Discussion/ Results Draft

3.1 Agency Relationships

To understand landowner respondent's baseline knowledge, familiarity and attitudes toward various sources of information, we asked who they personally used and trusted from a group of organizations, including federal and state governmental agencies, as well as management specific groups. We found that all sources of information have a generally high trust among respondents, with county extension offices being used the most1,2. In our study we found that the Bureau of Land Management was used the least, but that could be because there were small amounts of BLM managed land in the study area. Our study is not the only one to have found that county extensions offices are the most trusted as Liffman et al. (2000), found that these offices could be the ones to connect ranchers/ landowners and scientists together to allow information to be spread.

It was found that Pheasants Forever was also highly trusted, confirming the fact that industry related organizations are often trusted more than government agencies1,2, the exception being county extension. Although North Dakota does not have a sanctioned Prescribed Burn Association, other studies found that these groups use NRCS or Pheasants Forever significantly more than they use state or federal wildlife agencies3. Confirming the fact that groups including Pheasants Forever are the most trusted with environmental knowledge and actions.

We also asked what organizations and agencies they associated and trust with prescribed fire, as trust in an agency doing prescribed fire is a key variable that shapes public acceptance1,4. The US Forest Service is the most associated with prescribed fire but the least trusted, whereas Pheasants Forever is the most trusted with prescribed fire. Going along with the notion that the public gives greater trust to environmental groups than government entities4. Shindler and Toman 2003 found a decrease in public trust to the US Forest Service, their first study had 50% of respondents trust the US Forest Service, with just 4 year later that number decreased, respondents found that the US Forest Service was not building trust with landowners, potentially limiting public trust. It has been studied that trust can be perceived different ways, and oftentimes is not assigned to one person in an organization but as a whole, allowing one bad interaction to dissuade trust in the future5. Trust has been found to be a strong predictor of respondents approval and acceptance of government agencies to make the proper decisions about management methods, including prescribed burning6,7.

3.2.1 Perceptions of public grazingland management

Our study was focused around 4 National Grasslands in North Dakota/ South Dakota. Many of which respondents are located within or directly adjacent to the grasslands. Gathering the respondents' view of how the National Grasslands are being managed was important as we can understand how they view the frequency of prescribed fire. We found that the general attitude of management on the grasslands was positive and respectful, and that the best science should prevail on how they manage the land. But there was a disagreement that prescribed fire should increase in frequency. This leads to how lack of trust with the Forest Service can cause disagreements regarding management plans. Even if respondents believe that the best science should prevail, with a lack of trust they disagree that it should be fire. Without the trust, cooperation and coordination of landowners it is hard for the US Forest Service to conduct prescribed burns and other management methods on grasslands due to habitat fragmentation and conversion8. Vaske et al.9 Compiled that perceived similarity often initiates public trust, when someone believes that they share similar values as the management agencies, they tend to trust that agency more9

3.3.2 Contribution to management decision-making

We asked respondents what environmental concern is important to them to understand what could be driving motivators and co-benefits to introducing or increasing prescribed fire on respondent's land, we believed that answers would possibly go along with an increase in beef production. We found that ranchers seemed to value open rangelands, increasing plant diversity, woody plant control and restoring prairie/ grassland, but they do not seem to care about reducing wildfire risk. Other studies have shown that ranchers value open rangeland, noting that open space and wildlife habitat were as important as food and fiber production for protecting agricultural land (American Farmland Trust 2001.). Landowners worry about prescribed fire on their land due to the possibility of limited forage production in years to follow because of drought10. Except, cattle spend roughly 75% of their grazing time in recently burned areas11, allowing for greater forage utilization than unburned areas. As well as recently burned areas have a reduction of ticks12, horn, and face flies13. Patch-burn grazing reduces the risk of lack of forage, because there is always land that hasn't been burned recently. Wanchuk et al. 202214, found that recently burned areas had higher forage nutritional values than unburned areas, with patch-burn fire and grazing performing the best in mild drought years, like 2017.

After understanding what landowners valued, we wanted to understand what truly affected their decision making. Being a good land steward and what previous generations have taught were the highest motivators, although these could play into each other. Scientific research and what other neighbors do to their land was the smallest motivator, contrary to the belief that best science should prevail on National Grasslands, as well as Bendel et al. Study that had respondents saying that they valued scientific research most. But, having a strong stewardship aspect is noted in many studies throughout the Great Plains, where respondents value “conserving natural resources” over economic gain2. Having this feeling of stewardship, includes having a feeling of responsibility for environmental concerns15. The concept of stewardship is often passed down from generation to generation, so the notion of being a good steward and following what previous generations have taught, goes hand in hand.

3.3 Attitudes about prescribed fire

We wanted to gain perspective on how the respondents community felt about fire, as this can be a barrier to performing prescribed burns. Overall perception is that fire is risky, to people, property, and forage. Community members also understood that fire was beneficial for wildlife, and neutral regarding smoke, disproving a barrier that we believed was there. McCaffrey 20064 also disproved the barrier of smoke limiting people’s attitude towards fire as they felt the smoke was going to be there regardless from wildfire or prescribed fires alike. Having the idea that fire is risky towards property, people, and forage has been talked about before, where landowners believed there was negative effects of fire when on a neighboring property. Inciting a barrier, as landowners have a feeling of moral obligation to their neighbors15. Participants in Harr et al16. study outlined that fire did not directly benefit ranching operations as it benefitted wildlife and oftentimes destroyed food for their cattle.

