COMPARING PRAIRIE MANAGEMENT METHODS’ EFFECTS ON THREE NATIVE TEXAN GRASSES

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by

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ABSTRACT

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TEXAN GRASSES

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The Texas Blackland Prairie habitat is under extreme threat. Currently, only 1% of the original prairie remains. Restoration efforts across the state have aimed to address these concerns. This research set out to test the efficacy of the methods used to restore prairies regarding three grasses. Big Bluestem, *Andropogon gerardii*, Little Bluestem, *Schizachyrium scoparium*, and Indiangrass, *Sorghastrum nutans*, were surveyed to establish their species abundance on two fields in North Texas. Based on their abundance and the history of each field, conclusions were drawn on the efficacy of the maintenance. Seeding was found to be inconsequential for *A. gerardii* and *S. nutans*, while *S. scoparium* appeared inconclusive. Fires, mowing, and brush removal likely benefited *S. scoparium* while having minimal effects on *A. gerardii* and *S. nutans*. Overall, this research has shown the importance of old growth roots and continued monitoring of maintenance efficacy.

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CHAPTER 1

INTRODUCTION

1.1 Threats to Texas Prairies

Texas has lost 4.8 million acres of native prairie since 1997. Native rangeland continues to have the highest rate of land use in the state, putting the prairie at even further risk. Former prairie land is now being used for a variety of agricultural practices and urban development (Texas Parks and Wildlife 2009). Farming disturbs natural wildlife, often furthering the issue with chemical aids. Excess insecticides and fertilizers build up in the environment and can acidify the soil (Wallace 1994). Even without overuse of chemicals, farming directly removes native vegetation in favor of turning the field into a long-term crop monoculture. Similarly, urban development has turned vast swaths of open prairie into crowded concrete paths, virtually untouchable to most native plant and animal communities. Much of what is left is swiftly turning into non-native range. Eleven million acres have now been converted to non-native pastures that have the third highest land use in the state (Texas Parks and Wildlife 2009). The remaining prairie faces other threats as well. Texas is about 93% privately owned (Texas Parks and Wildlife 2009). This puts prairies under the direct control of private landowners who may or may not participate in conservation. As a result, scientists have focused their effort on restoration of publicly acquired land.

1.1.1 Invasive Species

Invasive species pose major threats to Texan prairies. To bolster the agriculture, many foreign grasses were introduced to Texas fields. These new grasses aimed to provide better nutrition to the herds that grazed on them (Wied et al. 2020). However, replacing the native vegetation had unintended consequences. Non-native grasses do not grow in the same bunches that native ones do. Instead of growing in independent bunches that leave channels between for wildlife, non-native grasses bundle close together limiting refuge and habitat. Studies suggest that prairies dominant in nonnative grasses host different species of small mammals than the original native prairies (Benedict et al. 1996). These populations of mammals have now been forced to find alternative habitats. This ecological concern becomes much larger when comparing the growth rates of invasive grasses vs native ones. The quick growth and expansion rates of foreign grasses were often a deciding factor in which species would be seeded on ranches. The comparatively slow growth of native grasses ensures invasive grasses have a competitive advantage, even as restorations aim to control them (Wied et al. 2020). Invasive species have other advantages as well. Every restoration effort must be carefully planned and executed, leaving native species just as vulnerable to practices that aim to control exotic grasses. However, because of their growth rate, invasive species often recover faster than native ones and many restoration practices are specifically aimed at the mitigation of invasive species (Havill et al. 2015).

