



Psychological distance of timber harvesting for private woodland owners



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ABSTRACT

Private woodland owners (PWOs) in the U.S.A. often do not actively manage their forests, and forest policies appeal to a small subset of owners that have management plans and participate in incentive programs. We address this policy disconnect by considering a new possible explanation; PWOs perceive forest management as an abstract and distant concept. Psychological distance (PD) is built on the premise that an individual's mental representations of objects and activities depend on four dimensions of distance between the individual and the object: spatial, temporal, social, and hypothetical. There are few applications of PD in natural resource and environmental research. Our objectives were to: 1) Understand the PD of private woodland owners; and 2) Evaluate how the four dimensions of PD are specifically related to the timber harvesting decision. We interviewed 32 PWOs in Maine, U.S.A. to understand their timber harvesting decision. Results suggest that PD can be described using frequency of harvesting, absentee ownership, co-ownership structure, and harvesting knowledge. PWOs with distant representations of harvesting require different policy mechanisms than those who are psychologically closer. PD is a useful theory in understanding forest management behavior by describing the extent to which timber harvesting is relevant to a private woodland owner. Social, temporal, and hypothetical distance can be shortened by offering frequent opportunities for woodland owner engagement like peer-to-peer networking and learning events and a deeper understanding of how timber harvesting promotes sustainable forest management.

1. Introduction

Private woodland owners (PWOs), specifically non-corporate individual and family owners, manage nearly half of United States forest land, yet few list timber harvesting as an important ownership objective, and fewer still ever intend to harvest trees from their land (Butler et al., 2016). Timber harvesting, the removal of merchantable timber beyond personal use, is a behavior of interest to forest stakeholders such as public and private foresters, the forest products industry, and policymakers who want to anticipate harvesting levels and encourage sustainable harvesting practices on privately owned land. A long, rich history of scholarship has been devoted to understanding why PWOs do or do not harvest timber from their woodland (for a review, see Fischer et al., 2010), with the general conclusion that PWO intention to harvest does not always match their actual behavior (e.g., Egan and Jones, 1995, Silver et al., 2015) due to measurement error and the length of time between the setting of the intention and the

expression of the behavior.

Over 80 years of scholarship on PWOs has not yet shed light on how to better engage PWOs with their woodland (Silver et al., 2015), and use limited theories such as utility maximization and the Theory of Planned Behavior. It is imperative that new frameworks are explored. One potential reason for these prior timber harvesting research results is that these studies have not adequately accounted for the relevance of timber harvesting to a PWO. Many survey-based studies demonstrate that a proportion of PWOs are disinterested or apathetic towards harvesting timber from their woodland (e.g., Dhubbain et al., 2007), and that very few private woodland owners have management plans or participate in cost-sharing programs designed to encourage active forest management (Butler et al., 2016). Often, the timber harvesting decision is made infrequently, and is an unfamiliar concept. Given this context for the timber harvesting decision, the social-psychological theory of psychological distance (PD) offers promising insight into the complicated timber harvesting decisions made by PWOs.

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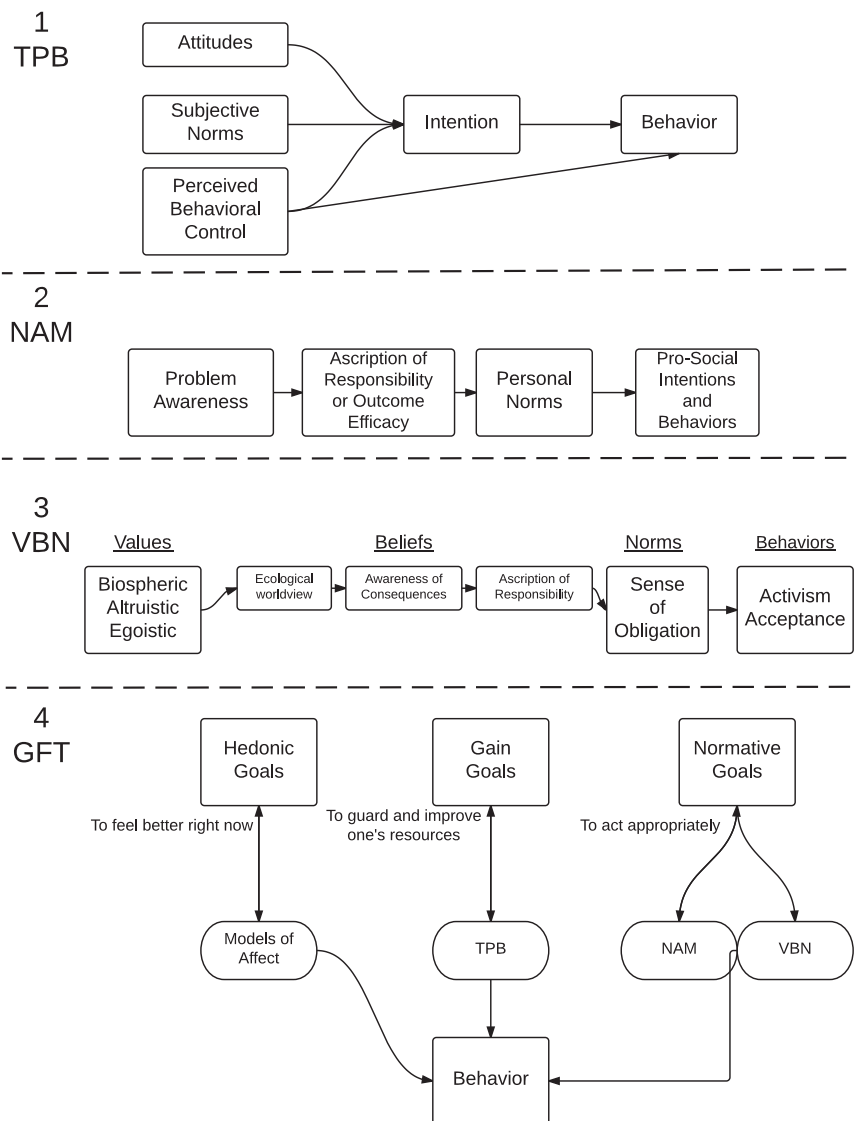


