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ARTICLE

Public and forest landowner attitudes towards longleaf pine ecosystem restoration using prescribed fire[1]

Jason S. Gordon, John L. Willis, and Robert K. Grala

Abstract: Once dominant across the United States (US) Southeastern Coastal Plain, the longleaf pine (*Pinus palustris* Mill.) ecosystem covers a fraction of its historic geographic range. Restoration efforts have largely occurred on public lands, while most private forests feature alternative pine species. A better understanding of public interest in ecological restoration is critical to sustained efforts and successes. This research examines both forest landowner and general public interest in longleaf pine restoration. Results contribute to research on the social dimensions of ecological restoration, much of which has focused on small-scale projects rather than landscape-scale initiatives. In addition, this study addresses the lack of knowledge regarding factors driving attitudes towards ecological restoration other than demographic and psychometric variables. We employed a telephone survey of 2700 participants across eight states in the southeastern US in the historical range of longleaf pine. A majority of respondents supported restoration as a general goal and were supportive of the use of prescribed fire as a restoration practice. Place attachment, knowledge about longleaf pine, and age were among the significant predictors of restoration support. Findings have implications for future research focusing on sociocultural influences of restoration projects, as well as expanded public support for restoration of fire-maintained ecosystems.

Key words: longleaf pine, place attachment, restoration, prescribed fire, southeastern US.

Résumé : Autrefois dominant dans la plaine côtière du sud-est des États-Unis, l'écosystème du pin des marais (*Pinus palustris* Mill.) occupe une fraction de l'aire de répartition qu'il occupait. Les efforts de restauration ont surtout été orientés vers les terres publiques, tandis que la plupart des forêts privées sont occupées par d'autres espèces de pin. Une meilleure compréhension de l'intérêt du public pour la restauration écologique est essentielle pour maintenir les efforts et les succès. Cette recherche explore l'intérêt des propriétaires forestiers et du grand public pour la restauration du pin des marais. Les résultats contribuent à la recherche sur les dimensions sociales de la restauration écologique qui a surtout mis l'accent sur les projets à petite échelle plutôt que sur les initiatives à l'échelle du paysage. De plus, cette étude s'intéresse au manque de connaissance sur les facteurs qui déterminent les attitudes envers la restauration écologique, autres que les variables démographiques et psychométriques. Nous avons réalisé une enquête téléphonique auprès de 2700 participants dans huit États du sud-est des États-Unis dans l'aire de répartition historique du pin des marais. Une majorité de répondants supportait la restauration comme objectif général et était en faveur de l'utilisation du brûlage dirigé comme méthode de restauration. L'attachement à un lieu, la connaissance du pin des marais et l'âge étaient parmi les prédicteurs significatifs du support pour la restauration. Les résultats ont des implications pour les recherches futures qui devraient mettre l'accent sur les influences socioculturelles des projets de restauration ainsi que sur l'élargissement du support publique pour la restauration des écosystèmes maintenus par le feu. [Traduit par la Rédaction]

Mots-clés : pin des marais, attachement à un lieu, restauration, brûlage dirigé, sud-est des États-Unis.

Introduction

Once dispersed across approximately 57 million acres (23 million ha) of the Southeastern Coastal Plain, longleaf pine (LLP; *Pinus palustris* Mill.) covers a fraction of its original native range, having largely been converted to loblolly pine (*Pinus taeda* L.) plantations, which landowners have tended to favor for its rapid growth (Frost 2007; Kirkman et al 2017). Following recent catastrophic storm events such as Hurricane Katrina (2005), there has been increased establishment of LLP by non-industrial private forest landowners (NIPFLs) on sites previously planted in loblolly pine (Browning et al. 2009). Potentially helping LLP gain traction as a viable economic alternative to loblolly pine is an increased recognition of its value in premium quality timber and pine straw production (Browning et al. 2009). NIPFLs interested in replanting longleaf pine must also be comfortable with the use of prescribed fire on their property, as it is the primary management tool for controlling brown-spot needle blight (*Mycosphaeralla dearnessii* Barr.), reducing competition on LLP seedlings, and maintaining overall biodiversity (Mitchell et al. 2006); however, there is a growing concern that many landowners are failing to apply the proper burning regimes, if any at all (Shrestha 2019).

Largely led by the public sector, LLP restoration has arguably been successful in reintroducing the species over the last three

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decades (America's Longleaf Restoration Initiative (ALRI) 2019). Continued expansion depends on greater participation by NIPFLs, as well as the general public, which supports restoration initiatives through taxes and public opinion. Arguments against restoration have referred to economic costs, loss of use values such as recreation and aesthetics, and that restoration perpetuates human interference with nature (Bright et al. 2002); however, information about public attitudes towards a particular restoration initiative is often anecdotal and (or) biased towards participants actively involved with the program (Solecki 1998). In short, evaluation of successful restoration should encompass ecological and spatial measures, as well as the perspectives and institutional benefits found across scales, land tenures, and land uses (Wyborn et al. 2012).

