

FACTORS THAT CHARACTERIZE LANDOWNER DECISION PROCESSES FOR THE USE OF PRESCRIBED FIRE IN THE GULF COASTAL PLAIN

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Abstract

For the last several decades, a substantial amount of effort towards longleaf pine (*Pinus palustris*) restoration has taken place on public lands, while comparably less work has focused on private lands. Restoration has been hampered by various constraints associated with prescribed fire, such as legal liability, smoke management issues, and cost-related issues. The overall objective of this study was to examine factors influencing the application of prescribed fire for ecological restoration on private land. Key informant interviews were conducted to explore challenges and opportunities for restoration. Interviews examined informants' interest in longleaf pine restoration, including reasons associated with not implementing prescribed fire, and motivations to apply fire. Findings demonstrate interest in ecological restoration, although this interest was tempered by challenges associated with complex land management practices. Such challenges included, prescribed fire costs, lack of knowledge, and concerns over regulatory issues. Still, informants expressed some interest in collaborative landscape management activities, whereby landowners would bundle expenditures and opportunities to conduct management activities. Findings can be applied to policy and programs that increase prescribed fire in general as well as efforts to increase the range of native longleaf pine.

Key words: Collaboration, longleaf pine, motivations, prescribed fire, restoration.

1. Introduction

Longleaf pine (*Pinus palustris*) was once one of the most ecologically important tree species throughout the southeastern United States with an estimated 92 million acres (Brockway et al. 2005; Frost 2006). Even though preservation and restoration of the longleaf pine ecosystem has become a top conservation priority, only 4.3 million acres of longleaf pine remain, with much of its acreage in poor or degraded condition (Oswalt 2012). In most parts of the southeastern region, the longleaf pine landscape was largely converted to loblolly pine (*Pinus taeda*) or slash pine (*Pinus elliottii*), which were favored because of their fast growth and associated economic benefits. The once massive longleaf pine ecosystem now nearly disappeared (Brockway et al. 2005).

The greatest loss in longleaf pine occurred on what is now nonindustrial private forest (NIPF) land (Outcalt and Sheffield 1996). Restoration and management of longleaf pine ecosystems is necessary if society values the variety of benefits associated with the habitat, including biodiversity, threatened and endangered species, recreation, aesthetics, and timber among others. In response, longleaf pine restoration has become an important policy and management objective for public entities and organizations such as the Longleaf Alliance and America's Longleaf (Knott 2001). Previous literature has documented the status of longleaf pine and biological restoration procedures (Frost 2006; Oswalt et al. 2012); however, this literature has failed to address how restoration can be achieved in the social science context.

A substantial amount of longleaf pine restoration has occurred on public lands; however, restoration cannot be fully realized without NIPF landowners (Outcalt and Sheffield 1996). Approximately, 87 percent of the Southern forests are owned by private companies (27%) and NIPF landowners (60%) (Hanson et al. 2010). Within these southern forests, NIPF landowners and private companies own more than 61 percent of the longleaf pine (America's Longleaf Restoration Initiative 2014). Following catastrophic storm events, such as Hurricane Katrina, there has been a growing interest in the management and restoration of longleaf pine forests (Guldin 2006). Falling timber prices, dominated by other southern yellow pine species, may also contribute to this increased interest in longleaf pine. Further there has been some interest among NIPF landowners in establishing longleaf in previously planted loblolly and slash pine tracts (Browning et al. 2009). Conservation of the remaining acres and restoring degraded remaining longleaf pine ecosystems is a top conservation priority for the National Fish and Wildlife Foundation, U.S. Forest Service, U.S. Department of Defense, and other organizations. To succeed in restoration and conservation of these ecosystems, there needs to be more understanding about the attitudes, knowledge, and motivations of NIPF landowners to successfully restore and manage longleaf pine ecosystems (Fischer 2011; Harr et al. 2014; Kreuter et al. 2008). To ensure long-term restoration success, private landowners must benefit from recovery of the longleaf ecosystem. Research is needed that examines how landowners will benefit from ecosystem restoration programs, other than through the traditional form of government rental payments- a short-term, expensive, and unsustainable conservation tool (Glenna 1999).

