Public Perceptions of Prescribed Burning and the Impact of Education Over Time

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Abstract

Communities should be in touch with the natural ecosystems that surround them, but often this is not the case which can cause many misunderstandings and frustrations. This is especially relevant for the Konza Prairie because of the unique land management that uses prescribed fires to maintain its native vegetation. Prairie burns have been a practice for hundreds of years but have become more complicated due to cities now being so close to where these fires are taking place. This has recently led to frustration and confusion around the country. In this study, we aimed to create a customized education format that can change the perspectives of these communities (environmental impact). We aimed to create a survey for students at Kansas State University to gauge their understanding of the impacts of prescribed burns and how they respond to education materials. From the information gathered in this survey, we learned that changing perspective and people retaining information are two different things. At times they can go hand in hand, however, in this case the educational video was successful in swaying perspective although the quiz sections did not produce the ideal outcomes.

1. Introduction

Prescribed burning is an important aspect of the tallgrass prairie ecosystem. Living in communities surrounded by this ecosystem, it is important to be educated on the topic. Public perception is an important factor in the effectiveness of the application of science in our management strategies. To track public perception, we created an educational video and a survey to track changes in public knowledge and perception of the topic of prescribed burning. All this in the hope that by learning more about the topic, the participants would develop a stronger opinion on the subject.

2. Background

Before starting on the official survey, first we divided up potential topics that could impact the environment and people who live near the Konza prairie and experience the fires. Following this initial step, taking the in-depth information from research journals and translating it into information that the public could consume was the next task. Then, we also investigated existing surveys that have been put out to see how we could fill in the gap of missing research. What we found was that most of the surveys were sent out to permanent landowners who were very familiar already with the ecosystem and why they might want to use fire as a management method. By targeting students, we were able to find a group to educate that is mostly new to the area which allows us to mold their perspective and offer new information to them. For the survey portion we wanted to find a way to record measurable objectives that were able to show if the education had an impact on perspective and if the information was retained

3. Literature Review

To understand the perceptions of students, it is important to have foundational background knowledge of the current research. This section will define key concepts of prescribed burning and its perceptions, which will aid in displaying the relevance of our research.

As stated before, the majority of the research done to this point on the perceptions of prescribed burning has been done on cohorts of people who are typically around prescribed fire or are more likely to be around it geographically. To understand the relevance of our project, it is important to understand the current research.

Prescribed fire is the intentional ignition of fire under control conditions for management practices (Hiers et al., 2020). Synonymous with controlled burns, these fires are used to manage native ecosystems, eradicate invasive species, and remove dead fuels from the landscape to limit wildfire risk. As a result of widespread fire suppression, government, and private landowners use prescribed fire to safely gain the benefits of fire in fire-dependent environments and decrease the number of invasive species and dead fuel build up (Rogers et al., 2025).

Starting fires will always come with its dangers and negative effects, on the tallgrass prairie though it is one of the only options for preservation (Morton et al., 2010). These burns can clear any dead plant litter that may be blocking new growth and more importantly keep woody shrubs at bay (Audubon, 2023). These woody shrubs have slowly been diminishing what is left of the tallgrass prairie ecosystem for the last couple of decades, so combating them is a top priority. Currently, estimates are that “Less than 4% of the world's tallgrass prairie remains,” (*Flint Hills Initiative*, n.d.).

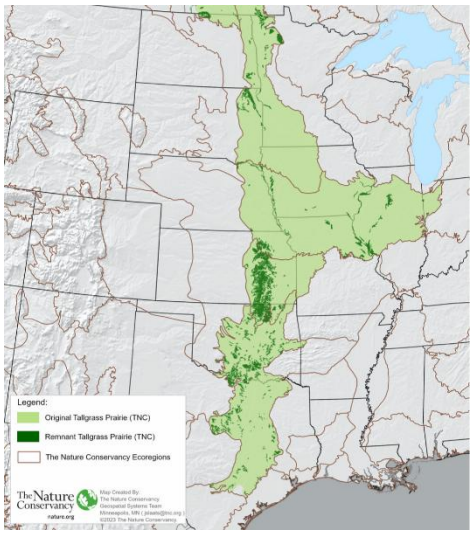


Figure 1: Darker green illustrates the remaining tallgrass prairie ecosystem, and the lighter green shows the original expanse of the tallgrass prairie (*Flint Hills Initiative*, n.d.).

The importance of the burns cannot be understated but without precise management these burns can have severe consequences. Ideally the burns are managed in a way so that minimal impact is made to the soil, air, and native vegetation so that in a few weeks following a burn the prairie is once again a thriving ecosystem. Some of the factors that can be managed are burning time, frequency, and intensity of the fire, if perfected all the cons should be minimized. If not, then damage can be done to the landscape, especially the soil. Research suggests that during low intensity burns that burn for an extended period of time can decrease aggregate stability of soils leading to erosion (Jian et al., 2018). This is due to vapors increasing pressure within the aggregates compromising the structure.

There are negative impacts of prescribed fire that surrounding communities may encounter. Breathing problems are typically the biggest concern for people around smoke. Exposure to smoke can cause irritation to the lungs and eyes, and potentially exacerbate asthmatic individuals (US EPA, 2019). Previous studies have been conducted that gauged the public's approval of prescribed burns in communities that have frequent wildfires. They found that members of the community

with health impacts from smoke and other irritants tended to show less approval for prescribed fire despite knowing the benefits of preventing wildfires (Rogers et al., 2025). They also found that individuals with previous wildfire smoke exposure showed more approval for prescribed fire. Not only does smoke impact community health, but it also causes concern for public safety in regard to road conditions. Reduced visibility from dense smoke can make driving more dangerous. Limited roadway visibility is a definite side effect of prescribed burning and must be considered by those conducting prescribed burns. This is one of the many considerations that the public may be concerned with, as it actively affects their safety on the roadway. Knowing this, it is important for members of the public to be informed and aware of when and where prescribed fires will occur so that they can avoid those areas that could potentially be affected by smoke obscuration.

Woody Encroachment/Invasive Species

Woody encroachment of invasive species into grasslands is putting ecosystem health at risk. Woody encroachment can be defined as the gradual fragmentation, or gradual conversion of grasslands into woody plant dominated systems (*Woody Plant Encroachment, Nebraska*, n.d.). Woody encroachment has many negative effects on grassland ecosystems. As woody species take over, species diversity and richness decrease (Van Auken, 2009). Herbaceous grass species are replaced by the woody species, as woody species pose significant competition for water and nutrient resources (Ding & Eldridge, 2024). Woody species can out compete with herbaceous species for sunlight as well. Eastern Red Cedar (ERC) (Juniperus virginiana) is a prevalent invasive species encroaching on tallgrass prairies in Kansas. ERC significantly decreases the amount of light reaching the ground surface (Pierce & Reich, 2010). This decrease in light leads to less species below and around the ERC trees, which decreases biodiversity on lands rich in ERC.

Outcompeting herbaceous species can slowly lead to monocultures of woody plants, which is undesirable in ecosystems as they are highly vulnerable to pest/invasive species as well as diseases (Altieri, 2009). Increases in woody species could have profound effects on the productivity of lands used for grazing, as there will be less forage production, and a decrease in forage quality (Ding & Eldridge, 2024). Rural landowners that rely on productive rangelands will be negatively affected by woody encroachment, as well as wildlife and the overall health of the native tallgrass ecosystems. In the absence of fire, woody encroachment will continue to degrade the tallgrass prairie, which is why use of prescribed fire is an integral part of the conservation in tall grass prairie ecosystems.

Landowner (Rural) Perceptions

Several studies have been conducted that involve private landowners and their perceptions on prescribed fire. Specifically in the flint hills, previous studies have found that there is a difference between the perceptions of rural and urban community members. Members of rural communities were less concerned about smoke, and more concerned about fires becoming uncontrolled and burning outside of containment lines (Rosen et al., 2023). These rural participants also shared their views on the benefits of prescribed fire, including: cattle production gains, invasive species mitigation, improved prairie health, and limit wildfire risk (Rosen et al., 2023) These findings suggest that landowners in the Flint Hills have been around prescribed fire for a long time as burning is a tradition in the region, and are therefore more receptive to the effects of prescribed fire.

While there are positive outlooks surrounding prescribed fire in the Flint Hills, landowners in Missouri and Iowa have different perceptions. Private landowners were surveyed on the far

eastern edge of the historic tallgrass prairie, gauging their perceptions of prescribed fire. Only half of the 99 respondents viewed prescribed fire as a viable option for woody species management, and only 25% of those respondents had participated in a prescribed burn (Morton et al., 2010). This indicates that there might be a difference between the perceptions of rural members based on geography, as prescribed fire isn't common practice in Missouri and Iowa. While still living in rural areas, these landowners haven't been around prescribed fire because of where they live, which might indicate that there is a connection between where you are from and your exposure to prescribed fire.

