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Public perceptions of county, state, and national forest management in Wisconsin, USA

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ABSTRACT

Attitudes toward public forest management actions can be sources of conflict among and between public stakeholders and managers. Understanding these forest stakeholders can help managers engage in planning processes more effectively. Residents of fifteen counties in Wisconsin were surveyed in summer 2013 to understand how management attitudes impacted respondents' acceptance of management at three levels of publicly managed forest: county, state, and national. Results from regression models reveal that similar attitudes consistently impacted stakeholders' acceptance of fire, timber, wildlife, and recreation management for county and state forests, but only the timber and wildlife management models were significant for the national forest. Forest managers can use these results to understand public perceptions of forest management, identify opportunities for outreach to stakeholders, and for alternative or complementary methods of public involvement in planning. There is increasing social pressure on forest managers that arises from public perceptions and can directly influence U.S. forest policy. Policymakers and managers can use this attitudinal information as one method of public involvement and to develop additional engagement tools.

1. Introduction

Public forests in the United States (U.S.) are managed for a variety of social, economic, and ecological benefits, many of which are accounted for in multiple-use statutes. While these benefits provide strategic direction for public land management, they can also be the source of conflict when management strategies do not match stakeholder values and perceptions of the resource. Almost one-third of the growing stock in the U.S. is on national forest land, which accounts for about 19% of U.S. timberland (land available for timber production), and approximately 12% of growing stock is held in public ownership other than the U.S. Forest Service (FS) (Oswalt et al., 2014). The 2012 National Forest System land management planning rule (USFS, 2015a) includes multiple directives and assessment requirements aimed at developing a fuller understanding of the impact of forest management activities on social systems and vice versa. At the state level, Wisconsin similarly requires public involvement for Wisconsin Department of Natural Resources managed lands (Wisconsin Administrative Code NR 44, 2014), and certification standards include consulting people who are impacted by forest management (FSC-US, 2010). Involving members of the public, hereafter referred to as stakeholders, in these planning processes can be complicated, due in part to changing social trends with respect to public forest land. The analytical framework of public participation (Buchy and Hoverman, 2000) posits that participation can either be an approach/ethos or a management tool. The ideal level of participation for a given forestry action (e.g., timber harvesting vs. fire management) differs by decision, and understanding public perceptions of various actions will help guide how public participation is structured. In this study, we test the applicability of forest management attitude scales developed by Kearney and Bradley (2011) with regard to forest scene preferences on forest management practice acceptability to inform public forest managers and guide participation processes.

1.1. Social trends and values affecting acceptability of management practices

Social trends impacting public forest management include decreases in per capita outdoor recreation opportunities due to population growth (USFS, 2012), economic impacts associated with decreased demand for

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timber and paper mill closures (e.g., Bidgood, 2014), and shifting forest values (Steel et al., 1994; Brown and Reed, 2000; Clement and Cheng, 2011). Across the U.S., small communities are being impacted by paper mill closures and question whether tourism related businesses can make up the economic losses. Trends in timber harvests and recreation demand are reflected in public forest values and attitudes toward their management, which have been studied in a variety of settings over the past several decades though the vast majority of research has focused on national forests. A gradual change from economic to non-economic values over time has been noted as evident in news stories about forests (Bengston and Xu, 1995; Bengston et al., 2004). This shift in the approach of public forest management from one centered on economic commodities and values such as timber to a more holistic set of human and ecological benefits has been found by others (e.g., Steel et al., 1994; Brown and Reed,2000; Clement and Cheng, 2011), but there remains a challenge on how managers can understand and use this information. Clement and Cheng (2011), for example, noted the difficulty the FS has had with incorporating stakeholder values into planning. In their discussion of social acceptability of management, Stankey and Shindler (2006) state that when actions are interpreted by stakeholders as "inconsistent with [their] values and concerns, an agency's ability to act effectively is compromised," (p.30), and acceptance occurs when management goals fit with stakeholder values (DeCaro and Stokes, 2013). Stern et al. (2009) found that interdisciplinary teams involved with FS planning often defined success as lack of litigation, advancing the proposed project toward implementation, recognizing and addressing public concerns, educating decision-makers, improving the quality of final decisions, and reducing conflict. Litigation regarding FS land management decisions is most commonly associated with timber harvesting (Broussard and Whitaker, 2009), providing further evidence for the shift toward non-economic public values for forests. While a variety of processes for incorporating public opinions into plans have been developed and investigated, some require a deeper commitment to participation than many are able to make (e.g., the "high-degree of participation" outlined by Appelstrand, 2002). Social surveys are another source of data that can be used to gather information about stakeholders and the level to which they find management practices acceptable, and they are not limited to those who can participate in an extensive planning process (Clement and Cheng, 2011).

