

The effects of place meanings and social capital on desired forest management outcomes: A stated preference experiment

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ARTICLE INFO

Article history:

Received 21 September 2011

Received in revised form 20 March 2012

Accepted 27 March 2012

Available online 12 April 2012

Keywords:

Ranked logit

Random utility model

Trust

Intra-community social networks

Public choice

ABSTRACT

Planners and managers responsible for public-trust resources are often faced with making difficult value-laden decisions requiring trade offs between alternative, and often competing, outcomes. To make more informed decisions within volatile socio-political climates, resource managers and planners need an understanding of the benefits local community members would like the resource to produce, and an understanding of the social and psychological factors that influence those preferences. In this research, we focused on two increasingly important factors – social capital and place-based social-psychological attachments – that influence public preferences for management outcomes. We conducted a stated preference field experiment on residents living in three forest related communities within Southern Appalachia in the Southeastern United States. The experiment elucidated responses to hypothetical management plans designed to produce distinctly different outcomes. The results reveal ecologically focused management plans were the most preferred, much more so than plans designed to produce aesthetic, recreational, or economic outcomes. The data also reveal both individuals' stocks of social capital as well as their place-based social-psychological attachments influence evaluation of competing management outcomes. Our methodological approach and empirical findings advance both the analytical approaches used to study multiple use public resources and existing knowledge regarding how social and psychological factors influence individuals' decision-making processes.

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1. Introduction

Planners and managers responsible for public-trust resources are often faced with making difficult value-laden decisions requiring trade offs between alternative, and often competing, outcomes (Lachapelle, McCool, & Patterson, 2003; McCool & Guthrie, 2001). A growing body of literature now suggest that for resource planners and managers to make more informed decisions within volatile socio-political climates, they need an understanding of the benefits local community members would like the resource to produce, and an understanding of the social and psychological factors that influence those preferences (e.g., Armitage et al., 2009; Berkes, 2009; Carlsson & Berkes, 2005). Equipped with knowledge about how local community members would like public-trust resources managed, and how those preferences are formed, planners and managers can be more prepared to proactively engage stakeholders in planning and management decisions, build consensus among

those stakeholders, and, ultimately, develop strong and reciprocal relationships that facilitate more efficient and socially acceptable future management decisions.

This study has two primary objectives. The first is to examine the management outcomes preferred by community members living adjacent to public forests. Specifically, we examine how individuals make trade-offs between competing outcomes produced by hypothetical forest management plans. The second objective is to examine the social and psychological factors that influence community members' preferences for management outcomes. Explicitly, we examine how two factors – individuals' stocks of social capital and the meanings they attach to the forest – affect preferences for forest management.

2. Desired outcomes from forest management

Based upon a review of existing literature concerning the values individual's ascribe to public forests (see Moyer, Owen, & Duinker, 2008; Owen, Duinker, & Beckley, 2009) and recent research addressing preferences for non-forest public-trust resources (Anderson, Davenport, Leahy, & Stein, 2008; Smith, Davenport, Anderson, & Leahy, 2011; Smith & Moore, 2011; Wyman & Stein,

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2010) we choose to focus on four outcomes produced as a result of nearly all forest management decisions:

- *Economic outcomes* include all of the market-based benefits ascribed to forest products and services; these include both direct economic impacts such as the creation of local jobs and tax revenues from forest-related industries, as well as indirect economic impacts such as tourism revenues and other capital flows attributable to the existence of the forest.
- *Ecological outcomes* refer to the suite of benefits derived from the functioning of forest ecosystems.
- *Recreational outcomes* refer to the set of benefits derived from individuals being able to realize desired recreational experiences from forest recreation settings (Driver, 2008; Moore & Driver, 2005).
- *Aesthetic outcomes* refer to the scenic quality of forest landscapes. Aesthetics are a fundamental component in the interpretation of forested landscapes and settings (Ryan et al., 2010).

If possible, public forest users would typically like managers to produce all of these outcomes. However, given planners and managers have only a finite amount of resources to allocate, producing all desirable outcomes is not feasible. Moreover, some desired forest management outcomes are discordant and cannot be simultaneously produced. Resource users, as a result, have to make trade-offs when preferences for forest management outcomes are elucidated.

Past research can offer insights on (1) whether certain outcomes tend to be preferred over others, (2) how trade-offs between competing outcomes are made, and (3) how social-psychological characteristics influence these trade-offs.

Regarding the first point, previous studies have suggested a decline in individuals' desire to see public forests managed for economic outcomes over the past four decades (Cordell, Helton, Tarrant, & Redmond, 1996). Simultaneously, there has been an increase in the desires for management to be focused on producing non-economic outcomes (Manning, Valliere, & Minteer, 1999).

Concerning the second point, previous research suggests the presence of a positive association between the types of experiences individuals desire from forest settings (e.g., recreational, aesthetic, etc.) and their preferences for management actions that enable the production of those experience opportunities (Smith et al., 2011). As to the third point, the general public tends to prefer forest management strategies that maximize aesthetic quality, regardless of whether those management strategies produce the most ecologically stable forests (Hunt & Haider, 2004; Kearney, Tilt, & Bradley, 2010; Ribe, 2005). Gobster (1999) notes the tensions between desired ecological and aesthetic outcomes is largely due to the general public's knowledge, or lack thereof, regarding best forest management practices. However, recent research suggests certain populations, such as those with strong pro-environmental attitudes (Ribe, 2002) or socio-economic ties to the timber industry (Ford, Williams, Bishop, & Hickey, 2009) do not always favor forest management decisions that produce the most aesthetically pleasing outcomes.