Fig. 1. Four models of environmental behavior. 1. The Theory of Planned Behavior (TPB), reproduced from [Ajzen, 1985](#). 2. The Norm-Activation Model (NAM), modified from [Schwartz \(1977\)](#), [Schwartz and Howard \(1981\)](#), and [Steg and de Groot \(2010\)](#). 3. The Value-Belief-Norm Theory (VBN) modified from [Stern, 2000](#). 4. Goal Framing Theory (GFT) after [Lindenberg and Steg \(2007\)](#) and [Steg et al., 2012](#).

1.1. Cognitive theories and environmental behavior

Environmental behaviors are broadly defined as “all types of behavior that change the availability of materials or energy from the environment or alter the structure and dynamics of ecosystems” ([Steg and Vlek, 2009](#), p. 309). Various psychological theories have been used to better understand environmental behavior, but four commonly used cognitive theories have the most relevance to the potential use of psychological distance. The long relied on Theory of Planned Behavior ([Ajzen, 1985](#)) posits that behavior is predicated by intention to engage in a behavior. This intention depends on attitudes towards the behavior, subjective norms about the behavior, and perceived behavioral control over the behavior ([Fig. 1](#)). The Norm Activation Model (NAM, [Schwartz, 1977](#); [Schwartz and Howard, 1981](#)) suggests that behaviors are preceded by the activation of personal norms ([Fig. 1](#)). The Value-Belief-Norm Theory (VBN, [Stern, 2000](#)) was developed as an extension of the NAM. The situational factors outlined in the NAM are dependent on values and a broader ecological worldview in VBN theory ([Fig. 1](#)). Finally, Goal Framing Theory (GFT, [Lindenberg and Steg, 2007](#)) predicates the other theories above by introducing three general goals that influence behavior: hedonic, gain, and normative.

These four cognitive theories have many advantages and disadvantages ([Steg et al., 2012](#)), the disadvantages being that the constructs are rarely stable over time and none adequately measure an individual who may have multiple goals or what happens when costs of a given behavior high. All theories are built on the assumption that humans desire conceptual coherence, defined as the groupings of objects or attributes that form a meaningful category or class to the perceiver ([Murphy and Medin, 1985](#)). The reduction of cognitive dissonance is a key motivation for perception and behaviors. Based primarily on this assumption, psychological distance (PD) is defined as anything (e.g. time, places, potential activities) not directly experienced, but that exist as a mental construct, anchored at a zero-distance starting point temporally, spatially, hypothetical, or socially ([Liberman et al., 2007](#)). It has been explored in consumer choice ([Dhar and Kim, 2007](#)), and used to study probability judgment, which is also related to risk perception ([Wakslak and Trope, 2009](#)). In all cases, varying levels of PD lead to significant differences in target behaviors and PD could augment theories in the human dimensions of natural resources that fail to fully explain behavior and decision making.

[Sigel \(1970\)](#) described PD as the mental representation of an object, but later refinements of PD specified the mental *separation* of distinct

concepts (Cocking and Renninger, 1993). The word “distance” is therefore related to the differentiation of topics either based on concept distinction, the passage of time, or relationships between the categories formed and the examples within each category (Cocking and Renninger, 1993). In its current form, PD describes an individual's mental representation of objects and activities and how those representations are differentiated based on distance between the individual and the object. PD is also difficult to measure because, as with many other models of environmental or ecological behavior, PD is mediated by intrinsic factors (e.g. attitudes and beliefs), external factors (e.g. opportunities and constraints), and individual and social norms. Therefore, if measures of PD are to be used in direct behavior prediction, it is important to understand how these factors regulate the transition of PD dimensions into a particular action or behavior.

Typically, PD is described using four dimensions: geographic/spatial, temporal, social, and hypothetical/uncertainty and is measured using construal levels ranging from high-level abstraction to low-level concreteness (Trope and Liberman, 2010). Geographic or spatial distance refers to the level of abstraction when an object or activity is physically distant from the perceiver. Uzzell (2000) found that individuals are able to concretely perceive objects that occur on broad spatial scales, but other research demonstrates increased abstraction of spatially distant objects and activities (Fujita et al., 2006). Temporal distance is based on research that suggest that events occurring in the far future are imagined or perceived with less vividness of detail (e.g., Arnold et al., 2011). Social distance can be measured in terms of abstractions related to perceptions of ‘others’ vs. the ‘self.’ For example, ‘others’ are described at an abstract high level, whereas our own behaviors are self-described and situational, as low-level concrete actions (Robins et al., 1996). Social distance may also include social roles; perception of oneself in a certain role may relate to the immediacy of enacting that role (Trope and Liberman, 2003). Finally, hypothetical distance refers to the perception of novel concepts, integrating knowledge and probability to form an individual's abstraction with a given decision or outcome (Trope and Liberman, 2010).

