COMMUNITY PERCEPTIONS
OF
WILDFIRE & CONTROLLED BURNING

by

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1. ABSTRACT

Community backlash following the western North Carolina wildfires in 2016 revealed patterns of miscommunication and distrust regarding forest management practices. To improve messaging in fire-impacted communities, a pilot survey study was conducted in Morganton, NC. The study explored community perceptions of wildfire and controlled burning threats, the variables that might explain them, and whether perceptions of controlled burning can be affected by messaging. Results show that survey respondents perceived fire to be beneficial for North Carolina forests. Survey respondents generally perceived wildfire to be an overall threat while they generally did not perceive controlled burning to be an overall threat. Political alignment, perceived wildfire risk to personal residence within ten years, and belief that wildfire is a natural part of the ecosystem were found to be statistically significant predictors of wildfire threat perceptions. Political alignment, years lived in Morganton, and the belief that wildfire is a natural part of the ecosystem were found to be statistically significant predictors of controlled burning threat perceptions. Perceptions of controlled burning may also be changed due to effective and targeted messaging.

2. EXECUTIVE SUMMARY

Fire is believed to be a natural and important component of forest health and functioning in south eastern ecosystems. However, years of fire suppression policies have led to shifts in forest stand and structure adversely impacting forest health and functioning. Controlled burning has frequently been used to reestablish natural ecosystems historically adapted to wildfire. Community backlash following the western North Carolina wildfires in 2016 revealed patterns of misunderstanding and distrust regarding wildfire and fire-related forest management practices, such as controlled burning. As human populations expand into forests, the need for people to become more comfortable living with fire, or fire-adapted, becomes increasingly important. The Nature Conservancy aims to improve communication and messaging to communities impacted by fire to help them become more fire-adapted. This study was conducted as a pilot project in Morganton, NC to understand if the community believes fire is good for North Carolina forests, if the community perceives wildfire to be a threat, if the community perceives controlled burning to be a threat, the variables that might explain wildfire and controlled burning threat perceptions, and whether perceptions of controlled burning can be affected by messaging.

A community focus group was conducted in Morganton, NC in October 2017. Results of the focus group informed survey instrument development and implementation. The survey was distributed online via community list serves and was active from January 23, 2018 to February 23, 2018. The survey received 163 submissions, 131 of which were complete. Survey results were analyzed in STATA using generalized linear models to predict or explain continuous responses using linear regressions and ordinal responses using ordered logistic regressions.

Overall, survey respondents perceived fire to be beneficial for North Carolina forests. Survey respondents generally perceived wildfire to be an overall threat while they generally did not perceive controlled burning to be an overall threat. Political alignment, perceived wildfire risk to personal residence within ten years, and belief that wildfire is a natural part of the ecosystem were found to be statistically significant predictors of wildfire threat perceptions. Political alignment, years lived in Morganton, and the belief that wildfire is a natural part of the ecosystem were found to be statistically significant predictors of controlled burning threat

perceptions. Perceptions of controlled burning benefits were changed through exposure to an informational vignette written in a personal narrative voice versus a vignette written in a scientific voice and a control vignette.

As this was a pilot study, I provide several recommendations for any future replications or implementations of this study across a broader spatial scale. Recommendations include:

- Adjusting survey sampling mode based on target community needs and access to resources (i.e. internet accessibility)
- Providing language translation services based on target community needs
- Consideration of timing for survey implementation (i.e. recent fire events)
- Adjusting survey instrument to account for more nuanced issues and perceptions around controlled burning
- Adjusting survey to address community values and use of surrounding forests
- Gathering site-specific photo and/or video time-lapse content for controlled burning communications and messaging testing

3. INTRODUCTION

Historically, many southern Appalachian plant species and communities, found along ridge tops, adapted to wildfire and relied on wildfire events for repropagation (Fesenmyer and Christensen 2010, Whittaker 1956). However, anthropogenic disturbances over the past few centuries have altered natural fire regimes in the southern Appalachians thus impacting ecosystem structure, composition and functioning (Fesenmyer and Christensen 2010, Mitchell 2014). Increased clear-cutting commercial logging practices in the late 1800's and early 1900's reduced forest cover across the southern Appalachian landscape. These practices initiated increases in wildfire events at low and high elevations (Fesenmyer and Christensen 2010, Jurgelski 2008). Around the 1920's, the public demanded preservation of forests, national parks formed, and fire suppression policies significantly reduced fire events in the eastern United States (Brose et al. 200l, Jurgelski 2008, Nowacki and Abrams 2008, Mitchell 2014). Today, we see how these wildfire suppressions have begun to alter forest compositions and structures in a way that makes forests less fire-adapted (Mitchell 2014).

Particularly in the southeast, studies have shown that long-term fire suppression has resulted in closed canopy forest (Nowacki & Abrams 2008). These ecological systems are cooler, damper, more shaded, and less flammable or receptive to fire (Nowacki & Abrams 2008). As a result, shade-intolerant flora is being replaced and stand-level species richness is declining in such a way that can negatively affect overall ecosystem health. These shifts in forest composition may result in reduced soil water availability (Swank et al. 2001), declines in habitat for some pollinators and songbirds that require grassland, the northern bobwhite, some reptiles and small mammals (NC State Extension 2017). Furthermore, shifts may result in reduced air quality from prolonged smoke events when wildfire events occur (McKenzie et al. 2014). According to Nowacki & Abrams (2008), this is in contrast compared to western United States where fire suppression has made forests far more prone to fire (Parsons 1976, Brown et al. 2000).

Controlled burning was adopted in the United States around the 1940's, and is used as a land management technique to restore woodlands, savannas, shrub-dominated habitat, and open forest (Fowler & Konopik 2007). The definition of controlled burning varies slightly across

organizations, however, the US Forest Service cites the Merill and Alexander (1987) definition as "any fire deliberately utilized for [controlled] burning: usually set by qualified fire management personnel according to a predetermined burning prescription" (USDA Forest Service 2006). The US Forest Service also identifies the important aspects of [controlled] burning from Wade and Lunsford (1989) as being used: "in a skilled manner, under exacting weather conditions, in a definite place, and to achieve specific results" (USDA Forest Service 2006). In many cases, controlled burns have been employed to reduce hazardous amounts of fuel accumulation (Melvin 2012, Mitchell 2014, Fowler & Konopik 2007), otherwise known as unburned woody material. Without fuel reduction, the intensity and magnitude of wildfire events can be severe and pose a threat to human populations residing close to these regions. In other management scenarios, controlled burns are used to restore threatened plants and communities, promoting growth of more fire-tolerant native plants, and reducing pests (USDA Forest Service 2006, Fowler & Konopik 2007). The southeastern United States will need to employ controlled burns more frequently, primarily for the latter purpose to maintain healthy ecosystems (Nowacki & Abrams 2008).

In 2016, western North Carolina experienced an unprecedented scale and intensity of wildfire, with severe drought conditions and over 60,000 acres burned. [1] The Nature Conservancy and fire practitioners observed community backlash to wildfire and fire management practices that appeared to reflect a lack of understanding about the role of fire in southeastern ecosystems. North Carolina has the largest land area of wildland-urban interface in the southeast region of the United States which was identified as fire practitioners' largest limitation for controlled burning (Kobziar et al. 2015, Radeloff et al. 2005). This might be, in part, due to perceived risks to things like personal property, health, and tourism.

The Nature Conservancy (TNC) would like to better understand community perceptions of the role and risks of fire in western North Carolina. As human populations expand into forests, the need for people to become more comfortable living with fire, or fire-adapted, becomes

[1] Information based off project description provided by TNC in fall of 2016

increasingly important. The Nature Conservancy aims to improve communication and messaging to communities impacted by fire to help them become more fire-adapted. This project is a pilot study conducted on behalf of TNC that may inform a larger study across a wider spatial scale in the future or replicated studies in other communities. TNC believes that survey study would be a useful means of gaining valuable information from fire-impacted communities across the United States, but specifically in other regions of western North Carolina.

I conducted a pilot survey study that examined wildfire-impacted community's perceptions threats of wildfire and controlled burning. Questions addressed risk perceptions of fire in regard to a variety of variables including safety, health, property, ecosystem health, and economy. The last portion of the survey tested two different messaging strategies in the form of an informational vignette that had an aesthetic frame for controlled burning benefits but used different 'voices'. Follow-up questions were asked after presenting respondents with vignettes to understand if we could change perceptions of controlled burning. Information gathered will be used to improve future messaging to communities in fire-prone areas and increase education about the benefits of fire for forest management.

Although there have been a few survey studies regarding perceptions of wildfire and wildfire--related programs in the southern United States (Busam and Evans 2015, Jarret et al. 2009; Kreuter et al. 2008), few studies have specifically addressed perceptions of controlled burns (Busam and Evans 2015). The majority of research regarding perceptions of wildfire and prescribed burns has been conducted in the western United States. One study conducted in San Miguel County, Colorado explored resident perceptions of living with wildfire (Meldrum et al. 2017). Several questions related to home wildfire risk for this study were modeled off of the Meldrum et al. (2017) survey.

No known research has been conducted specifically for North Carolina concerning these topics. However, a survey study was conducted for the South Carolina Forestry Commission and explored South Carolina residents' knowledge of, perceptions of, and opinions on wildfires and controlled burning (Responsive Management 2017). The study was conducted via telephone for residents who voted that were over 25 years old. The survey found that respondents perceived

wildfires to be a significant or somewhat significant threat (Responsive Management 2017). Knowledge of fire role in South Carolina ecosystems was more moderate. The survey asked true and false questions regarding beliefs that fire was important or necessary for the environment ranged from 41% to 66% (Responsive Management 2017). The majority of residents were supportive of controlled burning and did not consider them to be as great a threat as wildfire (Responsive Management 2017).

Note that the term 'controlled burning' was used for this survey study versus prescribed fire and will be used as such for the entirety of this paper. This decision was made based off a prior TNC study that evaluated language use regarding forest management. Results found that the general public viewed "controlled burning" as more palatable or less threatening than "prescribed fire" (Public Opinion Strategies & Fairbank, Maslin, Maullin & Associates Lori Weigel 2008).