Although having social acceptance from the community is important, we wanted to know how the respondents' attitude affected the use of prescribed fire as a management tool. We found that there is strong evidence that respondents are not prepared to nor willing to burn on their own land. Clark et al. 2022a17 compiled many studies together in the Great Plains to determine attitudes of fire and found that respondents of these studies don't see fire as a beneficial tool, similar to our findings of respondent's slight disagreement that fire was beneficial, in the Northern Great Plains.

Having this thought of unpreparedness or willingness to introduce prescribed fire back onto the landscape, has led us to believe that these respondents are in what Bendel et al18. Refers to as the precontemplation/ contemplation stage of the Transtheoretical model of behavior. These two levels are noted as having no intention of changing or being unaware of a problem that exists and being aware of a problem but no commitment to an action has taken place, respectively. Our results were split between whether fire was beneficial on the landscape or not, split between both levels of realizing a problem. Although it did lean more towards the disagreement side, allowing us to put more emphasis on the precontemplation level. An increase in information from sources that the respondents trust can help move people through the 5 levels of the Transtheoretical model of behavior including preparation, where there is intent or action on addressing a problem. Action where measures have taken place to address the problem, and following with maintenance, where change has occurred and been sustained for a period. Through adequate information, action and maintenance levels are feasible.

1. Shindler, B. & Toman, E. Fuel Reduction Strategies in Forest Communities: A Longitudinal Analysis of Public Support. *J. For.* **101**, 8–15 (2003).

2. Roche, L. M. *et al.* Sustaining Working Rangelands: Insights from Rancher Decision Making. *Rangel. Ecol. Manag.* **68**, 383–389 (2015).

3. Weir, J. R. *et al.* Liability and Prescribed Fire: Perception and Reality. *Rangel. Ecol. Manag.* **72**, 533–538 (2019).

4. McCaffrey. Understanding public perspectives of wildfire risk.

5. Emborg, J., Daniels, S. E. & Walker, G. B. A Framework for Exploring Trust and Distrust in Natural Resource Management. *Front. Commun.* **5**, (2020).

6. Examining Social Trust in Fuels Management Strategies | Journal of Forestry | Oxford Academic. https://academic.oup.com/jof/article/102/6/8/4613171.

7. Winter, G., Vogt, C. A. & McCaffrey, S. Examining Social Trust in Fuels Management Strategies. *J. For.* **102**, 8–15 (2004).

8. Augustine, D., Davidson, A., Dickinson, K. & Van Pelt, B. Thinking Like a Grassland: Challenges and Opportunities for Biodiversity Conservation in the Great Plains of North America. *Rangel. Ecol. Manag.* S1550742419300697 (2019) doi:10.1016/j.rama.2019.09.001.

9. Salient Value Similarity, Social Trust and Attitudes toward Wildland Fire Management Strategies on JSTOR. https://www.jstor.org/stable/24707708.

10. Holechek, J. L., Geli, H. M. E., Cibils, A. F. & Sawalhah, M. N. Climate Change, Rangelands, and Sustainability of Ranching in the Western United States. *Sustainability* **12**, 4942 (2020).

11. Fuhlendorf, S. D. & Engle, D. M. Application of the fire–grazing interaction to restore a shifting mosaic on tallgrass prairie. *J. Appl. Ecol.* **41**, 604–614 (2004).

12. Polito, V. J. *et al.* Tick Abundance and Levels of Infestation on Cattle in Response to Patch Burning. *Rangel. Ecol. Manag.* **66**, 545–552 (2013).

13. Scasta, J. D. Fire and Parasites: An Under-Recognized Form of Anthropogenic Land Use Change and Mechanism of Disease Exposure. *EcoHealth* **12**, 398–403 (2015).

14. Wanchuk, M. R. *et al.* Contrasts in forage mineral concentration with patch-burn grazing: a preliminary analysis. *Transl. Anim. Sci.* **5**, S75–S79 (2021).

15. Coon, J. J., van Riper, C. J., Morton, L. W. & Miller, J. R. What drives private landowner decisions? Exploring non-native grass management in the eastern Great Plains. *J. Environ. Manage.* **276**, 111355 (2020).

16. Harr, R. *et al.* Landowners’ perceptions of risk in grassland management: woody plant encroachment and prescribed fire. *Ecol. Soc.* **19**, (2014).

17. Clark, A. S. *et al.* Barriers to prescribed fire in the US Great Plains, part I: Systematic review of socio-ecological research. *Land* **11**, 1521 (2022).

18. Bendel, C., Toledo, D., Hovick, T. & McGranahan, D. Using Behavioral Change Models to Understand Private Landowner Perceptions of Prescribed Fire in North Dakota. *Rangel. Ecol. Manag.* **73**, 194–200 (2020).