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Public Opposition to Harvesting as a Barrier to Climate Change Adaptation: Perceptions and Responses of Foresters across the Northeastern United States

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ABSTRACT

In the northeastern U.S., climate change concerns are fueling public movements against forest harvesting, despite experts' assertion that harvesting is an important tool in climate adaptive forest management. Based on qualitative analysis of 32 interviews with urban and rural foresters ($n = 15$ and $n = 17$, respectively) across the region, this project examines how foresters in different professional contexts (e.g. urban or rural; public or private) perceive opposition to harvesting as a barrier to climate adaptive management; and how they are responding. We demonstrate that foresters use different strategies to increase public acceptance of management, including education, political advocacy, and public collaboration. While the use of these strategies appears critical to advancing adaptation of the Northeast's forests, foresters' professional contexts seem to guide their choice of and success with different strategies, calling for greater research into how different forester groups' behaviors impact the adaptive capacity of the region overall.

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Introduction

Professional foresters carry much of the responsibility for facilitating the adaptation of the world's forests to the compounding stressors and rapidly shifting conditions of anthropogenic climate change (D'Amato and Palik 2021; Janowiak et al. 2014; Messier et al. 2015). However, public attitudes—in the form of opposition to or support of management decisions—also play a crucial role in foresters' ability to manage forests in general (Brunner 2005; Pretty and Ward 2001; Susskind and McKernan 1999), and implement climate adaptive management in particular (Lachapelle and McCool 2012). In the United States, the significance of public attitudes first became a major focus of natural resource researchers and practitioners in the wake of the 1980s' Timber Wars of the Pacific Northwest, spurring the development of various frameworks (e.g. social license, social acceptability) and strategies (e.g. adaptive co-management, collaborative

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governance), to help explain the social dynamics of natural resource governance and aid managers in achieving more successful and democratic management (Edwards et al. 2016; Maier and Abrams 2018). Decades later, questions remain regarding their application in various real-world contexts (Fisher et al. 2020). Today, responses to climate change present a new and critical test of these strategies as the climate crisis triggers a new wave of public environmental concern over natural resource management and proposed adaptive responses may represent novel and uncertain technologies to civil society. Both conditions are believed to trigger opposition to natural resource management decisions (Niemelä et al. 2005; Rametsteiner et al. 2009; Kasperson and Ram 2013).

Such a test is presently unfolding in the northeastern United States, where a growing public faction is pushing on the ground (Wu 2019) and in the statehouse (Sabadosa 2021) for a significant reduction in harvesting in the region's forests. Often, the argument stated by such groups is that unharvested forests will store more carbon, and thus better help mitigate climate change (e.g. Moomaw et al., 2022). However, many experts within the forest science community advocate for the need to adapt to as well as mitigate climate change, and accordingly recommend a diverse mix of management practices—active and passive, novel and traditional—to help forests adapt within timeframes that are crucial to the wellbeing of their respective socioecological systems (e.g. D'Amato and Palik 2021; Janowiak et al. 2014; Millar, Stephenson, and Stephens 2007; Ontl et al. 2018; Swanston et al. 2016). It is widely accepted among foresters that harvesting of trees is a practice that serves as an important tool in the restoration and adaptation of the region's forests. For example, removing trees can create light, moisture, or structural conditions beneficial to forest species that are adapted to future climate scenarios, or improve the remaining trees' vigor, increasing forest resilience in the face of pests, pathogens, windstorms, and fire (Swanston et al. 2016). Additionally, revenue from harvesting and downstream processing is often the financial backbone of rural livelihoods and economies in the region, including forestry (TNC 2012).

To date, there is little data on how the Northeast's forestry community perceives or is responding to negative public opinion about forest harvesting. Nor is there substantial documentation of the experiences of foresters facing similar circumstances around the world. Historically, studies of foresters' relationships to public opinion have focused on public lands managers, particularly in the rural American west (Davenport et al. 2007; Maier and Abrams 2018; Nelson et al. 2017; Olsen and Shindler 2010). In contrast, the forests in the northeastern United States are divided among a mix of landownership types (with over 70% privately owned), spread across a broad spectrum of population densities (Butler 2021). This study investigates how the diverse professional community of Northeast foresters perceive and navigate opposition to their work. As such, it is relevant to foresters across the globe who face similar responses from the public regarding forest management, preservation, and climate change. As civil society looks to forests of all kinds as a promising solution to climate change, questions of how foresters navigate public opinion are increasingly pertinent for both urban and private lands foresters, who have long been underrepresented in this body of scholarship. Furthermore, examining the strategies that different groups of managers use to navigate conflict within the same region sheds light on different strengths and learning opportunities.