Historically, longleaf pine was a fire-dependent species and application of prescribed fire is a key component to the success of restoring longleaf pine's ecological landscape processes (Barnett 1999; Brockway 2002), with a suggested burning rate of every two to four years (Loudermilk et al. 2011). Studies have revealed that prescribed fire is an effective land management practice that promotes environmental and economic value (Kreuter et al. 2008; Piatek and McGill 2010). To develop successful longleaf pine restoration efforts, policy-makers must understand NIPF landowners' attitudes, perceptions, and beliefs about implementing prescribed fire (Harr et al. 2014; Morton et al. 2010; Piatek and McGill 2010). Understanding attitudes and perceptions is a complex process of ever-evolving decisions and selecting the alternative that is most appropriate given the cognitive beliefs and values of an individual (Brunson and Shindler 2004). To ensure landowner support for longleaf pine restoration, substantial efforts must be made to link the importance of and necessity for prescribed fire, while mitigating the negative perceptions of its use (Burke et al. 2012). This may be accomplished, in part, through landowner cooperative networks, as evidenced in Oklahoma, Texas, and northern Mississippi (Fawcett, March 3, 2017, personal communication). Building a positive peer network for private landowners that supports prescribed fire efforts is essential to overcome cost-related issues, lack of knowledge with prescribed burning, and permitting issues associated with available burn days (Knott 2001). Other key impediments include liability concerns over smoke emissions and escaped fires (McCaffrey and Olsen 2012).

Prescribed fire on NIPF lands is also hampered by increasingly restrictive federal air quality standards, multiple ownership patterns or small tract sizes, financial limitations, and lack of landowner understanding of fire's value (Brennan 1991; Brennan et al. 1998; Izlar 2000; Johnson 1984). Researches have considered the influence of financial assistance programs on longleaf

pine restoration activities with general agreement that landowners are more likely to conduct prescribed fire if these programs are available (Fischer 2011; Gunter et al. 2001; Jarett et al. 2009; Zhang and Flick 2001). Research has found that although most NIPF landowners reforested their land out of a feeling of responsibility to keep its productivity, incentives helped lessen a real or perceived increase in transaction costs associated with restoration (Royer and Kaiser 1983; Doolittle and Straka 1987). As Zhang and Flick (2001) noted, assistance programs are valuable in the short-term; however, they may be inappropriate in the long-term because they require political support.

2. Objectives

While published studies have documented prescribed fire as a restoration tool (Barnett 1999; Toman et al. 2013), limited research has addressed public attitudes and behaviors regarding restoration given high risk practices (such as prescribed fire) important to achieve restoration goals. To expand longleaf pine restoration efforts, research is needed to understand NIPF landowners' interest in implementing prescribed fire in longleaf pine restoration programs. To address this gap, this study explored attitudes of private landowners toward prescribed fire within the context of ecosystem restoration policy and management objectives. In turn, limitations regarding prescribed fire in longleaf pine ecosystems were explored. Although this article is presented as an independent study, findings support results and conclusions from a region-wide telephone survey conducted as part of the same research project. The following key questions were addressed:

- (1) Why private forest landowners are or are not applying prescribed fire on their property? and
- (2) To what extent are landowners knowledgeable about prescribed fire in longleaf pine forests?

To address these questions, this article synthesized responses from 47 key informant interviews across 4 states (5 counties). In addition to providing new information, key informant interviews cross-checked (i.e., validated) findings from Chapter II of this thesis and provided in-depth explanations for the survey responses.

3. Methods

3.1. Site Selection

Five research sites (Table 3.1) were selected for the proposed study along the U.S. Gulf Coastal Plain from eastern Texas to the Florida panhandle. Sites for this research were selected based on longleaf pine basal area addition or removal as reported by Southern Forest Future Project (Wear and Greis 2013). Based on the expectation that increase or decrease in acreage might affect attitudes, sites from both categories were selected. According to the Southern Forest Future Project (2013), gains and losses of longleaf pine reflect rural, slow growing counties or fast-growing counties (with associated longleaf pine forest fragmentation and loss), respectively. Jasper County, Texas and Evangeline County, Louisiana are located in the western portion of the study area; Marion and Forrest Counties, Mississippi represent the central portion of the study area; and Gadsden County, Florida represents the eastern extent.

