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Conclusion: A Resurgence of Disturbance

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After over 30 years of researching and recreating in the prairie landscapes of the Northern Great Plains (NGP), it is undeniable to me that the prairie evolved as a disturbance driven ecosystem. The living creatures of our prairies adapted to live with disturbances such as fire, grazing by large ungulates, and day-to-day and year-to-year fluctuations in climate. In the introduction to this special issue, I mentioned the concept of a Historic Climax Plant Community (HCPC) occupying certain soil types within an ecoregion, which would have evolved with these natural disturbances. Personally, the places where I could find plant communities closest to the HCPC were those areas being actively managed by a combination of fire and grazing. Did these areas still have Kentucky Bluegrass, Smooth Brome, and Crested Wheatgrass? Yes, but our data have indicated these areas had much more diverse native plant community components when compared to those with just one type of disturbance or a lack of disturbance.

Managers of natural areas in the NGP have widely accepted that disturbance is needed to maintain a diverse prairie ecosystem; however, the application of multiple disturbances is still far from practiced within our region. In contrast, the Southern Great Plains has led much of the research on the importance of fire/grazing interactions in maintaining diverse prairie, and certain land managers (e.g., The Nature Conservancy) have long been proponents of reintroducing natural disturbances to prairie landscapes. Most private land managers of native prairie in the NGP understand the need for, and management of, grazing animals to sustain forage production, but their understanding of maintenance and sustainability of native plant diversity through grazing is lacking. They have been educated in classic range management concepts based on historic plant communities which lacked introduced cool-season invasive grasses and are part of the culture that has been averse to fire in this region for generations. Federal and non-profit land managers have reintroduced fire to many areas in the NGP, and yet there are still limitations on the timing and execution of prescribed fires. These limitations are often driven by an understandable fear of wildfire. The fear of wildfire seems to be even greater among private landowners with misconceptions about fire decreasing the quantity and quality of forage, thus, decreasing weight gains in livestock, even though research has shown the opposite.

The social dynamics of the acceptance fire and grazing in combination cannot be underestimated. For example, wildfire is an understandable societal concern; however, prescribed fire can be carried out in a safe manner. Lessons from other parts of the Great Plains could benefit the NGP, such as the development of burn associations. We who are actively burning need to showcase the positive effects of prescribed fires to area landowners. There needs to be more flexibility in grazing management, too. The traditional "June 1" start date is too late for those native pastures that are being overtaken by introduced cool-season perennial grasses. There are many who believe fire and grazing at the same time is a mistake, so the actual understanding of these disturbances together in the NGP

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is greatly lacking compared to other areas in the Great Plains. For example, research from the Southern Great Plains has shown that patchy fires combined with grazing produces more resilience for wildlife and livestock production. One final concern that some have is that we might "harm" our native prairie by too much disturbance (i.e., fire and grazing in the same growing season). Unfortunately, we have discovered that a lack of disturbance is much more detrimental.

I also recognize that accepting change is a slow process, and there is the reality that these disturbances are not always feasible for many reasons (e.g. time, money, personnel, equipment, access to grazing animals, etc.). However, there is a need for managers of the remaining native prairie in the NGP to be adaptive in their management. Adaptive management requires some level of monitoring, and an understanding of the ecological processes being monitored. Managers should actually walk across their prairie and appreciate what they are seeing, and educate themselves on the good, the bad, and the ugly of their particular piece of prairie. As an academic, I recognize that I must be able to communicate the implications of our research to a wider audience that includes land managers. Above all, I need to remain open to other perspectives, active communication, and an understanding of the needs of those who manage our prairies.

Finally, there is a need for everyone involved in native prairie management to work together to fill the many knowledge gaps of ecological processes occurring within the NGP. We opened this special issue with a review of our understanding (and/or lack of understanding) of plant-soil feedbacks of our prairies. We wrote the paper based on the opinion of land managers in the NGP that this is an area which requires considerable research. The importance of soil microbiological processes on the maintenance of native plant communities and invasion dynamics is still in its infancy. I am sure there are many other knowledge gaps beyond plant-soil feedbacks which need to be explored which we as researchers could pursue. Again, we must have an openness to actively listen to other perspectives, and a willingness to work collaboratively to identify and fill these gaps. In closing, we want to thank *The Prairie Naturalist* for publishing this special issue on a topic that many believe is crucial to our time—saving what is left of the remaining native prairie of the NGP.