Gobster (1997) and others have found generally positive public attitudes towards restoration as an overall goal with societal benefits. Opposition and controversy have emerged over specific practices of restoration such as using herbicides, harvesting trees, applying prescribed fire, or reintroducing wildlife (Ostergren et al. 2008). Many of these studies examining social conflict in restoration have been limited to public lands and (or) volunteer efforts. By contrast, restoration of private lands has often applied some type of contingent valuation effort such as assessing willingness to pay for nonmarket goods applied to government cost-share programs. Such studies assume a primary economic rationale as the driving factor in individual conservation efforts (Amacher et al. 2004).

Individual background factors have also been influential on support for restoration, although it is important to consider the interactions of socioeconomic factors with the restoration goal of interest and the importance of the issue (Bright et al. 2002). For example, Bowman et al. (2004) found support for black bear (*Ursus americanus* Pallas, 1780) reintroduction diminished by rural residency and proximity to public land. In contrast, Alam (2011) found proximity to be a poor indicator of support, while knowledge about the river was important. Other studies have found income, property size, region, property ownership objectives, education, and direct experience with conservation issues as predictors of support for restoration (Solecki 1998; Connelly et al. 2002; Buijs 2009). Rural or urban residency is an important factor to consider in the LLP range, three-quarters of which is urban (U.S. Census Bureau 2012).

In addition, several studies have explored the underlying causes of attitudes towards restoration. Recreation benefits, physical landscape characteristics, aesthetic values, interference with nature versus human utility of the landscape, concern about the state of the ecosystem, and biodiversity conservation have been cited as key influences (Alam 2011). Westling et al. (2014) also noted historical relationships and cultural values between residents and the landscape feature of interest for restoration influence attitudes towards restoration projects. As such, some attitudes may be place-dependent rather than universal such that public opinion may vary substantially between projects.

Perhaps because of the place-dependent nature of attitudes towards restoration, place attachment (the emotional bond between a person and a place) or some similar measure of connectivity with the landscape should be considered in predicting support. Place attachment is a multidimensional construct that emerges from the physical setting, psychological and social processes of the person who interacts with the place, and the activities performed in the place (Stedman 2002). In the context of place attachment, a place is more than just a general space or a commodity — it becomes emotionally and symbolically significant when a person has experiences and finds meaning for that space. Thus, reducing a landscape such as LLP to a selection of goods or products ignores how places are linked to individual and group identity, including regionality, as well as the functional attributes of the place to support specific goals and activities (Williams and Vaske 2003). The importance of place may help explain why many studies concerning the social dimensions of ecological restoration have centered on micro- or meso-scale sites (e.g., rivers, parks) rather than macroscale landscape restoration such as the LLP historical range (Bangs and Fritts 1996).

This study contributes to previous research on attitudes towards ecological restoration by identifying factors that predict acceptance of LLP restoration as a regional effort compared with local initiatives. Further, we assess public attitudes towards restoration in addition to forest landowners' attitudes because landscape-scale LLP restoration efforts include public and private lands, as well as public funding sources. To this end, we focus on three objectives. First, we examined how place attachment influenced public support for restoration based on the assumption that LLP is an iconic ecosystem feature of the Southeastern Coastal Plain, particularly the Gulf Coast. Second, we explored whether attitudes towards prescribed fire lead to support for LLP restoration, given the importance of fire to the ecosystem. Third, we looked for differences between individual background factors in support for restoration such as landownership and urban or rural residency. The conceptual model for understanding support for ecological restoration examined the interaction of knowledge, attitudes, place attachment with forest landownership, and individual statuses (Fig. 1). Although LLP provides the management context for this study, findings have implications for various fire-maintained ecosystems and ecological restoration goals. Modified for place-based attributes, the conceptual model is applicable to other forest biomes, wetlands, and prairies, as well as urban and rural landscapes that are being restored.

A better understanding of public interest in ecological restoration is critical to sustained efforts and landscape-scale successes. William Jordan, one of the most influential writers on ecological restoration echoed the importance of public participation: "What is involved in [ecological restoration] is a continual dialogue rather than a program, paralleling in our dealings with the biotic community the dialogue that sustains a democratic society and makes it adaptable to change" (Jordan 1994, p. 24). To this end, results here lead to an improved understanding of the public's understanding of the intersection between prescribed fire and restoration and avenues for better communication between land managers, scientists, and stakeholders.

Methods

We employed a dual-frame, cluster area probability sample of telephone interviews that included cell phone and landline numbers of residents across 130 southeastern counties within LLP's historic range along the Gulf Coast (Fig. 2). The survey was conducted by a telephone marketing firm from March to June 2017. The average survey was completed in no more than 10 min, and the survey was piloted ($N = 50$) during a four-day test period.