1.2. Forest management attitudes

Attitudes are a person's "disposition to respond favorably or unfavorably to an object, person, institution, or event" (Ajzen, 1988, p 4) and are likely to play a strong role in public acceptance of forest management strategies, along with other factors like beliefs and trust (Shindler et al., 1993; Ford et al., 2014; McGrady et al., 2016). The cognitive hierarchy (Fulton et al., 1996) posits that specific attitudes are formed based on underlying values, value orientations, and beliefs. Because values are not specific to situations and represent, instead, "guiding principles of what people consider important in life" (Cheng and Fleishmann, 2010), they take shape with regard to specific topics and can be understood through measuring attitudes.

Empirical studies in the United States investigating the link between attitudes – and thus the values influencing their formation – have found disparate results in terms of how economic versus non-economic attitudes relate to forest management issues. Kearney and Bradley (2011) examined impacts of attitudes and other variables on forest treatment preferences, finding that positive commodity/utilitarian attitudes about forest management were related to a greater variety of treatments. However, ecosystem/amenity attitudes were not significantly related to treatment preference. Conversely, Manning et al. (1999) found that respondents to management attitude questions regarding the Green Mountain National Forest agreed more strongly with actions and policies that reflected a more holistic, ecosystem management approach. In a survey of urban residents regarding management goals of national forests located near major metropolitan areas, Dwyer (2002) found that only 39% of respondents agreed with extractive management, while statements promoting protection, ecosystem management, and recreation had the highest level of agreement.

Dwyer (2002) also found that individuals did not know who managed the nearby national forests. Given the proximity of different forest ownership types to each other in many areas of the US, this can have important implications. McCaffrey et al. (2008) found that preferences for management treatments change depending upon the type of land (privately owned, National Park Service, FS), positing that people "recognize management context" (p 232). Clement and Cheng (2011) examined attitudes toward uses and management actions at three different national forests, finding respondents strongly supported recreational uses and were more supportive of logging for reasons other than profit. Although the general trends were similar, context and population factors might influence attitudes. For instance, those living near the Shoshone National Forest had higher mean levels of agreement with oil and gas exploration though respondents overall tended to have negative attitudes toward these activities. There have been conflicting results regarding how proximity to public lands is related to treatment preferences, management techniques, or other constructs. Closer proximity has been found to increase support for restoration practices in the U.S. (Gobster et al., 2016), whereas in India (Badola et al., 2012) and Bangladesh (Roy, 2016) proximity to mangrove forests was found to be inversely related to conservation. However, the India and Bangladesh cases have more forest-dependent communities and less clearly defined property rights than the U.S.

1.3. Socio-demographic influences

Although not included in all studies on management attitudes, a variety of socio-demographic variables aside from proximity to public forests have been investigated. Research on public lakes in Wisconsin found that seasonal residents have higher levels of emotional identity tied to their lakes than year-round residents (Simoni and Floress, 2015). Studies of general environmental attitudes have found inconsistent evidence with regard to the impact of most socio-demographic variables, nevertheless education and age are often included in attitude models. Similar to gender, there is a general expectation that those who are younger and have more formal education will have stronger pro-environmental attitudes (Sarigöllü, 2009).