For this study, we interviewed private and public lands foresters across the urban-rural gradient in the northeastern region of the United States about their management responses to climate change. We observed that participants regularly described land-owner and other stakeholder perceptions of forestry to be a barrier to management. We specifically examined how interview participants perceived and responded to public opposition to forest harvesting in the Northeast. By analyzing their discussions of these issues, we attempt to answer:

1. When and how do participants perceive stakeholder opposition to forest harvesting to be a barrier to climate change adaptation?
2. What strategies have participants used to navigate this perceived barrier?
3. How do perceptions, strategies, and successes vary across the different forester communities (i.e. public vs private foresters)?

Through this investigation, we add to the growing literature on how natural resource managers in different contexts navigate strong public opinions as they respond to the pressing issue of climate change. We also highlight opportunities for the forestry community in the Northeast to more adeptly collaborate with civil society in helping forests adapt to climate change.

Background

Factors Contributing to Public Attitudes toward Natural Resource Management

A number of theoretical frameworks (e.g., social license, social acceptability, social capital) and applied strategies (e.g., adaptive co-management, collaborative governance) have been used in recent decades to help explain the relationship between natural resource management, managers' decisions, and public opinion. Despite differences in the lines of inquiry resulting from these concepts (Brunson 1996; Edwards et al. 2016; Plummer 2009; Pretty 2003), many point to overlapping factors in the generation and resolution of public opposition to natural resource management.

Primary among these factors is *trust*. In the concept of social capital, trust is held as one of several key features of society that lowers the transaction cost of collaboration (Putnam 1993), as it permits people to rely on one another to produce certain outcomes without needing to monitor each other (Rousseau et al. 1998). This usage of trust has been applied to natural resources, where it is presented as a key factor that facilitates the cooperation required to manage resources in the context of society (Pretty and Ward 2001). It is worth noting that another component of social capital, *norms*, is also discussed in the literature on collaboration and conflict resolution in natural resource management; norms facilitate cooperation by creating a sense of shared standards within which individuals believe their peers will act, and that they themselves should act (Pretty and Ward 2001). It has been documented that creating and following norms has afforded natural resource managers greater social license (Moffat et al. 2016) and increased the acceptability of specific management strategies (Shindler, Brunson, and Stankey 2002).

In application, empirical studies have linked a lack of trust in natural resource management actors and governance with skepticism, conflict, and opposition (Nie 2003; Wondolleck and Yaffee 2000), and have demonstrated that trust increases public acceptance of management decisions (Ford et al. 2014; Olsen and Shindler 2010; Winter, Vogt, and McCaffrey 2004). Trust has also been found to mediate conflict (Young et al., 2016), and is associated with greater capacity of managers to practice experimental and adaptive management (Lachapelle and McCool 2012; Rousseau et al. 1998). However, trust (or the lack thereof) is multidimensional, and overall levels of trust can be influenced by different factors, such as perceptions of the trustworthiness of individual managers and decision-makers (*affinitive trust*); of the fairness and legitimacy of the decision-making process (*procedural trust*); or of whether the given action will result in positive outcomes (*rational trust*; Nelson et al. 2017; Stern & Coleman 2015).

Accordingly, a number of different actions have been found to increase trust in natural resource management. Central among these are practices that facilitate the participation of diverse stakeholders and members of the public in different stages of the management process. Studies indicate that participatory and collaborative management can increase trust by creating positive, personal connections with managers (Davenport et al. 2007), by establishing procedural fairness in decision-making processes (Wondolleck and Yaffee 2000; Nelson et al. 2017; Peterson St-Laurent et al. 2019; Gray 1989), and by creating opportunities for hands-on learning about management processes (Cundill and Rodela 2012; Fernandez-Gimenez, Ballard, and Sturtevant 2008).