1.2 Maintenance Efforts

There are many maintenance practices commonly used in prairie restorations. These can range from removal and manipulation of natural materials to chemical treatments. Efforts to increase plant diversity often involve grazing, mowing, and controlled fires (Rowe 2010). Mowing and grazing keep individual specimens low to the ground, which decreases light competition for smaller or younger plants. Controlled fires are used when biomass accumulates and can be used as a natural fuel. This clears the field, saving roots underground for regrowth and offering more space for other species to establish. However, both weather and climate can play a major role in the availability of controlled burning. During droughts, extra care must be taken to avoid setting off wildfires. Because of this, burn bans are often put into place that put restrictions on controlled burns. Seeding is also common in restorations. This practice is used to establish, or reestablish, native species to the prairie. Differing methods of planting appear to have similar effects, but diversity in the seed mixture chosen can have more profound impacts on what species are able to establish (Rowe 2010). In addition, weather anomalies can have a large impact on the effectiveness of the practice. Droughts immediately following seeding can decrease its effectiveness (Springer and Carr 2022). As such, it is crucial to gather weather expectations for the coming summer when planting in the spring. Finally, herbicides are sometimes used as a chemical option. This can also help establish native grasses but may have little effect in controlling invasive grass species (Mittelhauser 2011).

1.3 Summary of Species Studied

There are five major native Texas grasses, the present research focused on three. *Andropogon gerardii* (Fig. 1.1), better known as Big Bluestem, was once the most prominent tall grass species in United States prairies. It is still the most common member of *Andropogon*, but its range has been drastically reduced. It could once be found across the whole of the great plains, but now survives in remnant prairies, along railroad tracks, and in intentionally restored fields. *A. gerardii* typically grows in bunches about 1-2 meters tall. Although the plant's rhizomes tend to be short, its root system can be up to 2.5 meters long (Moser and Vogel 1995). Big Bluestem can grow in many different soils but does not do particularly well in sandy areas. There is a subspecies of *A. gerardii* specifically adapted to sandy soils that is common in Nebraska (Chen and Boe 1988). Little Bluestem, *Schizachyrium scoparium* (Fig. 1.2), has been commonly used for both agricultural grazing and restoration. In conservation projects, Little Bluestem can be instrumental in providing soil stability and a habitat for wildlife. It grows from 0.5 to 1.5 meters tall (Stubbendieck 1994). Finally, *Sorghastrum nutans* (Fig. 1.3), Indiangrass, is a member of the Sorghum genus. This species can grow 1-2 meters tall with roots around 1.6 meters long. Indiangrass can also be commonly used for agriculture and restoration in warm areas, where it grows best. *S. nutans* can grow in many types of soil but prefers a pH range of 5.6-7.1 (Chen and Boe 1988). Both *S. nutans* and *S. scoparium* have short rhizomes and grow in bunches, much like Big Bluestem. All three species are native, warm season perennials that are well adapted for life in unpredictable Texas weather patterns. These species do a majority of their growth in spring and summer, with Indiangrass commonly beginning growth a few weeks later than either of the Bluestem species. All three species commonly go dormant in the winter, dying off to the roots and rhizomes during the coldest months (Stubbendieck 1994).

This research aimed to determine the efficacy of restoration methods commonly used to aid the establishment of Big Bluestem, Little Bluestem, and Indiangrass. These species were chosen for their importance to the natural prairie community and use in aiding conservation efforts.

Figure 1.1: Big Bluestem, *Andropogon gerardii,* single stem

Figure 1.2: Little Bluestem, *Schizachyrium scoparium,* single stem (left) and bunch (right)

Figure 1.3: Indiangrass, *Sorghastrum nutans,* single stem (left) and bunch (right)

CHAPTER 2

LITERATURE REVIEW

2.1 Importance of Historical Data

Studies have found that using original species richness data from when the plot was planted can be instrumental in determining its success (Larson et al. 2018). Having this historical data allows researchers to track how the plot is changing over time by comparing it to current data. Although weather history could also be tracked, results from these data are harder to quantify and therefore inconclusive. (Larson et al. 2018).