3. Factors influencing preferences for desired outcomes

Public preferences for forest management are not influenced solely by the particular attributes of competing management objectives. Rather, numerous social-psychological factors influence preferences for desired outcomes. Here, we focus on individuals' stocks of social capital as well as the meanings they ascribe to nearby publically managed forests. We suggest

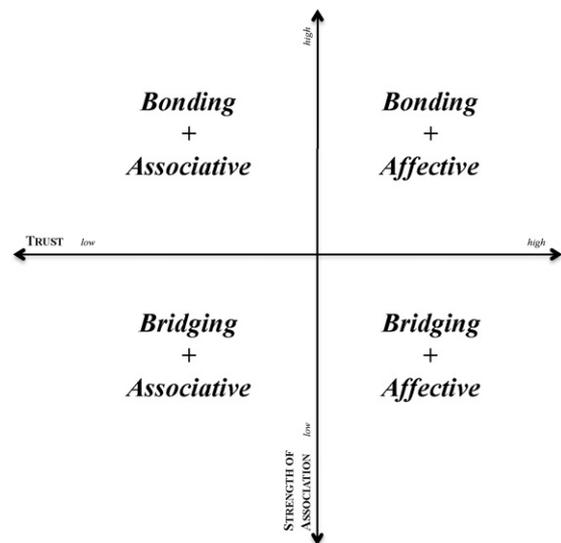


Fig. 1. Trust and objective ties: the dual axes of social capital.

these social-psychological concepts play a functional and cognitive role in individuals' decision-making behavior (Kahneman, 2003a; Kahneman, 2003b). In a choice process where individuals are elicited to choose between a set of alternatives, the social-psychological traits of the decision maker play a key role in making the decision (Louviere, Hensher, & Swait, 2000). These social-psychological traits influence decision makers' perceptions and evaluations of alternatives, the utility they ascribe to each alternative, and consequently, which alternative they are likely to choose.

3.1. Social capital

The presence of strong, reciprocal and trusting relationships between local community members can influence the social acceptability of resource management decisions (Leahy & Anderson, 2010; Stern, 2008; Wondolleck & Yaffee, 2000). The dissemination of information and the extent to which that information is trusted, can be described through the broad concept of social capital. Social capital is comprised of the information, trust and norms of reciprocity inhering in an individual's social network (Woolcock, 1998). Social capital is a theoretically diverse concept that is essentially comprised of two components – *trust* and *objective social ties* (Paxton, 1999). Trust and objective ties form two distinct axes of social capital (Fig. 1). The trust axis distinguishes between social relationships that are either associative and exchange based, defined by low levels of trust, or affective and reciprocity based, defined by higher levels of trust. The objective social ties axis differentiates between *bonding* and *bridging* social ties; the relative strength of association between individuals involved in social interactions (Gittell & Vidal, 1998). Bonding ties refers to relationships between family members, friends and neighbors in closed, tightly connected networks while bridging ties are relations between individuals in "weakly connected" social networks (Granovetter, 1973).

Previous reviews of social capital theory suggest individuals' preferences for specific management outcomes depend upon their stocks of social capital (Bodin & Crona, 2009). Explicitly, where individuals get their information, and how much they trust that information, will affect their preferences and the expected utility they believe will come from a particular management plan.

Bonding social capital can create dense social networks defined by high, localized levels of trust. Individuals in tightly knit, highly trusting social networks tend to share similar values, attitudes,

preferences and behavioral patterns (McPherson, Smith-Lovin, & Cook, 2001). As a result, bonding social capital can impose strict social norms that discourage change and foster increased homophily (Portes, 1998). Individuals embedded in highly bonded social networks are likely to prefer potential forest management outcomes that enable them to maintain their close ties to friends, family and other frequent contacts. For example, management actions that produce or maintain recreational opportunities are likely to be supported by highly bonded individuals if the maintenance of their social ties is dependent upon those recreational opportunities. Individuals in highly bonded social networks are also likely to prefer management actions which conform to within-group norms, yielding a narrower set of preferred management outcomes.

Bridging social capital, conversely, can give individuals access to resources and information that are not readily available in their immediate social networks. Bridging ties allow individuals to overcome within-group social norms through support from outside their local network (Granovetter, 1973; Pretty, 2003). As a result, individuals with access to information from outside their immediate social networks are more likely to consider and prefer a broader range of potential forest management outcomes. Bridging social capital is likely to yield a broader set of preferred management outcomes.

3.2. Place meanings

Individuals' preferences for forest management outcomes are influenced by the meanings they attach to the landscapes and resources being managed (Cheng, Kruger, & Daniels, 2003; Kruger, 2008; Kruger & Williams, 2007). Research concerning person/place relationships has been developed within numerous related disciplinary fields (Trentelman, 2009) making it difficult to discern both a relatively distinct set of meanings that individuals ascribe to forest landscapes and general trends or patterns in specific meanings' influence on particular management outcomes.

While many scholars who address place meanings or the broader concept of place attachment do not disentangle these constructs, we suggest there is a clear structure. Following Tuan (1977), we define place as physical space imbued with meaning. Meanings related to place are the most fundamental connections individuals form with specific spaces. Place meanings are discrete constructions formed by an individual that convey the personal significance of a particular geographic location. Place meanings can involve the personal significance of a space based upon numerous factors involving the characteristics of the individual, others, and the physical setting itself (Gustafson, 2001). Collectively, the set of meanings an individual ascribes to a particular space form their attachment to that place (i.e., their *place attachment*). Conceptualizing place attachment as a broad multidimensional and overarching construct is not novel, Kyle, Graefe, Manning, and Bacon (2004) note that this approach is quite common in research focusing on local residents who have a well-established connection to an area.

In this study, we choose to examine a set of seven distinct place meanings – *individual identity*, *family identity*, *self-efficacy*, *self-expression*, *community identity*, *economic meaning*, and *ecological meaning*. Previous research indicates these place meanings are empirically valid and generalizable to multiple resource management contexts (Smith et al., 2011) and that these place meanings can influence preferences for management outcomes (Davenport & Anderson, 2005). Each type of meaning is a relatively distinct way individuals ascribe importance or significance to the landscape.

Individual identity represents the extent to which individuals believe the forest informs their self-identity. More broadly, self-identity is a set of beliefs about an individual's personal appraisal of him/herself as well as their appraisals of how others view them

(Proshansky, Fabian, & Kaminoff, 1995). When an individual's identity is highly dependent upon *specific* physical settings, such as public forests, he/she can be said to identify strongly with that setting; the converse would also apply.