As a named theory, PD appears infrequently in natural resource- and environment-related literature. The most well articulated use of PD in the environment and natural resource fields relates to climate change (Spence et al., 2012). PD has also been used to investigate consumer attitudes towards electric vehicle use (Skippon and Garwood, 2011) as well as interest in “green products” (Pahl and Bauer, 2013). Clearly, there is room to explore this theory further in the context of natural resource science and management.

Hujala et al. (2007) posit that PWO decisions can only be understood in the context of their entire decision-making environment. Therefore, PD and its dimensions should be measured collectively to define the decision environment for an individual space and the mental representations of a land management decision or activity. For example, a description of a PWO's PD with respect to their social environment (e.g., spousal relations, children), their professional environment (e.g., occupation, educational background), and their personal environment (e.g., health, values) will greatly increase understanding of how PWOs make land management decisions and why decisions may or may not translate into actual management behaviors. PD is measured by construal level, or how concretely or abstractly a person perceives something (Trope and Liberman, 2010). Typically, decisions are made with fairly concrete representation of the inputs and outcomes of that decision, and individuals make decisions when these things are reasonably well-known. However, there may be times when a decision must be made with only an abstract sense of the outcomes, suggesting that measuring PD may describe the decision making environment of a landowner and improving understanding of what decisions are made given different perceptions and the decision timing.

Forested land is often owned by a family or individual owner, as opposed to by public agency representatives that collectively manage natural resources. PWOs have an objective or legal reality to their

ownership, and a psychologically-based experience of ownership (Lachapelle and McCool, 2005). Owning land influences the psychological representation of land management decisions by increasing perception of control, knowledge of, and investment in the land (Pierce and Rodgers, 2004). Individual PWOs decisions impact the quality and amount of natural resources available to others. The current paradigm in natural resource management is often to identify the desired management behavior and incentivize individuals to behave in that way, either through monetary compensation or programming. Using PD as a new paradigm, policies and management efforts could be refocused on moving the individual from a place of abstraction to an appreciation of which forest management details might be important to them.

We seek to expand PWO timber harvesting research by describing timber harvesting behavior using the theory of psychological distance (PD). The objectives of this study were to: 1) Understand the PD of private woodland owners; and 2) Evaluate how the four dimensions of PD are specifically related to the timber harvesting decision. The incongruence between harvesting intentions and behaviors, noted by several scholars (Egan and Jones, 1995; Silver et al., 2015) may have to do with how relevant timber harvesting is to a landowner and PD could also provide an understanding of why timber harvesting is not an important ownership objective for many PWOs. Furthermore, understanding a PWO's PD may help outreach and extension professionals better tailor services to PWOs when they need it and at a level of detail that resonates with their mental representation of forest management. After decades of attempted engagement on the part of foresters and extension professionals with forest PWOs, only 3% of PWOs have a management plan and only 16% get professional advice about their woodland in the U.S. (Butler et al., 2016). PD could offer a promising new way to frame the PWO land management issue and design better forest policies.

In addition to the applied research significance, the use of PD with PWOs could make a new contribution to forest social science. Though a handful of studies address the effect of certain PD characteristics (e.g. absenteeism) on the timber harvesting decision, we are unaware of a study that explores PD and timber harvesting explicitly. This study will qualitatively explore the concept of PD with PWOs to form a benchmark for future use of PD theory in relation to timber harvesting.

2. Methods

2.1. Qualitative approach

Given the new application of PD to PWO timber harvesting behavior, an in-depth qualitative study is warranted. Qualitative research explores data from individual cases or incidents, often involving simultaneous collection and analysis of data (Lincoln and Lincoln and Guba, 1985). Therefore, in the process of collecting data, conceptual categories were developed to identify patterns (Charmaz, 2006). Specifically, semi-structured interviews and cognitive mapping with forest PWOs were used to discover, define, and understand the PD of the timber harvesting decision and inform future research on the role of PD in forest management to construct a theoretical model. Although naturalistic inquiry often means a theory emerges as data are collected, we identified PD theory as potentially useful to understanding landowner behavior prior to beginning data collection. Thus, building upon previous theoretical and empirical literature, interview questions were developed to gauge the four dimensions of PD from the interviewees' perspectives using a more positivist approach.

2.2. Study location

The study took place in the state of Maine, U.S.A. where the forest products industry is viewed as a critical part of the state's economy

(MFS, 2012) and non-corporate PWOs constitute 30% of the state's forest ownership matrix (Butler et al., 2016). The forest products industry in Maine can provide a market opportunity for PWOs, and a significant potential sustainable revenue stream. Maine is representative of northern forested regions in the U.S. and although corporate PWOs control a significant proportion of woodland in Maine, results could apply to regions with higher proportions of non-corporate PWOs.