Urban Community Perceptions

Urban community members' perceptions in the Flint Hills differed from rural members. It was found that members of urban communities expressed more concern about smoke (Rosen et al., 2023). Compared to the rural members questioned, this differs as they are more concerned about the biproducts of prescribed fire, being smoke than property loss. While their concerns were different than the rural members, their perceptions on the benefits of fire on the environment were the same as rural members (Rosen et al., 2023). The urban community members have less of a stake in the land, which is why their concerns fall to the smoke pollution. This is similar to studies done on perceptions of wildfires in the western United States. A study in Redding, CA found that around 80% of citizens surveyed expressed concern about negative health effects from wildfire smoke (Macey, 2008). While from different sources of fire, perceptions about the negative impacts of smoke seem to carry between communities where wildfires and prescribed fires are present.

There seems to be a lack of research about how individuals that do not reside in areas or regions where prescribed fire is common perceive these fires. Many of the studies that have been cited take place in the western united states or great plains, where wildfires occur every year and

individuals that live there encounter the products of fire (smoke) frequently. While it is good data to have in those areas, it leaves a gap in information in areas where fire is not as common. This is where our study population is unique, as many students likely have not lived in Manhattan, KS before coming to Kansas State. Therefore, they are new to the experiences of the prescribed fire in the spring and may have different perceptions of prescribed fires comparatively.

Outreach/Education

Does education influence people's perceptions? Education is a very important part of forming lasting impressions. With more knowledge on a subject, people will be able to come to more informed conclusions and decisions about management practices. Inclusion of education on prescribed fire could be a powerful tool in influencing the perceptions of people who have never been around them. While there may be negative connotations about prescribed burning, education on the benefits and the "why" behind them may aid in support of the burns. A study in Tuscon, AZ investigated education and its impacts on perceptions of prescribed fire. This study focused on aesthetic values, and how education on the benefits of fire may influence or change their views on aesthetics following a prescribed fire. They found that following the reading of educational brochures on the benefits of prescribed burning, respondents showed more knowledge of prescribed fire as well as more tolerance (Taylor & Daniel, 1984). This shows that providing a form of education may be vital to positive perceptions of prescribed fire.

One method of outreach that is popular in the great plains region is the formation of burn cooperative groups. Burn cooperative groups can be defined as groups of landowners that form partnerships to share equipment, knowledge, experience, and other resources to conduct prescribed fires (Phinney & Pohlman, n.d.). Ranchers participating in fire cooperation groups had more knowledge of prescribed fires, and a willingness to aid in the conservation of grasslands (Raedeke

et al., 2001). Half of landowners supported the idea of burn cooperative groups but lacked the social infrastructure and experience to carry out prescribed burns (Morton et al., 2010). With the implementation of burn cooperatives, education on prescribed fire among landowners will increase, which could help build social infrastructure through the support of said burn cooperatives. While burn cooperatives are primarily intended for landowners, this same concept of creating a group to share information could be helpful in educating surrounding urban communities.

4. Objectives

We created a clear set of objectives to ensure that our questions stayed on track throughout and that we would get impactful results from the survey.

Main Objective:

How do the public perceptions of the impacts of prescribed burning on grassland ecosystems change over time, what is their previous knowledge, and how does this change after training?

Minor objective1:

Compare participants' knowledge of prescribed burning before and after watching the training material.

Minor objective 2:

Evaluate participants' understanding from key ecological challenges (e.g.,woody encroachment, water issues, erosion, air quality).

5. Methods

5.1. Study Area

For this study, we looked at the perceptions of students at Kansas State University, in Manhattan, KS. Students were the target demographic given most are not permanent residents of Manhattan and likely haven't been subjected to the effects of prescribed fire. Kansas State University manages the Konza Prairie Biological Station (KPBS), which is burned each spring and is a popular recreation area. The Konza prairie receives between 25,000 and 45,000 visitors annually (Kansas State University, n.d.), which makes it an ideal location for information on prescribed fire and base public perceptions.

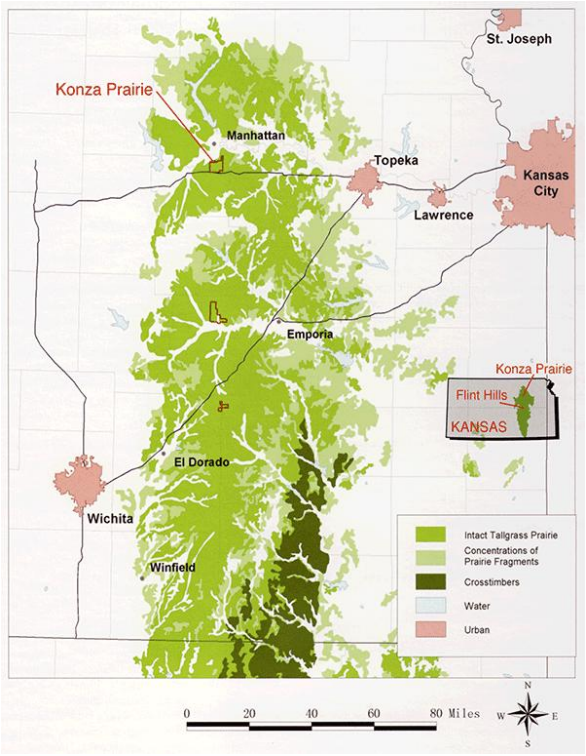


Figure 2: Location of the Konza Prairie Biological Station in Kansas. The red outline indicates KPBS, South of Manhattan, KS (Towne, n.d.).

The Konza Prairie Biological Station (KPBS) is a 3487-hectare (8616.5 acre) native tallgrass prairie located in the Flint Hills region of Kansas, owned and managed by Kansas State University and the Nature Conservancy. KPBS is dedicated to prairie conservation, long-term

ecological research, and education as stated by the Department of Biology at Kansas State. To conserve the natural tallgrass prairie, annual burning takes place on the Konza. Between 3000 and 5000 acres of KPBS are burned annually. KPBS is divided into watersheds, each with different fire prescriptions to test the effects of fire. With the annual burns, proximity to Manhattan, and extensive data on prescribed fire, we chose KPBS as our main study area.

5.2. Survey Design

We began the survey process with some main goals that we wanted to accomplish with each set of questions. These objectives were centered around knowledge, for example knowledge of the issues facing the Konza Prairie, or just knowledge of prescribed burns in general. This way it could be determined if our education was effective or if other alternatives should be explored. Some ways we tested their knowledge were through a short set of quiz questions that would be challenging for someone with little knowledge about prescribed burns to complete, to see if a short video would be enough to properly educate an individual. Beyond education, perception was also a main goal of ours to measure. Instead of quiz-based questions for this we used a series of questions where participants could answer as either agree, somewhat agree, indifferent, somewhat disagree, or disagree. This gave us an insight into how strongly our subjects felt about a topic and see how their outlook may change before vs. after education.

When deciding which questions to put in the survey, it was important to make each concise and in-line with the objectives. Our survey questionnaire composed of 23 questions divided in 5 sections:

I. Section one of the survey, titled *Background Information,* was used *to* understand who was completing the survey. Those questions gave us the demographic information we needed for the study. We only wanted to survey students, we wanted to categorize them into their academic college to gauge which colleges had more knowledge of prescribed burns, and we wanted to know how long they have lived in Manhattan to understand how long they have experienced prescribed burning on the Kona Prairie. The next questions of section one was asked to understand which survey takers had direct experience with burning in the area, and specifically, if they have had any training on prescribed burns.

II. Section two, titled *initial knowledge*, was used to gauge what prior knowledge the participant was bringing to the survey. Depending on what major and what background students have, it can depict how much preexisting knowledge they have regarding the topic of prescribed burns. The next part of this section includes a 5-point agree/disagree Likert scale, asking participants about how strongly they agree or disagree with topics relating to burning as a land management tool.

III. Section three contains a video comprised of information about prescribed burning, which was meant to educate survey-takers about the topic.

IV. Section four, titled post-education knowledge, was used to let survey-takers apply their knowledge from the video and to gauge how much they took from the video. These questions were the same as section two, initial knowledge.

V. Lastly, section five titled post-survey questions, was used to evaluate how survey-takers felt about the content after the survey, and how they opinions they had about distribution of information and content to the public.

All these sections and questions were able to provide us with the information we needed to inform the public about college student perceptions of prescribed burns.