2.2 Review of Management Practices

Manual management practices are essential to any restoration. Herbicide, mowing, grazing, seeding, and prescribed fires are the most common maintenance methods in the prairie. In most cases, herbicide is a controversial management practice. In general, modern scientists try to avoid introducing excess chemicals if they can be avoided. As such, herbicide is used as a last resort when other methods have not resulted in improvement. When it is used, herbicide shows varying rates of efficacy. In some studies, the practice has shown to be moderately successful in aiding native grass establishment but offered little control of exotic species (Mittelhauser et al. 2011). Other researchers appeared optimistic about herbicide use and noted that the practice warranted additional study (Simmons et al. 2007). In contrast, seeding appears to be under much less debate. Introduction of native seeds appears to positively influence the rate of establishment for many of the species seeded (Trowbridge et al. 2016). Seeding is so successful, in fact, one study found that seeded plots were composed of approximately 70% seeded species compared to only 10% on unseeded plots (Dowhower et al. 2020). Another practice, brush removal, is incredibly labor intensive. Most often done by hand, but with occasional machine use, brush removal can be difficult and expensive to undertake. The efficacy of brush management is debated. One study suggests it offers only short-term benefits (Scholtz et al. 2021). Others assert the importance of brush removal for making soil nutrients more available to grass species (Reisinger et al. 2013) Fire has also proved effective. When asked to rate its effectiveness, the majority of restorationists rated it highly effective. All researchers who responded rated the practice at least somewhat effective (Rowe 2010). However, studies also found that burning practices were only effective for the year of the burn and the year immediately after. In other words, fires were shown to be a short-term solution with little to no lasting effects. Burning practices also decreased biodiversity unless combined with grazing. (Dowhower 2021). The final practices, grazing and mowing, are used for much the same reason: decrease sunlight competition to aid native species establishment. Restorationists who use mowing commonly agree that mowing is an effective strategy (Rowe 2010). Another study found that, although grazing initially reduced grasses by a small portion, species were able to grow back and increase biomass in the next growing season (Dowhower 2021). All of these practices have been used in some combination on both prairies at the present study site, The Fort Worth Nature Center.

2.3 Remnants versus Restorations

When comparing native prairie remnants with restorations, remnants had more biodiversity, even when controlled for spatial scale and patterns (Polley et al. 2005). This indicates that future prairie seeding should include limitations on dominant species, an increase in the number of species seeded, and the close seeding of functional groups (Polley et al. 2005). Functional groups are a variety of species that occupy the same ecological niche or perform the same environmental function.

2.4 Restoration Vulnerabilities

Prairies are vulnerable to succession (Collins 1990). This is the process of larger and larger woody species encroaching on the prairie until it eventually turns into a forest. In an effort to understand methods that might slow succession, one prairie restoration has been studied extensively on the Lone Oak Ranch. The plots on this land are permanent and aim to provide a way to monitor vegetation changes over time. Initially, researchers established a baseline of vegetation on the plot, and data was gathered over the next 11 years to show how it changed (Kieth and Hyde 2006). Visually, the plots showed little difference over the course of the study. However, through careful data collection, it was established that woody species and native prairie grasses increased significantly. These species overtook or are in the process of overtaking the early succession species originally found on the land. Mowing the prairie showed moderate success in slowing the progression of woody species. Invasive species also seem to have been kept mostly at bay by the practice (Keith 2017).

CHAPTER 3

METHODOLOGY

3.1 Land Use and Maintenance Record

This research was completed at the Fort Worth Nature Center in two separate fields: Alice Ashley (AA) and the Demo Prairie (DP). The recorded history of maintenance on the site was gathered for each prairie. Information collected included historical land use, length of restoration, individual projects undertaken, and maintenance methods used. Additional focus was put on the level of disturbance from prior land use and the maintenance that occurred within the last five years.