2.3. Interview data

The sample consisted of 32 PWOs using recorded in-depth, semi-structured interviews. The study population consists of PWOs in the state of Maine with at least 4 ha (10 acres) of woodland that have harvested timber in the last 10 years, those that have not harvested in the last 10 years, but stated they intend to harvest in the future, and PWOs that stated they never plan to harvest. Sampling was purposive. Advertisements were placed in the Bangor Daily News, Maine Forest Service Woods Wise e-mail list serve, and the Small Woodland Owners Association of Maine newsletter. We screened potential interview candidates via telephone or e-mail to determine which of our sample strata they fit. We continued interviews until our data reached saturation (i.e. we were no longer identifying unique codes). We obtained Institutional Review Board approval prior to the beginning of the study. Participants were compensated with \$25 USD for their time, at the conclusion of the interview.

In these interviews, the PWO's decision making environment was explored and factors that owners consider or considered when deciding whether or not to harvest timber were identified (Silver, 2015). All questions were open-ended and focused on the history and tenure of land ownership, previous experiences with timber harvesting, frequency of thought regarding timber harvesting and the PWOs' sources of information, social network and community. These are topics that are explored in quantitative surveys (e.g., Butler et al., 2016), but explored very little in depth (Silver et al., 2015). We designed the interview script to explore the four dimensions of PD, as hypothesized in Fig. 2. The interview script was pre-tested on two PWOs and adjustments to the interview script were made based on the results and discussion with the PWOs, research team, and stakeholders (e.g., district foresters and extension agents). Interviews were approximately 1 h long and took place at the owner's residence, or at a neutral location (e.g., public library or coffee shop) if preferred.

2.4. Cognitive map data

Cognitive mapping is a technique that spatially represents the outside world as perceived by the mind (Downs and Stea, 1973). It was first introduced in cognitive psychology by Edward Tolman (1948) and has since been refined and advocated for use in multiple disciplines including psychology, sociology, anthropology, and geography (Kitchin, 1994). It has been used to understand the salience of communal forests to rural community members and the objectives structure of family forest owners (Tikkanen et al., 2006; Biedenweg and Monroe, 2013). We built cognitive maps of the timber harvesting decision for PWOs using an interactive process (Harris et al., 2002)

- 1) Responses to the question "What do you consider when making a decision about your woodland?" and these decision making factors (e.g., market price for timber, wildlife habitat) were written by the interviewer on index cards and checked by interview participants
- 2) Interview participants arranged the cards to demonstrate how concepts are related using provided arrows to show relationships and directionality
- 3) The participant described how relevant each concept is to their decision to harvest timber

2.5. Analysis

Interview data were analyzed using qualitative open and thematic coding in NVivo, memo writing, and cognitive mapping to operationalize PD. We coded interview transcripts to identify attitudes towards timber harvesting, and the decision-making environment of PWOs. After initial coding and memo writing, we explored the theory of PD by thematically categorizing the transcript data for PWOs that thought of timber harvesting frequently (daily or weekly), somewhat frequently (monthly or seasonally) and PWOs that thought of their land infrequently (every 5–10 years), representing the overall PD of PWOs. Based on interview responses and cognitive maps, we thematically coded responses to seek understanding of PD dimensions from the PWO's perspective. We also explored the dimensions of PD in PWO decision-making by assessing the relevance of timber harvesting to their land management and their lives more generally (Trobe and Liberman, 2010). Thus, PWO PD was measured by the frequency of thought on timber harvesting, accounting for how salient timber harvesting was overall for each PWO.

3. Results

The four dimensions of PD manifested during PWO comments on the frequency with which PWOs thought about timber harvesting. PD dimensions were related to PWOs' social environment, if they lived on their woodland, their frequency of management activities, and their level of knowledge about forest management options (Fig. 2). Many PWOs listed timber harvesting as a low priority and the majority thought about timber harvesting infrequently or somewhat frequently. PWOs who thought about timber harvesting daily typically did so because they were out in their woods cutting firewood and considered harvesting part of their lifestyle, as opposed to professional loggers paying for the right to harvest commercial timber that leaves the property and enters the marketplace. PWOs in this sample were particularly active regarding use of a forester, management plan, and membership in a woodland organization (Table 1).

3.1. Psychological distance dimensions and the harvesting decision

3.1.1. Spatial distance

Spatial PD was related most to whether or not a PWO lived on their land, and to a lesser extent to the size of their holding, confirming our suspected relationship (Fig. 2). The majority of PWOs lived on their land, but there were absentee landowners in the sample. Of the PWOs that lived on their land, a minority said timber harvesting was an important reason for the ownership. Of the absentee PWOs, most only thought about timber harvesting infrequently. The absentee owners that thought about their land and timber harvesting frequently lived within an hour's drive of their woodland. Even a PWO that lived across town from his woodland expressed high PD, remarking,

"... you know it's kind of like that out of sight out of mind thing, you know I don't think about it all the time, a hundred percent of the time. Whereas it would be different if I were driving by it every day."

[#8]

A PWO who lived on the property expressed an extreme familiarity with the property that decreased their mental representation of the woods, commenting:

"I can shake hands with almost every tree, so I know what's available and what to do..."