Table 1. Description of the questions analyzed and the possibilities of response.

Section Title	Questions	Type
Background Information	Are you a student at Kansas State University?	Yes/No
	What is your academic college?	Multiple choice
	How long have you been at K-State or lived in Manhattan?	Multiple choice
	Have you been to Konza Prairie?	Yes/No
	Have you ever been around a prescribed burn?	Yes/No
	Have you taken any coursework or general training on prescribed burns?	Yes/No

Initial knowledge	What benefits do prescribed burns have on Tallgrass Prairie Ecosystems?	Multiple Choice
	What are the negative effects prescribed burns can have on Tallgrass Prairie Ecosystems?	Multiple Choice
	In North America, roughly less than 5% of the tallgrass prairie ecosystem remains.	True/False
	90 percent of the remaining native prairie is burned on an annual basis.	True/False
	Fire is a mechanism that the tallgrass prairie has been using to control invasive species long before Humans settled on the Prairie.	True/False
	I am concerned about woody encroachment on the Konza Prairie.	Likert Scale
	I am concerned about soil erosion after a burn on the Konza Prairie.	Likert Scale
	I am concerned about the impacts of woody encroachment on water resources on the Konza Prairie.	Likert Scale
	I believe that although there are negative effects from prairie burns, the positives outweigh the negatives.	Likert Scale
	Prescribed burning is necessary to prevent/ slow woody encroachment on Tallgrass Prairie ecosystems.	Likert Scale
	I believe that although there are negative effects from prairie burns, the positives outweigh the negatives	Likert Scale
	How necessary are prescribed burns for the prairie ecosystem?	Likert Scale
Video	-	-
Post education	What benefits do prescribed burns have on Tallgrass Prairie Ecosystems?	Multiple Choice
	What are the negative effects prescribed burns can have on Tallgrass Prairie Ecosystems?	Multiple Choice
	In North America, roughly less than 5% of the tallgrass prairie ecosystem remains.	True/False

	90 percent of the remaining native prairie is burned on an annual basis.	True/False
	Fire is a mechanism that the tallgrass prairie has been using to control invasive species long before Humans settled on the Prairie.	True/False
	I am concerned about woody encroachment on the Konza Prairie.	Likert Scale
	I am concerned about soil erosion after a burn on the Konza Prairie.	Likert Scale
	I am concerned about the impacts of woody encroachment on water resources on the Konza Prairie.	Likert Scale
	I believe that although there are negative effects from prairie burns, the positives outweigh the negatives.	Likert Scale
	Prescribed burning is necessary to prevent/ slow woody encroachment on Tallgrass Prairie ecosystems.	Likert Scale
	I believe that although there are negative effects from prairie burns, the positives outweigh the negatives	Likert Scale
	How necessary are prescribed burns for the prairie ecosystem?	Likert Scale
Post survey	Would a sign at Konza with information about burns help improve your experience at Konza?	Yes/No
	Would a sign at Konza about erosion/woody encroachment help your understanding of the issues facing the prairie ecosystem?	Yes/No
	If there were to be educational materials on burns provided through university systems (email, etc.), what topics would be most helpful to know about?	Multiple Choice

5.3. Video Creation

Once we had the set of survey questions in place we could then make the educational portion of the survey. The video was under 5:00 long and mentioned information about the benefits of prescribed burns, negative impacts of woody encroachment, and human health effects associated with prescribed burns. We created our video by creating a short PowerPoint presentation as a visual and recording a voice over and posting the video to YouTube for easy access. We added the link to the video in the survey for participants to easily navigate to. For this we hoped to keep it very short but also find a way to make it useful to people with any educational background. Much of the video was based off the questions in the survey so that the results gained from the survey showed how education altered perspectives on specific topics.

5.4. Survey Distribution

Initially the survey was released to a small number of participants so that we could be sure that the format we used would work for a larger number of people. This first group was around 10-20 people then eventually we would accumulate 76 total responses. To get these responses we relied on a few different strategies including Instagram, groupme, email, posters, and word of mouth. Our goal was to reach as many different people as possible so to accomplish this we used a wide range of communication methods and reached out to as many groups as we had access to. As a group we worked on getting our survey in front of people for about 2-3 weeks trying new strategies about once a week whenever we would meet up as a group. Setting out we had a goal of reaching around 100 responses, and even though we fell short of that number there were still plenty of results to analyze.

6. Results

Below are the compiled results from our survey. Overall, we were able to see that perceptions were successfully changed. However, while many of the concepts were correctly portrayed a lot of the concrete facts for the quiz section were not retained.

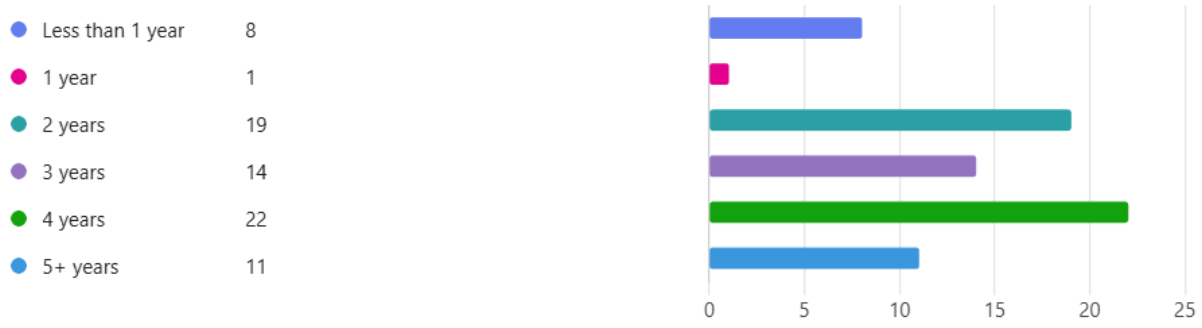


Figure 3: How long each survey participant has lived in Manhattan, KS

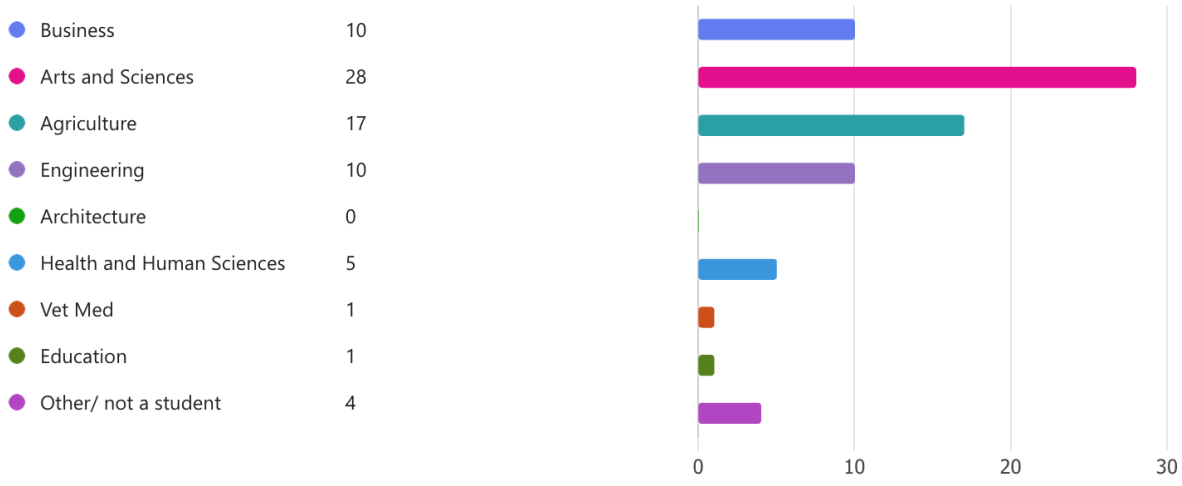


Figure 4: Academic majors of survey participants, grouped by college affiliation.

Figure 3 shows that only 9 (%12) of the participants have been in Manhattan for less than 2 years, suggesting that most respondents have had some exposure to the local environment. Figure 4 shows the academic majors of survey participants, grouped by their college affiliation. The

results showed that the majority of the students are in colleges associated with natural resources, the two most common colleges being agriculture and arts/sciences. This goes to show that there is a good chance that the majority of the participating subjects were already somewhat familiar with the prairie ecosystem that surrounds Manhattan, Kansas.