Table 3.1 Sites selected according to gain/loss of longleaf pine basal area from 2010 to 2016

Losses	Gains
Jasper County, Texas Forrest County, Mississippi	Evangeline County, Louisiana Marion County, Mississippi Gadsden County, Florida

Source: Southern Forest Futures Project (2013)

3.2. Key Informants

Key informant (KI) interviews were employed for data collection. KIs are qualitative in-depth interviews with people who are knowledgeable about the research problems. The purpose of KIs were to collect information from a wide range of individuals, representative of relevant interest groups and social status levels (Bryman 2012). Key informant interviews were conducted to assess the extent landowners were interested in planting longleaf pine, as well as attitudes of implementing prescribed fire, including risk perceptions and concerns about reasons to fire implementation. These interviews enabled identification and understanding of landowners' influence on forest management decisions. Although there are limitations to qualitative data collection (such as small sample sizes and lack of generalizable results), this study is focused on eliciting descriptions that cannot be fully captured by a quantitative study (Morgan 2002).

3.3. Data Collection Procedures

Forty-seven KIs were conducted in the study area. Initial KIs were identified by local directories and Internet sources and included interests representing: (1) NIPF landowners; (2) government natural resource agencies; (3) consulting foresters; (4) landowners' associations; (5) other land managers; and (6) other knowledgeable individuals who did not fit into these categories (Table 3.2.). Potential informants were contacted via telephone to introduce the study, its intent, and whether they were willing to participate. Interviews lasted approximately 35 minutes, ranging, in duration, from 18 minutes to one hour. Following each interview, subsequent sampling was accomplished through the use of a snowball procedure based on nominations by initial informants (Weiss 1995). Snowballing sampling involves asking interviewees to identify additional informants with knowledge and/or interest in the subject matter. There was some overlap among informant suggestions, which resulted in including those suggestions as the most appropriate individuals for the study. Data collection proceeded until saturation was reached. Data saturation was reached when successive interviews conducted provided recurring information, without adding any new knowledge to existing information (Morgan, 2002).

Table 3.2 Key Informant Categories

Key informant category	Florida	Louisiana	Mississippi	Texas
NIPF landowners	1	1	2	3
Government agency	2	2	2	5
Consulting forester	4	3	3	2
Landowner association	1	2	0	0
Other land managers	1	1	3	3
Others	3	1	1	1
Total	12	10	11	14

Table 3.3 Key Informant Characteristic

	Florida	Louisiana	Mississippi	Texas
Gender				
Male	10	8	10	12
Female	2	2	1	2
Total	12	10	11	14

A standard interview instrument was prepared (Appendix D) and accepted by Mississippi State University's Institutional Review Board (IRB) (IRB approval number 16-632). At the interview site, participants were informed about the nature of the study and signed an informed consent form. Interviews were audio recorded with the permission of the interviewee. Each KI was interviewed with a semi-structured instrument to explore: (1) attitudes towards longleaf pine forest, forest values, and forest management practices; (2) the role longleaf pine forests and forestry play in fostering degraded landscapes; and (3) social and biological constraints to prescribed fire.

3.4. Data Analysis

Interviews were transcribed and data were analyzed using a multi-step process. We combined theory- and data-driven procedures, i.e. deductive and inductive approaches, to analyze data using the qualitative data software application, QSR NVivo 11 (Richards 2002). Within the software, data were analyzed using systematic explanatory coding techniques (see Appendix E for codes). The analysis procedures generally followed the steps described by Strauss and Corbin (1997): organizing, obtaining a general sense, coding, condensing themes, representing and interpreting. The coding process helped to narrow the focus and reveal key themes. Each additional category or code that emerged within an interview was assigned a new node in the NVivo hierarchy. This type of design is usually appropriate when researchers seek to uncover emergent phenomena (Glaser and Strauss 1999). Relationships among categories were identified and themes were compared within and across cases. For reporting the findings, exemplars for each code, category, and case were identified.

4. Results

4.1. Longleaf pine restoration

Key informants were asked if landowners were interested in managing longleaf pine. Key informants regarded longleaf pine as a very important species, both ecologically and economically. When asked about whether or not landowners were managing their longleaf pine forest, one informant reported appealing attributes of the species makes longleaf important to manage and restore: “The most appealing [characteristics] is probably the legacy of where was all longleaf savannah and everything like that and continuing the legacy of what the land base used to look like” (Land manager, Mississippi).