Family identity extends the concept of individual place identity; the concept represents the extent to which an individual believes a specific physical setting or landscape has defined their beliefs about who their family is and how others perceive them (Davenport, Baker, Leahy, & Anderson, 2010; Smith et al., 2011). If individuals believe their intra-familial social bonds require the presence of a particular physical landscape to be maintained, their family's identity is highly dependent upon the presence and management of that landscape. Often, individuals express beliefs about their family's identity through recollections of past-experiences that occurred in particular landscapes (Kruger & Shannon, 2000).

Self-efficacy refers to the meanings associated with realizing desired experiences in a particular setting or landscape (Davenport et al., 2010; Smith et al., 2011). The concept represents the "behavioral" component of an individual's attachment to physical space (Low & Altman, 1992) and is both theoretically and empirically related to the concept of "place-dependence" (see Moore & Graefe, 1994; Williams, Patterson, Roggenbuck, & Watson, 1992; Williams & Vaske, 2003). Meanings associated with recreational or educational activities that can only occur in a public forest are the best example of self-efficacy.

Self-expression refers to the meanings associated with how a particular forest setting or landscape enables individuals to express themselves (Davenport et al., 2010; Smith et al., 2011). While the aforementioned concept of self-identity refers, in part, to personal appraisals of self, self-expression involves the ability of a physical setting or landscape to facilitate the communication of that identity. In the Southern Appalachian mountains, for example, many residents identify strongly with the forest because it has played a large part of the region's cultural history (Salstrom, 1994). In turn, the preservation of many Southern Appalachian forests enables residents to retell stories of the region's history and development. The presence of the forest, in short, enables residents to express, and retain, a portion of their personal self-identity.

Just as the family identity construct extended the bounds of individual identity to family, the *community identity* construct extends it further to encompass individual appraisals of what they believe their local community is and how it is viewed by outsiders. The community identity construct encompasses meanings associated with local character and culture. The belief that public-trust natural resources define a community's identity is one of the most consistent and significant predictors in shaping individuals' preferences for specific management actions (Smith et al., 2011). Local community members, by and large, prefer resource managers to make decisions that preserve the unique and distinctive nature (identity) of their communities (Kruger & Shannon, 2000).

Economic meanings refer to individuals' appraisals of how dependent their local economy is upon a particular forest landscape (Smith et al., 2011).

Ecological meanings refer to individuals' beliefs about how dependent they believe their local ecosystem is upon a particular public forest setting or landscape.

Based on the review of the literature above, we propose to examine the relationships between the meanings individuals ascribe to public forests, their stocks of social capital and their preferences for outcomes produced by alternative forest management plans. Based on existing social capital theory and empirical evidence, we expect both bonding and bridging social capital will significantly influence individuals' preferences for management outcomes. Concurrently, based on evidence from previous studies examining the connections between place meanings and desired management outcomes (Davenport & Anderson, 2005; Smith et al., 2011), we expect all

seven a priori place meaning dimensions will significantly influence individuals' preference for management outcomes.

4. Materials and methods

The primary objective of this study is to examine how both the meanings individuals attach to forested landscapes and the type and strength of their social capital influence preferences for forest management outcomes. The hypotheses being tested involve the presence of a relationship between seven hypothesized place meanings, four distinct stocks of social capital, and four primary objectives of forest management.

4.1. Measures

To assess place meanings, we used a 21-item scale shown to be an empirically valid measure of place meanings (Davenport et al., 2010; Smith et al., 2011). The scale is intended to measure seven relatively distinct meanings that individuals attach to managed public-trust landscapes. The intended meanings are: *individual identity, family identity, self-efficacy, self-expression, community identity, economic meanings, and ecological meanings*; each meaning is measured with between two and four statement items. Respondents are asked to indicate their level of agreement with each of the statement items on a 5-point agreement scale with the following response options: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, (5) strongly agree.

To assess social capital, we asked respondents about where they obtained information about local community issues (associational ties) and how much they trusted (affective) the information received from those sources. Respondents were given 14 potential sources of local community information and asked whether they received information from that source, and if so, the extent to which they trusted that information.

The bonding/associative form of social capital is assessed through a dichotomous measure assessed by respondents' use (scored 1) or non-use (scored 0) of close friends or immediate family for information on local community issues. The bonding/affective form of social capital is assessed through a continuous measure corresponding to the amount of trust respondents place in the information they receive from close friends and immediate family.

The bridging/associative form of social capital was assessed through a single measure corresponding to the number of information sources (besides close friends and immediate family) an individual draws upon for information about their local community. The bridging/affective form of social capital was assessed through a single measure that corresponded to the mean level of trust placed in local community information sources (aside from close friends and immediate family).

4.2. A model of preferences for desired management outcomes

To examine individuals' preferences for forest management outcomes, we utilized a survey-based stated preference field experiment where participants were presented with multiple forest management plans and asked to rank them in order of personal preference. Our model began with the assumption that forest planners and managers could produce four distinct outcomes – environmental, economic, recreational, and aesthetic. Management could either focus wholly on producing one outcome or, diversify their efforts and resources to produce multiple outcomes to a lesser degree. We developed a series of hypothetical management plans that varied in the extent to which they focused on producing each of the four outcomes. The experiment asked respondents to rank these plans based on their preferences.

According to random utility framework (McFadden, 1974), the utility derived from any particular plan is specified as:

$$U_{nj} = V_{nj} + \varepsilon_{nj} = \beta'x_{nj} + \gamma'z_{nj} + \varepsilon_{nj}$$

where U_{nj} is the random latent utility of a chosen management plan j for respondent n , V_{nj} is systematic (explainable) component of utility and ε_{nj} is random disturbance. Moreover, V_{nj} is a function of a matrix of attributes and their levels pertaining to the management plan (x_{nj}) and a matrix of other covariates z_{nj} pertaining to other factors thought to influence management preferences. Here, these other covariates are comprised of independent variables representing the meanings individuals ascribe to the forest and their stocks of social capital. Finally, β' and γ' are the vectors of coefficients associated with x_{nj} and z_{nj} .