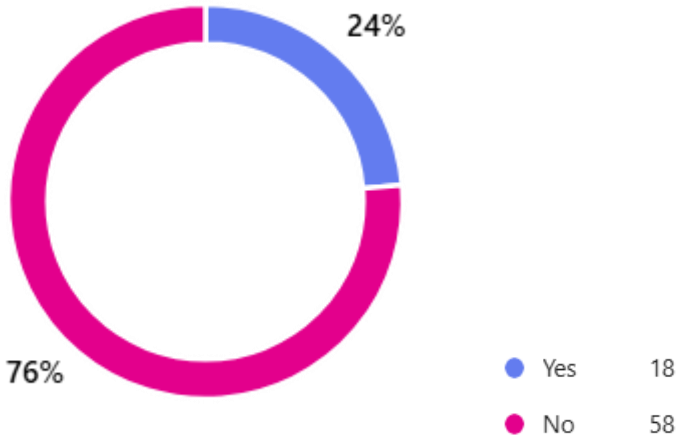


Figure 5: Participants responses to: "Have you taken any coursework, or general training on prescribed burns?"

Figure 5 presents participants' responses to the question, "Have you taken any coursework or general training on prescribed burns?" Notably, 58 out of 76 respondents (approximately 76%) indicated that they had not received any prior training or coursework on the topic, although most of them are affiliated with colleges focused on natural resources and environmental sciences.

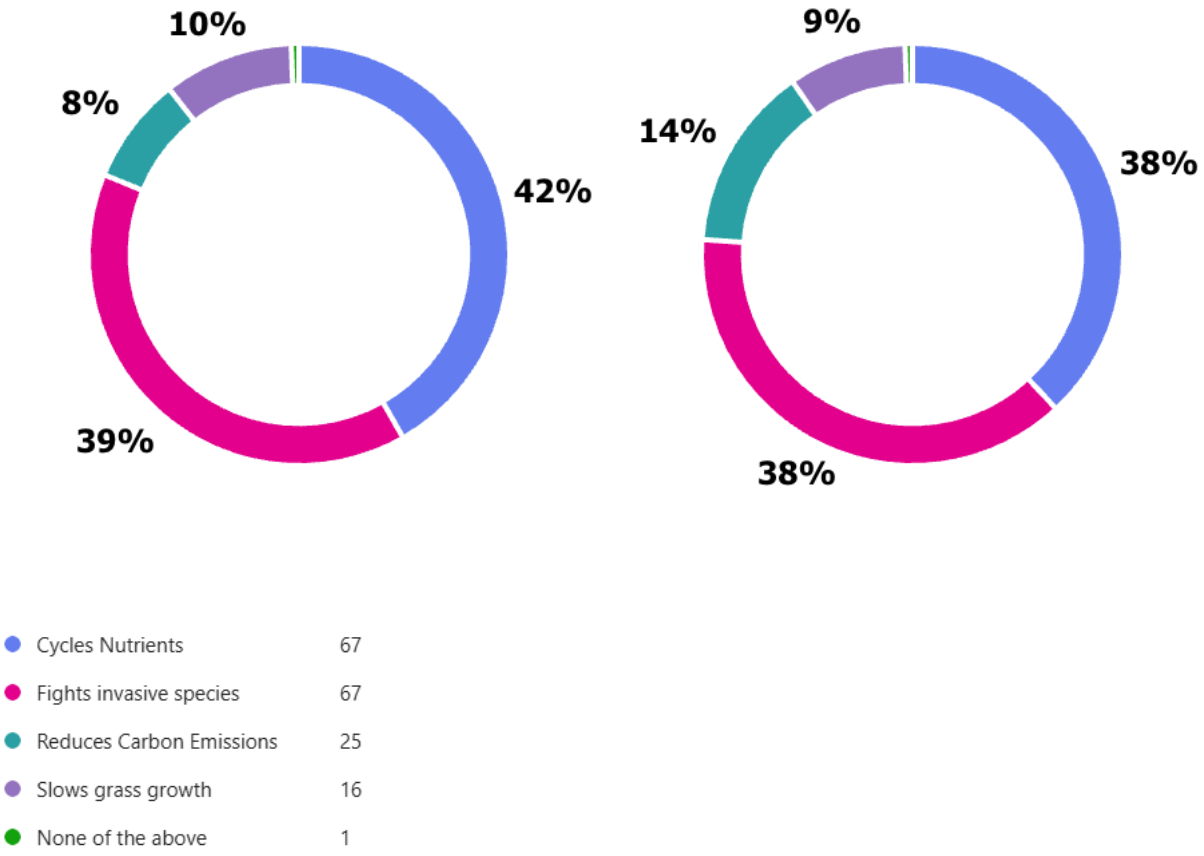
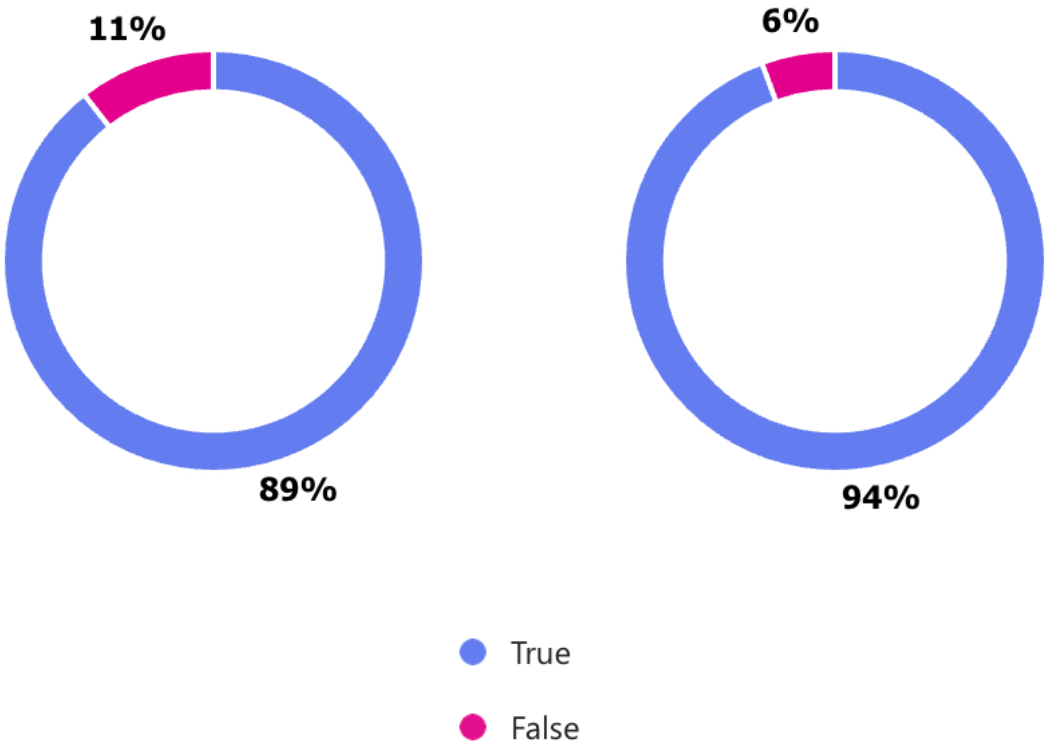


Figure 6: Participant responses to "What benefits do prescribed burns have on Tallgrass Prairie Ecosystems? Select all that you think apply." Pre (left) and post (right) education.

The graphs above show a slight difference in knowledge of the benefits of prescribed burns. The numbers are relatively comparable before and after training, except for a larger difference in knowledge about reducing carbon emissions. Only 8% of participants identified carbon reduction as a potential benefit of prescribed burn before the training, compared to 14% afterward. The specific numbers of people who chose each section are different for each, but the percentage ended up evening overall.



Figures 7: Participants' Responses to the Question "In North America, Roughly Less Than 5% of the Tallgrass Prairie Ecosystem Remains" (True/False), Before (Left) and After the Training (Right)

A Majority of the participants (89%) correctly answered that less than 5% of the tallgrass prairie remains even before the training. After watching the training video, this increased to 94%, showing the video increased their awareness and slightly improved their knowledge.