[#15]

The PWOs with > 400 ha (1000 acres) thought of land management daily. Of PWOs with 40–400 ha (100–1000 acres), half thought of their land frequently and the other half thought of their land somewhat

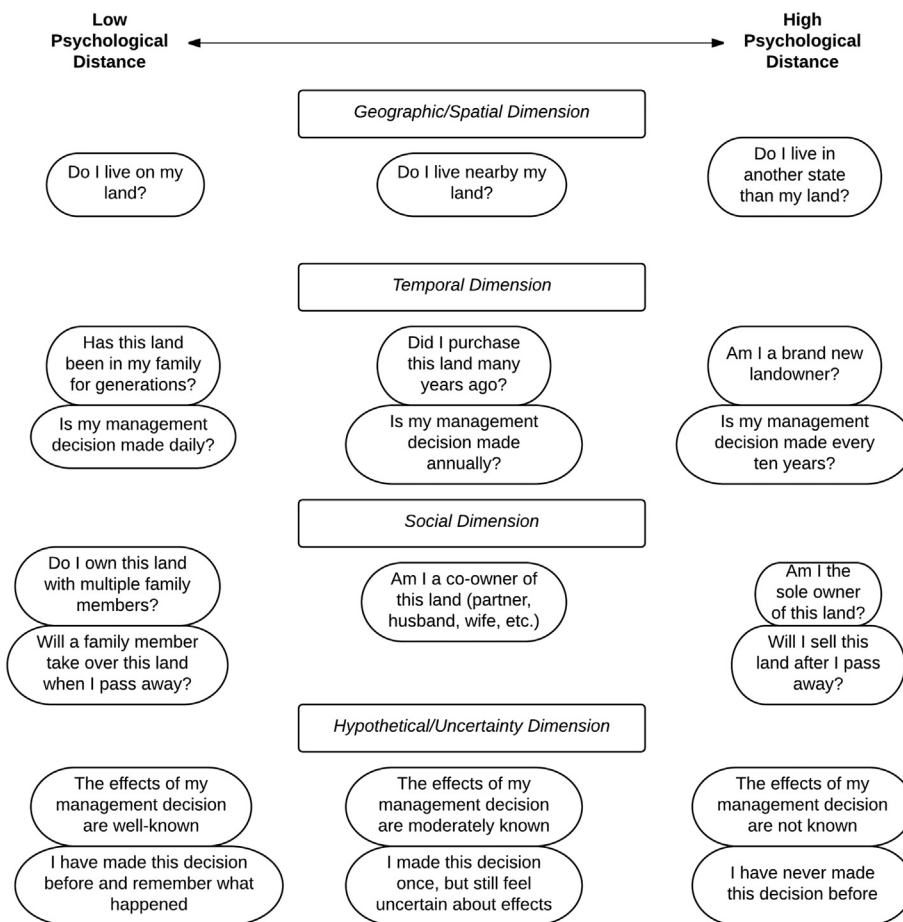


Fig. 2. Examples of psychological distance dimensions for a landowner making land management decisions. Examples are arranged from left to right from low to high psychological distance.

Table 1
Characteristics of interview participants.

Characteristic (Unit)	Value	Maine average ^a
Member of a woodland organization (%)	63	N/A
Male (%)	88	58
Management plan (%)	72	7
Hires a forester (%)	88	39
Harvested in the past (%)	81	47
Average acres (Min, Max)	236 (20, 2800)	250 (1, 5000 +)
Median acres	98	100
Intend to harvest in the future (%)	50	14
Age (%)		55–64
< 40 years	16	
40–60 years	29	
60 + years	55	

^a Based on averages from the National Woodland Owner Survey (Butler et al., 2016).

frequently or infrequently. Of PWOs with 10–100 acres, a minority thought about the woodland frequently.

3.1.2. Temporal distance

The PWOs that had frequent thinnings or harvests thought of their woodland more frequently. PWOs who thought about their woodland infrequently, when asked about how often they thought of timber harvesting, responded similarly to this PWO:

“Not very often. We don't think about harvesting...we started with a harvest because it hadn't been done in years.”

[#19]

The average ownership tenure was 26 years with a minimum of one

year and a maximum of 64 years. For PWOs that owned their land < 26 years, the majority thought about their land infrequently. For PWOs who owned their land > 26 years, there was an even split between those that thought of their land frequently and those that thought of their land infrequently. Results suggest that newer PWOs may have more PD, which may decrease over time as their woodland becomes conceptually coherent and concrete.

3.1.3. Social distance

Social PD manifested in the family ownership structure of the land and bequest intentions of the primary PWO. There were varying examples of social distance, typically to do with co-ownership of the woodland with a partner, spouse, or children. Some of the PWOs did not own the land with anyone else, but the majority either owned their woodland with a partner/spouse, children, extended family, or a group of families. Of PWOs that did not own the land with anyone else, the majority only thought of timber harvesting infrequently, exhibiting high PD. Conversely, the experiences of family members or co-owners helped diminish the mental distance of timber harvesting:

“I knew a little bit about it before that only because my aunt had had a lot of her land forested [harvested]...by one of the wood cutters in the town.”

[#8]

Another PWO with close social distance had a very concrete conceptualization of timber harvesting, maintained close contact with abutting neighbors during the harvesting process:

“Yeah, I wrote a letter to the person that owns the lot that borders us, and the sub-division that I was going to harvest, I invited them

up—they were from New Jersey. And I told them what I was going to do, asked if they had any questions or concerns.”

[#24]

Typically, contact with neighbors regarding timber harvesting happened when a PWO was in the middle of or about to start a harvest, which was a moment of very low PD related to the timber harvesting decision. PWOs commented on witnessing harvests on neighboring properties or the involvement of neighbors when the PWO chose to harvest timber. The majority of the PWOs had between 1 and 4 neighbors, while a minority had between 5 and 12 neighbors.