Based on a sampling frame developed by the firm, the survey was initiated with 29 415 working telephone records (Table 1). Of these, 1201 were not eligible due to being underage, language barriers, living outside the eligible counties, or other reasons. Additional sampling considerations included almost 5000 refusals before determination of qualification, 135 qualified respondent refusals, and 61 partial completions that did not include a response file. Sampling was closed at 2700 completed interviews. Subsampling included 30% ($n = 821$) of respondents who were NIPFLs owning at least 10 acres (4.05 ha) or more of forestland. Sample distribution across the region with dominant LLP cover type included Texas ($n = 7\%$; LLP = 111 thousand acres (45 thousand ha)), Louisiana ($n = 21.2\%$; LLP = 756 thousand acres (306 thousand ha)), Mississippi ($n = 18.4\%$; LLP = 831 thousand acres (336 thousand ha)), Alabama ($n = 27.5\%$; LLP = 1112 thousand acres (450 thousand ha)),

Fig. 1. The conceptual model for understanding support for ecological restoration examined the intersection of knowledge, attitudes, place attachment with forest landownership and individual statuses.

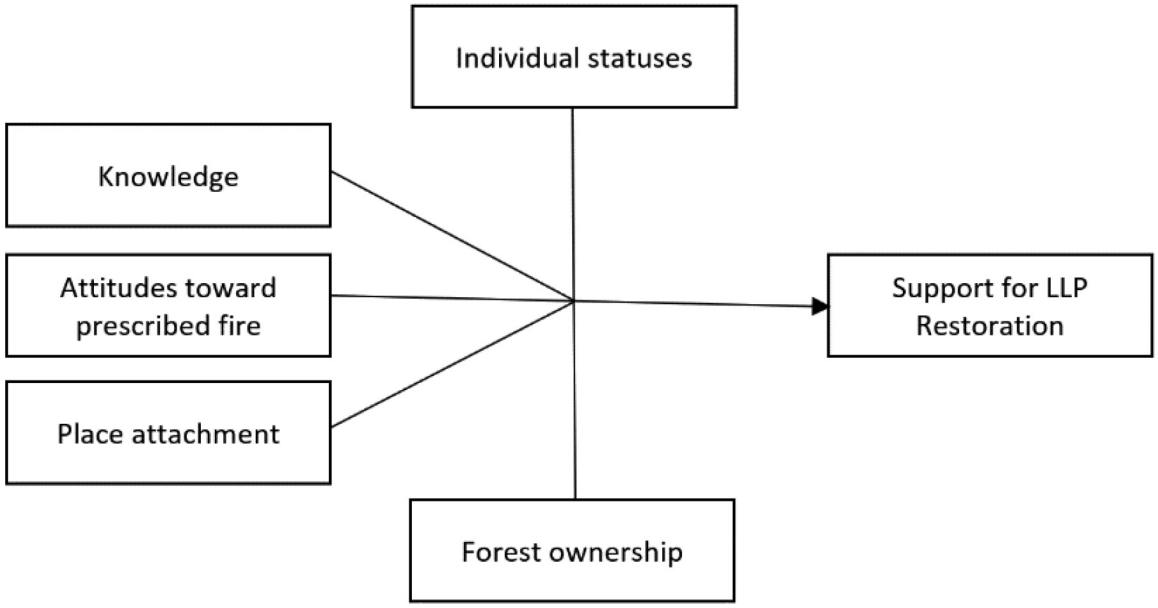
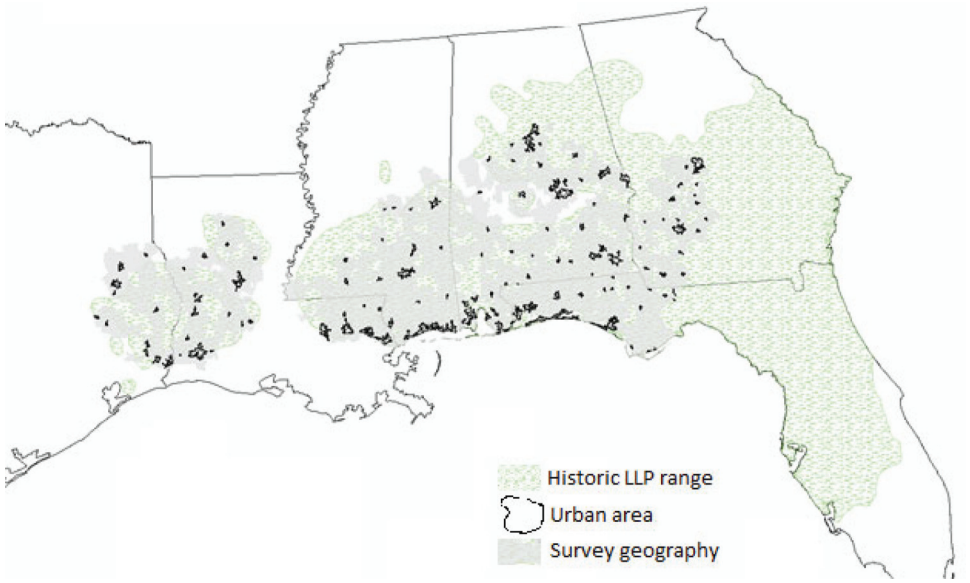