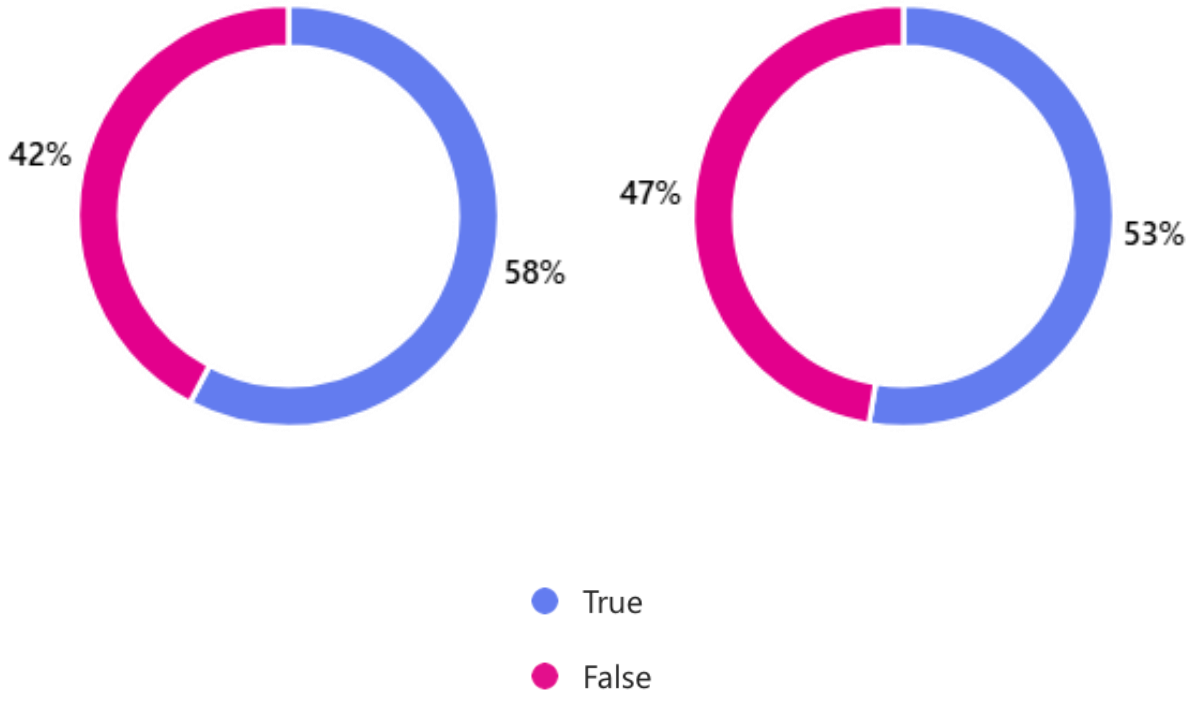


Figure 8: Participants responses to the question "90 percent of the remaining native prairie is burned on an annual basis." (True/False), before (Right), and after (left) training.

This was one of the only questions that the education portion was unsuccessful. As seen above following education more of the participants answered incorrectly, and the roughly 50/50 spread would suggest many were guessing.

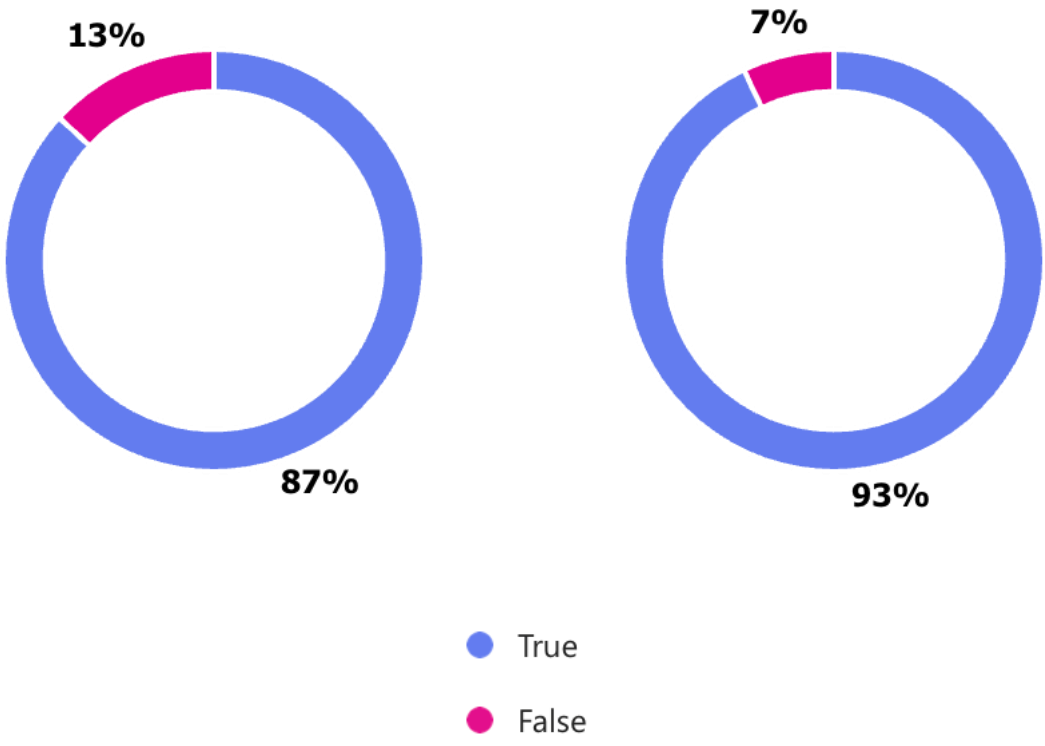


Figure 9: Participants responses to the question "Fire is a mechanism that the tallgrass prairie has been using to control invasive species long before Humans settled on the Prairie." (True/false), before(left), and after (right) training, Correct answer was true(blue).

As can be seen there was a slight increase to an already large number of participants answering this question correctly. This shows that a good number of them likely already knew the answer and the education only helped some of them.

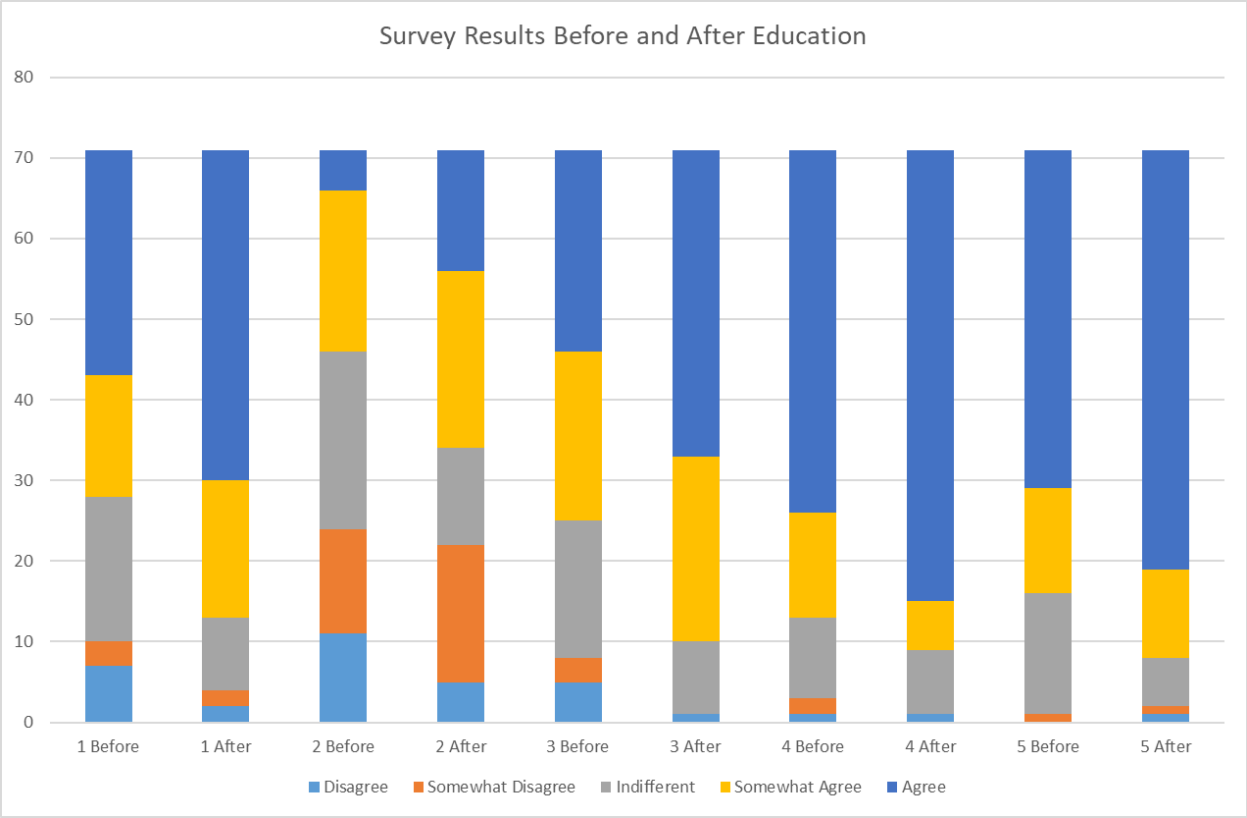


Figure 10: Changes in participants' agreement with ecological statements before and after educational training.