A basic assumption of all stated preference experiments eliciting ranked responses is that individuals' rankings of alternatives within a choice set reflect the relative utility they receive from each of the alternatives. Given this, the probability of any ranking of alternatives from best to worst can be expressed as the product of logit formulas. In this experiment, respondents are presented with four management alternatives $A, B, C,$ and D . For example, the probability of a respondent ranking the alternatives B, A, C, D is expressed as the logit probability of choosing alternative B from the set A, B, C, D times the logit probability of choosing alternative A from the remaining set of $A, C,$ and D , times the probability of choosing alternative C from the remaining set of C and D . The probability of ranking the alternatives B, A, C, D is expressed as:

$$\text{Prob}(\text{ranking } B, A, C, D) = \frac{e^{\beta'x_{nB}}}{\sum_{j=A,B,C,D} e^{\beta'x_{nj}}} \times \frac{e^{\beta'x_{nA}}}{\sum_{j=A,C,D} e^{\beta'x_{nj}}} \\ \times \frac{e^{\beta'x_{nC}}}{\sum_{j=C,D} e^{\beta'x_{nj}}}$$

Since ranked data can be expressed as the product of logit formulas, they can be analyzed as independent choices. A respondent's complete ranking of all the alternatives (a single observation) is exploded into a series of pseudo-observations (Hanemann & Kanninen, 1999). Each pseudo-observation beyond a respondent's first choice omits the probability of the respondent choosing that alternative again. To accommodate the pseudo-observations, the data are set up in long format where $J - 1$ pseudo-observations for each ranking are treated as $J - 1$ choices for each respondent with the omitted choice acting as the base comparison choice.

4.3. Attributes

In developing the four outcomes produced by public forests (attributes) under examination in this study, we drew upon the literature addressing forest values (see Moyer et al., 2008; Owen et al., 2009) and recent research addressing preferences for non-forest public-trust resources (Anderson et al., 2008; Smith et al., 2011; Smith & Moore, 2011; Wyman & Stein, 2010). From the cited literature, we selected four common sets of desired outcomes we believed could be easily interpreted through a single statement included in the experiment. The four common desired benefits were: *ecological, economic, recreational, and aesthetic*. Based upon psychometric scales used by Smith et al. (2011), we selected one statement for each of the four desired outcomes. These statements were:

- Management should focus on conserving natural environments (*ecological*).
- Management should focus on attracting tourists to public lands (*economic*).

- Management should focus on improving recreational amenities on public lands (*recreational*).
- Management should focus on enhancing the visual appeal of forest settings and landscapes (*aesthetic*).

4.4. Experimental design and survey instrument

The experiment provided potential respondents with four discrete hypothetical management plans. The management plans varied in the extent to which they focused on providing the four outcomes outlined above. Each hypothetical management plan summed to a “100% management effort”. Respondents were asked to rank the four hypothetical management plans based on their personal preferences.

Following the vernacular of choice experiments, the four management outcomes elicited in each choice set are the experiment’s “attributes”. Each attribute could vary across three “levels”. Given four attributes with three levels each, our experiment has $3^4 = 81$ potential combinations of attribute levels plus an opt-out attribute of preferring none of the plans. We deemed this to be too large for our empirical study and instead opted for a smaller fractional factorial design. We followed the factorial design strategies presented by Louviere et al. (2000) and settled on a design containing 36 distinct hypothetical management plans plus the opt-out choice. To reduce the number of management plans that respondents had to rank, we blocked the design into nine versions of four management plans each. A typical block of plans is presented in Fig. 2.

4.5. Management context and data collection

The study populations for this experiment were three small cities located near public forests in Southern Appalachia. The three cities were Waynesville, North Carolina; Spruce Pine, North Carolina; and Franklin, North Carolina. Each of the three cities has transitioned from extractive forest or mining based economies to being primarily dependent upon regional tourism; all three communities have experienced large increases in the number of individuals buying second homes and vacation properties.

The USDA Forest Service manages both the Nantahala and the Pisgah National Forests, which comprise nearly all of the public forest lands within the region. The Nantahala and the Pisgah National Forests are managed under a 1994 Forest Management Plan. The original Forest Management Plan, passed in 1987, was legally challenged by several interest groups who argued the plan allowed for excessive timber harvesting (USDA Forest Service, 1994a; USDA Forest Service, 1994b). A subsequent re-analysis process by the agency generated substantial interest from the public. Over 2500 letters were received in response to the revised draft plan. After taking the public’s comments into consideration, the Forest Service amended the Forest Management Plan in the spring of 1994. The amended plan allocated much less area for timber harvesting (from 59,253 acres to 38,498 acres) and more area for aesthetic preservation and recreational opportunities with ‘backcountry’ areas increasing from 79,587 acres to nearly 120,000 acres. This shift in resource plans represents a decline in the social acceptability of producing benefit opportunities to support the forest’s economic value and a subsequent increase in producing benefit opportunities that support recreational and aesthetic values.

A random sample of 300 full-time resident homeowners was drawn from tax records within each of the cities (900 total households sampled). During the summer of 2011, potential respondents were sent mail questionnaires. The questionnaires, which included the place meanings scale and the social capital measurement instrument, were administered according to the Tailored Design Method (Dillman, Smyth, & Christian, 2008). A total of 40

questionnaires were undeliverable. Of the successfully delivered questionnaires, 420 were returned completed (48.8% response).

4.6. Data analysis

Data analysis proceeded through four distinct steps:

1. Analysis of the place meanings scale using confirmatory factor analysis (CFA).
2. Analysis of the social capital measures creating four indexes to measure each type of social capital.
3. Analysis of individuals’ preferences for forest management outcomes through a ranked logit specification.
4. Subsequent post-estimation tests to determine if, and how, the various social–psychological factors of interest influenced management preferences.