3.2 Survey Methods

An online mapping tool, ArcGIS®, was used to set the boundaries of these prairies. The perimeter of each was drawn along the major tree line encompassing the open field, as *A. geradii, S. nutans,* and *S. scoparium* do not commonly grow in well shaded areas. The same mapping tool was then used to plot 10 random survey points within the set perimeters. Two different survey methods were used to collect quantitative data at each random point. The first, Point-Intercept, involved the use of a five-foot pole supported five feet off the ground. At every randomized point, the pole was placed facing North. The pole was drilled with 10 holes, equal distances apart and a thread was pushed through each hole with a large needle on the end to weigh it down. Anything that touched the thread was identified and the three present species were recorded by number of identifications per randomized point. The second method involved the use of quadrats. After the data from point intercept was collected, the five-by-five-foot frame was laid down to the East with the feet of the frame remaining in the same place. If any of the three grass species were present, they were identified and recorded. Data was taken for the number of bunches present and tallest height of each species. An attempt was made to count the number of seeding individuals as well, but data could not be collected due to drought conditions preventing seed development. Qualitative information on soil type and level of shade were collected at each point. Statistical analyses in the form of a t-test were conducted to determine the significance of the data.

CHAPTER 4

RESULTS

All three grasses, *A. geradii, S. scoparium,* and *S. nutans,* were present and identifiable in both of the surveyed fields. However, *A. geradii* and *S. nutans* did not appear in survey samples on AA. Because of this, data for these species could only be collected on the second prairie, DP. In addition, statistical analysis could only be performed on *S. scoparium* because it was the only species present in both AA and DP survey points. An unpaired t-test was performed to determine if the difference between AA and DP *S. scoparium* samples was significant.

Using the point intercept method, the following data was collected (Fig. 4.1). *A. geradii* could be identified an average of 2.1 (SD=3.18, SE=±1.97) times per random survey point on the DP prairie. *S. scoparium* averaged 3.1 (SD=3.48, SE=±2.16) identifications per point on AA and only 1.5 (SD=2.76, SE=±1.71) times on DP. This difference was not calculated to be statistically significant (*P*=0.269) (Table 4.1). Finally, *S. nutans* was identified an average of 1.7 (SD=2.26, SE=±1.40) times per survey point on DP.

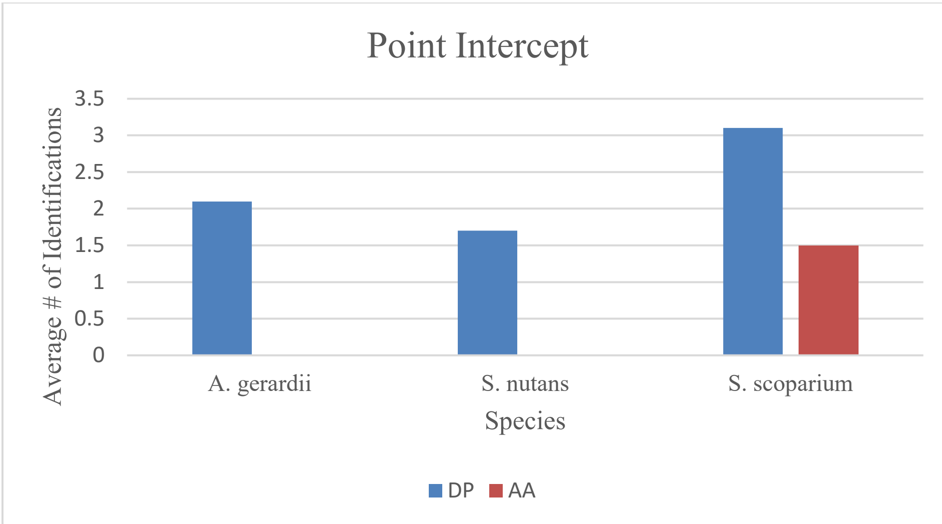

Figure 4.1: Comparison of Point Intercept Data

Table 4.1: Statistical Analysis of Point Intercept Data

Species	Prairie	Standard Deviation (SD)	Standard Error (SE)	P value
A. gerardii	DP	3.18	1.97	--
S. scoparium	AA	3.48	2.16	0.269
	DP	2.76	1.71	
S. nutans	DP	2.26	1.4	--

Data collected using quadrats revealed *A. geradii* grew in an average of 4.8 (SD= 3.88, SE=±2.41) bunches per frame on DP. The average for *S. scoparium* was 4.3 (SD=2.98, SE=±1.85) bunches per frame on AA and 3.6 (SD=3.63, SE=±2.25) on DP. This result was also considered statistically insignificant (*P*=0.643) (Table 4.2). *S. nutans* was found to be growing in individual stems rather than the expected bunches and was counted as individual stems. The average for *S. nutans* was 8.7 (SD=10.68, SE=±6.62) stems per frame on DP.