Educational campaigns can also lead to greater trust, particularly rational trust, when they effectively increase public understanding about the positive outcomes of and reasoning behind forest management decisions (Davenport et al. 2007). However, the manner in which information is communicated significantly influences whether it leads to greater understanding. Indeed, numerous studies have debunked the *knowledge-deficit model*, which holds that simply delivering facts will lead to changed opinions or behavior (Brown 2009). And yet, it has been suggested that knowledge can contribute to such changes when it is communicated through trusted sources (Nelson et al. 2017) and told through stories (Shindler, Brunson, and Stankey 2002) that are connected to the values and experiences of the audience (Vulturius and Gerger Swartling 2015). When communicated well, information and educational campaigns can also lead to shifts in public opinion through avenues other than trust, such as by shaping public knowledge of the alternative options against which they judge a given decision (Murray and Nelson 2005), or by shifting expectations, norms, and individuals' perceptions of what their peers think is "right" (Arias 2019; Borg, Curtis, and Lindsay 2020).

Forestry in the Northeast

The Northeast, defined in this study as New England and New York, covers over 32 million hectares combined and contains some of the most densely populated and forested land in the United States. The study area is home to over 35 million people, heavily concentrated in the coastal metropolitan areas of New York City, NY and Boston, MA (US Census Bureau 2020). About 70% of the region's land is forested, although this number rarely includes naturally forested areas within developed landscapes (Duveneck,

Thompson, and Wilson 2015; Widmann 2016). The Northeast's forests are mostly temperate broadleaf deciduous and mixed forests, with areas of lowland and montane spruce-fir more concentrated in the north, and oak, pine, and hickory forests at lower elevations and in the south (NRCS 2011).

A long history of frequent interactions between humans and forests in this region has contributed to the diversity of ownership types, management relationships, and forest management practices that exist on the landscape today (Foster et al. 2010). Over 70% of forested land in the rural Northeast is privately owned, the predominant landowner being small non-corporate owners like families and individuals. Corporate and industrial ownerships make up most of the rest of private landowners, with other private groups (namely conservation organizations) owning roughly 2% of total forest land (Butler 2021). Other major landowners include federal, state, and Tribal groups (Duveneck and Thompson 2019). Management of much of the Northeast's rural forests largely falls into the hands of independent consulting foresters, who work primarily with individual and family forest owners. Meanwhile, state, federal, corporate and Tribal entities generally own large tracts of land and have capacity to hire full-time foresters. The interests, objectives, and the degree of landowner involvement in management varies widely. Accordingly, the foresters who manage these different lands develop different focuses and skillsets in the process of balancing landowner interests with the needs of the land.

Urban forestry is often considered distinct from forestry that occurs on rural lands. Although urban forestry shares principles with rural forestry, the field generally promotes goals of human safety, recreation, and environmental protection over timber and wood fiber production (Miller 1997). While rural forestry has been established as a profession and field of study since the late 19th century (Foster et al. 2010), urban forestry was not established as such until the late 1960s (Konijnendijk et al. 2006). Recent studies suggest that urban foresters still lack a unique professional identity and community of practice, and frequently incorporate elements (and professionals) from different backgrounds, such as urban planning and arboriculture (O'Herrin et al. 2020). Despite the variability in professional backgrounds of urban foresters in the northeastern region, these professionals are commonly municipality employees. Nonprofit conservation organizations and independent consulting foresters also manage portions of the urban forest (Pregitzer et al. 2019). Given the diversity of professional contexts, it is important to examine a range of roles held by rural and urban foresters in order to understand forest management in the Northeast.

Methods

Sampling

Thirty-two rural (n = 17) and urban (n = 15) foresters were interviewed in this study. For our purposes, we define *rural foresters* as professionals who make decisions about silvicultural practices on forests in rural areas, defined as anywhere that is not urban by the U.S. Census Bureau (Ratcliffe et al. 2016). *Urban foresters* are professionals who manage forested greenspaces in urbanized areas (population > 50,000) and urban

clusters (population > 2,500; Ratcliffe et al. 2016), but do not necessarily practice silviculture.