1.4. Objectives and hypotheses

In the United States, there have been investigations on public perceptions of forests comparing different populations (e.g. Oregon residents vs. U.S. residents, Steel et al., 1994), the same population's perceptions of different national forests (e.g. Dwyer et al., 1993), and different populations' perceptions of different national forests (e.g. Clement and Cheng, 2011). Others have used general attitudinal measures – the New Ecological Paradigm Scale (Dunlap et al., 2000) – to understand willingness to pay for altering management strategies of a public forest in Poland (Bartczak, 2015). However, most studies have not explored how people's assessment of whether a forest is managed according to their values – management acceptance – is influenced by their management attitudes. The present study contributes to this base of literature in its study of attitudes related to forests within the same geographic area and managed by three different agencies, but with similar multiple-use missions. The research focus on national forests found in the literature offers an interesting opportunity to examine whether the lessons learned about management attitudes in this context transfer easily to other types of public forests. This research attempts to describe the population with regard to factors that could prove useful in future planning and policy decisions. To do so, we first tested forest management attitude factors previously used to understand management preferences (Kearny and Bradley, 2011) for their validity with our

studied population and forests. We then used the attitude factors along with *Age*, *Gender*, *Education*, *Distance* from each type of forest, and *Seasonality* (length of time spent at residence annually) to examine acceptance of management (Stankey and Shindler, 2006; DeCaro and Stokes, 2013) with regard to fire, timber, wildlife, and recreation. We hypothesized that a similar set of variables would impact acceptance across forest type, but would differ based on the dependent variable. For example, acceptance of fire management would have a similar set of significant predictor variables regardless of whether the forest was managed by a county, the state, or FS.

2. Materials and methods

2.1. Study area

Public forests cover approximately 4.4 million acres within the state of Wisconsin. Each type of publicly managed forest in Wisconsin (county, state, FS) is managed for multiple uses, though the language and priority of activities within the context of multiple-use management varies slightly between forests (Cubbage et al., 1993; Rohe et al., 2004; Sohasky, 1994). The County Forest System (comprised of 29 forests) is the largest with approximately 2.4 million acres (WCFA, 2015). This is followed by the Chequamegon-Nicolet National Forest (CNNF) with 1.5 million acres and the 11 State Forests with approximately 530,000 acres (USDA, 2015b; WCFA, 2015; WDNR, 2015a). County forests have the highest percentage of their accessible acres harvested (2.5%), followed by state forests (1.7%) and CNNF (1.0%; WDNR, 2015b).

Fifteen counties in northern Wisconsin were identified for inclusion in this study [Fig. 1]. Each county had at least two types of public forest, and all 15 counties had county forests. The state forests in the study area include the Northern Highlands American Legion State Forest that crosses three counties – Vilas, Oneida, and Iron, and the Flambeau River State Forest that crosses Sawyer, Price, and Rusk counties. The CNNF crosses 12 of the 15 counties.

2.2. Sampling

Two thousand randomly selected residential addresses across the 15 counties were purchased from Survey Sampling, Inc. The survey sampling company recommended excluding post office boxes to ensure the highest rate of deliverable questionnaires. It is possible that this is a source of coverage error in our survey. To at least partially reduce coverage error, and based on our experience conducting surveys in the region with 30–40% response rates, we purchased more addresses than necessary to achieve our target response sample of approximately 400 individuals (Dillman, 2000).

2.3. Questionnaire design

Nine semi-structured interviews with forest managers and one focus group with other forest stakeholders were conducted in fall 2012 and spring 2013 to identify and prioritize topics for the questionnaire. The guide included questions about participant perceptions about: the purpose of the type of public forest being discussed with them; personal and community benefits provided by the forest; potential negatives associated with the forest; and similarities and differences between county, state, and national forest. Based upon analysis of the interviews and focus groups, an initial survey instrument was developed and pretested with a group of volunteers to reduce measurement error. The final questionnaire included 13 items measuring attitudes toward forest management practices [11 based upon Kearney and Bradley, 2011, described below], and acceptance of *fire management, timber management/logging, wildlife management,* and *recreation management*. All items were measured using a five point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Socio-demographic information was also collected, including *Age*, *Gender*, *Seasonality*, and *Distance* from each type of forest. Variable information can be found in Table 1. Each set of questions was asked for county, state, and national forests. Respondents answered questions only about the forests with which they indicated they were familiar (county, state, or CNNF), accounting for the different sample sizes in the results.