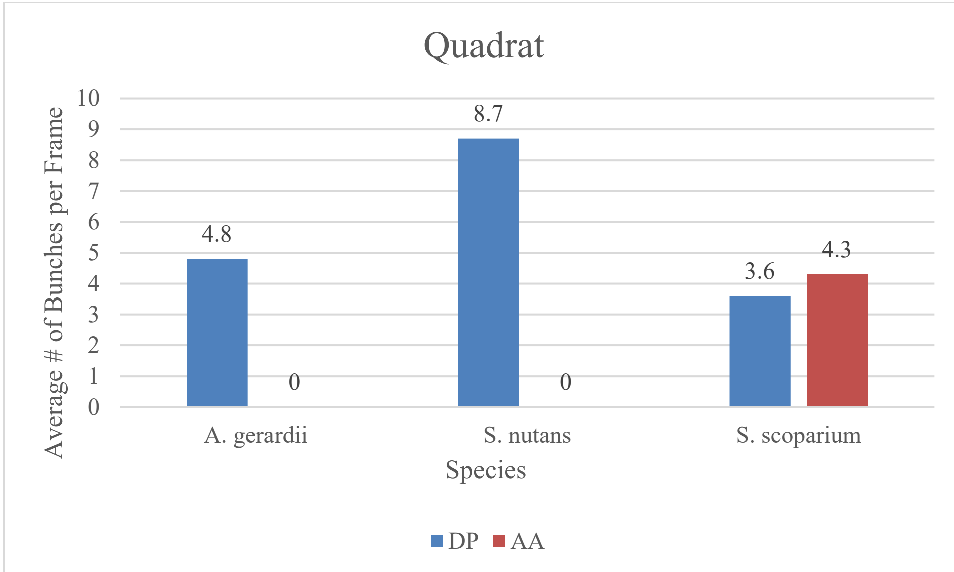

Figure 4.2: Comparison of Quadrat Data

Table 4.2: Statistical Analysis of Quadrat Data

Species	Prairie	Standard Deviation (SD)	Standard Error (SE)	P value
A. gerardii	DP	3.88	2.41	--
S. scoparium	AA	2.98	1.85	0.643
	DP	3.63	2.25	
S. nutans	DP	10.68	6.62	--

CHAPTER 5

DISCUSSION

5.1 History and Maintenance of the Surveyed Prairies

A detailed record has been kept of the histories of both the Demo Prairie (DP) and Alice Ashley (AA). These prairies have the same two types of soil in different areas throughout the fields: Silawa fine sandy loam and Bastsil fine sandy loam. Both fields have trees present, but in different amounts with different species common on each site. On AA there are three species of native Oak, commonly called Blackjack, Post, and Bur Oak. A few Pecan trees can also be found there. The trees on DP are also native but are considered invasive natives due to their rapid growth and expansion rates. There are two species of this kind on DP. One is Mesquite trees, *Prosopis glandulosa*, and the other is Flameleaf Sumac, *Rhus copallina*. Before restoration began, both sites were extremely overgrazed and farmed. Because of this, they were in a state of severe disturbance and long-term plans were created for their restoration.