4. MATERIALS & METHODS

4.1 RESEARCH SITE

The focus group and survey were conducted in the Morganton, North Carolina community located in Burke County. TNC identified this location as the target community because it suffered impacts by the 2016 Chestnut Knob Fire and is also subject to controlled burns as a means of forest management. The community is identified by four zip codes: 28655, 28666, 28671, and 28680. Sampling efforts targeted the Morganton community but analysis included survey submissions from surrounding communities. Based on proximity, it is believed that those surrounding communities suffered impacts from the same fires and rely on the same forested areas for recreational use.

As of 2016, Morganton, NC was estimated to have a total population of 16,665 people (US Census Bureau 2016). Approximately, 86.6% of citizens are white, 6.2% are Hispanic, 6.3% are black, and the remaining percentage identifies as more than one race or another racial minority group (US Census Bureau 2016). The majority of the population, 25 years old and higher, have at least a high school education at 79.6% and 16.9% have a Bachelor's degree or higher (US

Census Bureau 2016). Median household income in Morganton as of 2016, was $39,759 (US Census Bureau). The population is relatively evenly split between females and males at 50.9% and 49.1%, respectively (US Census Bureau 2016).

4.2 Focus Group

Focus groups can serve as an investigative approach (Nassar-McMillan and Borders 2002) to gain insight to people's perceptions, experiences, and personal knowledge (Ernst et al. 2009). Given that little research has addressed human perceptions of fire, especially in this region, I held an initial focus group in Morganton to inform the development of the survey instrument. This allowed me to better understand how community members may process sampling approaches and topics (Fowler 2014), giving my survey instrument more place-based context. I recruited adult permanent residents in Morganton with mixed demographics (i.e. income, education, political affiliation) to draft my survey instrument. The focus group recruitment processes and facilitation methodologies were approved by Duke University's Institutional Review Board (IRB) prior to focus group facilitation.

Avery Lennard, a TNC Associate, and I conducted the wildfire and controlled burning focus group on October 30, 2017 in Morganton, North Carolina. The following information provides information about participant recruitment, focus group orchestration, and information gained from the participatory process.

I recruited for the focus group using community e-mail listserves (see Appendix A for copy of recruitment e-mail) and by distributing flyers (Appendix B) in community centers and hubs around Morganton. I approximate that the listserves reached 2,000 people. Incentives for participation included a $25 gift card, light dinner, and non-alcoholic beverages. I asked that interested participants complete a brief intake survey that covered a variety of demographic questions including: education level, age, race, income, etc. (Appendix C). The demographic questions allowed me to select as much of a representative population for the focus group. My target number of participants was between six to ten people. Fifteen people completed the intake survey, I asked twelve to participate, eight RSVP'd yes, and seven people showed up on the day

of the focus group. Of the seven people who showed up, four were men and three were women. Participants had diverse political affiliations, income levels, and education. However, all participants were white.

The focus group was conducted at the Foothills Higher Education Center in Morganton, NC from 6:00pm to 8:00 pm on Monday October 30th, 2017. I facilitated the focus group while Avery Lennard took notes. Questions addressed participant's experiences with fire (wildfire and controlled burning), perceived risks and benefits, and information sources (Appendix D). Participants were asked to sign a consent waiver at the beginning of the focus group. The focus group was recorded and transcribed at a later date. See results (section 5.1) for a discussion of information gained through this process.

4.3 Survey Development

Survey development began in November 2017 and continued until January 2018. The survey was developed in Duke Qualtrics and was approved by Duke University's IRB prior to distribution.

The survey was developed based on the information gathered during the community focus group (see section 5.1). The survey was primarily divided into seven sections: experience with wildfire, opinions about fire (wildfire or controlled burning), perceived threats of wildfire, perceived threats of controlled burning, written vignettes about controlled burning benefits, information sources for wildfire and control burning, and demographic information. Demographic questions included age, race, gender, political affiliation, household income, education, and residence type.

Questions regarding experience with fire addressed any prior experience with property damages or evacuations due to wildfire events, perceived wildfire risk to respondents' residences and how close a wildfire has come to the respondents' property. These questions were asked as potential explanatory variables for why a respondent may perceive a greater or lesser threat from wildfire or controlled burning.

Perceptions of the role of fire in North Carolina ecosystems were collected in a series of questions that explored if respondents believed fire was necessary, beneficial, or dangerous. These questions were used as an indicator of community knowledge of fire and fire management in addition to potential explanatory variables.

Threat perceptions of wildfire and controlled burning was primarily addressed in two matrix questions, respectively. The matrix questions asked about threat perceptions of: personal safety, community safety, personal property, community property, personal health, community health, local economy, tourism, water quality, air quality, wildlife, forest health, outdoor recreation opportunities (hiking, camping), and the natural beauty of the forest. These questions were used as response variables for community perceptions of wildfire and controlled burning threats.

As part of the survey instrument, I developed three different informational vignettes about controlled burning improving the beauty of western North Carolina ecosystems. This included discussion of the growth of charismatic flowers. This section also included one control vignette that did not describe growth of charismatic flowers, but simply used the introductory line of the other vignettes which defines general uses of controlled burning. These vignettes were used to understand if community perceptions of controlled burning could be impacted through messaging about the benefits of controlled burning with an aesthetic frame and to see if voice had any impact on that shift.

I chose to use an aesthetic frame based off the information gathered in the focus group (section 5.1). However, information was presented in two voices: scientific and personal narrative. The purpose of this distinction was to understand if community members would feel more influenced by information provided from the experience of a local citizen or information grounded in scientific research and fact. Informational vignettes were randomized during distribution.

The following informational vignette was written in a scientific voice:

> *Controlled burning is used in North Carolina for several reasons including reducing wildfire risk, improving forest health and functioning, and promoting the growth of native plants. Research shows that without fire, dead trees, leaf litter and pine needles build up*

on forest floors, blocking new vegetative growth. Scientists have demonstrated that controlled burning consumes deadwood and shrubby understory but typically does not harm big fire-adapted oaks and pines. Studies show that when controlled burning clears the forest floor, new plants like Heller's Blazing Star, Trillium, and Jack-in-the-pulpit will emerge. Continue to the next page for follow-up questions.

The following informational vignette was written in a personal narrative voice:

Controlled burning is used in North Carolina for several reasons including reducing wildfire risk, improving forest health and functioning, and promoting the growth of native plants. Dan Howard, resident of western North Carolina, has hiked around Linville Gorge almost every Sunday for the past 5 years. This is his experience with controlled burning… "I've noticed that when certain areas go years without a fire, lots of dead plants pile up on the forest floor. There's not many flowers, not even much sunlight. After a controlled burn, it's pretty desolate. It can look a bit like a moonscape. But a few months after that? Things really start to green up and bloom. You see flowers like Heller's Blazing Star, Trillium, and Jack-in-the-pulpit. I hadn't seen some of those in years." Continue to the next page for follow-up questions.

The following information vignette was written as a control:

Controlled burning is used in North Carolina for several reasons including reducing wildfire risk, improving forest health and functioning, and promoting the growth of native plants.

Follow-up questions addressed risk perceptions of controlled burning to forest beauty, tourism, and ecosystem health.

4.4 Survey Distribution

The survey was web-based and was primarily distributed through local community listserves. Listserves were identified through community networking. Several different types of local contacts offered to help distribute the survey link, including HOAs, a brewery, church, fire department, public health department, and Downtown Morganton. As I did not have access to the listerves directly, local citizens and leaders sent the emails out on my behalf. I also requested that distributors send out one reminder email a week after the initial survey link distribution. It is possible that not all distributors followed through with initial survey distribution and/or the reminder e-mail. That being said it is unclear how many people received the survey link. I estimate that the survey reached somewhere between 2,000 and 3,000 individuals, however it is also unclear if there was any overlap in listserves.

The survey was active from January 23, 2018 to February 25, 2018. I received 163 total submissions though only 131 were complete. This reflects a completion rate of approximately 80.3%.

4.5 Data Analyses

To explore variables that might explain threat perceptions, survey responses were analyzed in STATA using multiple linear regressions to predict or explain continuous responses and ordered logistic regressions to predict or explain ordinal responses.

Explanatory variables for models 1 & 2 were calculated from wildfire and controlled burning threat matrix questions. Two survey matrix questions asked about perceived threats of wildfire and controlled burning by addressing the following variables: personal safety, community safety, personal property, community property, personal health, community health, local economy, tourism, water quality, air quality, wildlife, forest health, outdoor recreation opportunities (i.e. hiking, camping), and the natural beauty of the forest (Table 2). Questions from each respective matrix were analyzed using Cronbach's Alpha to determine the internal consistency of questions or correlation of variables (IDRE 2018). Each matrix was indexed into one variable using

Cronbach's Alpha which produced an average scale, or continuous variable. Model 1 used the wildfire threat indexed variable as the response variable and model 2 used the controlled burning threat indexed variable as the response variable. Both models were controlled for demographic information including age, gender, and education. Responses were analyzed using linear regressions.

Model 3 analyzed whether messaging could impact perceptions of controlled burning. As discussed in section 4.3, respondents were presented with several questions post-vignette. The vignette had an aesthetic frame, so model 3 used the following question as the response variable: *how much do you agree or disagree with the following statement – controlled burning can improve the beauty of NC forests*. Responses were measured ordinally on a Likert scale (1 = strongly agree to 5 = strongly disagree) and therefore analyzed using an ordinal logistic regression.

General perceptions of fire were analyzed by calculating one variable from a 'general perceptions of fire' matrix question (Appendix F). Similarly to response variables for models 1 & 2, questions asked within the matrix were answered on a Likert scale but analyzed and indexed using Cronbach's alpha. Mean and standard deviations were calculated to understand community perceptions of the role of fire.

5. RESULTS

5.1 FOCUS GROUP

Focus group participants had largely similar, but relatively positive, opinions towards fire. All participants expressed mild safety concerns in regard to wildfire and controlled burning but felt that fire was an important part of the southeastern ecosystem for forest functioning and health. Furthermore, everyone agreed that controlled burning was a necessary preventive strategy to prevent potential devastating impacts from wildfires. Focus group participants felt that wildfire was a greater risk overall than controlled burning overall.

