional knowledge about when and where areas of green vegetation are likely to occur.


## The Student.

Rob is a Master of Environmental Science candidate at the Yale School of the Environment. His thesis research combines simulation modeling and field research to assess the potential of climate change to alter the plant community phenology of Southwest Wyoming through shifts in functional type. He is interested in incorporating species interactions and climatic changes to conservation decision-making. Prior to coming to YSE, Rob contributed to the protection of shorebirds with Mass Audubon, and then came to the EEB department at Yale to work on a global biodiversity mapping project. He received his B.S. in Environmental Science from Northeastern University.