We utilized different sampling strategies to identify interview participants in rural and urban communities. Rural foresters in the Northeast are fairly well-networked, many belong to established professional networks, and they often have a similar educational or professional training. Based on these factors, we used key informants to select initial participants who were thought to be knowledgeable about climate change and climate change adaptation. Urban foresters, in contrast, are less well-networked, and have varied educational or professional training. Many who our study would define as urban foresters do not belong to an urban-focused professional association. The diffuse and heterogenous nature of the urban forester community required us to take a different sampling approach. Specifically, we identified target municipalities using U.S. Census Bureau classification. Once we identified the municipalities we wished to reach, we used public directories to solicit participation from staff who actively managed urban forests or greenspaces. We additionally asked urban participants to refer potential future participants (i.e., a snowball sampling approach), though participants were rarely able to do so. We believe that this reflects the low-levels of professional connectivity among urban foresters, which has been documented previously (O'Herrin et al. 2020).

Data Collection

We interviewed participants individually about their perceptions of and responses to climate change risks. We additionally asked about foresters' motivations and limitations when it came to implementation of climate change adaptation strategies. We developed a semi-structured interview guide, which was tested by forestry researchers and foresters prior to conducting the interviews (the full 18-question guide is available in [Supplemental Materials I](#)). We conducted interviews in person until COVID-19 lockdown orders were instituted in March 2020. In the months following, single-session interviews were conducted via telephone or video calls. Phone and in-person interviews were recorded, with participant permissions, using a digital voice recorder. Video calls were recorded in Zoom. All recordings were then transcribed in preparation for textual analysis. The study was reviewed and approved by the University of Vermont Institutional Review Board (STUDY00000550).

Coding and Analysis

Informed by Grounded Theory (Charmaz 2014), we developed an initial codebook, or list of emergent themes and corresponding definitions, from a close reading of five transcripts. To reduce interpretation bias and verify the reliability of results, each interview was then coded in NVivo 20 (QSR International Pty Ltd 2020) by two coders. Dual-coding was conducted in sets of 5-10 interviews. We used Cohen's kappa coefficient (k) to check inter-coder reliability and to refine our coding approach. We continued this iterative process, known as the *constant comparison method* (Emerson 1995), until all interviews were coded. The final codebook contained nine major themes such as *challenges* and *adaptive practices*, and 67 codes that addressed the specific themes of

Table 1. Gender of rural and urban participants, number of years they spent professionally managing forests, and land base and state in which participants primarily worked.

	Gender		Years in profession				
	Male	Female	<15	15-30	30+		
Rural	13	4	3	9	5		
Urban	13	2	6	5	4		
	Primary land base						
	Municipal	State	Federal	Tribal	Conservation ^a	NIPP ^b	Industrial
Rural	0	4	2	1	3	3	4
Urban	11	1	0	0	2	1	0
	State						
	NY	VT	NH	ME	MA	CT	RI
Rural	3	2	5	4	2	0	1
Urban	4	2	1	3	3	1	1

^aLand owned by nonprofit conservation organization; ^bNon-industrial private forest.

participants' experiences (e.g. *economics* and *public perceptions*). We verified saturation using Guest et al.'s (2020) method, which states that saturation is met when the number of new themes identified in each subsequent round of coded interviews makes up less than 5% of the themes already identified. This manuscript reports on one subset of themes, namely those that emerged through the coding process but which were not anticipated at the outset of the study ([Supplemental Materials II](#)). Specifically, we present results pertaining to the role that public opposition to forest management strategies plays in foresters' ability to effectively adapt to a changing climate, and strategies employed by foresters of different groups to address this perceived barrier to adaptation.

Results

Participant Demographics

We interviewed 17 rural foresters, mostly men (76%), who had been employed as foresters for 15-30 years (53%, [Table 1](#)). Of these, ten were primarily employed by private landowners, including industrial timber producers, nonprofit conservation organizations, or other non-industrial private forest owners. Six rural foresters managed public lands (state or federal), and one was employed to manage lands owned by a Tribal nation. A little over half ($n=9$) were primarily employed to manage forests in Maine or New Hampshire.