Fig. 2. Survey sample area and LLP historic range within the southeastern US. Base map and urban area data from the U.S. Census Bureau (2010). LLP range data from the U.S. Department of Agriculture, Natural Resource Conservation Service (2014). Map created using ArcMap 10.6.1 (Esri). [Colour online.]



Georgia (n = 8.6%; LLP = 3546 thousand acres (14 thousand ha)), and Florida (n = 17.3%; LLP = 5627 thousand acres (2277 thousand ha)).[2]

The conceptual model was operationalized to measure knowledge, attitudes, and place attachment, as well as account for socioeconomic statuses and forest ownership. Variables are described here in the order in which they appeared in the survey (Table 2). Respondents were asked if they were familiar with LLP. Responses included (1) never heard of it, (2) I've heard of it but don't know much about it; (3) I know the difference between longleaf pine and other pine species; and (4) I have knowledge of the conditions that LLP needs to grow. These responses were recoded to a binary format: 0, no (never heard of LLP); and 1, yes. If the respondent had never heard of LLP, the interviewer provided a brief explanation to facilitate response for a question asking about her (his) support for LLP restoration.

For those with knowledge of LLP, a summative scale was created based on five items with (1) yes and (0) no responses to the question "Were you aware of the following regarding longleaf pine forests: longleaf pine was once the dominant forest ecosystem in the southeastern United States; longleaf pine forests have been increasing in the region since Hurricane Katrina (2005); longleaf pine ecosystems provide habitat for many plant and animals spe-

[2]LLP data are from Forest Inventory Analysis data for the most recent statewide assessment in each state according to longleaf – slash forest type: Texas (2018), Louisiana (2016), Mississippi (2017), Alabama (2018), Georgia (2018), and Florida (2016) (U.S. Department of Agriculture, Forest Service 2019).

Table 1. Telephone survey response frequencies.

Total good records	29 415
Contacted but refused to participate	4 992
Not eligible	1 201
Qualified but refused	135
Qualified but suspended (partial complete)	61
Completed interviews	2 700
Percent completed of qualified	53

Note: The sample included 2700 completed surveys after accounting for bad records, refusals, ineligible respondents, and partial completions.

cies; longleaf pine forests require fire to regenerate; and some property owners are participating in conservation programs to reestablish longleaf pine within its historical range." A composite index (LLP knowledge) was created with the previous question such that a knowledge score (α = 0.701) could range from zero (never heard of LLP) to five, with five being most knowledgeable.

Following measurement of LLP knowledge, respondents were asked to what extent they were interested in the reestablishment of LLP forests (LLP support), the dependent variable in the analysis. A five-point scale (not at all, not much, some, a lot, don't know) was recoded to 0 (not supportive) or 1 (supportive), with "don't know" responses excluded from final analysis. After asking if respondents were familiar with prescribed fire and providing an explanation if they had no knowledge, we asked respondents about their attitudes towards prescribed fire using four items: "Prescribed fire …" endangers wildlife and (or) human life, removes accumulated material on the ground to prevent wildfire, improves conditions for longleaf pine establishment, or maintains the natural balance in the ecosystem. Responses were based on five-point Likert scales reflecting standard telephone survey methodology in which respondents were asked if they agreed or disagreed. Conversely, they could volunteer "don't know" or "no opinion". Then the interviewer probed if they strongly agreed, strongly disagreed, or somewhat agreed. Responses were recoded to 0 (disagree, neither agree nor disagree, don't know, or no opinion) and 1 (agree, strongly agree, or somewhat agree). The first item, reflecting a negative attitude towards prescribed fire, was finalized as an independent binary response (prescribed fire endangers). A summative scale was created from items two through four representing positive attitudes about prescribed fire (prescribed fire benefits) with a minimum of zero and a maximum of three.

Place attachment has been measured using a variety of approaches and scales (Stedman 2002). Likert scales (1, strongly agree; 2, somewhat agree; 3, neither agree nor disagree; 4, somewhat disagree; and 5, strongly disagree) were summed to measure agreement with 10 statements. The scale (place attachment) included six emotional attachment measures and four functional attachment measures and had a high level of internal consistency represented by a Chronbach's alpha of 0.942 (Williams and Vaske 2003).