4.6.1. Confirmatory factor analysis

We began with CFA of the place meanings scale to determine if a model of the seven a priori dimensions of place meanings actually fit the data well. Our assessment of model fit was based on the following fit indices: the maximum likelihood χ^2 , the relative χ^2 (χ^2/df), the root mean-square error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker–Lewis index (TLI). The maximum likelihood χ^2 is a statistic of discrepancy between the sample and model covariance matrices; larger values indicate greater discrepancies and therefore poorer model fit. Because the maximum likelihood χ^2 is sensitive to large sample sizes, the relative χ^2 is divided by the model’s total number of degrees of freedom. Kline (2011) suggests a relative χ^2 value of three or less indicates acceptable model fit. The RMSEA assesses model fit while penalizing model complexity (i.e., large df). RMSEA values between 0.06 and 0.08 are acceptable if the upper bound of the RMSEA’s confidence interval is below 0.10 (Hu & Bentler, 1999). Both the CFI and the TLI indices indicate the extent to which the model fits better than a null model with uncorrelated indicator variables. The values of the CFI and the TLI range from 0 to 1 with values nearer to 1 indicating a better fit; 0.90 is a widely used cut-off value originally proposed by Hu and Bentler (1999).

4.6.2. Estimation

When field experiments ask respondents to rank distinct alternatives, the resulting data can be modeled with a standard logit, mixed logit, probit, or rank-ordered logit specification (Train, 2009). We choose to specify a rank-ordered logit model given it accounts for correlation in unobserved factors across individual responses and specifies clusters of respondents. The rank-ordered logit regression model acknowledges each respondent has his/her own valuation weights as applied to his/her ranking of alternatives; subsequently, it accounts for correlated valuation weights within each choice set for each respondent (Train, 2009).

The rank-ordered logit model has been used in previous natural resource management research in several different contexts. Researchers in Canada used the model to examine how various stakeholder groups ranked potential values (e.g., “spiritual”, “environmental”, “recreational”, etc.) for forested landscapes (Kumar & Kant, 2007). The model has also been used to examine preferences for different invasive species control methods (Paudel, Dunn, Bhandari, Vlosky, & Guidry, 2007) and preferences for irrigation water allocation schemes (Speelman, Farolfi, Frija, & van Huylenbroeck, 2010).

The rank-ordered logit model assumes that respondents use unique valuation functions (i.e., decision weights) when deciding between possible alternatives. Testing for variations in valuation

MANAGEMENT FOCUS

We would like to better understand how you think public lands in Southern Appalachia should be managed. To do this, we would like you to choose between four different management plans. Each of the plans focuses on producing different outcomes. Consider how the four plans below are different. After looking over each plan, please rank order each plan from 1 to 4 to indicate your preference for each plan.

Outcomes	PLAN 1	PLAN 2	PLAN 3	PLAN 4
	% of mgmt. effort	% of mgmt. effort	% of mgmt. effort	% of mgmt. effort
Focus on conserving natural environments	0	20	70	40
Focus on attracting tourists to the public lands	0	60	0	20
Focus on improving recreational amenities on public lands	30	20	0	40
Focus on becoming more involved in community development.	70	0	30	0
Please look over the plans and rank order each of them. Or, if you prefer none of these plans, please check the box below	<input type="checkbox"/> 1 st CHOICE			
	<input type="checkbox"/> 2 nd CHOICE			
	<input type="checkbox"/> 3 rd CHOICE			
	<input type="checkbox"/> 4 th CHOICE			
I do not prefer any of these plans	<input type="checkbox"/>			

Fig. 2. Typical block of hypothetical management plans.

functions due to the differing social–psychological characteristics of respondents involved the following steps:

1. Including each social–psychological characteristic in the rank-ordered logit regression model.
2. Estimating all interactions between the characteristic and the attributes of the choice set.
3. Conducting a Wald χ^2 postestimation test to determine if those parameter estimates are not zero (Allison & Christakis, 1994).

The null hypothesis of the Wald χ^2 test is that all interaction coefficients are 0, thus indicating no effect of that characteristic on valuation function. Characteristics with significant influence on valuation functions are retained and their interaction with choice set attributes can be interpreted accordingly.

5. Results

5.1. Descriptive statistics

Descriptive statistics for the place meanings scale items are shown in Table 1, Panel A. Initial checks for skewness or kurtosis, which would indicate a non-normal distribution of responses to the place meaning items, revealed no abnormal values (± 2). Subsequent analysis of the means and standard deviations reveal local residents attach a diverse array of meanings to the public forests that surround their communities, as all scale-item means were above the neutral value of 3. The strongest meanings related to the forests' ecological importance ($M=3.95-4.62$). Ecological meanings were also the most consistently ranked scale-items ($SD=0.92-1.02$). Respondents also tended to believe the forests contributed to the uniqueness of their community's identity

Table 1
Descriptive statistics, internal consistencies, and factor loadings for place meaning measurement items.

Panel A: Descriptive statistics, internal consistencies and factor loadings						
Dimension and statements	<i>M</i>	<i>SD</i>	α	$\Delta\alpha$	λ	
Individual identity						
I am very attached to the forest	4.01	1.11	0.92	0.91	0.85	
I feel this forest is a part of me	3.70	1.11		0.90	0.87	
I identify strongly with the forest	3.89	1.11		0.86	0.92	
Family identity						
I have pride in my heritage because of the forest	3.86	1.15	0.90	0.89	0.79	
The forest is a special place for my family	3.89	1.12		0.84	0.87	
Important family memories are tied to the forest	3.75	1.18		0.83	0.88	
Self efficacy						
The forest is best for the activities I like to do	3.60	1.12	0.90	0.86	0.88	
I have satisfying experiences when I visit the forest	4.05	1.05		0.88	0.83	
No other place can compare to the forest	3.78	1.13		0.89	0.77	
The forest is my first choice for outdoor recreation	3.60	1.16		0.87	0.84	
Self expression						
I feel that I can really be myself at the forest	3.87	1.07	0.93	0.91	0.87	
Visiting the forest allows me to express myself	3.57	1.05		0.87	0.92	
Visiting the forest says a lot about who I am	3.67	1.11		0.91	0.87	
Community identity						
The forest contributes to the community's character	4.24	1.00	0.93	0.91	0.89	
The community's history is defined by the forest	4.14	1.01		0.88	0.93	
The forest has helped put the community on the map	4.10	1.03		0.92	0.86	
Economic meanings						
The community's economy depends on the forest	3.79	1.02	0.90	–	0.86	
Appalachia's economy depends on the forest	3.95	1.02		–	0.86	
Ecological meanings						
The forest is important in conserving the landscape	3.95	1.02	0.96	0.96	0.92	
The forest is important in providing wildlife habitat	4.50	0.93		0.95	0.94	
The forest is important in protecting water quality	4.62	0.92		0.93	0.96	
Panel B: Confirmatory factor analysis fit statistics						
	χ^2	<i>df</i>	χ^2/df	RMSEA [90% CI]	CFI	IFI
Multi-group measurement model	1157.27	492	2.35	0.06 [0.06, 0.07]	0.92	0.92