Figure 11 shows the participants' responses to indicate their level of agreement with five statements related to woody encroachment, soil erosion, water resources, and perceptions of prescribed burns on the Konza Prairie, mentioned below:

Statement 1: I am concerned about woody encroachment on Konza

Statement 2: I am concerned about soil erosion after a burn on the Konza Prairie

Statement 3: I am concerned about the impacts of woody encroachment on water resources on the Konza Prairie.

Statement 4: I believe that although there are negative effects from prairie burns, the positives outweigh the negatives.

Statement 5: Prescribed burning is necessary to prevent/ slow woody encroachment on Tallgrass Prairie ecosystems.

The responses show a general shift toward stronger agreement with scientifically supported statements following the training.

For Statement 1, regarding concern about woody encroachment on Konza, the number of participants who "agree" increased after the training, while those who were "indifferent" dropped from 15 to 6. This shift suggests that the training successfully raised awareness about the ecological threat of woody encroachment.

In Statement 2, concern about soil erosion after a burn, agreement increased from 45 to 56 participants, indicating that students gained a stronger understanding of erosion risks associated with prescribed burns. For Statement 3, which links woody encroachment to impacts on water resources, a notable shift occurred: agreement rose from 25 to 38, while disagreement dropped from 5 to 1.

Statement 4, which acknowledged both positive and negative effects of burns, saw a meaningful reduction in disagreement (from 11 to 5 for "disagree") and a rise in "agree" responses from 5 to 15, suggesting that participants became more supportive of prescribed burning overall, recognizing its ecological benefits.

For Statement 5, regarding the necessity of prescribed fire to slow woody encroachment, agreement increased. The number of indifferent or disagreeing participants fell significantly, indicating that the training enhanced understanding of the role of fire as a management tool for maintaining Tallgrass Prairie ecosystems. Together, the results to this question show that participants ecological knowledge has increased by training and they show stronger support for prescribed burning.

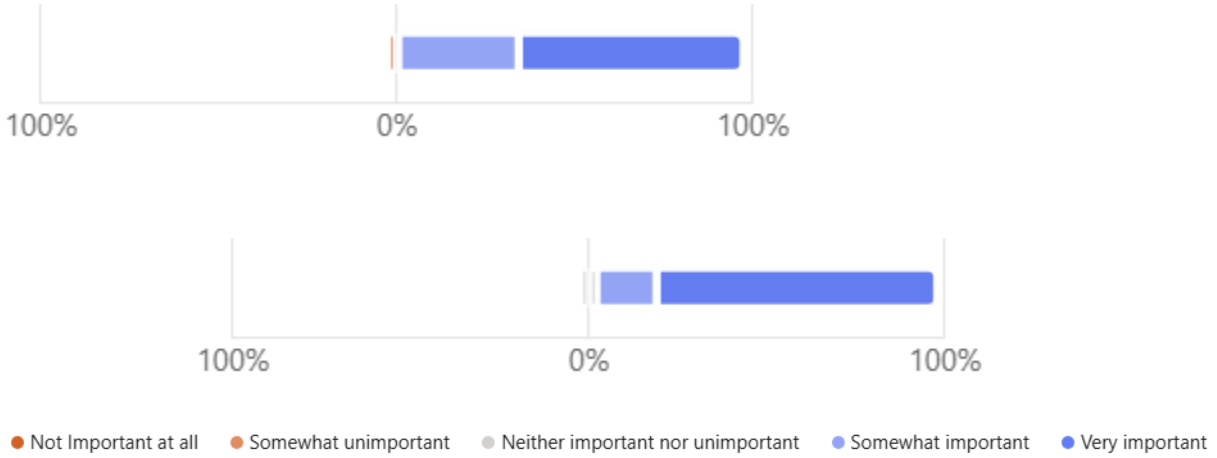


Figure 11: Participants Responses to the question "How necessary are prescribed burns for the prairie ecosystem?" Before (top), after (bottom) training.

Figure 12 shows the participants Responses to the question "How necessary are prescribed burns for the prairie ecosystem?" Before and after training. Prior to the training, while most participants already viewed prescribed burning as important, at least one individual rated it as unimportant. After the training all participants rated prescribed burning as either "somewhat important", or "very important" with a notable increase in the number of respondents selecting "very important."

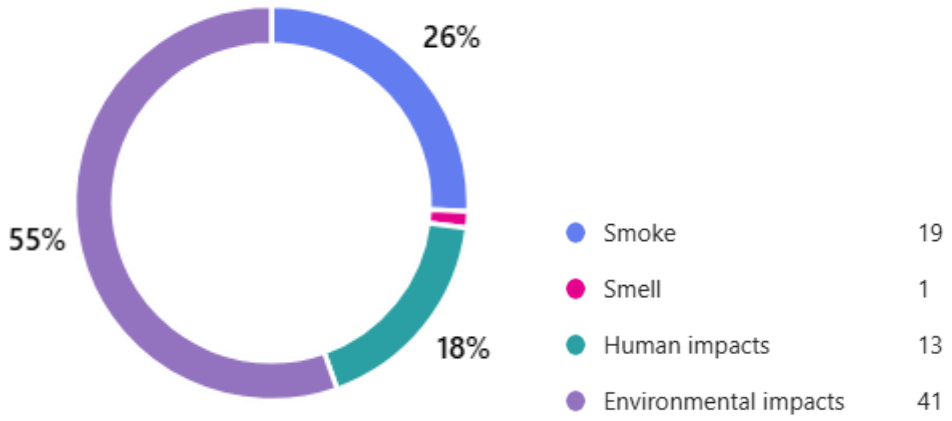


Figure 12: Participants responses to "If there were to be educational materials on burns provided through university systems (email, etc.), what topics would be most helpful to know about?"

Figure 12 summarizes participants' preferences for educational content related to prescribed burns. A majority of respondents (55%) indicated that they would find information on the environmental impacts of prescribed burns most helpful. Human impacts, such as safety and health concerns, were selected by 18% of participants, while smoke-related issues were noted by 26%. One participant also mentioned smell as a concern. These responses suggest that students are most interested in understanding the broader ecological effects of fire.

7. Discussion

Overall, we did see a positive result following the training with the participants developing a stronger opinion, signifying they cared more about the topic after gaining more knowledge. This trend was confirmed as each statement had on average an increase of 16.5% in "agree" responses. This was the intended result, although it would be interesting to compare this to other forms of education in the future to see which can be the most efficient method of education. Something else to consider was that about 59 percent of respondents were from the college of agriculture or arts

and sciences (45 out of 76 students) which are fields that are likely to have previous education about the topic. The observed gains in knowledge and attitude might be smaller than if the survey reached students from unrelated majors. This means that before education most of the subjects already had knowledge and maybe strong feelings about prescribed burning prior to the survey making it more challenging to see if the education actually worked. 47% of participants completed the survey in under 5 minutes. Of that group, 66% of survey participants that completed the survey in under 5 minutes were from either the college of agriculture or college of arts and sciences, suggesting that their prior knowledge of prescribed burns was sufficient for the survey. Across all participants, no matter what the major we also saw that 76 percent had mentioned having prior coursework or training in prescribed fire, furthering the point that most of our subjects had an advanced understanding about prescribed fire and did not need our brief training.

Next, I was to see if they successfully completed the survey twice, there were a few that had just taken the first part but not the second so these results could not be used to see the effect education had. We excluded the responses from 5 subjects who did not complete the second half of the survey after watching the video. Finally, we were able to start working with the data to convert it into forms that would be more useful to us. This included converting the word responses of agree to disagree to numbers then taking those values and putting them in graph format so that we could better visualize what the results showed.

In the quiz portion, we found that the video did not have the same success as in the perception portion of the survey (true/false questions vs likert scale questions). Instead of seeing an intended trend we found that many of the participants were selecting the wrong answers before and after the educational video. Specifically, in the true false question "90 percent of the remaining native prairie is burned on an annual basis," which the correct answer to this was false. In the

results, however, we saw that 40 respondents answered true before education and 41 answered true post education, this is a clear indicator that our video was unsuccessful in relaying this information. This shows some of the strengths and weaknesses of the video, where it does a good job of changing perception but maybe moves too quickly for people to retain facts for a long period. In this case a poster or infographic may do a better job of highlighting specific facts that would be important for the subjects to remember rather than them blending in with the rest of the video. We aimed to create a short, concise video that communicates key concepts about prescribed burning, including the positive and negative environmental and human health effects. The most retained information was not the facts, but rather the overall change in opinion. This demonstrates that prescribed burn education changes perspectives without having to gain a lot of knowledge.