Emotional statements

(1) I feel strong, positive feelings for the Gulf Coast;
(2) I identify strongly with the Gulf Coast;
(3) I feel Gulf Coast is a part of me;
(4) I feel I can really be myself in the Gulf Coast;
(5) I feel happiest when I am at Gulf Coast; and
(6) I really miss Gulf Coast when I'm away too long.

Functional statements

(7) I get more satisfaction out of visiting the Gulf Coast than any other natural area;
(8) The Gulf Coast is my favorite place to be;
(9) The Gulf Coast is the best place for what I like to do; and
(10) I wouldn't substitute any other area for doing the types of things I do at Gulf Coast.

Table 2. Descriptive statistics for variables used in the analysis of the support for restoration of LLP.

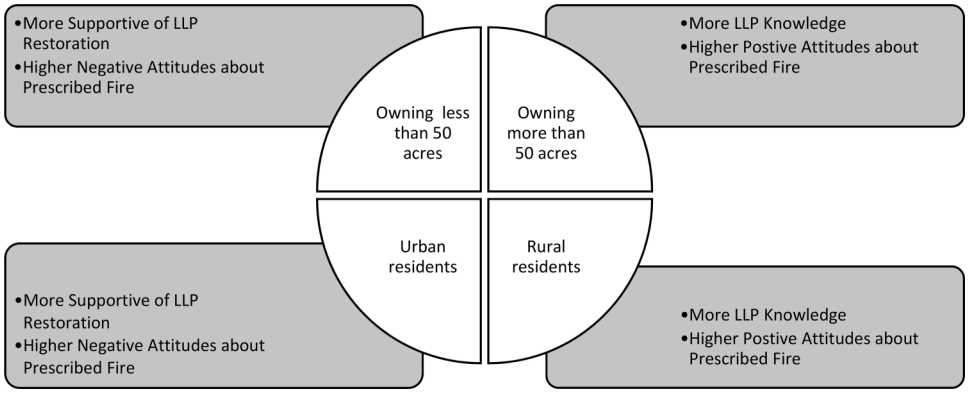
Measure	Mean	SD	Percent
LLP support (DV)	0.85	0.361	
Do not support (reference)			15.4
Support (1)			84.6
LLP knowledge (interval)	2.00	1.758	
Prescribed fire endangers	0.46	0.499	
Disagree, N, DK, NO (reference)			53.6
Agree (1)			46.4
Prescribed fire benefits (interval)	2.43	0.902	
Place attachment (interval)	20.94	10.247	
Age (interval)	50.77	17.593	
Gender	0.48	0.500	
Female (reference)			51.8
Male (1)			48.2
Education	0.44	0.496	
Less than 4-year degree (reference)			55.5
At least 4-year degree (1)			44.5
Household income	0.5	0.464	
Less than $50 000 (reference)			42.9
$50 000 or more (1)			57.1
Race	1.94	0.439	
African American (reference)			12.6
Caucasian (2)			80.4
Other (3)			7.0
Residence tenure	1.47	0.651	
Less than 25 years (reference)			55.4
25 to 49 years (2)			12.6
50 to 74 years (3)			35.6
More than 75 years (4)			0.7
Rural/urban	0.63	0.483	
Rural (reference)			37.0
Suburban + urban (1)			63.0
Forest acres	0.37	0.612	
Non-NIPFL (reference)			69.6
1 to 50 acres (2)			23.4
More than 50 acres (3)			7.0
LLP acres	0.16	0.368	
No, DK, maybe (reference)			83.9
Yes (1)			16.1

Note: See text for operational coding of the variables; means adjusted for nonresponse. DV, dependent variable; N, neither agree nor disagree; NO, no opinion; DK, don't know; 1 to 50 acres equals 0.40 to 20.23 ha; SD, standard deviation.

Socioeconomic statuses consisted of age (age), race (race), education (education), amount of time that the respondent had lived in the Gulf Coast (residence tenure), household income (household income), gender (gender), and rurality (rural/urban). Age was the age of the respondents as a continuous variable in years. Race was the respondent's self-reported race or ethnicity with six different original categories (African American, Caucasian, Asian, Hispanic/Latino, Native American, and other) recoded to 1 (African American), 2 (Caucasian), and 3 (other). Education was the respondent's level of education, originally with six categories ranging from less than high school to post-college degree. To account for greater than 20% of expected cell values of less than five respondents and because this analysis was interested in whether or not advanced education impacted the dependent variable, education was recoded to a dummy variable: 0 (less than a 4-year degree) and 1 (at least a 4-year degree).

Residence tenure was coded as 1 (less than 25 years), 2 (25–49 years), 3 (50–74 years), or 4 (75 or more years). Household income originally had seven different categories ranging from less than $15 000 to $150 000 or more. Responses were recoded as

Fig. 3. Support for LLP restoration and attitudes about prescribed fire by respondent type: (1) owing less than 50 acres (20.23 ha) versus owning more than 50 acres of forest and (2) urban versus rural residence. Note: 50 acres equals 20.23 ha.