There were mixed results when asked about whether there had been an increase or decrease in interest in planting longleaf pine. One informant responded:

Increased. Because of two-fold, one is public perceptions so preaching that longleaf pine was natural and then landowners say well I want what’s natural and then number two would be government incentives programs. (Fuel coordinator, Texas)

By contrast another said: Definitely decrease without a doubt. Because the cost of the trees and the planting’s more expensive and even the cost of site preparation is more expensive. (Land manager, Mississippi)

Key informants were also asked whether landowners were knowledgeable about longleaf pine as a fire dependent species. The majority of responses answered there was widespread knowledge about longleaf pine as fire dependent species. Even if the landowner was not well informed, they had a forester who was. One informant responded: “Yes. I think for the most part they do. You may have a guy who owns the land, but he’s got a forester managing for him and the forester understands that situation” (Land manager, Texas). Another informant reported: “Most landowners who do research into [longleaf pine] whatsoever learn that quickly, yes” (Consulting forester, Louisiana).

Further, key informants reported that landowners who were interested in restoration of longleaf pine ecosystems frequently used fire as a restoration tool. One informant mentioned:

It’s very common here. We use it a lot in our site prep. We use a lot of prescribed burning and you do see a lot more longleaf in this area, so you do have landowners that use prescribed burning when they do they get on the two- to three-year interval that they burn. (Soil conservationist, Texas)

This quote suggests an interest in prescribed fire, at least among some landowners. Also, the quote demonstrates positive attitudes towards prescribed fire’s benefits.

Key informants were asked if landowners had more knowledge about the link between fire and longleaf pine would there be increased interest in prescribed fire. Most of the informants were in agreement that for continued expansion of longleaf pine, more landowner education is needed.

One informant responded: “Yes, some of them would. Some of them would be really interested” (Timber land manager, Texas). Another informant qualified his statement:

Every landowner is different. Every landowner has their own goals as to what they want their property to be like. All of those factors combine to dictate a given landowner’s choices so but yeah, the short answer I think is yes. (Consulting forester, Texas)

The information from these interviews suggests that increased knowledge would lead to increased interest in using prescribed fire for ecological restoration goals.

4.2. Limiting factors to apply prescribed fire

Interviews explored the factors influencing the decision to use prescribed fire as a management tool in the Gulf Coast region. Major factors that emerged from analysis were smoke management issues, potential liability concerns, and cost-related issues that influenced the decision to apply prescribed fire. Key informants mentioned the role of regulatory factors in the decision to use prescribed fire, whereas increasingly restrictive smoke management guidelines restricted landowners’ abilities to conduct prescribed fire at the frequency and for the area they would prefer. This feeling was even more pronounced among NIPF landowners, as they all mentioned smoke management as a main reason for not using prescribed fire: “Smoke, yes the smoke. I don’t think we are scared as much about the fire getting away from us it’s, it’s the smoke getting on the roads and making people mad or causing a lawsuit” (Private landowner, Louisiana). In contrast, another informant did not rank smoke issues as the major reason: “Well most, most people that are burning don’t care about smoke” (Land manager, Texas).

Key informants indicated other factors such as liability issues, availability of training, and costs. In particular, key informants expressed concern with potential liability and public safety, especially near smoke sensitive areas:

Because of liability, it’s big here on all highways and all that’s going on they might burn their timber and when it crosses the road you have accidents and it burns your neighbors to death and you have a liability. (Forestry association staff, Florida)

There’s always a liability of burning and that’s always going to put, the fear of that’s always going to reduce the number of people that are willing to burn. (Landowner, Texas)

The fear of liability near major highways resulted in risk averse behavior of private landowners. As one informant mentioned, “because of living in a smoke sensitive area, [landowners] can’t burn because of liability issue” (Consulting forester, Florida).

Key informants also indicated cost as another reason for not applying prescribed fire:

Yes, yes, yes. How expensive it is to burn would be, you know, and that's why just about everyone I know that does burning they are doing it in partnership with some kind of government grant or something like that. (Consulting forester, Louisiana)

In contrast to cost, some informants thought: "I feel like the cost is pretty reasonable because prescribed burning is one of the cheapest tools in the toolbox of forestry" (Soil conservationist, Texas). This finding infers price relative to subjective value as defined by individual landowners. These findings suggest these limiting factors may influence landowners' decisions regarding the use of prescribed fire.