3.1.4. Hypothetical distance

Hypothetical PD arose for PWOs during a discussion of their knowledge of woodland management practices and the uncertainty surrounding different harvesting practices including machinery options and effectiveness of harvesting practices (e.g., clearcutting vs. uneven-age management) at giving them their desired results (Fig. 2). The hypothetical dimension included statements about woodland management knowledge and confidence, but also what factors might influence the decision to harvest. PWOs with very high hypothetical distance expressed great uncertainty about the effect of harvesting practices on their woodland, stating “...It's a lack of experience and knowledge on how to go about it,” [#25] while PWOs with very low hypothetical distance either knew a lot about woodland management or were learning, stating:

“I've learned how to split wood, I've learned how to use a prism, I've learned you know, I mean I had GPS before and I knew how to use it...”

[#1]

Most of the PWOs actively sought advice; the majority had used a forester in the past or currently. However, many relied on the forester and associated management plan documents to dictate the schedule for timber harvesting and thus hypothetical distance did not seem to relate as strongly to whether or not a PWO had a relationship with a forester. Of all the PD dimensions, the hypothetical dimension was weakly connected with frequency of thought for PWOs and their woodlands.

3.1.5. Decision-making environment

Of the 32 PWOs interviewed, 28 were able to make a cognitive map of their timber harvesting decision-making process. The cognitive maps ranged from very simplistic decision-making processes (Fig. 3a) to very complex processes catalyzed by a particular event (Fig. 3b). In both examples, PD changed through the decision making process. For PWO A (Fig. 3a), seeking advice from a forester, trained to guide a PWO through the timber harvesting process, helped reduce the hypothetical distance that involves a lack of knowledge or certainty about timber harvesting. For PWO B (Fig. 3b), a major natural disturbance event shrunk the temporal distance of timber harvesting, inspiring the PWO to action.

PWOs had an average of 5 factors they considered when making a decision about harvesting timber. The most common factors were wildlife and recreation considerations and some reference to economic or financial factors such as income, market conditions, or taxes. Many of the cognitive maps included reference to interaction with a forester for advice or directly via their management plan document. These are key decision points where PD could be explored and used to tailor the outreach experience to match a PWO's PD, and thus their receptivity to woodland management information. In fact, the reliance on a management plan for all timber harvesting information appeared to manifest in PWOs with high PD; the existence of the document meant PWOs didn't have to keep track of harvesting or think about it as frequently, much like writing down a reminder means it can be dismissed from the memory. More regular and experiential learning with a forester was associated with PWOs that thought about timber harvesting more often

and considered it more important.

4. Discussion

Although many PWOs thought about timber harvesting infrequently, the PWOs who thought about their land frequently and for whom timber harvesting was an important land ownership objective had several characteristics in common. First, they tended to co-own the land, had relationships with their neighbors, lived on their land, and sought out knowledge about harvesting practices.

The key decision points where PD could be explored and used to tailor the outreach experience to match a PWO's PD, and thus their receptivity to woodland management information seemed to be interaction with a forester or other professional and consulting a management plan. In fact, the reliance on a management plan for all timber harvesting information appeared to manifest in PWOs with high PD; the existence of the document meant PWOs didn't have to keep track of harvesting or think about it as frequently, much like writing down a reminder means it can be dismissed from the memory. More regular and experiential learning with a forester was associated with PWOs that thought about timber harvesting more often and considered it more important.

This cognitive mapping process support the finding that many U.S. landowners consider amenity, recreation, and wildlife factors when making management decisions, while fewer consider financial objectives (Butler et al., 2016). The process further supported the dynamism of PD for a PWO. A landowner's PD can fluctuate during their land tenure based on social encounters, communication with professionals, and interventions. The cognitive mapping exercise could be a useful tool for professionals to quickly assess the abstractness or concreteness of a PWOs timber harvesting perception based on the number of factors considered and the level of word specificity used to describe those factors.

4.1. Relating the four dimensions of PD to the PWO timber harvesting decision

The geographic/spatial dimension of PD for private land management decisions is reflected in the literature of absentee PWOs (e.g., Petrzalka, 2011). These studies demonstrate that absentee PWOs tend to think of their land less frequently, although the level of abstraction of absentee vs. local PWOs has not been directly tested. This study found that absentee PWOs thought of their woodland infrequently. The level of abstraction can potentially increase between an owner who lives directly on the land vs. an owner that lives five miles away and must get in a vehicle to visit the land. Absentee PWOs may still harvest their timber to meet financial obligations, but the decision to harvest timber may still be a very abstract and distant concept. A different outreach strategy will be necessary to engage absentee PWOs. First, because spatial distance makes the timber harvesting decision abstract, harvesting should be discussed in an abstract fashion (e.g., major goals) as opposed to the details of a harvest (e.g., the number of trees removed per acre) to match the PWOs mental representation of a harvest. Second, offering photos and other information that helps bring the woodland spatially ‘closer’ to the PWO can decrease the abstraction or distance. However, spatial PD is the most difficult dimension to decrease or shorten for a PWO.