The most notable risk concerns voiced about wildfire and controlled burning were aesthetics, loss of recreational opportunity, and economic impacts from loss of tourism. Participants explained that Morganton's community identity was coined "Nature's playground". To lose outdoor recreational access and aesthetic integrity in the community might have a strong impact on tourism and perceptions of citizens that moved to Morganton for aesthetic values. Aesthetic integrity refers to the perceived beauty of the forest. Participants discussed that many people found the forests to be less beautiful after fire events, referring to burned trees and lack of greenery. Otherwise, participants noted many instances of community members worrying about wildlife safety during fire events.

Participants suggested using visual time-lapse photographs and/or video following controlled burns to show the positive effects of fire and gain community support. While these were not available for this study, it might serve as a good communication tool in the future for messaging in fire-impacted communities (see section 7.0).

I gained valuable insight to how and where the community receives wildfire and controlled burning information. Participants felt strongly that information should be distributed through multiple sources (i.e. radio, television, smart-phone alerts) in order to reach the wider community. There were also notable differences in voice preference for emergent fire situations or educational purposes. Participants expressed that they would prefer to hear information from the agency "on-site" during emergent situations but from local organizations agencies (i.e. fire departments) when receiving educational information.

5.2 SURVEY

5.2.1 DEMOGRAPHICS

The following section describes demographic information for survey respondents. According to Morganton, NC census data gathered in 2016 (see section 4.1), survey respondents were older, more educated, and had a higher household income than the average Morganton citizen. Survey

respondents had a mean age of 56.9 years (minimum = 22, maximum = 78, standard deviation = 12.89). See table below for descriptive statistics for education and annual household income.

Table 1: Descriptive statistics for education and household income

Variable	Sub-group	Percent (%) of respondents
Education	less than $20,000	0
	$20,000-$34,999	3.82
	$35,000-$49,999	7.63
	$50,000-$74,999	22.14
	$75,000-$99,999	13.74
	$100,000-$149,999	16.03
	$150,000 or more	21.37
	Prefer not to say	15.27
Annual Household Income	Less than high school	0
	High school graduate	2.26
	Some college	16.54
	2-year degree	15.79
	4-year degree	27.82
	Professional degree	30.08
	Doctorate	6.77
	Prefer not to say	0.75

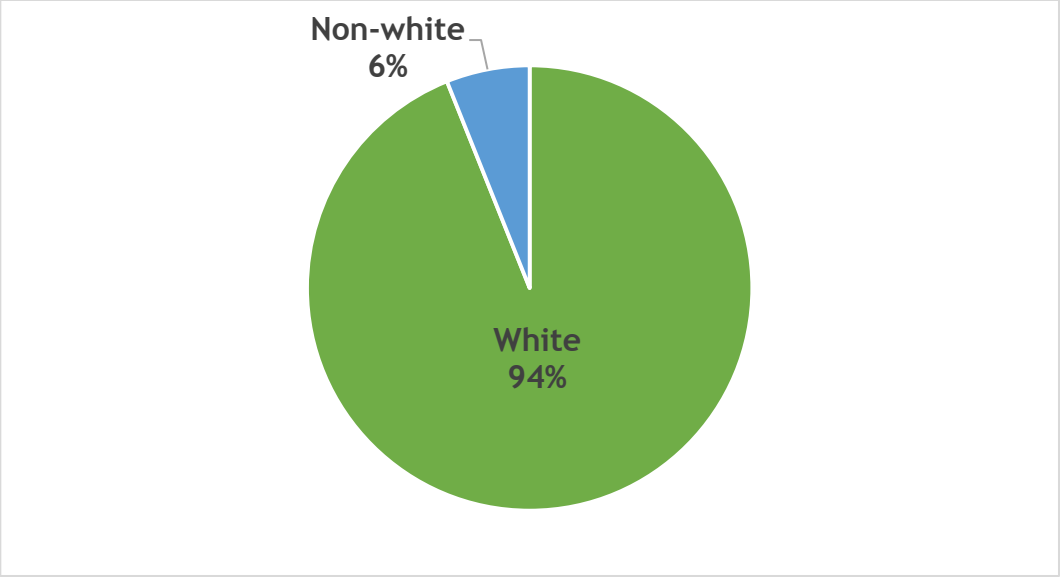

Figure 1: Race distribution across survey respondents

Survey respondents were majority white with only 6% identifying as non-white. Morganton, NC census data gathered in 2016 (see section 4.1), indicates that the community is majority white at 86.6%. Survey respondent races were generally consistent with those of the Morganton community.

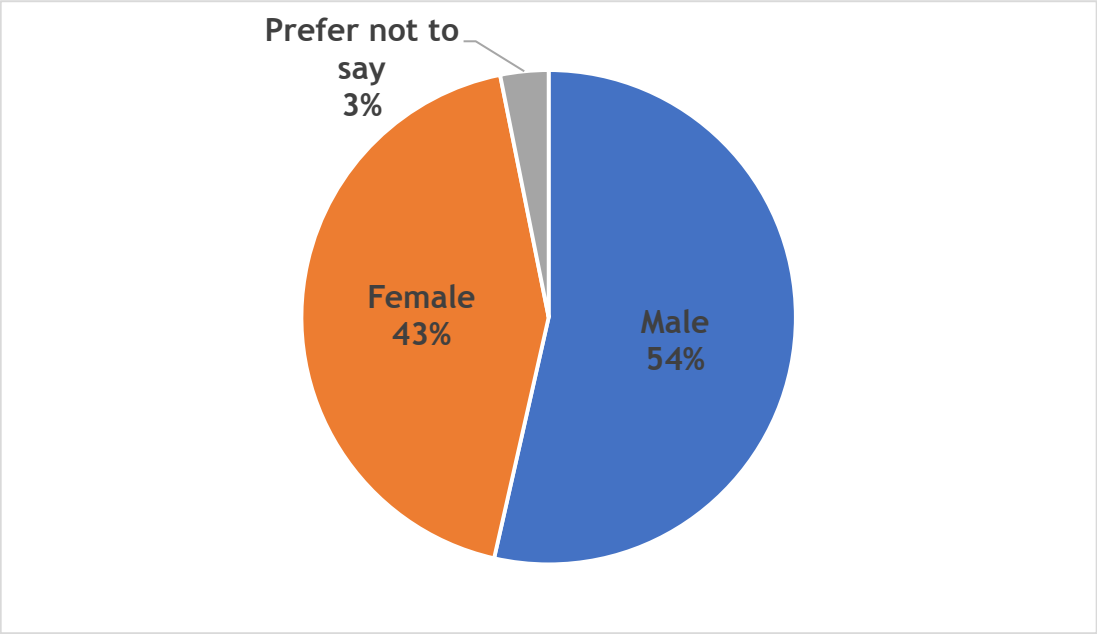

Figure 2: Gender distribution across survey respondents

Survey respondents were majority male with only 3% indicating that they would prefer not to say. Morganton, NC census data gathered in 2016 (see section 4.1), indicates that the community is divided relatively evenly between males and females. Male and female gender distributions for survey respondents were slightly inconsistent with those of the Morganton community.

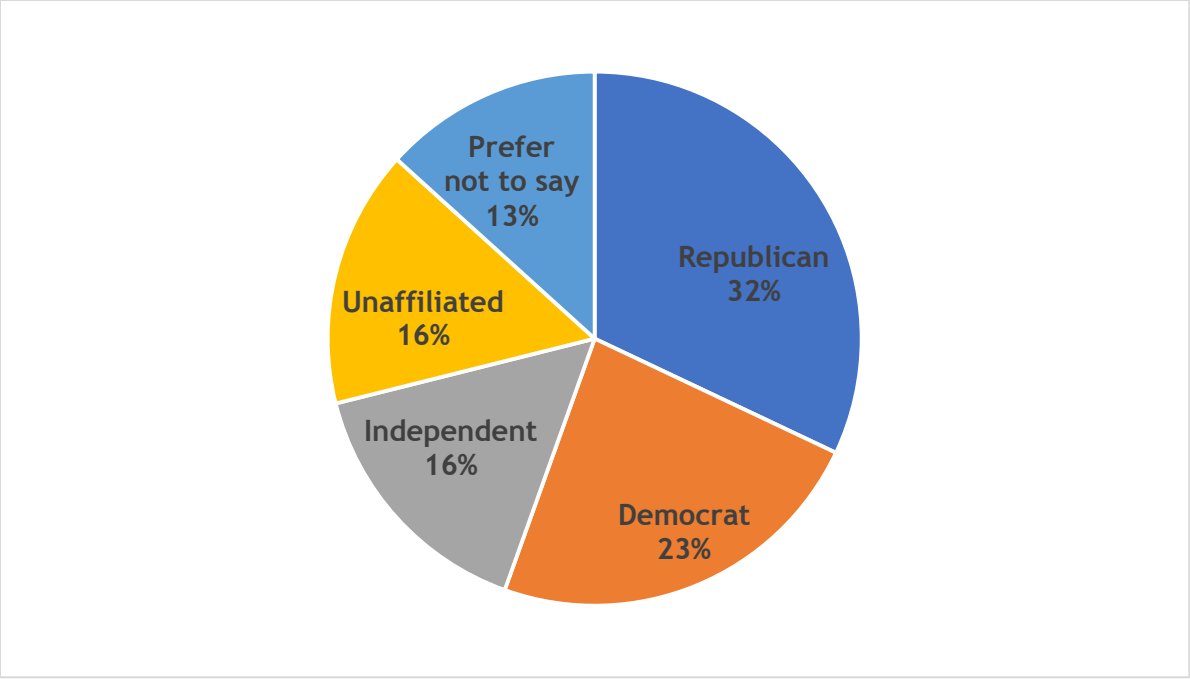

Figure 3: Political affiliation distribution across survey respondents

Survey respondents were majority Republican followed by Democrats. The remainder of survey respondents were somewhat evenly distributed among the other affiliations: Independent, Unaffiliated, and Prefer not to say.