We also interviewed 15 urban foresters. Again, most were men (87%) who were employed in urban forestry for less than 15 years (40%, [Table 1](#)). Twelve urban participants were public land managers, 11 were employed by municipalities, two were employed by nonprofit conservation organizations, and one was a private consulting forester who primarily worked for small family landowners, but who also regularly contracted with urban municipalities. Urban interviewees were distributed evenly across the Northeast. The exception to this was three urban foresters practicing in New York City, NY.

Opposition to Harvesting as a Barrier

In the interviews, nine rural foresters and seven urban foresters described public opposition to tree harvesting as a barrier to adaptive management. The barrier manifested in two ways: 1) foresters suggested that public opposition made it harder to prescribe adaptive harvests (one tool of adaptive management), and 2) they expressed concern that it weakened the economic foundations of forestry, making it harder to utilize any active adaptation practices.

Both rural and urban participants commonly shared stories of finding it more difficult or choosing not to prescribe adaptive harvests due to public opposition. They described the nuance of the barrier as the cost in time and energy required to advocate for a controversial practice, which the landowner may ultimately choose not to utilize. For example, a forester for tribal lands (TH-18) explained that he and his fellow managers experimented with strip clear-cutting to limit the amount of blowdown from increasingly common extreme wind events. Despite positive outcomes in the forest, he did not even attempt to utilize the practice widely because, “it’s a hard sell.”

Beyond the costs of advocating for a given action/prescription, several participants, namely rural, also expressed fear that exposing laypeople to controversial harvesting practices could trigger lawsuits or political activism, which by extension might limit the ability to practice forestry in general. In almost every case, participants connected this concern to recent activism in Massachusetts, which resulted in the proposal of a bill in fall of 2019 (Whipps 2019) to restrict harvesting on state lands in the name of environmental protection and climate change mitigation. About 10-years prior, similar activism resulted in a 3-year moratorium on commercial logging on state lands, which remained fresh in many participants’ minds. In the words of a consulting forester in eastern Massachusetts,

The state basically had to shut down any cutting on their own lands for many years ... that really set us back in the forestry community. We don’t want to go through that again. So, I think everybody has got to be a little bit careful how they proceed with cutting.
(TH-17)

While the moratorium did not legally prevent this forester from harvesting, he and other participants believed that it and similar policy measures encouraged a popular movement against active forestry and weakened the local forest products industry, leading to present restrictions and additional potential restrictions in the future. Accordingly, these foresters described being more “careful” and limiting their prescriptions of large harvests to avoid triggering such public reactions.

Participants’ concerns about the rippling effects of legal actions point to ways that some participants perceived public opposition to harvesting as a barrier to active management more broadly. Several rural participants expressed fear that in the coming decades, the cultural and institutional trends in opposition to cutting trees may lead to the collapse of the local infrastructure and experienced workforce that underpin all active forest stewardship. A consulting forester in southern New Hampshire explained,

I’m really concerned industry-wise about just markets and this idea of “not in my backyard”, not harvesting locally, like people losing the idea of this locally renewable resource that we can manage sustainability ... I worry about people losing that connection,

Table 2. Number of foresters in each professional group who utilized each strategy in response to public opposition to harvesting.

Participant group	Response Strategy		
	<i>Outreach & education</i>	<i>Political advocacy</i>	<i>Participation & collaboration</i>
Urban			
<i>Public</i>	4	0	5
<i>Private</i>			
<i>Conservation</i> ^a	1	0	0
<i>Total</i>	5	0	5
Rural			
<i>Public</i>	3	0	3
<i>Tribal</i>	0	0	1
<i>Private</i>			
<i>Small landowner</i>			
<i>NIPF</i> ^b	1	0	0
<i>Large landowner</i>			
<i>Conservation</i> ^a	2	2	1
<i>Industrial</i>	1	3	0
<i>Total</i>	7	5	5

^aLand owned by nonprofit conservation organization; ^bNon-Industrial Private Forest.

and that compounding itself ... So, in 50 years the idea of someone actively managing their land? I don't know. (TH1)

As stated above, participants generally placed this fear in the future and did not perceive public opposition to harvesting to limit other forms of active management in the present. However, some indicated that such limitations may occur sooner than 50 years, believing public opposition to harvesting will exacerbate other negative economic trends, such as mill closures and logger shortages that foresters widely cited as additional, concerning barriers to their management.