($M=4.10$ – 4.24). The data also suggest that not all respondents consistently use public forests for recreational purposes, as indicated by the two activity-related scale-items (within the *self efficacy* dimension) with means of 3.60. However, on average, respondents did report having satisfying experiences when they did visit public forests ($M=4.05$). The reliability of scale-items relative to their hypothetical dimensions was acceptable ($\alpha \geq 0.90$) and no single item reduced the internal reliability of its dimension ($\Delta\alpha < \alpha$). Also, each statement item exhibited an acceptable ($\lambda > 0.70$) correlation with its latent dimension.

Analysis of the social capital measures indicate the majority of respondents utilize either “close friends” or “immediate family” (*bonding/associative* ties) to obtain information about local issues; 88.7% indicated using close friends and 85.4% indicated using immediate family members. Respondents indicated they generally trust the information obtained from close friends. Among respondents who obtain community information from close friends, 28.5% report always trusting that information while another 68.5% report sometimes trusting that information (3.0% of respondents indicate distrust in close friends). Similarly, respondents indicated they generally trust information obtained from immediate family members. Of those using family members as an information source, 45.5% indicated always trusting their information and another 51.8% indicate sometimes trusting that information (2.8% indicated distrust).

Further analysis of the social capital measures reveal individuals use a wide variety of sources to obtain information about community issues (Table 2). The majority of respondents indicated using all 12 informational sources queried about. Of these bridging connections, the most trusted source was “churches” (31.4% of respondents indicating always trusting information from this source), followed by “local newspapers or periodicals” (27.5%), “local television news” (23.7%) and “local civic groups” (22.1%).

The least trusted informational sources were “other online news sources (e.g., blogs, facebook, etc.)”, “elected officials” and “national television news”.

5.2. Confirmatory factor analysis

Results from the confirmatory factor analysis of the 21-item place meanings scale support the use of our hypothesized seven-factor model. The fit indices resulting from a comparison of our model implied covariance matrix and the actual covariance matrix are reported in Table 1, Panel B. A good fit is indicated by the relative χ^2 value of 2.35, a RMSEA of 0.06, and CFI and TLI values above 0.90.

5.3. Management preferences

Results from the rank-ordered logit regression model are shown in Table 3. Environmental outcomes had a positive and significant coefficient estimate ($\beta=0.008$, $z=3.19$, $p \leq 0.001$), indicating respondents highly favored management plans with a larger proportion of management efforts directed toward “conserving natural environments”. For each of the other three potential management outcomes, the data yielded negative and significant coefficient estimates, indicating respondents do not favor forest management focusing their efforts in producing these types of outcomes. Specifically, the economic outcome involving officials' efforts designed to “attract tourists to public lands” were the least preferred ($\beta=-0.026$, $z=-21.06$, $p \leq 0.001$) followed by the officials' efforts to “improve recreational amenities on public lands” ($\beta=-0.019$, $z=-12.71$, $p \leq 0.001$) and, finally, officials' efforts to “improve the aesthetic or visual appeal of the forest” ($\beta=-0.017$, $z=-12.98$, $p \leq 0.001$).

Table 2
Percentages of respondents indicating use of particular social ties and extent of trust in that tie.

	Associative ties	Affective ties		
	Respondents indicating use (%)	Always trust (%)	Sometimes trust (%)	Always distrust (%)
Bonding				
Close friends	88.7	28.5	68.5	3.0
Immediate family	85.4	45.5	51.8	2.8
Bridging				
Local newspapers or periodicals	91.1	27.5	65.4	7.2
Infrequent contacts	81.3	15.4	70.3	14.3
Coworkers	73.8	13.4	75.7	10.9
Extended family	80.7	19.9	70.5	9.6
Local television news	91.7	23.7	59.7	16.6
National television news	89.3	19.3	55.3	25.3
Civic groups	72.6	22.1	68.4	9.4
Education groups	75.6	19.0	71.2	9.9
Elected officials	81.9	9.5	65.1	25.5
Churches	75.0	31.4	60.7	7.9
Online news	77.1	12.4	70.7	16.7
Other online news sources	66.1	4.5	59.5	36.0

5.4. Social capital

The Wald χ^2 postestimation tests for the social capital measures are shown in Table 4, Panel A. All four postestimation tests were significant at the 0.001 level indicating significant influences on the valuation functions applied to choosing forest management alternatives. Bonding/affective ties had the most significant influence on respondents' preferences ($\chi^2 = 7089.71$). The second most significant influence on respondents' preferences was the strength of their bonding/associative ties ($\chi^2 = 134.39$) followed by bridging/associative ties ($\chi^2 = 82.19$) and finally, bridging/affective ties ($\chi^2 = 34.97$).

The coefficient estimates for all interaction effects are also reported in Table 4, Panel A. For bonding/affective ties, all four coefficient estimates were significant and negative indicating greater levels of trust in either "close friends" or "immediate family members" moderated management preferences, reducing the probability that plans designed to produce high levels of any one specific outcome will be most preferable.

In a similar fashion, greater levels of trust placed in bridged ties was also related to management plan preferences. However, the strength of individuals' bridging/affective ties was only related to one desired management outcome, environmental benefits. The more trust an individual places in bridging ties, the more likely they are to prefer management plans which focus the majority of their efforts on conserving natural landscapes ($\beta = 5.539e^{-4}$).