The temporal distance dimension of PD for land management decisions could be related to the frequency at which the management decisions must be made, to the time an owner has owned the land, as shown in the results. PWOs who have owned their land for a shorter period of time did not think about their woodland often. It is also possible that temporal distance could relate to the size of the woodland parcel, because larger woodland parcels provide a PWO with more management opportunities (Jannick and Beckett, 1988), suggesting that increasing parcelization may increase the temporal PD of timber

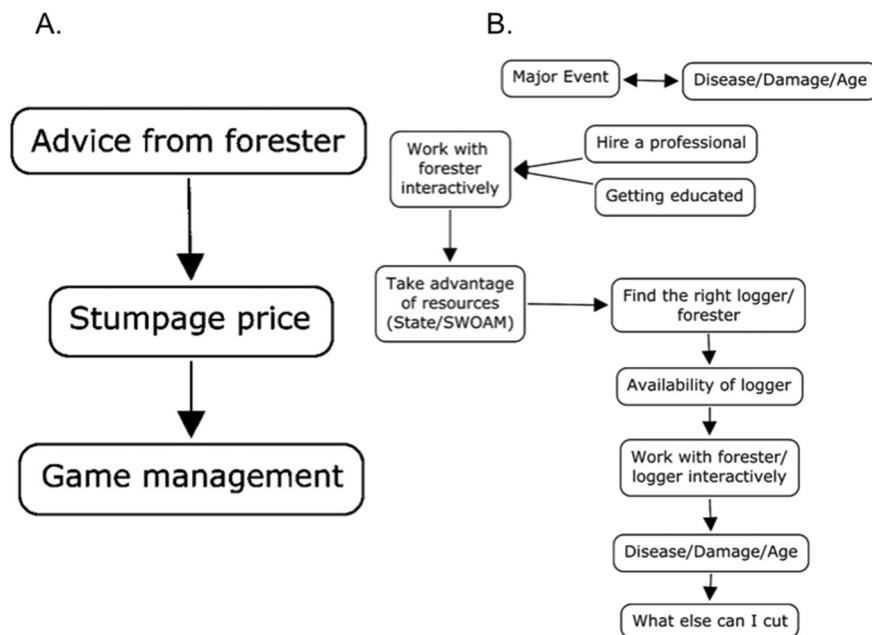


Fig. 3. Examples of cognitive maps constructed interactively with landowners. Landowner A has a very simple decision making process while Landowner B thinks about the timber harvesting decision as a series of linear steps. Stumpage price is the value of timber, as it stands uncut in term of amount per unit area.

harvesting for PWOs. As PWOs sell off portions of their woodland, large contiguously owned woodland become smaller woodlands that have a higher marginal cost for sustainable timber harvesting (Hatcher et al., 2013). Management decision frequency has not been formally studied, but in the case of forestry, it is generally agreed that timber harvesting occurs infrequently. Engaging PWOs with a high degree of temporal distance may involve increasing existing incentives for management activities that could occur on a more frequent basis such as firewood removal for wood banks, compensation for invasive species removal, or simply annual visits from a forester. Overall temporal PD can be shortened or decreased by providing more frequent opportunities for PWOs to meet, interact, receive information, or visit other woodlots.

Social distance could be measured as the context within which the land is owned (e.g. family, or solitary ownership), and the perception of others involved with the land in the future. The literature on bequest motives and estate planning starts to measure the latter (Hultkrantz, 1992; Majumdar et al., 2009), while the former has been studied more qualitatively (Bliss and Martin, 1989). There is additional research from Sweden suggesting that some private woodland owners perceive a responsibility to manage their forests for society (Björstig and Kvastegård, 2016). Results suggest that when families make a plan for the future of the woodland, the land tends to stay wooded as opposed to a non-forest use such as development into residential or commercial use, and the current PWO is typically more engaged. No known research focuses on the relationships between PWOs and immediate abutting neighbors, although there is research on PWO willingness for cross-boundary cooperation (Finley et al., 2006). There is also evidence that the weak ties of neighbors and other peer PWOs may be more influential than that of forestry professionals (Kittredge et al., 2013; Kueper et al., 2013). If landowners prefer to receive information and advice from peers, neighbors, and other informal sources, it may be more efficient to fund programs that train and provide peer leaders with scientific information and management best practices to go back into their communities and be peer-to-peer learning advocates. If PWOs own their land for privacy and have no interest in timber harvesting, their social distance may only be changed by forestry and natural resource professionals who respect these goals and provide them assistance that doesn't seem to interfere with their privacy. PWOs with more social distance are likely to make manage-

ment decisions alone, thus outreach and extension professionals that tap into existing networks may not reach these individuals. Finally, social norms could interact with PD to change decision-making. Individuals with high PD and thus greater abstraction of woodland management may be more likely to conform to group norms, relying on these norms to fill in the 'gaps' in their perception and understanding of woodland management (Ledgerwood and Callahan, 2012). Social PD can be shortened or decreased by getting PWOs to meet and learn from one another and share experiences with others.