Participant Responses to Opposition to Harvesting

Participants discussed a variety of practices they employed in response to the concerns described above. These practices fell into three categories: *outreach and education*, *political advocacy*, and *participation and collaboration*. Table 2 shows how many foresters in each of the different professional groups utilized each strategy.

Outreach and Education

Participants most commonly addressed public opposition to harvesting by attempting to educate the public about active forest management. Participants from nearly each professional group used this strategy (Table 2). Usually, their discussions centered on instances in which they gained social acceptance of a specific controversial harvest by actively publicizing the harvest's operations, goals, and outcomes. For example, an urban land trust manager in Massachusetts explained how he was able to carry out harvests to create open, early-successional habitat in a beloved city forest:

... we put up a 4'x8' sheet of plywood with an explanation of what we were doing and why we were doing it. 'And you should expect that there'll be blueberries!' ... we had a newspaper article and we brought people in and we talked about it. (TH15)

Nine other foresters shared similar stories of garnering support for controversial harvests. These participants utilized multiple communication pathways (media, tours,

signage), and emphasized the importance of providing reasoning behind management decisions and connecting harvest outcomes to public values. Usually, participants highlighted harvests' benefits to wildlife habitat or human recreation (e.g. blueberries) in order to gain public acceptance. Fewer participants specifically focused their communication on the climate change adaptation benefits of harvesting, and those that did often shared their desire for more tools to help them talk to the public about climate adaptive forestry.

In addition to increasing the acceptance of individual harvests, the participant above also suggested that engaging in such outreach campaigns consistently and repeatedly helped lower opposition to harvesting within his community over time, making subsequent harvests easier to carry out.

Well *every time* I do a cut, I bring in the [local newspaper] and I show the really fancy equipment. And we talk about all the positive things that will come for habitat ... for recreation ... for climate. And people are like 'Ah yeah, [retracted] Land Trust, they cut trees, that's cool, whatever.' And [other foresters] are like, 'How do you do that? Because like it's getting harder and harder for us to cut trees even in the state parks and forests.' And I'm like 'I don't know.' *Every time* we have a cut, I bring in the press and I talk up how awesome this is. (TH15)

Two other urban foresters reported similar long-term outcomes, though more commonly, participants shared stories of garnering support for single harvests.

Political Advocacy

Five rural participants (all working for private industry or conservation organizations, [Table 2](#)) described their efforts to navigate the barriers posed by public opposition by engaging with the policy cycle. In particular, these participants attempted to mitigate what they feared might ultimately result from public opposition—legal restrictions and the loss of critical infrastructure (e.g., local mills and markets). They discussed actions such as testifying for state legislatures or public agencies to help shape regulations or support policies beneficial to the forestry industry (such as incentives for local wood markets). One consulting forester who worked for industrial-scale landowners described his past efforts to help craft and advocate for increased regulation of forestry in his state:

So, the environmental community was in a panic and they have a tendency, like many interest groups, to get the hammer out instead of the, you know, the needle and thread. And so, we said, 'Look, we can't let that get in front of the legislature. We need to get in front of the legislature with something better.' (TH-8)

This forester was able to help prevent the passing of legislation motivated by negative opinions of harvesting, instead creating regulation more favorable to foresters. Other participants found similar success by shaping or opposing regulations already proposed by others. TH-8 also said that he hoped that by creating clear standards of behavior for foresters, the legislation would help the public distinguish the "bad actors" in the industry, instead of portraying these bad actors as representative of the whole: "That's why [we] set up the... law, because we wanted the people to recognize the difference between sustainable forest management, and mining of timber" (TH8).

Participation and Collaboration

Participants in this study also spoke about how facilitating public participation and collaboration in the management process created opportunities to address or diffuse public opposition to harvesting. Usually, this participation occurred in the planning stages of management processes as part of a requirement for managing public lands. Both urban and rural managers (all publicly employed) mentioned engaging in processes such as public meetings or comment periods to solicit public input about management objectives and activities. However, while it was often implied that this process helped managers avoid conflict with the public in the future, only two explicitly named it as an opportunity to shift negative public opinions about harvesting. One, a consulting forester who occasionally worked for rural town forests, shared,

Yeah, so a lot of foresters aren't willing to work with towns because there's this whole extra layer of public involvement. We encourage it and embrace it... there's always a contingency of folks that are really against the idea of active management or have concerns and so those are the people we really embrace. (TH1)

This forester went on to explain that she saw seeking input and involvement in public planning workshops as a way to “establish relationships” with concerned citizens, which she saw as key to navigating opposition to forestry.