5.2.2 Community Perceptions of Fire, Wildfire, and Controlled Burning

To determine general perceptions of fire, wildfire, and controlled burning, I calculated the variables from respective matrix questions that were measured on a Likert scale (see section 4.5). Generally, respondents believed that fire is good for North Carolina forests and the mean (mean = 2.02; std. dev = 1.01) fell around somewhat agree (Figure 4). Respondents generally perceive wildfire to be a threat, with the mean (mean = 2.62; std. dev = 1.02) falling between neutral and somewhat agree (Figure 5). Respondents generally perceive controlled burning to not be a threat,

with the mean (mean = 3.76; std. dev = 1.10), falling between neutral and somewhat disagree (Figure 6). After running a paired t-test I found that overall, respondents generally perceived wildfire to be a greater threat than controlled burning ($p < .05$).

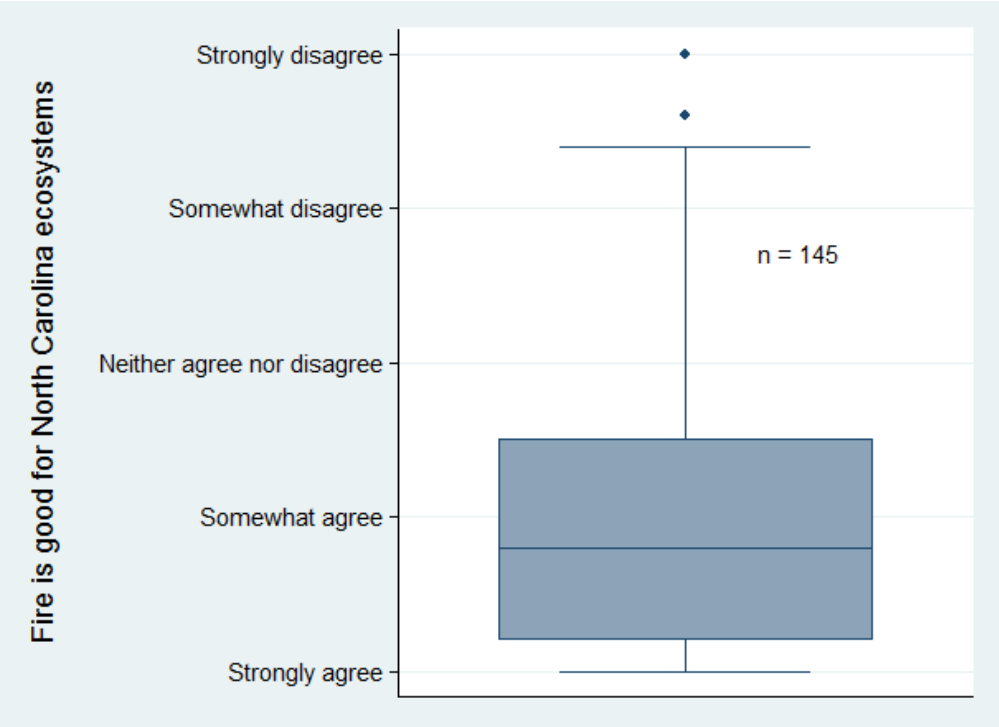

Figure 4: Boxplot: community perceptions that fire is good for North Carolina forests

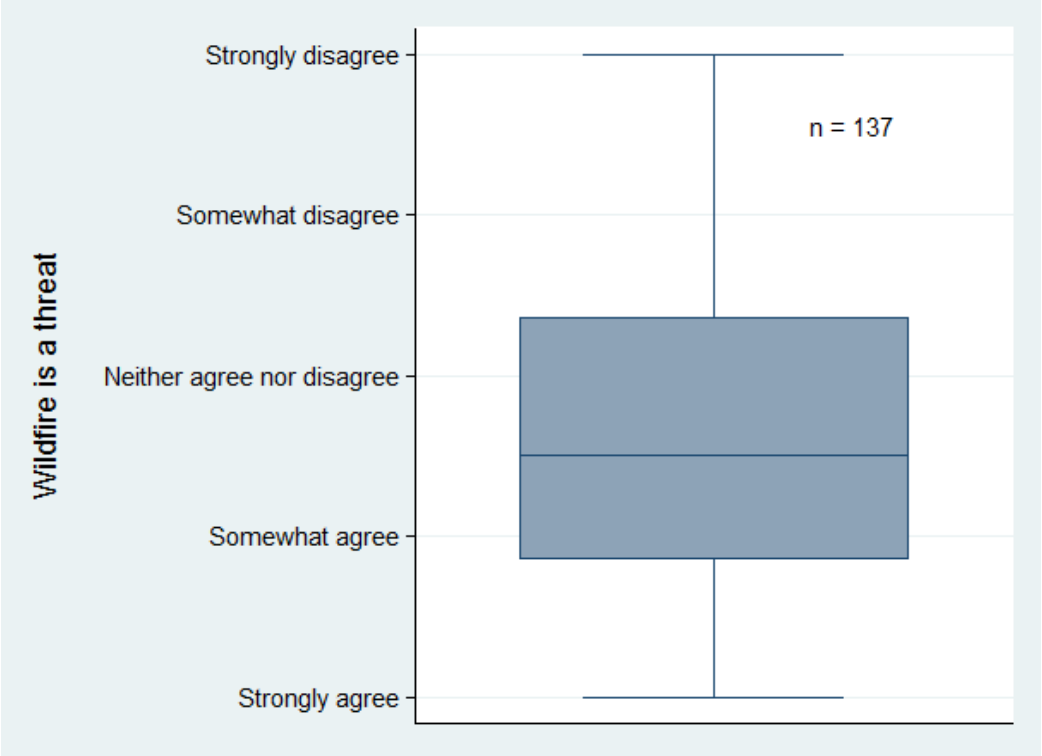

Figure 5: Boxplot: community perceptions that wildfire is a threat

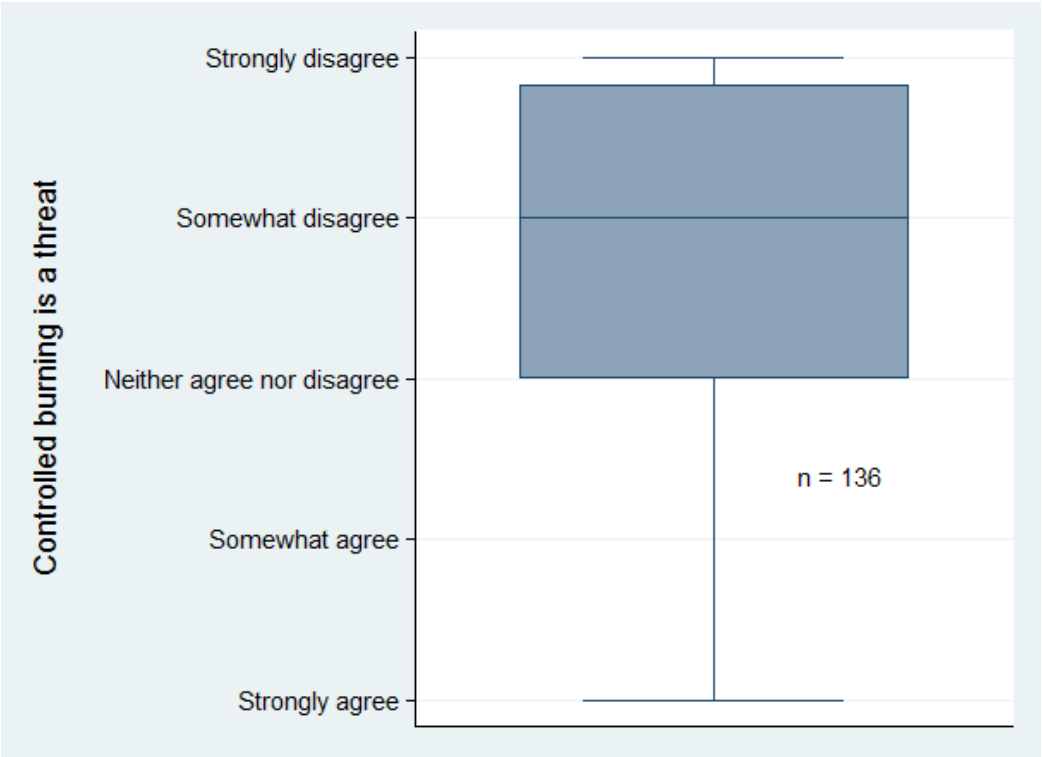

Figure 6: Boxplot: community perceptions that controlled burning is a threat

Averages were calculated independently for each of the wildfire and controlled burning variables included in the matrix questions (Table 2). The variable that was considered the highest perceived threat for wildfire was air quality with an average falling between somewhat agree and strongly agree (mean = 1.97; std. dev = 1.09). The second highest perceived threat for wildfire was outdoor recreational activities with an average falling between somewhat agree and neither agree nor disagree (mean = 2.34; std. dev. 1.23).

Note that community members generally did not perceive controlled burning to be a threat overall. All averages for each variable were above 3 or "neither agree nor disagree" indicating that no variable was perceived as an outstanding threat. However, a separate question (from matrix questions) asked if respondents believed that smoke from controlled burning was as bad as smoke from wildfire. Respondents generally agreeded that it was, with the mean calculated to be 2.53 (std. dev. = 1.32). The average for the in-matrix question - *I consider controlled burning to be a threat to air quality* - was calculated to be 3.05 (std. dev = 1.36). This may indicate that while air quality, due to smoke, might be as bad during all active fire event (wildfire or controlled burning), people perceive smoke from controlled burning to be a less of a threat because they are better able to prepare for reduced air quality and perceive the event to be less threatening overall.