4.3. Motivations to apply fire

Results highlight incentive programs as an effective tool for initially motivating landowners. Incentives come in the form of cost share payments and annual payments that serve to offset the initial cost of what is usually long-term forestry investment. One informant mentioned:

I feel like prescribed fire is increasing due to a lot more of programs that the state and government agencies have been offering. So, there is definitely an increase in interests with the cost share money, so I do feel like that every time they throw money this way in this area people do take advantage of it, so I would like to see that continued. (Consulting forester, Texas)

Similarly, another informant mentioned: "Right. Cost-share programs be the bottom line, kind of. Money motivates folks" (Land manager, Louisiana). Some informant argued there should be more cost share programs. One of the informants mentioned: "Yeah if we had more cost share programs that would definitely help. But we have way more applications that we do money to give out for burning" (Consulting forester, Florida).

Another motivating factor for landowners was outreach programs educating landowners about personal safety and risk reduction, while preserving and enhancing the health of forests. Informants were aware of educational programs: "Longleaf Alliance has tours and everything and I think a lot of that stuff is available to people" (State wildlife manager, Florida). Another informant added: "Texas Forest Service sends out e-mails all the time and has seminars on it. The Longleaf Alliance has really worked hard educating people..." (Landowner, Texas). For landowners to truly understand the role of prescribed fire, educational programs must communicate clearly and consistently across all areas where longleaf pine used to be a native habitat. Results documented landowners were interested in collaborating with other landowners and various organizations at the regional, state, and local levels for applying prescribed fire. It was reported: "Landowners have a lot of lands out there and they actually do have burn associations, a co-op, they call it a burn co-op and they do [prescribed burn], it works good" (State forester, Texas). Another response similarly advocated burn cooperatives: "Most everyone I talk to about longleaf is interested in [collaboration]" (Land manager, Texas). Such collaboration has its own benefits and challenges. Reduction of cost was considered to be a benefit: "Collaborating with various organizations gets the costs down" (Consulting forester, Louisiana). These findings suggest that factors such as incentives, outreach, and collaboration are necessary to the success of prescribed fire programs.

5. Discussion

Interview findings provided insights into the future potential of prescribed fire for ecological restoration efforts, in particular, longleaf pine habitat. This study examined knowledge regarding longleaf pine and prescribed fire, as well as factors influencing decisions to use prescribed fire on private lands. Several important points emerged from these findings including three main themes: (1) longleaf pine restoration; (2) reasons not to apply prescribed fire; and (3) motivations to apply fire.

Restoration of longleaf pine was one of the important themes throughout the interviews and dominated how most informants valued longleaf pine and its restoration, which was consistent with previous studies (Brockway et al. 2005; Lavoie et al. 2011; Thomas 2013). Much of the interest in longleaf pine restoration has been the result of an increasing interest in ecological values (Barnett 1999). Also, the products derived from longleaf pine can be more valuable than those of other southern pines. The economic and ecological benefits of longleaf pine are generally well-known: high quality fire tolerance, insect and disease resistance, storm tolerance, and ability to grow and thrive on harsh sites (Johnsen et al. 2009). Interested landowners perceive ecological and economic benefits, which encourage them to restore longleaf pine on their lands.

Another important research finding is the effect of knowledge on landowners' support for use of prescribed fire for restoration process. Prior research demonstrated knowledge regarding prescribed fire is important for public acceptance of fire as a management tool (Kreuter et al. 2008; Morton et al. 2010; Piatek et al. 2010). These studies identified knowledge about the need and acceptance of fire for longleaf pine restoration as an important contributor of restoration goals. Study findings here supports this previous research (also Manfredo et al. 1990). Understanding the role of knowledge, as well as previous experience with fire, has important effect for prescribed fire planning at the longleaf pine stands.

An implication of this finding is that educational programs and information dissemination play vital roles in prescribed fire use. These roles might continue to grow and become more critical as more private landowners are exposed to prescribed fire as a management tool. This finding is consistent with Loomis et al. (2001) and Toman and Shindler (2006) who found that landowners' exposure to various educational programs resulted in a significant increase in both understanding and support for prescribed fire use. This result revealed that for substantial expansion of longleaf pine across its native range, more efforts are required to increase general awareness and knowledge regarding longleaf pine and prescribed fire among private landowners. Educational programs which help them understand forestry opportunities and incentive opportunities for practicing prescribed fire on their land has also been reported in Blanchard and Ryan (2007) and Kobziar et al. (2015). Workshops, bulletins, on-site visits, and land management demonstrations plays a significant role in improving landowners understanding of fire- related issues. General public education is needed as well because private landowner work and reside in communities that include non-landowners as well.