The data also reveal the quantity of social ties (associative) significantly influenced individuals' management plan preferences. The more bridging ties an individual utilized, the more likely they were to prefer management plans designed to produce economic ($\beta = 0.001$) and recreational outcomes ($\beta = 0.001$). Conversely, individuals who utilized bonding ties were significantly

less likely to prefer plans focused on producing economic outcomes ($\beta = -0.002$).

5.5. Place meanings

The Wald χ^2 postestimation tests for the place meanings measures are reported in Table 4, Panel B. All seven distinct meanings exhibited a significant influence on respondents' valuation weights. The place meanings in order of their greatest influence on respondents' preferences for the management plans were:

- *Self-expression* ($\chi^2 = 626.09$). Individuals who believed the forest enabled them to express themselves tended to prefer management plans focused on producing recreational outcomes ($\beta = 0.006$).
- *Economic meanings* ($\chi^2 = 592.17$). Individuals who believed the forest was important for economic reasons tending *not* to prefer management plans focused on producing environmentally focused outcomes ($\beta = -0.012$) or aesthetically focused outcomes ($\beta = -0.006$). A greater belief in the economic importance, however, was associated with stronger preferences for management to produce recreational outcomes ($\beta = 0.006$) and economic outcomes ($\beta = 0.007$).
- *The belief that the forest defined a respondents' family identity* ($\chi^2 = 497.97$). Management plans focused on economic outcomes ($\beta = -0.009$) and recreational outcomes ($\beta = -0.007$) were all given less weight by respondents who held stronger beliefs about the forest defining their family's identity.
- *Ecological meanings* ($\chi^2 = 295.38$). Respondents who held strong beliefs about the forest's importance in maintaining their community's ecological integrity preferred management plans focusing on producing those environmental outcomes ($\beta = 0.005$).

Table 3
Ranked logit results: determinants of management plan preferences.

Attribute	Coef.	Robust SE	z	$p \leq z$	95% conf. interval	
					LB	UB
Management focus						
Environmental outcomes	0.008	0.003	3.19	0.001	0.003	0.131
Economic outcomes	-0.026	0.001	-21.06	0.000	-0.029	-0.024
Recreational outcomes	-0.019	0.002	-12.71	0.000	-0.022	-0.016
Aesthetic outcomes	-0.017	0.001	-12.98	0.000	-0.020	-0.014
Model fit statistics						
Log pseudolikelihood				-686.070		
AIC				1378.139		

Note. Ties handled via the Efron method.

Table 4

Wald-tests of constant valuation weights.

Panel A: Social capital factors affecting valuation weights							
	Bridging/affective ties	Bonding/affective ties	Bridging/associative ties	Bonding/associative ties			
Management focus							
Environmental outcomes	5.539e ⁻⁴ *	-0.002 [*]	3.653e ⁻⁴	0.008			
Economic outcomes	-4.710e ⁻⁵	-0.006 ^{***}	0.001 ^{***}	-0.002 ^{***}			
Recreational outcomes	3.680e ⁻⁵	-0.004 ^{**}	0.001 ^{**}	0.002			
Aesthetic outcomes	1.717e ⁻⁴	-0.003 [*]	0.001	0.011			
Wald-test							
χ^2	34.97	7089.71	82.19	134.39			
<i>p</i>	<0.001	<0.001	<0.000	<0.000			
Panel B: Place meaning factors affecting valuation weights							
	Individual identity	Family identity	Self efficacy	Self expression	Community identity	Economic meaning	Ecological meaning
Management focus							
Environmental outcomes	0.001	-0.005	-0.002	-0.001	0.000	-0.012 ^{***}	0.005 [*]
Economic outcomes	-0.004	-0.009 [*]	-0.006 [*]	-0.004	-0.004	0.007 [*]	-0.003
Recreational outcomes	0.005 [*]	-0.007 [*]	0.005 ^{**}	0.006 ^{**}	-0.004 [*]	0.006 ^{**}	-0.003
Aesthetic outcomes	-0.003	-0.006	-0.004	-0.003	-0.004	-0.006 ^{***}	0.000
Wald-test							
χ^2	32.24	479.97	130.67	626.09	282.84	592.17	295.38
<i>p</i>	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000

Note. Ties handled via the Efron method.

* $p < 0.050$.** $p < 0.010$.*** $p < 0.001$.

- *Meanings of self-efficacy* ($\chi^2 = 130.67$). Individuals with a greater dependence upon the forest to engage in desired activities placed greater emphasis on plans focused on producing recreational benefits ($\beta = 0.005$); they also placed less emphasis on economic outcomes ($\beta = -0.006$), namely attracting more tourists to public lands within the area.
- *Meanings of individual identity* ($\chi^2 = 32.24$). Explicitly, respondents who held higher levels of place-based individual identity placed a greater importance on plans focusing on producing recreational benefits ($\beta = 0.005$).

6. Discussion

6.1. Summary

Forest planners and managers continue to face the problem of having to make value-laden decisions in the face of scientific uncertainty, reduced fiscal resources, and increased demands to acknowledge and accommodate public desires regarding the outcomes of their decisions. To aid forest planners in making these decisions, we have suggested they need an understanding of the outcomes local community members would like management actions to produce and a clearer understanding of how various social and psychological factors influence those preferences.

We have attempted to make both methodological advances in how natural resource social scientists study these questions and theoretical advances that deepen the scientific understanding of how social and psychological factors influence individuals' management preferences. Methodologically, the decision-making framework of discrete choice models enabled us to design a field experiment whereby local community members expressed their preferences for management plans that produced distinct outcomes to varying degrees. The key to our experiment is that respondents must make trade-offs between the various outcomes they would like management to produce. Preferences are not bounded solely by the desires of the respondent, but also by the reality that management can only allocate so many resources to the production of any one outcome before the ability to produce

other outcomes diminishes. Theoretically, we coupled our discrete choice experiment with several well-known and frequently discussed concepts within natural resource social science – social capital and place meanings – in an effort to deepen the scientific understanding of how these concepts influence preferences for management outcomes.