Table 2: Descriptive variables used for model 1 and 2 regression response variables

Variable	Description and code	Wildfire			Controlled burning		
Threat variables	Five-point Likert scale, where 1 = strongly agree to 5 = strongly disagree:	Mean	Std. Dev	N	Mean	Std. Dev	N
My safety	I consider wildfire* to be a threat to my safety	3.06	1.44	137	4.16	1.10	135
My community's safety	I consider wildfire* to be a threat to my community's safety	2.63	1.31	137	4.10	1.16	136
My property	I consider wildfire* to be a threat to my property	3.04	1.44	135	4.15	1.16	136
My community's property	I consider wildfire* to be a threat to my community's property	2.56	1.30	136	4.04	1.20	136
My health	I consider wildfire* to be a threat to my health	2.66	1.41	135	3.73	1.34	136
My community's health	I consider wildfire* to be a threat to my community's health	2.50	1.30	135	3.67	1.36	136
Local economy	I consider wildfire* to be a threat to local economy	2.70	1.29	136	3.81	1.26	136
Tourism	I consider wildfire* to be a threat to tourism	2.52	1.31	136	3.68	1.32	136
Water quality	I consider wildfire* to be a threat to water quality	2.56	1.19	135	3.69	1.31	134
Air quality	I consider wildfire* to be a threat to air quality	1.97	1.09	135	3.05	1.36	133
Wildlife	I consider wildfire* to be a threat to wildlife	2.54	1.22	134	3.59	1.31	133
Forest health	I consider wildfire* to be a threat to forest health	3.14	1.42	135	4.01	1.17	134
Outdoor recreation opportunities (hiking, camping)	I consider wildfire* to be a threat to outdoor recreation opportunities	2.34	1.23	136	3.49	1.38	133
The natural beauty of the forest	I consider wildfire* to be a threat to the natural beauty of the forest	2.60	1.39	136	3.54	1.40	132

* *question also asked for controlled burning*

Table 3: Descriptive statistics for explanatory variables used in regression models

Variable	Description and Code	Mean	Std. Dev.	N
Believe wildfire is natural	Respondent belief that wildfire is a natural part of the balance of a healthy forest/ecosystem: Five-point Likert scale, where 1 = strongly agree to 5 = strongly disagree	1.74	0.92	143
Wildfire risk to residence	Respondent's concern that their residence is at risk for wildfire damage within the next 10 years: Five-point Likert scale, where, 1 = not at all; 2 = slightly; 3 = moderately; 4 = very; 5 = extremely	1.56	0.96	145
Variable	Description and Code	Percent respondent distribution		
Years lived in Morganton	How many years respondent has lived in Morganton: 0 = less than 20 years; 1 = more than 20 years	less than 20 years = 49.03%; more than 20 years = 50.97%		
Distance to wildfire	How close a wildfire has come to respondent's residence: 0 = farther than 10 miles; 1 = within 10 miles	within 10 miles = 53.34%; farther than 10 miles = 46.67%		

5.2.3 Multiple Linear Regressions

Models 1 and 2 evaluate overall threat perceptions of wildfire and controlled burning via their respective calculated explanatory variables as described in section 4.5. Response variables fell on a scale from 1 (strongly agree that wildfire/controlled burning is a threat) to 5 (strongly disagree that wildfire/controlled burning is a threat).

Table 4: Variable coefficients for community perceptions of wildfire threat perceptions model

Model 1: Perceptions of wildfire threats OLS					
Variable	Coefficient	Std. Error.	t value	P-value	Reference
Believe wildfire is natural	-0.437	0.085	-5.11	0.000***	
Gender (female)	-0.268	0.170	-1.58	0.118	
Political Affiliation					Republican
Democrat	-0.195	0.224	-0.87	0.385	
Independent	-0.198	0.232	-0.85	0.397	
Unaffiliated	-0.289	0.251	-1.15	0.252	
Prefer not to say	-0.933	0.264	-3.53	0.001***	
Age	0.006	0.006	0.91	0.363	
Years lived in Morganton (> 20 years)	-0.011	0.162	-0.07	0.943	< 20 years
Residence distance from wildfire (< 10 miles)	-0.177	0.161	-1.10	0.274	> 10 miles
Wildfire risk to residence	-0.349	0.093	-3.75	0.000***	
Education (4-year degree + professional degree + doctorate)	0.118	0.175	0.68	0.500	< 4-year degree
_cons	4.030	0.449	8.99	0.000	
Number of observations	119				
F (17, 101)	6.93				
P-value	0.000				
Adjusted R^2	0.356				

***** significant at p < .01; ** significant at p < .05; * significant at p < .10**

A multiple linear regression was used to explain community perceptions of wildfire threats based on belief that wildfire is natural, gender, political affiliation, age, years lived in Morganton, residence distance from wildfire, perceived wildfire risk to residence, and education. The model was statistically significant with an $F(17, 101) = 6.93$ and p-value < 0.001 and an adjusted R^2 value = 0.365.

Holding all other variables in the model constant, belief that wildfire is natural was a statistically significant predictor ($p < 0.001$) of wildfire threat perceptions. Belief that wildfire is natural had a negative correlation with wildfire threat perceptions showing that with every one unit increase

in wildfire threat perceptions, there was a 0.437 decrease in belief that wildfire is natural. This demonstrates that the less respondents believe that wildfire is natural, the more they perceived wildfire to be an overall threat.

Holding all other variables in the model constant, political affiliation was a predictor of wildfire threats. When compared to the majority group, Republicans, those who prefer not to reveal their political leanings had a statistically significant ($p = .001$) negative correlation with wildfire threat perceptions. On average, the prefer not to say group perceives wildfire as more of a threat by -0.933 units as compared to Republicans, holding covariates constant. This demonstrates that the prefer not to say group perceived wildfire to be a greater overall threat.

Holding all other variables in the model constant, wildfire risk to residence was a statistically significant predictor ($p < 0.001$) of perceived wildfire threats. For every one unit increase in wildfire threat perceptions there was a 0.349 decrease in predicted perceived wildfire risk to residence over ten years. This demonstrates that the more people perceive their home to be at risk for wildfire damage over the next ten years, the more they perceive wildfire to be an overall threat.

The remaining variables included in the model were not statistically significant predictors of wildfire threat perceptions.

Table 5: Variable coefficients for community perceptions of controlled burning threats model

Model 2: Perceptions of controlled burning threats OLS					
Variable	Coefficient	Std. Error.	t value	P-value	Reference
Believe wildfire is natural	-0.447	0.098	-4.54	0.000***	
Gender (female)	-0.126	0.195	-0.64	0.522	Male
Political Affiliation					Republican
Democrat	-0.550	0.258	-2.13	0.035**	
Independent	-0.422	0.268	-1.58	0.118	
Unaffiliated	-0.352	0.290	-1.22	0.226	
Prefer not to say	-0.711	0.304	-2.34	0.021**	
Age	0.001	0.007	0.18	0.855	
Years lived in Morganton (> 20 years)	-0.349	0.186	-1.87	0.064*	< 20 years
Residence distance from wildfire (< 10 miles)	-0.086	0.186	-0.46	0.644	> 10 miles
Education (4-year degree + professional degree + doctorate)	0.024	0.201	0.12	0.905	< 4-year degree
Wildfire risk to residence	0.003	0.107	0.02	0.980	
_cons	4.626	0.486	9.51	0.000	
Number of observations	119				
F (13, 105)	3.92				
P-value	0.000				
Adjusted R^2	0.214				

***** significant at p < .01; ** significant at p < .05; * significant at p < .10**

A multiple linear regression was used to explain community perceptions of controlled burning threats based on belief that wildfire is natural, gender, political affiliation, age, years lived in Morganton, residence distance from wildfire, perceived wildfire risk to residence, and education. The model was statistically significant with an $F(13, 105) = 3.92$ and p-value < 0.001 and an adjusted R^2 value = 0.214.

Holding all other variables in the model constant, belief that wildfire is natural was a statistically significant predictor ($p < 0.001$) of wildfire threat perceptions. Belief that wildfire is natural had a negative association with controlled burning threat perceptions showing that with every one unit increase in wildfire threat perceptions, there is a 0.447 decrease in belief that wildfire is

natural. This demonstrates that the less respondents believe that wildfire is natural, the more they perceived controlled burning to be an overall threat.

Holding all other variables in the model constant, political affiliation was a predictor of controlled burning threats. When compared to the majority group, Republicans, those who prefer not to reveal their political leanings had a statistically significant ($p = .021$) negative correlation with controlled burning threat perceptions. On average, prefer not to say group perceives wildfire as more of a threat by 0.711 units as compared to Republicans. Furthermore, Democrats had a statistically significant ($p = .035$) negative correlation with controlled burning threat perceptions. On average, Democrats perceive wildfire as more of a threat by 0.550 units as compared to Republicans. These results demonstrate that the prefer not to say group and Democrats perceive controlled burning to be a greater overall threat as compared to Republicans.

Holding all other variables in the model constant, years lived in Morganton was a statistically significant predictor ($p = 0.064$) of perceived controlled burn threats. For every one unit increase in controlled burning threat perceptions there was a 0.349 unit decrease in those who have lived in Morganton 20 years or more as compared to those who have lived in Morganton less than 20 years. This demonstrates that people living in Morganton for a longer period of time (20 years or more) perceive controlled burning to be a greater threat than those who have lived there a shorter period of time.

5.2.3 Ordinal Logistic Regression

Model 3 was developed using the following question as the response variable: *Controlled burning can improve the beauty of North Carolina forests*. The question was presented to all survey respondents after informational vignettes (section 4.3) to understand if perceptions of controlled burning could be changed through messaging. The response variable was measured ordinally on a Likert scale with 1 = strongly agree, 2 = somewhat agree, 3 = neither agree nor disagree, 4 = somewhat disagree, and 5 = strongly disagree.

Table 6: Variable coefficients for community perceptions that controlled burning can be improved

Model 3: Post-Vignette "Controlled burning can improve beauty of the forest" Ologit					
Variable	Coefficient	Std. Error.	z value	P-value	Reference
Believe that wildfire is part of natural balance	0.917	0.234	3.92	0.000*	
Gender (female)	0.338	0.403	0.84	0.402	Male
Political Affiliation					Republican
Democrat	0.104	0.570	0.18	0.855	
Independent	0.781	0.591	1.32	0.187	
Unaffiliated	0.330	0.610	0.54	0.589	
Prefer not to say	2.220	0.641	3.47	0.001***	
Age	-0.010	0.016	-0.65	0.514	
Education (4-year degree + professional degree + doctorate)	-0.122	0.423	-0.29	0.773	< 4-year degree
Vignette					Control
Scientific	0.074	0.465	0.16	0.872	
Personal Narrative	-0.979	0.491	-1.99	0.046**	
Years lived in Morganton (> 20 years)	0.223	0.400	0.56	0.577	< 20 years
Number of observations	118				
LR chi2 (13)	39.64				
P-value	0.000				
Psuedo R^2	0.140				

***** significant at p < .01; ** significant at p < .05; * significant at p < .10**

An ordered logistic regression was used to understand if perceptions of controlled burning could be changed through messaging using the following variables: belief that wildfire is natural, gender, political affiliation, age, years lived in Morganton, informational vignettes, and education. The model was statistically significant with an LR Chi2(13) = 39.64 and p-value < 0.001 and Psuedo R^2 value = 0.140.