2.4. Survey implementation

A four wave mixed-mode (combination mail and web-based) survey was conducted in summer 2013. Greenlaw and Brown-Welty (2009) found that mixed-mode surveys achieved higher response rates than either paper or web surveys alone, potentially positively impacting the validity of results. A cover letter was mailed to 2000 potential respondents informing them of the survey and inviting them to either participate online or wait for the hardcopy survey to be sent. Each was given a unique code in order to track response rate and subsequent mailings. Those who did not respond online within 2 weeks were sent a hardcopy survey. A reminder postcard was sent approximately 2 weeks after the hardcopy survey, with a final replacement survey sent 2 weeks after the postcard. Each mailing offered respondents the opportunity to complete the survey online.

2.5. Data analysis

2.5.1. Principal axis factoring

Principal axis factoring was performed as the individual questionnaire items were assumed to be measuring an underlying latent construct (Conway and Huffcutt, 2003) prior to formulating regression models for acceptance of various forest management strategies. As correlation among the factors was likely, Promax rotation was used. Communalities were examined for each item to ensure they were ≥ 0.3. Eigenvalues > 1 were used to determine the initial number of factors, and scree plots were used to determine the number of factors to retain. The Kaiser-Meyer-Olkin measure of sampling adequacy was used to examine sampling adequacy (county = 0.836, state = 0.819, CNNF = 0.836) and Bartlett's test of sphericity was used to ensure factorability (χ: county = 1834.25, state = 1614.55, CNNF = 1619.13, *p*-value: 0.000 for all) Factor loadings from our analysis and Kearney and Bradley (2011) can be found in Table 2.

2.5.1.1. Commodity/utilitarian. Seven items from Kearney and Bradley (2011) were included on our survey. Of those, five loaded on the *Commodity/Utilitarian* factor. Two items loaded negatively and heavily on a separate factor – Preservation – discussed below. Kearney and Bradley (2011) reported a higher Cronbach's α (0.96) than the three obtained from our sample for each type of forest (0.813, 0.821, and 0.838 for county, state, and CNNF, respectively). With the exception of the two items, the *Commodity/Utilitarian* factor confirms the original factor structure.

2.5.1.2. Ecosystem/amenities. Three items from Kearney and Bradley (2011) were included on our survey. All three loaded on the Ecosystem/Amenities factor as expected. The recreation item loadings were low (0.525, 0.452, and 0.474 for county, state, and CNNF, respectively). Cronbach's α was higher in the original study (0.75) than for county, state, and CNNF (0.724, 0.684, and 0.684, respectively).

2.5.1.3. Preservation. As with the Kearney and Bradley (2011) study, the loadings for these items were negative, though in the original study they loaded on the *Commodity/Utilitarian* factor. The *Preserve Nature* item had lower factor loadings than the *No Cutting* item. Because the factors were correlated (oblique rotation was used), the loadings represent regression coefficients rather than correlations and a loading over 1 is possible (Joreskog, 1999), as seen on the *No Cutting* item with regard to the CNNF. While the two statements did load