5.1.1 The Demo Prairie

Restoration for the Demo Prairie began in 1972. This field has received 50 years of intense restoration and serves as a demonstration of native prairie species for visitors to the Fort Worth Nature Center. When restoration began, the first method used was seeding. The site was seeded for several native species including *S. nutans,* but not *S. scoparium* or *A. gerardii.* Indiangrass, *S. nutans*, has made a comeback since the initial seeding and now has established communities throughout the plot. Despite not being included in the seed mix, both species of Bluestem, *S. scoparium* and *A. gerardii,* have also reappeared. Workers at the Nature Center suspect this is due to two possible causes. One cause may be rhizomes that were not removed in the farming process survived in the soil. As long as the meristem is not damaged, the plant can survive without aboveground mass (Oregon State University 2022). Once farming ceased, the Nature Center acquired this land and began attempting to restore the space to its original prairie. Given enough time, these rhizomes grew and eventually sprouted, returning both species of Bluestem to the field. Another possible cause is that seeds were carried in on the wind and re-established populations on their own. Most likely, it was some combination of the two, helped along by the favorable conditions they created.

Other efforts have included prescribed fires, brush removal, and mowing. Collectively, these terms are referred to as brush control. Prescribed fires aim to imitate natural wildfires and remove excess debris from dead plant matter. Native Texas plant communities tend to be more capable of withstanding fires than invasive communities, because they evolved with fires in the environment (Simmons et al. 2007). As a result, this practice not only protects human communities by mitigating the chance of true wildfires, but it also gives native species an advantage over invasive exotics. DP has had five prescribed burns since the start of the project. The most recent one occurred three years ago in March 2019.

Brush removal is the physical removal of invasive species, mostly trees. This practice is labor intensive, because the brush is mostly removed by hand, with only occasional machine use. Consequently, the Nature Center is limited in their ability to perform this maintenance. In DP, brush removal is carried out periodically, but not enough to completely remove the invasive species. Efforts are typically centered around *P. glandulosa* and *R. copallina.*

The last frequently used method is mowing. The Demo Prairie is bush hogged, mowed for small tree and bush species, once every three years. This offers more space for native species to grow without competing with woody ones. Brush removal has not been thorough enough to allow mowing as the only woody maintenance on the field, but well cleared areas can be managed with bush hogging. The grasses here are also regularly mowed, with hay bales taken to feed bison that are on-site. This also allows space for new growth and limits how often prescribed fires are necessary.

Finally, herbicide has been used in the past, but is done very rarely. Herbicide can be very effective in killing off invasive species; however, it is indiscriminate and will often take native species with it. As such, this is a last resort for the nature center when other maintenance practices have failed.

5.1.2 Alice Ashley

The restoration of Alice Ashley began later than the Demo Prairie in 1987. Despite 35 years of efforts, AA remains in a state of severe disturbance. The project on this field has been less intensive than DP and has a deficit in length of restoration. Some large trees of the species listed prior remain spotted across the field. Additionally, invasive species make up the majority of vegetation on the site. The North side of the field is mainly comprised of four invasive species with common names Greenbrier, Prickly Pear, Western Ragweed, and Camphor weed. The main concern in the southern portion is a species called Chinese Privet that has overtaken the area. Significant stands of Bermuda grass, another exotic invasive, can be seen surrounding the open-air shelter on site. There is a significant amount of thatch build up on the field as well, which may be hiding additional species underneath.

When AA was first incorporated into the Nature Center, it was to be used as an ecological study site. Two main restoration attempts have occurred, each covering only an acre. The first occurred in 1987 when an acre in the Southeast section of the plot was planted for *S. scoparium* and *S. nutans.* The second took place in the North of the field in 1996. Here, another acre was mowed and subsequently planted with a mix of grasses that included *A. gerardii, S. nutans,* and *S. scoparium*, among other species. Mowing may have had the added effect of increasing the amount of thatch build up, as hay was not removed from AA. Although there have been fewer attempts at full restoration here than on DP, the general maintenance practices remain the same. In an effort to control the thatch build up and rampant invasive species, AA has undergone five successful prescribed burns, just like DP. The most recent one occurred just last year in January 2021. Mowing occurs here as well, though less often. The area has been bush hogged four times, last in 2009. Brush removal has been attempted sporadically, almost exclusively by hand. Just like DP, herbicide has been used only sparingly.