Five urban foresters also shared stories about the positive effects of facilitating public participation in other stages of the management process as well. An urban forester who successfully carried out commercial harvests in a small city stated that public participation in implementation and monitoring of active management facilitated greater connection and “buy-in” with the process, making his other management work less controversial. He shared,

We're doing a project with [a local wildlife society] where we get students out in the forest and reclaiming some of the urban parks into open space... We're planting native wildflowers and understory plants and the kids get to be part of that. And so that's really rewarding when it's... that buy-in from the community—you know, I have no qualms about saying, 'Hey, we're going to do this forest management work.' (TH-30)

This forester also collaborated with the wildlife society to write forest management plans in order to design harvests that were positive for bird habitat. Elsewhere in the interview he emphasized the effect that this collaboration had in “advocating for forest management work,” given the public's positive perceptions of the society. Two other urban foresters and one rural forester echoed this sentiment regarding collaboration with public interest and stakeholder groups.

Discussion

This study indicates that public opposition to harvesting represents a barrier to adaptive management in the eyes of the forest managers. This reaffirms prior findings that public opposition influences the behavior of public lands and industrial foresters in general (Maier and Abrams 2018), and limits adaptive behaviors specifically (Lachapelle and McCool 2012), signaling the need to include such social factors in considerations of a region's adaptive capacity. Public opposition to harvesting has not previously been documented as a barrier to adaptation for urban foresters, nor non-industrial private

forest (NIPF) managers. The findings presented here may be indicative of the increasing public awareness of the climate mitigation benefits provided by private and urban forests, and a resulting increase in public scrutiny of the management of these systems. In other words, climate change concerns may be contributing to an increase in public opposition to forest management activities, which prevents managers from helping forests adapt to climate change.

Both rural and urban foresters who participated in this study perceived the costs of navigating conflict as a barrier to conducting silvicultural harvests, but only rural foresters expressed concern that the anti-harvesting movement may threaten their ability to finance and carry out management in general. This difference reflects the traditional foci and economic realities of each profession—rural forestry was developed to help sustainably harvest wood (Foster et al. 2010) and is still largely focused on and financed by this process, while urban forestry has historically been funded as a public service oriented toward balancing safety risks with the non-timber benefits that trees provide to urban residents (Konijnendijk et al. 2006). While viewing public opposition as an existential threat to their livelihoods may prompt more active responses from rural foresters, it may also make conflict resolution more difficult, given the magnitude of emotions involved (Vining 1992).

Despite differences in levels of concern reported by urban and rural foresters, this study found that northeastern foresters successfully navigate instances of public opposition with tools and practices described elsewhere in the literature, reaffirming the utility of these tools in different geographic and institutional contexts. Participants reported engaging in outreach and education tailored to the values of the target audience (Vulturius and Gerger Swartling 2015), which set realistic expectations (Davenport et al. 2007; Shindler, Brunson, and Stankey 2002), and referenced trusted scientific data (Murray and Nelson 2005; Nelson et al. 2017). These practices have been shown to increase rational trust in and public acceptance of forest management. Participants also engaged in the creation of policy, which sets clear expectations and norms, thus facilitating cooperation in society (Moffat et al. 2016). Finally, foresters facilitated public participation and sought collaboration with stakeholder groups, which have been promoted as strategies to increase affective, procedural, and rational trust in forest management (Bethmann et al. 2018; Davenport et al. 2007; Leys and Vanclay 2011; Spies et al. 2010).

Data from the interviews suggest that foresters found the greatest success (i.e. significant and lasting shifts in public opinion and acceptance, which increased their capacity to implement adaptive management) when their outreach efforts were consistent and repeated within a single community; when they proactively set clear expectations and standards for the outcomes of their work; and when they went beyond the requirements of their job to establish deeper relationships or connections between stakeholders at various stages of the management process. While each of these findings are consistent with the literature (Bethmann et al. 2018; Cundill and Rodela 2012; Borg, Curtis, and Lindsay 2020; Moffat et al. 2016), this study does not represent a rigorous investigation into the relative effectiveness of the strategies used by participants, and greater research into this question is needed to promote more successful and adaptive forest management. This is especially important given the relatively small amount of research conducted with private or municipal forest managers, compared to the greater evidence supporting these findings among public foresters.