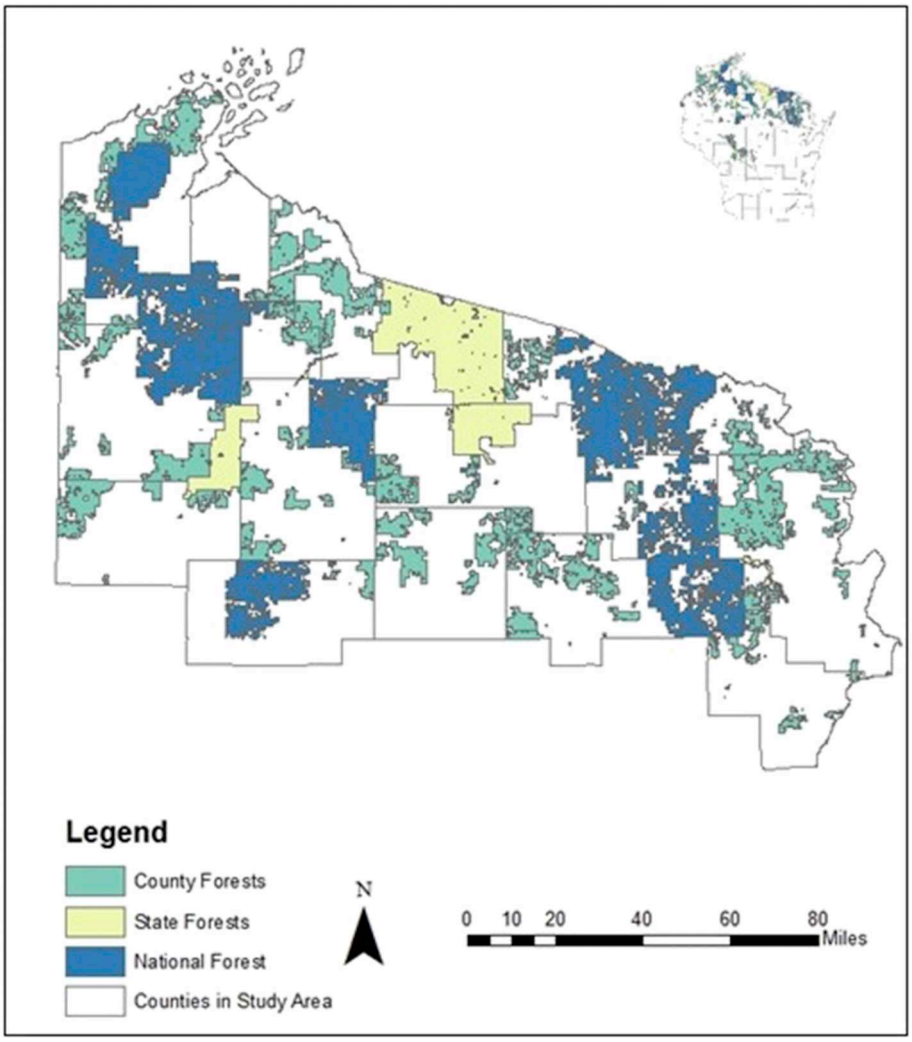

Fig. 1. Map of study area.

Table 1
Description of variables included in analyses.

Variable	Description	Measurement Scale
Commodity/Utilitarian Attitudes	5 statements about economic and human benefits, timber harvesting	1 = strongly disagree
Ecosystem/Amenities Attitudes	3 statements about managing for fish and wildlife, the environment, and recreation	2 = disagree
No Cutting Attitude	1 statement that forests would be healthier if no cutting were allowed	3 = neutral
Preserve Nature Attitude	1 statement that more attention should be given to preserving nature	4 = agree
Management acceptance	1 statement each that the forest is managed according to respondent's values with regard to fire, timber/logging, wildlife, recreation	5 = strongly agree
Distance from the Forest	Minutes it takes to travel to each forest from respondent's residence	1 = < 10 2 = 10–19 min 3 = 20–30 min 4 = 30 min or more
Gender	Male or Female	1 = male 2 = female
Education	Highest level of formal education	1 = Some high school 2 = High school or GED 3 = Some college 4 = 2 year degree 5 = 4 year degree 6 = Graduate degree
Seasonality	Months of year respondent lives at residence	1 = Year round resident 2 = > 6 months but fewer than 12 3 = 3–6 months 4 = fewer than 3 months

Table 2
Factor loadings for county, state, and CNNF management attitudes.