We found respondents living near public forests in Southern Appalachia preferred management plans that produced environmental outcomes more so than economic, recreational, or aesthetic outcomes. Respondents believe the conservation of natural environments (environmental outcome) should be the number one priority for public forest managers near their community. The second priority should be preserving the aesthetic or visual appeal of the forest (aesthetic outcome) followed closely by improving recreational amenities in public forests (recreational outcome). Finally, respondents believe attracting tourists to public forests (economic outcome) should be the least important priority for forest managers. For forest managers within the region, these findings are an expression of public choice and can be used to produce forest plans that not only meet agency mandates, but also the standards of social acceptability well (Brunson, 1996; Stankey & Shindler, 2006).

Our data suggest individuals' stock of social capital influences their valuation of potential forest management outcomes. The analyses reveal both individuals' bridging ties as well as their bonding ties can influence their evaluation of management preferences (Table 4). While existing social capital theory does not provide us with evidence for which form of ties are stronger predictors of individuals' preferences, our data suggest it is the quality of the tie (i.e., affective or reciprocity based) as opposed to the quantity (i.e., associative or exchange based) that carries substantially more weight in individuals' decision-making processes. For forest planners, this finding has direct implications for the dissemination of forest management related information (e.g., current issues, climate change education, etc.). As the data suggest information obtained from specific highly trusted sources influences the evaluation of management alternatives, planners should focus the dissemination of forest management related information to highly trusted informational outlets such as churches, local newspapers or periodicals,

and local civic groups. The dissemination of information through these sources is likely to have the greatest influence on individuals' evaluation, and potential acceptance, of management actions.

Our data also indicate that the meanings individuals attach to public forests influence their preferences for potential forest management outcomes. This finding is consistent with previous empirical evidence conducted within non-forest settings (Smith et al., 2011). The finding also provides further support for the acknowledgement and integration of place meanings into formal forest management frameworks (Cheng et al., 2003).

Regarding specific place meanings, we found meanings of *self-efficacy*, *self-expression*, and *individual identity* have similar effects on individuals' preference for management outcomes. Specifically, all three types of place meanings had a positive influence on appraisals of management plans designed to produce recreational outcomes. This finding is logical and intuitive. The more individuals depend upon the forest as a setting for desired recreational experiences that allows them to express themselves, the more likely they are to desire management plans focused on maintaining those opportunities. Collectively these findings extend previous research, primarily focused on recreationists (e.g., Kyle, Absher, & Graefe, 2003, Vogt & Williams, 1999), linking individuals' place identity with stronger preferences for management outcomes. Our findings reveal a more finely tuned conceptualization and measurement of the place identity construct, parsing it into components of individual identity (related to a more generalized appraisal of the extent to which the forest defines one's identity) as well as self-efficacy and self-expression (more specific behaviorally focused constructs).

6.2. Limitations

One limitation of this research was our sole focus on the management plan preferences among residents living *near* public forests. Forest management decisions are also required to consider the preferences of individuals who do not live directly adjacent to the resource. This is particularly true in the United States where accommodating *all* public concerns in National Forest decision-making is a fundamental principle of resource governance. Considering and responding to public comments are explicitly mandated under the National Environmental Policy Act and the National Forest Management Act. The consideration of preferences held by both proximate and distant forest users are important. However, we have chosen to focus solely on proximate resource users given the increased likelihood they will be impacted by management decisions and more directly involved in collaborative planning processes (Selin & Chavez, 1995; Steelman, 2001). Subsequent research needs to more acutely address how forest management preferences differ between proximate and distant populations.

Another limitation of this research is the use of individual statement items to represent broad sets of desired management outcomes. All of the outcomes from any particular plan cannot wholly be represented with a single statement item. However, we drew upon the unique forest planning context of Western North Carolina to develop statement items which accurately reflect past and ongoing forest planning efforts. This limitation is largely a product of the breadth of the research foci (Forest Management Plans) coupled with the requirements of accepted methodological protocols of stated preference research. A fruitful avenue for future research might focus on distinct management decisions (e.g., whether to conduct prescribed burns or not) and more finite and separable sets of desired management outcomes. Despite these limitations, this research moves the study of preferences for forest management outcomes into new methodological directions and contributes to the knowledge concerning social and psychological factors influencing individuals' preferences.

The final limitation of this research is that our methodological design was developed to gauge *intra-community* social capital and not existing stocks of social capital held between local community members and resource management agencies. As evidenced by the findings of this research and the existing literature on agency/community social capital (e.g., Smith et al., *in press*), both measures can influence public preferences and, ultimately, influence the acceptability of a management agency's decisions and plans. Future research, focused more directly on the stocks of social capital held between local communities and management agencies, is needed to establish a better understanding of where individuals acquire information about resource planning and how their trust in that information influences personal preferences.

6.3. Conclusion

Most, if not all, state and federal forest management agencies are mandated to produce multiple benefits from the forestlands under their control. More frequently than not, the production of one type of benefit comes at the expense of the production of others. As a result, forest planners are faced with making difficult trade-offs between alternative desired management outcomes. In making these difficult trade-offs, forest planners often have little guidance as to which outcomes are preferred by local community members. Through this study, we have suggested individuals' management preferences can be influenced by their stocks of social capital as well as the meanings which they ascribe to the forest. In a novel choice experiment, we have produced a scenario where local community members, similar to forest managers, must balance the costs and benefits associated with the production of economic, ecological, recreational and aesthetic management outcomes. The results of our experiment have produced a clearer understanding of how place meanings and individuals' stocks of social capital affect their appraisals of different forest management outcomes. Our findings, ultimately, can provide forest managers with useful information to producing socially acceptable management outcomes.

Acknowledgements

This research was supported by a doctoral dissertation improvement grant from the National Science Foundation (Award No. 1030395) and a Hoffmann Fellowship from the College of Natural Resources at North Carolina State University. The authors would like to thank Dr. Ed Kick, Dr. Hugh Devine, and Hollie Smith for their comments and suggestions.

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