5.2 Implications of the Survey

5.2.1 Seeding

Seeding the prairies has not appeared to aid the establishment of either Bluestem grass and is inconclusive on Indiangrass. Neither Bluestem grass, *S. scoparium* nor *A. gerardii,* have ever been seeded on DP. *S. scoparium* appeared in the survey. It is important to note, only one acre on this plot was seeded for *A. gerardii* and the species could be identified on the field. However, its lack of presence in survey points at AA while it had healthy growth throughout DP suggests its success had more to do with leftover roots or windblown seeds than seeding. Similarly, the presence of *S. scoparium* on both plots, despite not being seeded on DP, suggests seeding was not a large contributing factor to the reestablishment of the species. Both prairies have been seeded for *S. nutans*, though AA was on a much smaller scale. Because of this, its lack of presence in AA survey points seems to have one of two causes. Seeding may not have helped *S. nutans* establishment on DP, with credit going more to roots or wind much like the Bluestems. Alternatively, survey points on AA may simply not have been generated in the area where seeding originally occurred. Thus, the effectiveness of seeding for *S. nutans* is inconclusive. Further studies on additional fields would need to be conducted before a true judgment could be made.

5.2.2 Brush Control

Fires, brush removal, and mowing have occurred on both plots, indicating these practices may have benefited Little Bluestem with little effect on the others. *S. scoparium* was found on both plots with no significant difference between them. Because successful fires were on both AA and DP in the last few years, prescribed burns may have aided the establishment of strong *S. scoparium* communities. The lack of *A. gerardii* and *S. nutans* in survey points on AA suggest that the fires were not helpful to these species. Brush removal and mowing likely had a similar effect. These practices remove competition for these species but seem to have only aided *S. scoparium.* The limited scale of mowing on AA likely skewed these results. Further research on plots that have all been fully mowed is needed.

5.3 Effects of Current Climate Conditions

Attempts were made to collect data on seed production, but climate conditions made this impossible. The growth and production of new seeds is essential for the continued health of grass communities. Without manual seeding by restorationists, the established community must be able to reproduce on its own. The timing of the field study was intended to coincide with the time of year all three grasses would be fully grown and seeding for the season. Unfortunately, this summer experienced an intense drought. During times of environmental stress, these plants become relatively dormant, and energy is reserved for the survival of the individual. This means excess energy and resources could not be spared to create seeds and data on reproduction could not be collected. This could have different consequences depending on the length of the drought. At the time of this study, the region incorporating the Nature Center was listed under severe drought by the National Integrated Drought Information System (Drought 2022). This stage of water scarcity is characterized by poor pasture conditions, hard soil preventing proper vegetation growth, and a high wildfire risk (Drought 2022). If the drought does not return next summer, this will not be a significant issue. The present species are adapted to periods of drought and will likely have little to no long-term consequences. However, if the drought does return, this could be a much greater concern. Perennial species, like the present grasses, tend to decline in periods of drought and are replaced by short lived forbs (Morecroft et al. 2004). If drought conditions continue for an extended period, *S. nutans, A. gerardii,* and *S. scoparium* could all be under serious threat.

5.4 Limitations

This study had its limitations. Some, like drought conditions, have already been discussed. The other limitations primarily come from differences in the two plots. The DP has a much longer and more intensive restoration history than AA. Most maintenance methods on DP took place over the whole of the field. Seeding of *S. nutans* on DP was spread throughout the entire plot. While AA has been seeded for all three species, it was only done in small portions. The complete lack of seeding for *S. scoparium* and *A. gerardii* on DP means the results for these two species are more conclusive. Meanwhile, results for *S. nutans* may have been skewed by the range of planting. The other restoration methods (mowing, brush removal, prescribed burns, and herbicide) are relatively equal on both sites and can be regarded as more conclusive. However, this study took place over a single summer in only two prairies. More survey sites are needed to make true judgements on the effectiveness of restoration, especially with the absence of *A. gerardii* and *S. nutans* in the AA survey points. Results over more than one growing season are also necessary, preferably with at least one season undergoing typical climate conditions.