Item	Commodity/Utilitarian				Ecosystem/Amenities				Preservation[b]		
	County	State	CNNF	K&B 2011	County	State	CNNF	K&B 2011 α = 0.7	County	State	CNNF
	(33.37%; α = 0.813)	(33.70%, α = 821)	(35.84%; α = 0.838)	α = 0.96	(13.26%; α = 0.724)	(12.98%; α = 0.684)	(12.82% α = 0.684)	5	(6.11%)	(6.33%)	(8.91%)
It is important to manage _ forests for fish and wildlife	0.013	0.042	−0.032	NR[a]	**0.690**	**0.569**	**0.670**	0.76	−0.029	−0.029	0.062
Partial cutting is an acceptable timber harvesting technique on _forests	0.114	0.115	0.167	NR	0.337	0.405	0.329	NR	0.386	0.410	0.312
It is important to manage _forests for environmental quality	−0.082	−0.104	−0.065	NR	**0.916**	**0.921**	**0.836**	0.74	−0.052	−0.004	−0.023
_ forests should be managed for recreational use	0.099	0.201	0.208	NR	**0.525**	**0.452**	**0.474**	0.63	0.018	−0.057	−0.093
Clear cutting is an acceptable timber harvesting technique on _forests	**0.602**	**0.550**	**0.591**	0.81	−0.093	−0.103	−0.124	NR	0.092	0.105	0.137
It is important to manage _ forests for economic returns	**0.634**	**0.777**	**0.787**	0.84	0.180	0.103	0.083	NR	0.055	−0.001	0.003
Timber harvesting is usually the best way to enhance other multiple uses	**0.742**	**0.686**	**0.675**	0.83	−0.013	0.079	0.026	NR	0.143	0.184	0.241
It is important to manage _forest for local employment	**0.738**	**0.782**	**0.769**	0.78	0.114	0.085	0.111	NR	0.013	−0.056	−0.016
_ forest management should be based on human benefit	**0.705**	**0.706**	**0.730**	0.77	−0.042	0.009	0.004	NR	−0.275	−0.227	−0.230
The health of _forests would be better if no cutting were allowed	−0.217	0.166	0.169	−0.70	−0.052	−0.017	−0.065	NR	**−0.965**	**−0.974**	**−1.020**
In managing _forests, more attention should be given to preserving nature for its own sake rather than producing goods	−0.256	−0.371	−0.333	−0.64	0.271	0.312	0.256	NR	**−0.515**	**−0.422**	**−0.464**

[a] NR = Kearney and Bradley (2011) did not report item loadings on other factors. Bold font highlights the factor loading for the item.
[b] indicates an anti-preservation attitude when items are negative.

together, the loading of *No Cutting* was much higher than *Preserve Nature*. Cronbach's alpha is not a useful test of scale reliability for fewer than three items, and the statements were included as individual variables in the regression models.

2.5.2. Regression analyses

Twelve total linear regression models (four per each type of publicly managed forest) were run after checking assumptions. The dependent variables were acceptance of *fire management, timber management/logging, wildlife management,* and *recreation management,* measured by level of agreement that the agency was managing forests in ways consistent with the respondent's values for each. The scale used to measure these variables can be considered continuous due to the underlying, continuous nature of attitude constructs, and is robust in meeting the assumptions of ordinary least squares regression (Vaske, 2008). The independent variables were *Commodity/Utilitarian*, *Ecosystem/Amenity*, *No Cutting*, *Preserve Nature*, *Seasonality*, *Distance*, *Gender*, *Education* and *Age*. Because the number of women responding to the survey was much lower than population parameters, a post-stratification weight was assigned to *Gender*. Analyses were conducted in Stata version 14.

3. Results

3.1. Description of respondents

Of the 2000 people in the initial sample, 204 questionnaires were returned non-deliverable and 649 completed questionnaires were received (36% response rate). Approximately 73% of the respondents were men (n = 477) and 21% were women (n = 134) while the remaining respondents did not identify their gender (Table 3). Approximately 43% had some level of college education, and only 4% did not graduate high school (n = 29). On average, respondents were 61 years old, and the majority (89%, n = 546) were year round residents. Our respondents, compared to the averaged statistics for the 15 county study area (US Census Bureau American FactFinder, 2016a,b,c), are somewhat older and moderately more educated than the population, and a higher percentage are year-round residents (see Table 3). Respondents were asked whether or not they were familiar with each type of forest, and were directed to only answer questions regarding those with which they were familiar: 509 were familiar with county, 428 with state, and 389 with the CNNF.

3.2. Management acceptance

Four regression models were developed for each forest ownership category to examine the impacts of different types of management attitudes on acceptance of timber, fire, wildlife, and recreation management. All models (four each) of management acceptance were significant for county and state forests, and two models (timber management and wildlife management) were significant for CNNF.

3.2.1. Timber management

The overall acceptance of timber management models for county, state, and CNNF were all significant (Table 4). *Commodity/Utilitarian* management attitudes had a significant, positive impact in all models, as did *Ecosystem/Amenity* attitudes for both county and state. *No Cutting* had a negative impact in the county timber management model, while *Gender* was significant in both county and CNNF models. However, *Gender* had a significant and positive impact on acceptance of timber management for CNNF, while it was significant and negative for county forest. *Distance* from state forests was significant only in the state model, where increased distance from state forests was associated with increased management acceptance. County (R^2 = 0.341) and state (R^2 = 0.382) models explain more variance than CNNF (R^2 = 0.245).