The last portion of our survey was an informative question about what aspects of the training were most impactful. Most responses indicated that environmental insights were important to changing perspectives, rather than human health impacts. This is consistent with the responses in the Likert-scale section, where most responses were more positive after training on questions about the perceptions of the overall environmental benefits of prescribed fire. Tailoring educational training to change attitudes about the environmental impact would be the most successful format.

8. *Recommendation*

Based on our findings, students in the College of Arts and Sciences and Agriculture have enough background knowledge of prescribed burns from classwork and would benefit from a deeper understanding of the issues facing the prairie ecosystem. Students in other colleges at the university without a science background would benefit from general knowledge about prescribed burns and the ecological benefits of fire on the prairie. To effectively provide these varied

audiences, we recommend developing tiered educational materials: introductory-level resources (e.g., short, engaging videos or posters) for general audiences, and more in-depth seminars for students already engaged in environmental disciplines. Most respondents have been living in Manhattan, Kansas for 2-4 years. Education would be more impactful for new residents of Manhattan, as they likely haven't been exposed to the effects of prescribed burns yet. Our survey results would have been more reliable if more respondents had lived in Manhattan, KS for 1 year or less, so the education portion would have made a bigger impact. Understanding what information, the target audience has been exposed to is essential when crafting educational materials. Using our survey data, we can highlight the concepts that community members need clarification or more information on, like air quality health concerns and the environmental impact of woody encroachment.

We could also provide educational materials to professors in different colleges at K-State that they could share with their class or send materials to the school newsletter. Something else shown by that data is some of the topics maybe the subjects need more in-depth information about, such as statements 2 and 3 where more people were confident however, still not a large majority.

The way this knowledge is presented is also something that we found to be very important. We chose to do a short YouTube video that was around 5 minutes long and found that not all participants opened the video, and some may have not watched the entirety of it. Some other options that may work better in the future would be even shorter *TikTok*-like videos or something even simpler like an infographic. Getting college students to engage with the information is the main challenge as most students are very busy and already tired of learning throughout the day.

Something like an infographic or *TikTok* video would accomplish this by allowing the students to comprehend the information even more quickly.

9. Conclusion

Prescribed burns are an often-misunderstood piece of tallgrass prairie management. Using fire can be a delicate system to manage so that the negative effects are minimized. Keeping community members informed of the management is important, so that support for the health of the prairie is preserved. We set out to show a clear correlation of the effect education can have on the public's perception of prescribed burns. The survey and educational portion that was created was able to show that after education the subjects changed their answers to show development of a stronger opinion. Going forward, other avenues to present education should be explored to compare and see if efficiency is improved. Demographics wise, we were not able to cast as wide of net as we would have liked to especially regarding students in the college of business, veterinary medicine, human and health sciences, and education, and first year students. Using the data will also be important so that we can focus future efforts on things that more depth is needed. Overall, improvement in responses was made, which indicates an improvement of understanding, however in the future emphasis should be made on reaching first year students, other majors that do not have background education in the sciences, and finding a good mix of forms of education as our results suggested.

10. References

Altieri, M. (2009). *Red sugar, green deserts: Latin American report on monocultures and violations of the human rights to adequate food and housing, to water, to land and to territory* (1. ed). FIAN International/FIAN Sweden.

Ding, J., & Eldridge, D. J. (2024). Woody encroachment: Social–ecological impacts and sustainable management. *Biological Reviews*, *99*(6), 1909–1926. https://doi.org/10.1111/brv.13104

Flint Hills Initiative. (n.d.). Flint Hills Initiative. Retrieved March 6, 2025, from https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/flint-hills-initiative/

Hiers, J. K., O'Brien, J. J., Varner, J. M., Butler, B. W., Dickinson, M., Furman, J., Gallagher, M., Godwin, D., Goodrick, S. L., Hood, S. M., Hudak, A., Kobziar, L. N., Linn, R., Loudermilk, E. L., McCaffrey, S., Robertson, K., Rowell, E. M., Skowronski, N., Watts, A. C., & Yedinak, K. M. (2020). Prescribed fire science: The case for a refined research agenda. *Fire Ecology*, *16*(1), 11. https://doi.org/10.1186/s42408-020-0070-8

Jian, M., Berli, M., & Ghezzehei, T. A. (2018). Soil Structural Degradation During Low-Severity Burns. *Geophysical Research Letters*, *45*(11), 5553–5561. https://doi.org/10.1029/2018GL078053

Macey, S. M. (2008). *PUBLIC PERCEPTION OF WILDFIRE SMOKE HAZARD*.

Morton, L. W., Regen, E., Engle, D. M., Miller, J. R., & Harr, R. N. (2010). Perceptions of Landowners Concerning Conservation, Grazing, Fire, and Eastern Redcedar Management

in Tallgrass Prairie. *Rangeland Ecology & Management*, *63*(6), 645–654. https://doi.org/10.2111/REM-D-09-00041.1

Phinney, D., & Pohlman, J. (n.d.). *What are Prescribed Fire Associations, and Why Should You Join One? – Clemson Extension Forestry and Wildlife*. Retrieved May 2, 2025, from https://blogs.clemson.edu/fnr/2024/04/25/what-are-prescribed-fire-associations-and-why-should-you-join-one/

Pierce, A. M., & Reich, P. B. (2010). The effects of eastern red cedar (Juniperus virginiana) invasion and removal on a dry bluff prairie ecosystem. *Biological Invasions*, *12*(1), 241–252. https://doi.org/10.1007/s10530-009-9446-z

Raedeke, A. H., Nilon, C. H., & Rikoon, J. S. (2001). Factors Affecting Landowner Participation in Ecosystem Management: A Case Study in South-Central Missouri. *Wildlife Society Bulletin (1973-2006)*, *29*(1), 195–206.

Rogers, C. J., Beck, C., Habre, R., & Ghosh, J. K. (2025). Perceived wildfire risk and past experiences with wildfire smoke influence public support for prescribed burning in the western conterminous United States. *BMC Public Health*, *25*(1), 102. https://doi.org/10.1186/s12889-025-21295-5

Rosen, Z., Henery, G., Slater, K., Sablan, O., Ford, B., Pierce, J., Fischer, E., & Magzamen, S. (2023). A Culture of Fire: Identifying Community Risk Perceptions Surrounding Prescribed Burning in the Flint Hills, Kansas. *Journal of Applied Communications*, *106*(4). https://doi.org/10.4148/1051-0834.2455

Taylor, J. G., & Daniel, T. C. (1984). Prescribed Fire: Public Education and Perception. *Journal of Forestry*, *82*(6), 361–365. https://doi.org/10.1093/jof/82.6.361

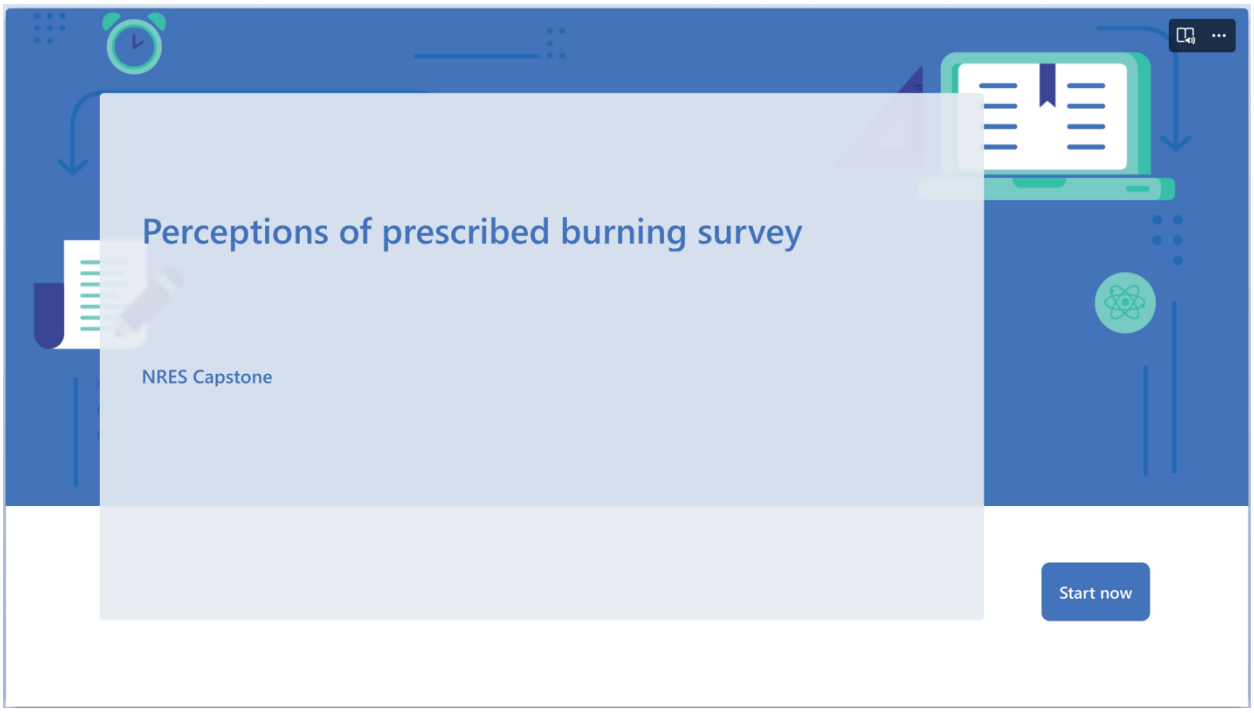
Towne, G. (n.d.). *KGS--Tech. Series 21—Pre-Meeting Field Trip 2*. Retrieved April 17, 2025, from https://www.kgs.ku.edu/Publications/Bulletins/TS21/field_trip2.html