Implementation of prescribed fire is becoming extremely difficult (Kreuter et al. 2008; Kobziar et al. 2015; Morton et al. 2010) despite increasing interest in restoration of longleaf pine. In line

with this study, this has been explained by various factors such as liability issues, smoke issues, and cost-related issues as documented by Harr et al. (2014), Kreuter et al. (2008), and Morton et al. (2010). The concerns of liability were a leading factor for landowners' decision to use prescribed fire. This behavior seems reasonable given the potential of financial liability in the incident of an escape. Although offering some opportunity, liability insurance is cost-prohibitive for many forest landowners. By developing state policy addressing the acquisition of acceptable and reasonable liability insurance for prescribed burners, liability issues can be addressed. Another major reason cited for not using prescribed fire is smoke issues, similar to findings from Blanchard and Ryan (2007) and Morton et al. (2010). Based on the findings presented here, NIPF landowners become discouraged because of air-quality guidelines which are difficult to follow. If guidelines continue to expand, landowners will become increasingly less likely to use prescribed fire. A uniform, comprehensive system of data collection for burned area would facilitate to better understand current status and trends of prescribed fire and future prescribed fire needs for longleaf restoration to mitigate the negative perceptions regarding smoke. Findings highlight cost of prescribed fire as another reason to its limited use which is consistent with Fischer (2011), Harr et al. (2014), Kobziar et al. (2015), and Yoder (2008). This is linked to a lack of funding for prescribed fire programs, presenting a barrier to private landowners. Also because of lack of liability coverage, the cost of private insurance proved to be too costly for private landowner. To address issues of cost, coalitions with other landowners could be formed to create economies of scale to facilitate landowners' ability to apply fire on their forest land.

Cost-share programs motivate private forest landowners to manage their forest land. Cost-share programs are popular among landowners, which reduce initial investment costs, which may directly increase the number of landowners using prescribed fire in their forest land. This is consistent with discussions by Fischer (2011), Jarret et al. (2009), and Newman et al. (1996). These studies found that cost-sharing and other governmental payments were strong factors influencing restoration activities using prescribed fire. These incentives programs provide technical and/or financial assistance to private landowners for the benefit of conserving, managing, or enhancing longleaf pine habitat using prescribed fire.

This study also highlights collaboration as another motivating factor for the use of prescribed fire, which is similar to a study from Burke et al. (2012) and Kobziar et al. (2015). Collaboration can vary from information sharing, coordinating services, and sharing of services between landowners and agencies/organizations as well as among landowners (Bryson et al. 2006). One reason collaborative activities are important is because such activities make the best use of limited resources and produce a consistent system that could be used to track prescribed fire activity for longleaf pine restoration efforts. This study highlights some types of collaboration for prescribed fire among different landowners or different organizations. Some collaborative efforts are currently in place for prescribed fire outside the longleaf pine range, however more resources are needed, such as technical assistance to develop burn associations. Although collaborative efforts have often been considered as helping initiatives to succeed (Gruber 2010; Moore 2011), little to no research has been conducted specific to prescribed fire collaboration.

6. Conclusions

Results from this study provide a deeper understanding of the factors that influence decisions to use prescribed fire in the coastal plain and suggest the need for future research to further understanding of these factors. Research in this area could apply the principle of Belief-Attitude-Behavior model to better understand acceptance of prescribed fire (Brunson and Shindler 2004). This framework seeks to understand landowners' beliefs about the benefits of prescribed fire and comparing these to actual behavior (such as accepting prescribed fire) could fill a vital gap in understanding not only what the landowner thinks about prescribed fire, but how they react to it based on those beliefs. Prescribed fire on NIPF forest lands substantially aids restoration and maintenance of fire-dependent plant communities such as longleaf pine. There is a clear need for effective and efficient use of budgetary and technical resources, and partnerships, given various reasons not to implement prescribed fire. Overcoming these limiting factors requires a joint effort by all those that will benefit, including the general public, environmental groups, and agencies. Efforts to educate landowners will provide opportunities to increase burning on NIPF lands in the Southeast region. Furthermore, as Longleaf pine restoration efforts are scaled up, more monetary resources will be needed to further incentive landowners and reduce their risk. Future research could include determining how collaboration can be more efficiently developed and whether existing collaborative efforts can be replicated and made more effective.

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