Holding all other variables in the model constant, belief that wildfire is natural was a statistically significant predictor ($p < 0.001$) of belief that controlled burning can improve the beauty of NC forests. The odds ratio of moving from a higher-level belief that controlled burning can improve forest beauty to a lower-level of belief increased by a factor of .917 for belief that wildfire is

natural. This demonstrates that the less respondents believe that wildfire is natural, the less they will believe that controlled burning can improve forest beauty, holding other factors constant.

Holding all other variables in the model constant, political affiliation was a statistically significant predictor for the belief that controlled burning can improve the beauty of forests. The odds ratio of moving from a higher-level belief that controlled burning can improve forest beauty to a lower-level of belief increased by a factor of 2.220 for those who prefer not to reveal their political leaning as compared to Republicans ($p = 0.001$). This demonstrates that the prefer not to say politically affiliated group are less inclined to believe that controlled burning can improve forest beauty as compared Republicans.

Holding all other variables in the model constant, the personal narrative vignette was a statistically significant predictor ($p = 0.046$) for the belief that controlled burning can improve the beauty of forests. The odds ratio of moving from a higher-level of belief that controlled burning can improve forest beauty to a lower-level of belief decreased by a factor of 0.979. This demonstrates that people who received the personal narrative vignette were more inclined to believe that controlled burning can improve forest beauty as compared to the control.

5.2.4 Information pathways for wildfire and controlled burning

The survey instrument also asked where respondents had received information about wildfire and controlled burning. Results showed that information pathways were similar between wildfire and controlled burning. The majority (%) of people received information from media (newspaper, TV, radio, social) but was followed by the NC State Forest Service and then US Forest Service. This information can be used to effectively disseminate information for communication and messaging strategies regarding wildfire and controlled burning.

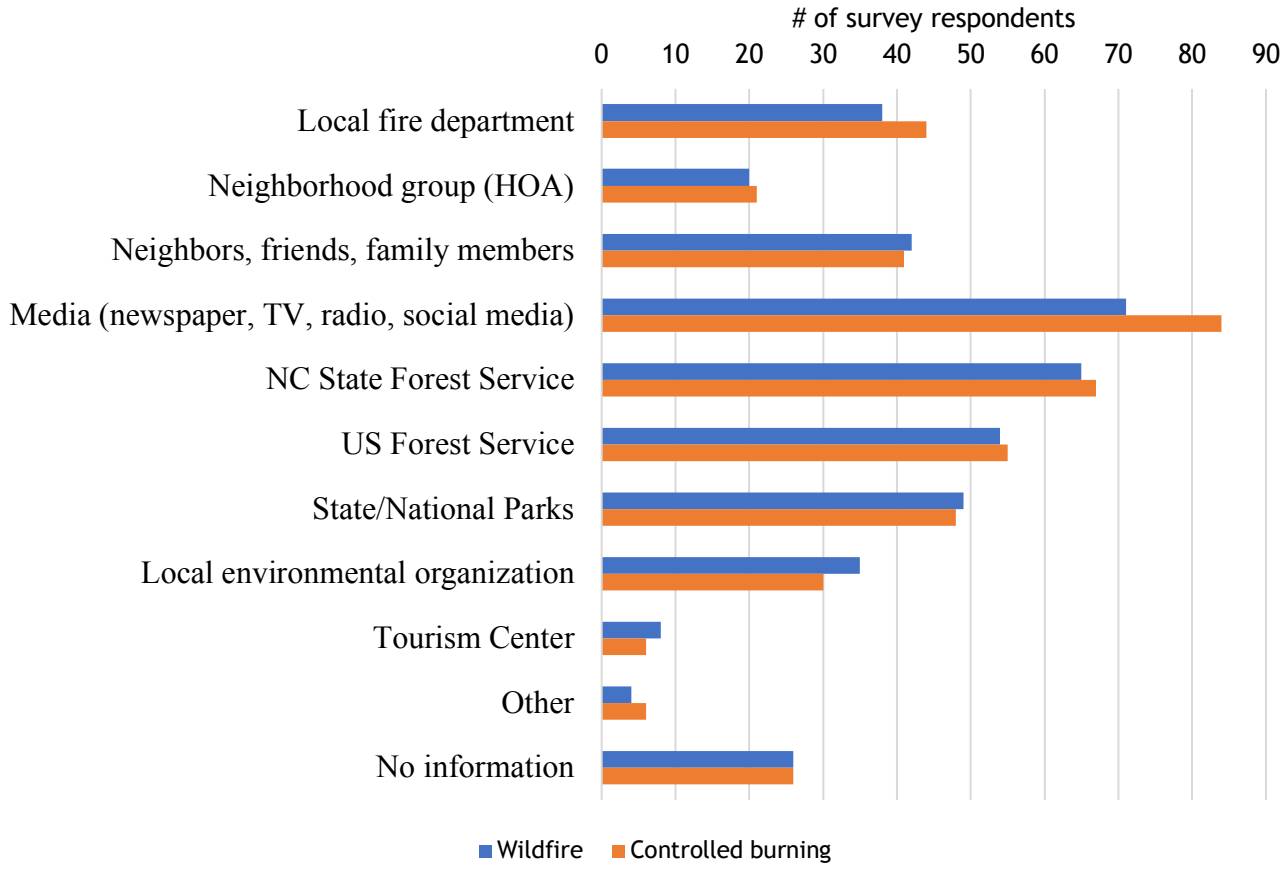

Figure 7: Bar graph of respondent information sources about wildfire and controlled burning

6. DISCUSSION

6.1 RESULTS

Based on the results of all models, it was determined that community perceptions of wildfire and controlled burning rely heavily on people's belief that fire is a natural part of the ecosystem. This was demonstrated consistently in all three regressions, suggesting that the more people believe that fire is natural, the less of a threat they perceive wildfire and controlled burning to be. If wildfire and controlled burning events increase in frequency around this community, focusing on the fundamental belief that fire is a natural part of the ecosystem, will be key in addressing threat perceptions and discomfort living with fire.

Community perceptions of wildfire and controlled burning may be impacted by political affiliation. In all models, we saw statistical significance for the "prefer not say" politically affiliated group when compared to the majority group, Republicans. Those in the 'prefer not to say' group perceived wildfire and controlled burning to be more of a threat and generally reflected anti-fire beliefs. While it is difficult to determine who exactly this group consists of, it may be that those who were uncomfortable with revealing their political affiliation are also those who are distrustful of groups that might represent authoritative power (i.e. Duke University or TNC), particularly for forest management activities. If this is the case, communication efforts might be focused on improving interactions and relationships between fire/forest management practitioners and the impacted community. Model 2 also showed statistical significance for Democrats when compared to Republicans. Democrats perceived controlled burning to be a greater threat than Republicans, holding covariates constant. Reasons for this also cannot fully be determined from the results of this survey. However, adjusting the survey in the future to better understand forest values and use in surrounding communities and adjusting the survey to account for more nuanced issues surrounding controlled burning (see section 7.0) may help to understand these differences more fully.

Model 1 also found that community perceptions of wildfire threat also rely on people's perceived wildfire risk to their residence over the next ten years. It was demonstrated that the more that people perceive risk to their residence, the more that they perceive wildfire as an overall threat. As people continue to move into the mountains and/or forests, this problem will likely be exacerbated. However, it should be encouraging that community and wildfire intervention programs have already been established to help community members reduce their residence's wildfire risk (i.e. Firewise USA 2018). If community members are able to prepare their homes in a way that reduces their risk perception, they might perceive wildfire as a lesser threat overall, increasing comfort with wildfire and improving fire-adaptedness.

Model 2 demonstrates that community perceptions of controlled burning threats may also rely on how many years respondents lived in Morganton. Those who lived in Morganton for 20 years or more, perceived controlled burning to be a greater threat than those who lived in Morganton less than 20 years. This trend may be due to increased controlled burning management activities over

the past 20 years. It may be possible that if people who are native to Morganton have observed increases in controlled burning activities over the last 20 years and they may be distrustful of why those practices are being used at higher rates. This would be in comparison to those who are considered transplants into the community and have only experienced the intensified level of management activities, perceiving them as common and unchanged.

The last regression suggests that perceptions of controlled burning may be changed due to effective and targeted messaging. We observed marginal significance for vignette 2, the personal narrative, as compared to the control group. This vignette was written in the voice of a local community member and included site-specific references. Results may suggest that people are more trusting of experiences and viewpoints from internal members of their community. Messaging effectiveness might be improved if it is site-specific and is inclusive of opinions of internal community members.

Survey respondents received information from media (newspaper, TV, radio, social) but was followed by the NC State Forest Service and then US Forest Service. Moving forward, this information should be considered when distributing information to the Morganton, NC community.

6.2 LIMITATIONS

Coverage error: The results of this survey are subject to coverage error. Coverage error is the "the degree to which statistics are off due to the fact that the sample used does not properly represent the underlying population being measured" (Stanley 2011). For this study, coverage error includes the remaining portions of the Morganton, NC population that the survey did not reach.

The community in which this study was employed was largely rural and several people informed me that not all geographic regions had internet access. Many of those regions were located in the mountains and might have been areas that were most impacted by wildfire and controlled burning events. The survey sampling mode was web-based and it is possible that many potential

respondents did not have access to the internet or did not use it with a consistency in which they would receive or see the survey.

There was further potential for respondent exclusion based on the pathways used for survey distribution. The survey was distributed via community e-mails and through local citizens who agreed to distribute the survey on my behalf. Those who distributed were citizens that were, on some level, comfortable aligning themselves with a survey produced from TNC and Duke University. Also, people that were comfortable aligning themselves with the topic of wildfire and controlled burning, an otherwise contentious topic in the community. Their personal networks may have also been people that had similar alignments, therefore not reaching as many different viewpoints as possible.

It is also important to note that while the Morganton population is predominately white (see section 4.1), there was a large Hispanic population. We did not develop a Spanish version of the survey for the purposes of this pilot project and thus potentially excluded a portion of the community. See recommendations for a discussion of adjustments to be made for future studies using this research instrument.