Finally, hypothetical distance, defined as the mental representation of the probability or uncertainty of an object or activity, seems to be linked to prior experience of making a land management decision and knowledge of how that decision affects the land. There is potential within this dimension to better understand PWO risk perception, PWO communication with professionals, and PWO confidence and experience with management. With a few exceptions (e.g. West et al., 1988; Rickenbach et al., 2006; Keskitalo and Lundmark, 2009; Andersson and Gong, 2010), these topics have not been fully explored in the context of PWO management. In particular, the interaction between foresters, who facilitate the process of harvesting timber, and PWOs is a key component to the hypothetical distance dimension. Gootee et al. (2010) found that PWOs do not evaluate woodland management information the same as forest professionals. Forest professionals tend to use scientific credibility and credentials while forest owners prefer empathy, experiential learning, and mutual respect. This could, in part, relate to the role and interaction of trust and knowledge in social and professional relationships. Many types of trust could exist between a PWO and forestry professional such as trust based on economic exchange or trust based on repeated interactions (Rousseau et al., 1998). If PWOs trust forestry professionals, their knowledge of timber harvesting may increase and PD from timber harvesting may decrease. Thus, our findings about hypothetical distance may be moderated by a PWO's trust level. Results suggest the overall saliency of harvesting may be moderated by the hypothetical dimension of PD, given that the saliency of harvesting is based on PWOs knowledge of how harvesting may achieve their ownership objectives. Hypothetical distance may influence how concretely or abstractly a PWO understands timber harvesting. Hypothetical PD can be shortened or decreased by providing forest management information that is most relevant to a PWOs ownership objectives.

4.2. Study limitations

As an early attempt to frame PD in a forestry context, this study is limited in scope to the small and heterogeneous sample of PWOs interviewed, and cannot be validated by other PD studies as it is the first time using PD in a PWO context. As with previous PWO studies, it was likely difficult for PWOs to retrospectively assess how frequently they think about timber harvesting. A comprehensive review of PWO timber harvesting decision research revealed only a few theories have been used (e.g., utility maximization and the Theory of Planned behavior, Silver et al., 2015). Other theories are possible and could shed light on the PWO include social capital or risk perceptions. For example, using social capital theory might suggest that PWO make decisions based on trust, social networks, reciprocity and shared norms (Pretty and Ward, 2001), while risk perception theory might suggest that PWO view timber harvesting with varying degrees of risk and avoid harvesting when actions are seen as too risky (Slovic, 1987). The PWOs in this sample differ from the national population of PWOs by having more contact with forestry professionals, having woodland management plans, and being more likely to attend a woodland owner organization (Butler 2008), so results from this study cannot be generalized to all U.S. PWOs. However, this study does provide valuable insight and a foundation for future quantitative research on this topic.

Given that the broader population of PWOs are less likely to have a management plan or seek advice than in this study sample, this lower level of activity may manifest in even more PD with respect to a management decision like timber harvesting. This study represents a conservative assessment of PD with respect to landowners who were generally more engaged with woodland management activities. This higher PD would necessitate a modified approach to technical and financial assistance to encourage sustainable private forest management and provide support for more constant peer-to-peer networking opportunities that decrease social and temporal distance, in addition to providing management advice that decreases hypothetical distance. This is consistent with findings that policy target groups and segmentation may improve landowner outreach (Kilgore et al., 2008; Urquhart and Courtney, 2011; Fischer, 2012).

4.3. Future research

Subsequent research should explore this theory across a broader range of PWOs and could experimentally test the effect of different forest policies on PD and associated timber harvesting behaviors. Little is known about how the dimensions of PD may combine or be related to one another in the context of natural management decisions. Research suggests that the dimensions may interact and that some could be interchangeable, but further study is needed (Pronin et al., 2008; Stephan et al., 2010). PD should be quantified to aid in the comparison of different populations and regions. Finally, PD could be integrated with existing theories of environmental behavior to see how and where PD may modify the processes that lead to behavior and decision making.

Beyond its utility as a social science theory, the mental representation and abstraction level for various objects and activities provides insight into the cognitive processes of individual PWOs, due to many external forces. These external forces may influence a PWO's PD, but likewise an individual's PD could influence how they respond to these barriers, opportunities, and constraints. The relative impact and directionality of influence is an area for further study. PD could also be valuable to forestry and extension professionals and these professionals could be the study population for further exploring PD and timber harvesting. An understanding of the frequency and density of engagement opportunities will be necessary to quantify the effect of peer-to-peer networking on shortening social, temporal, and hypothetical PD. It will also be important to measure what types of opportu-

nities are most effective at shortening PD (e.g., woodlot tours, evening speakers).

4.4. Conclusion

PWOs make decisions about land management options, which affect the quality and amount of natural resources available to others. PD has the potential to shift the forestry paradigm away from the status quo of targeting PWOs to 'sell' woodland management and timber harvesting to a paradigm where forest professionals understand and accept PD and use the different dimensions to strengthen the support and assistance available to PWOs. Forest professionals have the tools to decrease temporal, social, and hypothetical distance for PWOs, but first must think of PWO engagement as an iterative process of working within the existing PD context for the PWO. This research suggests forest professionals should meet PWOs where they are in abstraction and construal of timber harvesting; there is no one-size-fits-all approach. Based on these results, efforts could be refocused on moving the individual from a place of abstraction to an appreciation of which timber-harvesting details might be important to them. Forest policy programs typically assume that all PWOs have equal and short PD; that woodland management is a very concrete and familiar process. However, this research demonstrates that PWOs have varying levels of PD and some have very high PD. Programs that invest in peer-to-peer programming and leverage social networks could improve the odds that a PWO with high PD will interact with PWOs that have low PD and more experience with woodland management. Existing financial incentive programs could have more success if presented to a landowner at a time when their PD is low and they are nearing a decision point. Understanding PWO PD could help signal when a landowner is ready and able to make management decision and determine what support is needed. PD is a conceptual tool that could be used to strengthen sustainable forest management policies by providing a broader framework to understand the various PD factors that influence the policy-making process, particularly with respect to development and implementation.

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