0 (less than $50 000) and 1 ($50 000 and above). Those who refused to answer or didn't know were removed from the analysis. Gender referred to the respondent's gender (0, female; 1, male). Rural/urban was coded according to zip codes included with the sampling frame of phone numbers using the U.S. Census rural–urban identifier. A zip code was classified as 0 (rural) or 1 (urban or suburban; "urban") based on U.S. Census characterization of the majority area in the zip code.

Finally, we measured forest acreage owned (forest acres) and LLP acres owned (LLP acres). Respondents were initially asked if they owned forest land and, if so, the number of acres owned, measured as interval data. If they were unsure of the number of acres, the interviewer prompted them with nine categories of unequal ranges (1 to less than 5, 5 to less than 10, 10 to less than 25, and so on up to 5000 acres or more)[3]. Coding used in the analysis included 1 (do not own forest land), 2 (1 to 50 acres (0.40 to 20.23 ha)), and 3 (more than 50 acres). LLP acres followed a similar approach. LLP acres was recoded to 1 (yes, respondent owns LLP) and 2 (no, don't know, or maybe). We were interested in LLP ownership's clear influence on support for restoration; therefore, we treated uncertainty to the degree that a numerical response was unobtainable as equivalent to not owning LLP.

We used logistic regression to examine the relative importance of knowledge of LLP, attitudes towards prescribed burning, place attachment, socioeconomic statuses, and forest ownership to explain support for LLP restoration. Data satisfied assumptions of independence of observations in that the categories of the dependent variable and independent variables were mutually exclusive and exhaustive. Outliers were tested based on standardized residuals with any residuals greater than ±2.5 standard deviations (SDs) removed from analysis. There were 107 standardized residuals with a value of ±2.5, which were removed from analysis based on irregularity. In addition, there were no relationships among independent variables as determined from the correlation matrix. All continuous independent variables were linearly related to the logit of the dependent variables as assessed via the Box and Tidwell (1962) procedure with Bonferroni correction resulting in statistical significance being accepted when $p < 0.002$ (Tabachnick and Fidell 2014). Reflecting the components of the conceptual model, the sets of indicators were entered in successive stages to observe changes in the model (i.e., change of coefficients and model fit). Mean replacement was used in the variables of race, education, and income; however, this constituted a relatively small proportion of the data (at most, 9% in income) and did not considerably affect the SDs. The first model examined the influence of only the socioeconomic statuses. This was followed by introducing forest ownership (model II), LLP knowledge (model III), place attachment (model IV), and finally prescribed fire attitudes (model V). The sets of indicators were entered in successive stages to observe changes in the model (i.e., change of coefficients and model fit).

Results

Respondents

More than 80% of respondents were supportive of LLP restoration (Table 2). On a scale of zero to five, with zero indicating no knowledge of LLP, the sample demonstrated some knowledge (mean = 2.00) based on the statements provided. A slight majority (53%) of respondents disagreed with the statement that prescribed fire endangered life, while tending to have positive attitudes towards prescribed fire (mean = 2.43). In addition, respondents demonstrated a strong attachment to place (mean = 20.94). On average, respondents were almost 51 years old, female (almost 52%), Caucasian (over 80%), had less than a 4-year degree, including an associated degree (55%), reported more than $50 000 per year in household income (57%), had lived in the region for less than 25 years (55%), and tended to live in suburban–urban places (63%). In accordance with the sampling approach, approximately 70% did not own forestland, while 16% owned LLP.

Support for LLP restoration and attitudes about prescribed fire by respondent type

Of respondents supportive of restoration, 31.9% were forest landowners and 7.6% of landowners owning over 50 acres (20.23 ha) supported restoration ($\chi^2 = 7.984$, $p = 0.18$) (Fig. 3). Urban respondents tended to be more supportive than rural respondents (62.6% versus 37.4%), although this was not a significant distribution with 95% confidence. Regarding knowledge of LLP, however, rural residents had higher scores than urban residents (2.22 versus 1.87; $t = 4.952$, $p < 0.001$), equal variances assumed ($p > 0.05$), and respondents with more than 50 acres (20.23 ha) scored higher than their counterparts (3.42 versus 2.65; $t = 5.456$, $p = 0.000$), equal variances assumed ($p > 0.05$).

Rural residents also tended to score slightly more favorably in their attitudes towards the benefits of prescribed fire than their counterparts (2.48 versus 2.39; $t = 2.588$, $p = 0.010$), equal variances not assumed ($p < 0.05$). It is unlikely that this slight difference would be noticeable outside of statistical analysis. By comparison, respondents with more than 50 acres (20.23 ha) of forestland perceived greater benefits from prescribed fire, on average (2.69 versus 2.59), although the difference was not statistically significant.