Nonresponse error: The results of this survey are subject to nonresponse error. Nonresponse error may occur if someone does not respond to a survey for reasons including unavailability or unwillingness (Miller 2018). This type of error may occur in a web-based survey when community members received the survey link, but did not choose to participate in the study. Furthermore, approximately 19.7% of respondents began the survey but did not complete it which is another example of nonresponse error. Several respondents skipped certain questions which in some cases appeared through the survey at random, but most consistently occurred throughout demographic questions. It is also possible that in some cases, one person responded the survey on behalf of their household or family, regardless of other adults residing there, excluding potential respondents.

Sampling & Self-selection error: The results of this survey are subject to sampling error. This refers to the "possible error that stems solely from the fact that data are collected from a sample

rather than from every single member of the population" (Fowler 2017, pg. 10). As previously discussed, pathways for survey distribution may have been biased therefore resulting in a less-accurate sample of the wider community. Proof of this error might be found in the demographic coverage of our survey compared to that of census data. As discussed in the results section, respondents were generally more educated, older, and had a higher income than the average Morganton adult. Respondents were also primarily male and white compared to the distribution of gender and race in Morganton census data. This may also be indicative of self-selection error or bias. This occurs when respondents are given entire freedom to determine if they want to participate in the survey or not (Sage Research Methods 2008). Those who feel very strongly for or against fire may have been more inclined to participate in the study versus those who have less of a strong opinion.

7. CONCLUSIONS & RECOMMENDATIONS

This study aimed to understand community perceptions of the role of fire, community perceptions of wildfire and controlled burning threats, the variables that might explain them, and whether perceptions of controlled burning can be affected by messaging. Results show that survey respondents perceived fire to be beneficial for North Carolina forests. Survey respondents generally perceived wildfire to be an overall threat while they generally did not perceive controlled burning to be an overall threat. Political alignment, perceived wildfire risk to personal residence within ten years, and belief that wildfire is a natural part of the ecosystem were found to be statistically significant predictors of wildfire threat perceptions. Political alignment, years lived in Morganton, and the belief that wildfire is a natural part of the ecosystem were found to be statistically significant predictors of controlled burning threat perceptions. Perceptions of controlled burning may also be changed due to effective and targeted messaging.

This survey was also conducted as a pilot study and may be replicated or implemented across a broader spatial scale in the future. If replicated, I have provided recommendations that should be considered to enhance effectiveness, robustness, and efficiency of data collection.

Survey mode should be chosen based on prior analysis of target demographics. In rural communities, it is possible that certain regions do not have access to internet and therefore are automatically excluded from sampling. In these cases, it may be more appropriate to use a mail survey or intercept survey. This also will allow the researcher to manage survey distribution geographically more effectively. Mail survey sampling procedures can ensure there is at least a strong attempt to achieve appropriate spatial coverage across a community.

Further, it is important to cater effectively to the language needs of the larger community. In the case of Morganton, NC, the Hispanic population was significant. It came highly recommended from focus group participants to develop a Spanish version of the survey instrument to include those who do not speak English as their primary language. Due to resource constraints, we did not do this as part of the pilot study. However, in the future language needs should be a consideration when trying to survey a wider community and sampling procedures should offer translation services.

I also recommend adjusting the survey instrument to account for more nuanced issues and perceptions around controlled burning. Qualitative information gathered through networking, interaction with the community, and comments on the survey instrument led me to believe that people might not understand the processes of controlled burning. For example, several people expressed that they weren't not necessarily against controlled burning but did not understand why certain areas were burned more than once. Further understanding of this gap in community perceptions and education may also help to bridge communication gaps between forest management practices and community acceptance of fire.

The survey could also be adjusted to better address what community members value most about the forests that surround them or use of the forest. For example, the survey asked if respondents considered wildfire or controlled burning to be a threat to wildlife. Separately, we asked if people considered wildfire or controlled burning to be a threat to outdoor recreation opportunities. However, we did not distinguish between activities such as hunting or birdwatching for either variable. Forest use might differ amongst groups of people (i.e. political affiliation, gender, etc). Understanding uses might better inform effective messaging strategies.

I recommend gathering more visual messaging content to use for communication about fire. Focus group results suggested that photo and/or video time-lapse content for site-specific regions may be one of the most effective communication strategies for people in their community. Before and after content (for wildfire and/or controlled burning) may be an incredible useful tool to emphasize the benefits of fire in southeastern ecosystems for aesthetics and forest health.

Lastly, it will be important to consider timing when conducting research around contentious topics like fire. Time elapsed from the last wildfire event and/or last controlled burning event may influence respondent perceptions/opinions. If burning is conducted during the sampling time frame, it may skew results accordingly. Further, if sampling is conducted too far from a fire event, threat perceptions may be skewed towards complacency and not provide deeper insight into effective messaging strategies.

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9. APPENDIX

A. RECRUITMENT E-MAIL

A Duke University graduate student is conducting a study in collaboration with The Nature Conservancy on community perceptions of wildfire and controlled burning in Morganton, NC. Participants are needed for a focus group. The focus group will inform the design of a survey that will be distributed later in the year.

The focus group will be held on Monday, October 30th, at 6:00 pm, and it should take approximately two hours. This is a crucial step to ensure that the views of Morganton, NC, community members are most accurately represented, and your participation would be greatly appreciated. Participants should be permanent residents of Morganton and 18 years of age or older.

Participants will receive a $25 VISA gift card, light dinner, and non-alcoholic drinks. If you are interested in participating, please click here or on the link below to fill out the participant survey. If you are chosen to participate, you will be contacted separately with the location of the focus group. For more information, please contact Kathryn Gaasch at kg169@duke.edu.

Link to participant survey:
https://duke.qualtrics.com/jfe/form/SV_5bEitW8ZzWFCj7T

B. RECRUITMENT FLYER

The Nature Conservancy
nature.org

Duke
NICHOLAS SCHOOL OF THE ENVIRONMENT

PARTICIPANTS NEEDED FOR RESEARCH STUDY

A Duke University graduate student is conducting a study in collaboration with The Nature Conservancy on community perceptions of wildfire and controlled burning in Morganton, NC. Participants are needed for a 2-hour focus group.

ELIGIBILITY: Participants must be permanent residents of Morganton, NC and 18 years of age or older.

IF INTERESTED: Fill out the following survey: **http://bit.ly/2hBZK9r**

WHEN: Monday, October 30th (if you are selected to participate, you will be provided with the location and time)

COMPENSATION: Each participant will be provided with a $25 VISA gift card in addition to light food and drinks

CONTACT: Kathryn Gaasch at kg169@duke.edu
IRB: 2018-0066

Participant Survey: http://bit.ly/2hBZK9r
Contact: kg169@duke.edu

C. Focus Group Intake Survey

The purpose of this survey is to identify participants for a focus group that will address community perceptions of wildfire and controlled burning. The focus group will be a group discussion of participants' experience with fire and how they think of the risks/benefits of fire. Information gathered will be used to inform the design of a survey.

The focus group is being held on October 30th, 2017 from 6:00pm-8:00pm in Morganton, NC. Participants will be given a $25 VISA gift card for their time, in addition to light dinner and non-alcoholic drinks.

This study is being conducted by a graduate student at Duke University in collaboration with The Nature Conservancy (TNC). Responses will be confidential and are completely voluntary. You may skip any questions you prefer not to answer or end the survey at any time by closing your browser. This survey will take approximately 5 minutes to complete.
If you have any questions, please feel free to contact Kathryn Gaasch at Duke University: kathryn.gaasch@duke.edu

What is your zip code?

_____

Did you live in Morganton, NC in the fall of 2016?
Yes
No

What is your age?

_____

Skip To: End of Survey If What is your age? < 18

What is your gender?

Male

Female

Prefer not to say

What is the highest level of school you have completed or the highest degree you have received?

Less than high school

High school graduate

Some college

2 year degree

4 year degree

Professional degree

Doctorate

Prefer not to say

What is your average annual household income?

Less than $20,000

$20,000 to $34,999

$35,000 to $49,999

$50,000 to $74,999

$75,000 to $99,999

$100,000 to $149,999

$150,000 or more

Prefer not to say

What is your ethnicity? (check all that apply)

American Indian or Alaska Native

Asian

Black or African American

Native Hawaiian or Other Pacific Islander

White (Not Hispanic of Latino)

Hispanic or Latino (All Races)

Other

In general, how would you describe your political affiliation?

Republican

Democrat

Independent

Unaffiliated

Prefer not to say

Are you available to participate in a focus group on October 30th from 6:00pm-8:00pm in Morganton, NC?

Yes

Maybe

No

What is your e-mail?

_____

End of Block: Default Question Block

D. FOCUS GROUP GUIDE/QUESTIONS

WILDFIRE

When you think of wildfires, what comes to mind?

What have your experiences been with wildfires?

In your experiences, what do you think are the impacts of a wildfire, broadly?

- Impacts forest ecosystems
- Impacts human health
- Impacts human safety
- Impacts human property
- Impacts local economy
- Impacts communities
- Impact water quality
- Impact air quality
- Impact wildlife

Were you impacted by the 2016 western North Carolina wildfires?

Personally (ex: house wasn't burnt, but road was closed, schools were closed)

- Neighborhood
- Community

How were you impacted by the 2016 western North Carolina wildfires?

Do you consider wildfire to be a threat? In what ways?

- Impacts forest ecosystems
- Impacts human health
- Impacts human safety

Impacts human property
Impacts local economy
Impacts communities
Impact water quality
Impact air quality
Impact wildlife

Have you received information about wildfire? Who did you receive that information from?

Were you satisfied with the information received? Was it adequate for your/communities needs?

Who should be responsible for distributing information about wildfire?

How would you like to receive that information?

CONTROLLED BURNING

Are you familiar with the concept of prescribed fire or controlled burning?
Prescribed or controlled burning is a technique sometimes used in forest management, farming, or prairie restoration. Controlled burning stimulates the germination of some forest trees. It is also used to reduce fuel buildup and decrease the likelihood of serious fires

What are your general perceptions of prescribed fire/controlled burning?

Do you see any benefits to prescribed fire/controlled burning?

Do you see any risks to prescribed fire/controlled burning?