CHAPTER 6

CONCLUSION

6.1 Old Growth

This research has shown the importance of old growth in prairies. Evidence from the survey suggests that blown in seeds and leftover roots from before the land was disturbed is a large factor in the current success of grass species. Despite never being seeded, *A. gerardii* and *S. scoparium* have made a comeback on DP. Similarly, the plantings of both Bluestem grass on AA were extremely limited, yet *S. scoparium* has a strong presence on the field. Even in an extreme state of disturbance, seeds were able to establish and roots from these species survived underground well enough to reappear when conditions were favorable. Furthermore, prior studies have shown that remnant prairies invariably have more biodiversity than restored ones. Fields that have been largely untouched by human activity support plant communities far better than any of the fields that scientists have attempted to restore (Polley et al. 2005). This speaks to the importance of not only learning from nature but leaving it as it is. It is vital that restoration methods consider how nature operates on its own, without human disturbance. One of the largest successes of the fields surveyed here, the reappearance of *A. gerardii* and *S. scoparium*, was a credit to the environment and largely out of scientist hands. Additionally, it is important that current remnant fields are protected. Restoration is valuable, but it takes large amounts of time, money, and effort. When it is done well, restorations bring back native grasses much better than simply allowing a field to revegetate on its own (Feher et al. 2020). Even so, restored fields never compare to original remnant prairies. Efforts should continue to be made to identify and protect these remnants.

6.2 Climate Concerns

The prairie is also under another human-made threat: climate change. The effect of current droughts has already been discussed, but there are other concerning weather patterns. Extreme winter storms in February 2020 and 2021 were severe natural disasters that affected, and ended, the lives of many Texans. This threat is not isolated to humankind. Although native Texas grasses have evolved to survive droughts, the same cannot be said for extreme winters. Studies on exactly how the past two years have affected the prairie still need to be done, but some prior research shows reason for concern. Studies have been done to show how different regional ecotypes adapt to alternate weather conditions. When Southern ecotypes are moved North, they often do not survive the winter (Moser and Vogel 1995). These ecotypes are adapted for a growing season that extends into a warm fall, making them grow for a much longer period than Northern ecotypes. If the Southern adapted grasses are moved too far North, the community experiences heavy casualties due to the cold (Moser and Vogel 1995). Similar to drought conditions, one or two seasons of adverse weather can be survived. Communities of native grasses will suffer, but they can make a comeback once normal climate conditions return. If extreme winter conditions continue to occur, this will prove a much larger threat than even the extended drought. These are only the threats we can already see. As global temperatures continue to rise, other climate conditions like flooding, extreme heat, and increased storm severity may begin affecting native grasses. Prairie conditions will need to be continually monitored in the coming years.

6.3 Future Research

Future research will be necessary to understand the true effects of maintenance methods and how they can be used in a changing climate. For this study specifically, a longer research period, preferably with at least one climate typical growing period, would provide more conclusive results. Extending the surveys into additional restoration fields would offer a similar benefit. When designing other studies, it may be useful to dedicate specific plots where only one or two maintenance methods are carried out to measure their individual efficacy more precisely. Additionally, studies will need to be done with climate change in the forefront. Establishing how prairies have already changed and begun adapting to climate conditions will provide invaluable foresight into how we might protect the prairie moving forward.

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BIOGRAPHICAL INFORMATION

Stephanie Howell will graduate with an Honors Bachelor of Arts degree in Biology and a minor in Environmental and Sustainability studies in the summer of 2023. This will be her second degree, after receiving an Associates of Arts degree three years prior. She has spent her time as an undergraduate getting heavily involved on campus with special emphasis on the Honors College. Stephanie participated in the Undergraduate Research Opportunity Program during the process of completing her Honors Capstone. She plans to take a year off after graduating to settle into her career and then begin her Masters in Higher Education. She plans to work in the realm of student affairs.