[3]In hectares: 0.40 to less than 2.20, 2.20 to less than 4.05, 4.05 to less than 10.11, 10.11 and over.

Table 3. Logistic regression for the five models to determine the support for restoration of longleaf pine (LLP): I, socioeconomic status only; II, addition of acres of forestland; III, addition of knowledge measure; IV, addition of place attachment measure; and V, addition of prescribed fire measures (perceptions of benefit and risk).

	Exp(*B*) of Models				
Measure	Model I	Model II	Model III	Model IV	Model V
Social landscape					
Prescribed fire endangers					1.004
Prescribed fire benefits					1.496‡
Place attachment				1.963‡	1.965‡
LLP knowledge			2.617‡	2.632‡	2.496‡
Forest acres		1.087	0.917	0.961	0.999
LLP acres		2.183†	1.014	0.924	0.857
Socioeconomic					
Age	0.983‡	0.982‡	0.977‡	0.979‡	0.978‡
Race	2.129‡	2.138‡	1.626†	1.569†	1.498*
Education	0.921	0.899	1.690*	1.716*	1.700†
Residence tenure	1.632†	1.552*	1.080	0.976	0.963
Household income	1.396*	1.345*	1.251	1.239	1.225
Gender	0.584‡	0.563‡	0.384‡	0.386‡	0.356‡
Rural/urban	0.732†	0.794	0.909	0.864	0.892
Constant	14.114‡	12.847‡	12.120‡	27.502‡	12.882‡
–2(log-likelihood)	1796.414	1777.414	1461.523	1425.649	1390.272
χ^2	97.835	116.835	432.726	468.6	503.977
R^2	0.071	0.085	0.297	0.319	0.341
n	2593.000	2593.000	2593.000	2593.000	2593.000

Note: Means replacement was implemented for missing data in race (2%), education (1%), and income (9%).
*Significant at $p < 0.05$.
†Significant at $p < 0.01$.
‡Significant at $p < 0.001$.

Regarding the statement that prescribed fire can endanger life, landowners with less than 50 acres (20.23 ha) were more likely to agree than landowners with over 50 acres (20.23 ha) (71% versus 28.9%; $\chi^2 = 14.432$, $p = 0.001$); however, there was no statistical difference in distribution between urban and rural residence (36% versus 64%) regarding the statement.

Predicting support for LLP restoration

Indicators were entered in successive stages as predictors of support for LLP restoration starting with only socioeconomic statuses (Table 3). All models were statistically significant, with model fit indicators improving the most between the second and third models (introducing LLP knowledge). Model I (socioeconomic status only) explained only 7% of the variance in support for LLP restoration ($\chi^2 = 97.835$). Six of the seven predictive variables in model I were significant: age, race, residence tenure, household income, gender, and rural/urban. Support for LLP restoration was more likely with decreasing age ($p = 0.000$), Caucasians compared with African Americans ($p = 0.000$), those with 25 to 49 years in the area versus less than 25 years ($p = 0.005$), income of over $50 000 compared with less than $50 000, females rather than males ($p = 0.000$), and rural compared with urban ($p = 0.022$). Notably, education was the only socioeconomic status not significantly associated with likelihood of supporting restoration.

After introducing forest acres and LLP acres, model II (acres) explained slightly more of the variance in the dependent variable ($R^2 = 0.085$, $\chi^2 = 116.835$) compared with the first model. Model II retained six significant predictors with rural/urban losing statistical significance and LLP acres being significant. Residence tenure dropped out of this model. Education became significant with those having at least a 4-year degree being more likely than their counterparts to support restoration ($p = 0.011$). Directions of other socioeconomic statuses remained unchanged, while those who owned LLP were more likely to support restoration than their counterparts ($p = 0.004$).

Model III (knowledge) introduced LLP knowledge, explaining nearly 30% of the variance in support for LLP restoration ($\chi^2 = 432.726$). The number of significant predictors decreased to five: age, race, education, gender, and LLP knowledge. Household income and LLP acres became statistically insignificant with the addition of LLP knowledge. Remaining odds ratios were consistent with previous models, and support for restoration was likely to increase with increasing knowledge about LLP ($p = 0.000$).

Place attachment was introduced in model IV (place attachment), helping to explain slightly more of the variance in the dependent variable ($R^2 = 0.319$, $\chi^2 = 468.600$), with the other significant predictors age, race, education, gender, and LLP knowledge. All predictors retained their directions from previous models. The likelihood of supporting restoration increased with increasing place attachment, which was significant at $p < 0.001$.

The final model (prescribed fire) introduced attitudes towards prescribed fire. Of the two predictors, only prescribed fire benefits was significant ($p < 0.001$), with increasing support for restoration associated with increasing positive attitudes about the benefits of prescribed fire. The addition of these variables increased the explanation of the variance in the dependent variable slightly to 34% for the full model ($\chi^2 = 503.977$). The significant predictors from the previous model (age, race, education, gender, LLP knowledge, and place attachment) retained significance and direction.