Participants' discussions in this study indicate that their professional context significantly shapes their choice and use of different strategies. For example, only urban foresters described long-term shifts in public opinion (e.g. lower levels of opposition over time). While these foresters attributed this decline to their consistent education efforts, it may also be related to the fact that urban foresters work more consistently than many rural counterparts with more discrete populations, which helps facilitate the development and maintenance of trusting relationships.

These differences also manifested in other strategies. In the interviews, only privately-employed participants discussed their attempts to shape state policy—likely resulting from the fact that public foresters' positions as public servants limits their ability to take strong political stances or advocate for specific legislation at the state or federal level (Hatch 1939). It is also important to note that this strategy was only used by foresters working for large, private landowners, suggesting that the strategy might be most attractive or accessible to foresters whose employers have the financial capacity to pay for such work. Finally, public foresters facilitated public participation and collaboration far more than their private counterparts, likely because for these foresters, members of the public are the landowners. According to the norms of the profession, a forester's work should be guided by the landowners' goals and objectives (Nyland 2007). Thus, facilitating public participation is likely a less intuitive option for foresters who work for private landowners.

This variation in professional groups' utilization of different strategies implies variability in their capacity and/or willingness to implement those practices which may be more impactful on public opinion and trust. Studies have indicated that the behaviors of few key industry actors can impact public perceptions of the industry as a whole (Zhang et al. 2015), which may suggest that those actors with greater capacity in the Northeast could play a significant role in the ability of all groups to manage their forests effectively. However, it is not clear whether or how the public's perception of different professional groups of foresters might color this effect. In other words, if an urban forester attains public acceptance of harvesting within her community, would members of her community also demonstrate greater acceptance of harvests conducted by a state agency or private company on rural lands?

This question points to the need for greater research into the drivers of public opposition to harvesting in the Northeast, including whether or how the public perceives differences between industry actors, and the role those perceptions play in public opposition to forest management in different contexts. It is also unclear how much of the opposition is rooted in public understanding and comparative valuing of climate change mitigation versus adaptation, or other longstanding beliefs and attitudes about the connections between timber harvesting and environmentalism. Combined with greater research on the effectiveness of different strategies utilized by foresters, investigations into the beliefs, attitudes, and values of public opponents of forest harvesting could help diffuse conflict and promote adaptation in the Northeast and for natural resource managers in similar contexts.

Conclusion

This study suggests that foresters across the northeastern U.S. perceive public opposition to forest harvesting to be a significant barrier to their ability to utilize management practices which help the forest adapt to climate change. Recently, this opposition has

been heightened by growing public concerns about climate change and forests' role in sequestering carbon dioxide. Rural foresters in particular perceive this movement to not only limit their ability to implement climate adaptive harvests, but see it as a threat to their ability to carry out any future active management, adaptive or otherwise.

Finding ways to create significant and lasting shifts in public opinion and acceptance of forest harvesting appears critical to increasing foresters' capacity to implement climate adaptive forestry. Participants of this study utilize various strategies to effect such change, namely through educational campaigns, political advocacy, and efforts to facilitate public participation. Their uses of and successes with these strategies align with previous findings in the literature, reaffirming the importance of building trust and norms, and paying attention to the way in which information is delivered, as well as its content.

However, participants' professional contexts—whether they manage public or private lands, in rural or urban landscapes, for large organizations or single families—appear to influence which strategies they use to navigate public opposition, how they implement them, and the outcomes of their efforts. Given that some strategies or methodologies will prove more effective at creating lasting shifts in opinion than others, the differences between foresters' professional groups may influence their ability to facilitate public acceptance of harvesting, in specific instances and for the region overall. More studies of forester behavior and public opinion are needed to identify what strategies are most effective in the northeastern United States and beyond, and whether and how foresters in different contexts can utilize these strategies to diffuse conflict and promote climate change adaptation at various scales.

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