Have you received information about wildfire? Who did you receive that information from?

Were you satisfied with the information received? Was it adequate for your/communities needs?

Who should be responsible for distributing information about wildfire?

How would you like to receive that information?

Is there anything else we didn't talk about that you feel is important for us/me to know?

E. Consent Form

You have been selected to participate in a focus group hosted by a Duke University student working in collaboration with The Nature Conservancy. The purpose of this discussion is to obtain your insights, opinions, and perceptions of wildfire and controlled burning in western North Carolina. The information will be used to inform the design of a pilot survey that will explore larger community perceptions of fire and test initial communication methodologies about fire in western North Carolina.

The discussion will take approximately 2 hours. During this discussion, you will be asked to share your opinions and perceptions; there are no right or wrong answers.

In order to ensure your privacy, only first names will be utilized during this discussion and there will be no personal information associated with any information obtained from this focus group. If all group members consent, the discussion will be audio recorded. The recording will be used by the students to summarize the meeting and for reference during survey design. As soon as the summary and survey design is finished, the recording will be erased. Only my advisor, Elizabeth Albright, and I will have access to the recording.

You will be compensated $25 for your participation here today.

Your participation in this focus group is entirely voluntary. You may decline to answer any question and you may leave at any time. If you have any questions or concerns regarding this discussion please ask now or at any time during or after the discussion. You can contact me later at kathryn.gaasch@duke.edu. You may also contact Duke University Professor Elizabeth Albright at elizabeth.albright@duke.edu.

I agree to participate in this focus group and to be audio recorded. I understand that I will receive a copy of this consent form for my records.

_____

Print name

_____ _____

Signature Date

F. SURVEY INSTRUMENT

MP Survey - Wildfire & Controlled Burning - 1.23.17 Final

This study is being conducted by a graduate student at Duke University in collaboration with The Nature Conservancy (TNC). The purpose of the survey is to gather information about community perceptions of wildfire and controlled burning. This survey will take about 10-12 minutes. Responses will be confidential and are completely voluntary. You may skip any questions you prefer not to answer or end the survey at any time by closing your browser.

If you have any questions, please feel free to contact Kathryn Gaasch at Duke University: kathryn.gaasch@duke.edu

If you have questions regarding your rights as a participant, any concerns regarding this project or any dissatisfaction with any aspect of this study, you may report them -- confidentially, if you wish -- to the Office of Research Support at Duke University, Suite 710 Erwin Square, 2200 W. Main Street, Durham, NC 27705, (919) 684-3030 or campusirb@duke.edu using IRB Reference Number: 2018-0066. Do you agree to participate in this study?
Yes
No

Skip To: End of Survey If This study is being conducted by a graduate student at Duke University in collaboration with The... = No

How many years have you lived in the Morganton area?
Less than 1 year
1 to 5 years
6 to 10 years
11 to 20 years

More than 20 years

What is the closest distance (the way a crow flies) a **wildfire** has come to your current Morganton area residence?

There has been a wildfire on your property

2 to 10 miles away

More than 10 miles away

Unsure

Has your current Morganton area residence ever been damaged by a **wildfire** or affected by smoke from a wildfire?

No

Yes, your current residence suffered only smoke damage

Yes, your current resident suffered fire and smoke damage

Have you ever evacuated from your current residence due to a **wildfire** or threat of a **wildfire**?

Yes

No

Have you ever owned a home (in NC or elsewhere), other than your current residence, that was located in an area at risk of **wildfire**?

Yes

No

Unsure

Do you know anyone (in NC or elsewhere) who has been evacuated from their home due to a **wildfire**?

Yes

No

Unsure

Do you know anyone whose home (in NC or elsewhere) has been damaged or lost due to a **wildfire**?

Yes

No

Unsure

Do you own or rent your current residence?

Own

Rent

Other _____

How many months per year do you live at your Morganton, NC residence?

_____

Is your Morganton area residence your primary residence?

Yes

No

To what extent do you agree or disagree with the following statements about **fire (wildfire or controlled burning)**?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Unsure
Fire is beneficial to some of North Carolina's native plants and trees.						
Fire is not necessary to maintain a natural balance in North Carolina's ecosystems.						

Fire is beneficial for wildlife habitat.
Some plants and animals benefit from fire.
Fire is dangerous and has no role in North Carolina forests.

How aware of **wildfire** risk were you when decided to buy or rent your current residence?

Not aware

Somewhat aware

Very aware

Don't remember

How would you rate your current residence's **wildfire** risk?

Low

Moderate

High

Very high

Extreme

Unsure

Are you concerned about **wildfire** affecting your current residence in the next 10 years?

Not at all

Slightly

Moderately

Very

Extremely

How much do you agree or disagree with the following statement:

Wildfires are a natural part of the balance of a healthy forest/ecosystem.

Strongly agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Strongly disagree

Unsure

How much do you agree or disagree with the following statement:

Wildfires should always be put out.

Strongly agree
Somewhat agree
Neither agree nor disagree
Somewhat disagree
Strongly disagree
Unsure

How much do you agree or disagree with the following statement:

Wildfires that threaten human life should always be put out.
Strongly agree
Somewhat agree
Neither agree nor disagree
Somewhat disagree
Strongly disagree
Unsure

How much do you agree or disagree with the following statement:

Wildfires that threaten personal property should always be put out.
Strongly agree
Somewhat agree
Neither agree nor disagree
Somewhat disagree
Strongly disagree
Unsure

How much do you agree or disagree with the following statements?

"I consider **wildfire** to be a threat to..."

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Unsure
My safety						
My community's safety						
My property						
My community's property						
My health						
My community's health						
Local economy						
Tourism						
Water quality						
Air quality						
Wildlife						

Forest health
Outdoor recreation opportunities (hiking, camping)
The natural beauty of the forest

Have you seen or heard the term controlled burning?

Yes

No

Unsure

Skip To: End of Block If Have you seen or heard the term controlled burning? = No

How much do you agree or disagree with the following statements

"I consider **controlled burns** to be a threat to..."

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Unsure

My safety	
My community's safety	
My property	

My community's property	
My health	
My community's health	
Local economy	
Tourism	

Water quality	
Air Quality	
Wildlife	

Forest health	
Outdoor recreation opportunities (hiking, camping)	
The natural beauty of the forest	

Controlled burning is effective in preventing future wildfires.

Strongly agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Strongly disagree

Unsure

Smoke from **controlled burning** is as much a threat to public health as smoke from **wildfires**.

Strongly agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Strongly disagree

Unsure

The risks of **controlled burning** outweigh the benefits.

Strongly agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Strongly disagree

Unsure

Some plants and animals benefit from **controlled burning.**

Strongly agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Strongly disagree

Unsure

Who have you received information from about **wildfire** or **controlled burning**? (check all that apply)

	Wildfire	Controlled burn
Local fire department		
Neighborhood group (HOA)		
Neighbors, friends, family members		
Media (newspaper, TV, radio, social media)		
NC State Forest Service		
US Forest Service		

State/National Parks

Local environmental organization

Tourism Center

Other

I have not received any information

Start of Block: Vignette 1

Controlled burning is used in North Carolina for several reasons including reducing wildfire risk, improving forest health and functioning, and promoting the growth of native plants. Research shows that without fire, dead trees, leaf litter and pine needles build up on forest floors, blocking new vegetative growth. Scientists have demonstrated that controlled burning consumes deadwood and shrubby understory but typically does not harm big fire-adapted oaks and pines. Studies show that when controlled burning clears the forest floor, new plants like Heller's Blazing Star, Trillium, and Jack-in-the-pulpit will emerge. Continue to the next page for follow-up questions.

End of Block: Vignette 1

Start of Block: Vignette 2

Controlled burning is used in North Carolina for several reasons including reducing wildfire risk, improving forest health and functioning, and promoting the growth of native plants. Dan

Howard, resident of western North Carolina, has hiked around Linville Gorge almost every Sunday for the past 5 years. This is his experience with controlled burning… "I've noticed that when certain areas go years without a fire, lots of dead plants pile up on the forest floor. There's not many flowers, not even much sunlight. After a controlled burn, it's pretty desolate. It can look a bit like a moonscape. But a few months after that? Things really start to green up and bloom. You see flowers like Heller's Blazing Star, Trillium, and Jack-in-the-pulpit. I hadn't seen some of those in years." Continue to the next page for follow-up questions.

End of Block: Vignette 2

Start of Block: Vignette 3

Controlled burning is used in North Carolina for several reasons including reducing wildfire risk, improving forest health and functioning, and promoting the growth of native plants. Continue to the next page for follow-up questions.

End of Block: Vignette 3

Controlled burning can improve the beauty of North Carolina forests.
Strongly agree
Somewhat agree
Neither agree nor disagree
Somewhat disagree
Strongly disagree
Unsure

The risks of **controlled burning** outweigh the benefits.

Strongly agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Strongly disagree

Unsure

Controlled burning helps to balance a healthy forest/ecosystem

Strongly agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Strongly disagree

Unsure

Controlled burning will ultimately keep tourists from visiting the Morganton, NC area

Strongly agree

Somewhat agree

Neither agree nor disagree

Somewhat disagree

Strongly disagree

Unsure

How would you describe your Morganton, NC area residence?

Mobile home

Single-family home

Multi-family dwelling (townhouse, apartment, condo)

Other _____

What is your zipcode?

_____

What is your race? (check all that apply)

American Indian or Alaska Native

Asian

Black or African American

Native Hawaiian or Other Pacific Islander

White (Not Hispanic or Latino)

Hispanic or Latino (All Races)

Other _____

What is your age?

_____

What is your gender?

Male

Female

Prefer not to say

What is the highest level of school you have completed or the highest degree you have received?

Less than high school

High school graduate

Some college

2 year degree

4 year degree

Professional degree

Doctorate

Prefer not to say

What is your average annual household income?

Less than $20,000

$20,000 to $34,999

$35,000 to $49,999

$50,000 to $74,999

$75,000 to $99,999

$100,000 to $149,999

$150,000 or more

Prefer not to say

In general, how would you describe your political affiliation?

Republican

Democrat

Independent

Unaffiliated

Prefer not to say

Do you have any additional comments?

_____

_____

_____

_____

_____