Discussion

Former Secretary of Agriculture of the United States John Vilsack said, "Hunters, anglers and multi-generational small private landowners are very important to the rural areas where longleaf restoration is most likely to occur" (Dennis 2010). With more than half of the existing LLP on private land, NIPFLs are critical to restoring continuous and non-continuous habitat, which is important for the conservation of species within the LLP ecosystem (Damschen and Brudvig 2012). As well, due to the large public and

private investment in restoration, it is important to understand attitudes of the general public, who hold values and attitudes that influence restoration policy and NIPFLs with whom they interact. In short, for restoration efforts to be socially accepted (and supported), as well as ecologically successful, they must align with social goals and values (Kellert 1996).

Although this study found widespread support for LLP restoration, forest ownership did not influence the likelihood of supporting LLP restoration, controlling for other variables in the final model. Thus, as with previous research, the general goal of restoration appeals to the general public, even at the landscape level (Bright et al. 2002). This finding has implications for expanded public investment into restoration initiatives to meet the goal of 8 million acres (3 237 485.14 ha) of LLP by 2025 (ALRI 2019). Despite this, challenges continue to materialize in the form of marginal decision-making of NIPFLs when deciding to convert their forest to LLP, as well as technical support for private landowners.

Theoretically, the most impressive, and anticipated, findings were the strong correlations of place attachment and positive attitudes towards prescribed fire with support for restoration of LLP habitat. Thus, this study contrasts with previous efforts showing broad support for restoration dependent on specific activities applied in the restoration process (Gobster and Barro 2000). By employing an established place attachment scale, this study measured the contribution of place attachment on support for restoration but did not measure whether LLP was a significant component in place attachment. However, like live oak (*Quercus virginiana*) and coastal wetlands, LLP likely contributes to place identity as observed in a broad spectrum of media and literature (Dennis 2010). As a potential key feature informing attachment to place, widespread knowledge of LLP, including its interactions with fire, unsurprisingly influenced support for restoration.

This finding also reflects human dimensions of fire research, which is fairly consistent in demonstrating the general public's knowledge, albeit coarse, of local ecology regarding fire (Gordon et al. 2018). That research, however, did not examine factors informing public ecological knowledge, and therefore, the findings here offer a future research avenue. Besides ecological knowledge, findings here coincide with studies of residents of the southeastern US showing positive attitudes about prescribed fire and less concern about prescribed fire endangering welfare compared with residents in other regions (Shrestha 2019). Along with broad support for restoration, support for prescribed fire offers opportunities to build public awareness and backing for future LLP restoration efforts that simulate natural processes, particularly those occurring on private lands. As such, communication materials about restoration should contain principles of ecosystem management, species present, the role of fire in ecosystem functioning, and information on recreation and wildlife observation (also see Jacobson and Marynowski 1997).

Less expected was the finding that rural or urban residence did not influence support for restoration, while several other sociodemographic factors (age, race, education, and gender) were important. These sociodemographic findings reflect inconsistencies in the literature about the importance of socioeconomic statuses in predicting attitudes towards restoration and suggest the relative influence of the specific restoration goal of interest (Bright et al. 2002). Residence was expected to influence restoration support through value orientations. Rural residents may be more closely associated with working rural landscapes such as forests than their urban counterparts (Flora et al. 1992). For rural residents, a forest's value may lie primarily in the income that it can generate (often understood in a fungible economic context).

By contrast, urban and suburban residents might be more likely to view the value of forestland in the pleasure that it provides as a place for hiking, hunting, fishing, and (or) bird watching or knowing that it exists even if they will never see or use it. Of course, value orientations were not operationalized per se, and the measure was simply a geographic variable, which could partially explain the lack of difference between rural and urban residence. This analysis was part of a larger project, which limited space for explanatory measures. Nonetheless, future research should attempt to include a number of additional variables, including value orientations (e.g., environmental and political values), recreation preferences, physical landscape characteristics, aesthetic preferences, and behavioral measures (e.g., donating money for restoration, planting LLP, etc.).

In some ways, the direction of future research should focus on more in-depth examination of the public's definition and preferences regarding restoration. This and previous studies have found support for restoration, but what the public perceives as desirable in terms of returning an ecosystem to a "natural" state is not well-understood (which could partially reflect disagreement among scientists about what constitutes a natural state). Although restoration initiatives often imply that their need is inherently obvious and their goals are honorable, the quality of restoration is mediated by alternative notions of restoration emergent through interactions with the landscape and various social actors over time. Because the lack of clarity in the terms "natural" and "historical" has led to confusion and debate over what constitutes a restored landscape, Landres et al. (1999) suggested that restoration will always depend on the ecological and social context of the area and the issue.

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