US EPA, O. (2019, August 13). *Health Effects Attributed to Wildfire Smoke* [Overviews and Factsheets]. https://www.epa.gov/wildfire-smoke-course/health-effects-attributed-wildfire-smoke

Van Auken, O. W. (2009). Causes and consequences of woody plant encroachment into western North American grasslands. *Journal of Environmental Management*, *90*(10), 2931–2942. https://doi.org/10.1016/j.jenvman.2009.04.023

Woody Plant Encroachment | Center for Resilience in Agricultural Working Landscapes | Nebraska. (n.d.). Retrieved May 9, 2025, from https://centerforresilience.unl.edu/resilience-practice/woody-plant-encroachment/

11. Appendix A – Survey



Section 1: background Information

2

What is your Academic College?

- Business
- Arts and Sciences
- Agriculture
- Engineering
- Architecture
- Health and Human Sciences
- Vet Med
- Education
- Other/ not a student

3

How long have you been at K-State/lived in Manhattan?

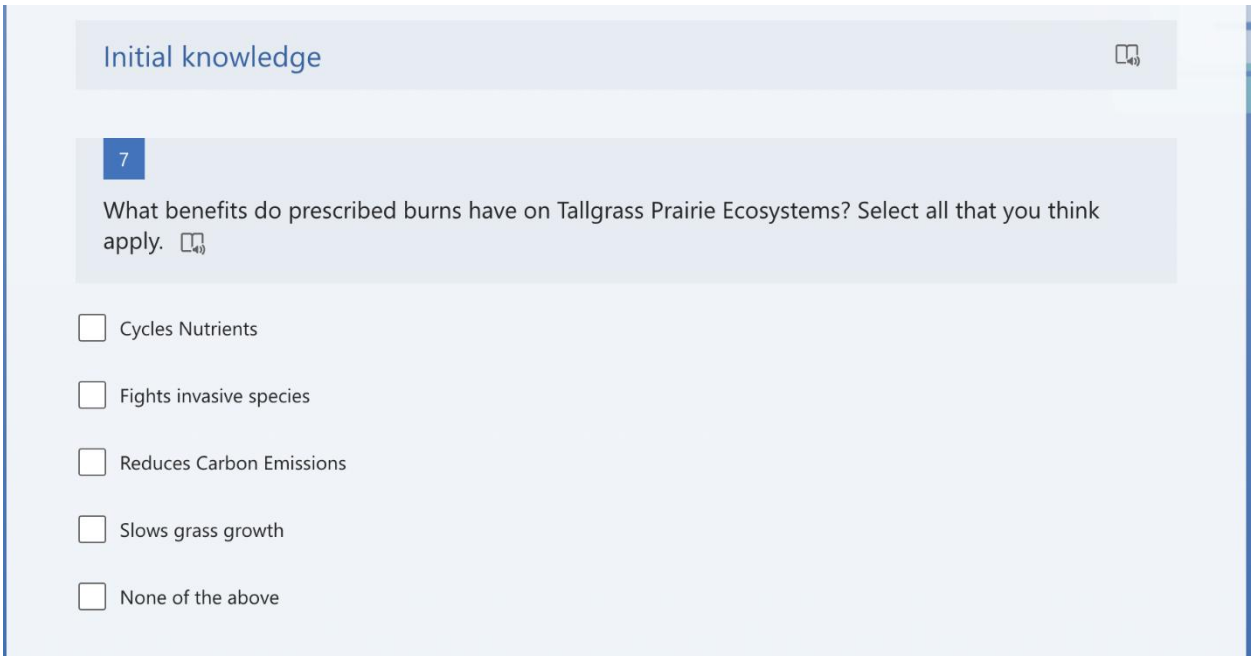
Select your answer

4

Have you been to Konza Prairie?

- Yes
- No
- Unknown

Section 2: Initial Knowledge



9

In north America, roughly less than 5% of the tallgrass prairie ecosystem remains.

- True
- False

10

90 percent of the remaining native prairie is burned on an annual basis.

- True
- False

11

Fire is a mechanism that the tallgrass prairie has been using to control invasive species long before Humans settled on the Prairie.

- True
- False

12

Agree/disagree statements

	Disagree	Somewhat Disagree	Indifferent	Somewhat Agree	Agree
I am concerned about woody encroachment on the Konza Prairie.	○	○	○	○	○
I am concerned about soil erosion after a burn on the Konza Prairie.	○	○	○	○	○
I am concerned about impacts of woody encroachment on water resources on the Konza Prairie.	○	○	○	○	○
I believe that although there are negative effects from prairie burns, the positives outweigh the negatives	○	○	○	○	○
Prescribed burning is necessary to prevent/ slow woody encroachment on Tallgrass Prairie ecosystems	○	○	○	○	○
I believe that although there are negative effects from prairie burns, the positives outweigh the negatives	○	○	○	○	○

13

How necessary are prescribed burns for the prairie ecosystem?

Not Important at all	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Very important
○	○	○	○	○

Section 3: Initial Knowledge

Watch this video: https://youtu.be/CtwtKZn3qtg

Optional- for more information about prescribed burns, watch this K-State Exetnsion video: https://www.youtube.com/watch?v=mOOZpq4u0iA

Section #: POST-Education knowledge

Post-education knowledge

14

What benefits do prescribed burns have on Tallgrass Prairie Ecosystems? Select all that you think apply.

- [ ] Cycles Nutrients
- [ ] Fights invasive species
- [ ] Reduces Carbon Emissions
- [ ] Slows grass growth
- [ ] None of the above

15

What are the negative effects prescribed burns can have on Tallgrass Prairie Ecosystems? Select all that you think apply.

- [ ] Can lead to erosion of soil
- [ ] Allow contaminants to run off into streams
- [ ] Air quality issues
- [ ] Negative effects on wildlife
- [ ] Reduces ground nesting bird populations
- [ ] Ability to drive safely
- [ ] None of the above

16

In north America, roughly less than 5% of the tallgrass prairie ecosystem remains.

- ◯ True
- ◯ False

17

90 percent of the remaining native prairie is burned on an annual basis.

- ◯ True
- ◯ False

18

Fire is a mechanism that the tallgrass prairie has been using to control invasive species long before Humans settled on the Prairie.

- ◯ True
- ◯ False

19

Agree/disagree statements

	Disagree	Somewhat Disagree	Indifferent	Somewhat Agree	Agree
I am concerned about woody encroachment on the Konza Prairie.	○	○	○	○	○
I am concerned about soil erosion after a burn on the Konza Prairie.	○	○	○	○	○
I am concerned about impacts of woody encroachment on water resources on the Konza Prairie.	○	○	○	○	○
I believe that although there are negative effects from prairie burns, the positives outweigh the negatives	○	○	○	○	○
Prescribed burning is necessary to prevent/ slow woody encroachment on Tallgrass Prairie ecosystems	○	○	○	○	○
I believe that although there are negative effects from prairie burns, the positives outweigh the negatives	○	○	○	○	○

20

How necessary are prescribed burns for the prairie ecosystem?

Not Important at all	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Very important
○	○	○	○	○

21

Would a sign at Konza with information about burns help improve your experience at Konza?

- ◯ Yes
- ◯ No

22

Would a sign at Konza about erosion/woody encroachment help your understanding of the issues facing the prairie ecosystem?

- ◯ Yes
- ◯ No

23

If there were to be educational materials on burns provided through university systems (email, etc.), what topics would be most helpful to know about?

- ◯ Smoke
- ◯ Smell
- ◯ Human impacts
- ◯ Environmental impacts