3.2.2. Fire management

Both county and state acceptance of fire management models were significant (Table 5). Like with timber, both *Commodity/Utilitarian* and *Ecosystem/Amenity* variables were significant. *No Cutting* was significant only for state, and, once again, *Distance* from state forests had a significant and positive impact on acceptance. Having a 2 year degree also had a significant and positive impact in the state forest model – this is the only time *Education* is significant across all models. *Age* is significantly and positively associated with acceptance of fire management for both county and state models. The variance explained for county (R^2 = 0.160) and state (R^2 = 0.197) models is lower than for timber management.

3.2.3. Wildlife management

As with timber management, *Commodity/Utilitarian* was significant and positive across all three forest types, while *Ecosystem/Amenity* was in county and state models, only (Table 6). As with the fire management model, *No Cutting* was significant and positive in the state model, while *Preserve Nature* was in the CNNF model. Gender was significant in both state and CNNF models, but being a woman was positively associated with management acceptance for CNNF, and negatively for state. Seasonal residents who live on their property for fewer than 3 months each year had a significant and positive impact in the county model. The variance explained by the models (0.193, 0.200, and 0.208 for county, state, and CNNF, respectively) was similar.

3.2.4. Recreation management

Commodity/Utilitarian and *Ecosystem/Amenity* factors were significant and positive predictors of acceptance of recreation management for both county and state forests (Table 7). *No Cutting* was once again significant and positive in the state model, as was *Distance*: the further away respondents were, the more highly they rated acceptance of recreation management on state forests. The variance explained by the state model (R^2 = 0.253) was somewhat higher than county (R^2 = 0.177).

Thus, across all county and state models, *Commodity/Utilitarian* and *Ecosystem/Amenity* factors were the only variables that were consistently significant and positively related to greater management acceptance.

4. Discussion

Much of the research that has been conducted on forest management attitudes and values falls into four categories: problem specific research focusing on issues like forest planning or climate change (e.g. Clement and Cheng, 2011; Laakkonen et al., 2018); comparisons of different stakeholder groups (e.g. Van Riper et al., 2012); investigations of values and attitudes more generally and outside of the context of a specific plan or problem (e.g. Manning and Minteer, 1999); or some combination of the three (e.g. Lim et al., 2015). This research took the third approach: while there was a general sense among managers in the region that there was conflict and disagreement with some of the management activities on forests, our purpose was to describe the population and the types of attitudes that predicted whether residents thought the forests were being managed in ways that reflected their values.

We expected that variables predicting management acceptance would differ based on whether the dependent variable was fire, timber, recreation, or wildlife management, as others have found that different management attitude factors impact preferences (Kearney and Bradley, 2011). Instead, we found *Commodity/Utilitarian* and *Ecosystem/Amenity* attitude factors to be significant, positive predictors for both county and state forests across all four models, suggesting people either may not perceive timber harvests and environmental quality to be contradictory management goals (or detrimental to other management activities) or that acceptance of management is dependent more upon the agency

Table 3
Description of respondents and population.

Age (n = 604)	Sample	Population
18–34	4.5%	13.5%[a]
35–49	12.8%	19.6%
50–64	41.0%	24.1%
65–79	32.6%	14.6%
Older than 79	9.11%	5.6%
Gender (n = 611)		
Male	78.1%	50.5%
Female	21.9%	49.5%
Education (n = 611)		
Less than high school degree	4.7%	10.9%
High school degree or equivalent	32.1%	39.9%
Some college but no degree	17.5%	22.2%
Associate degree	12.4%	9.4%
Bachelor degree	19.2%	11.8%
Graduate degree	14.1%	5.8%
Type of resident (n = 617)		
Year round resident	88.5%	63%
Fewer than 3 months out of the year	1.8%	
3–6 months out of the year	3.4%	
> 6 months but < 12 months	6.3%	
Income (n = 532)		
Under 24,999	17.3%	16.8%
25,000-49,999	28.0%	30.8%
50,000–74.999	25.2%	23.4%
75,000–99,999	13.5%	14.5%
100,000 and more	16.0%	14.0%

Minutes from forests	County (n = 548)	State (n = 525)	CNNF (n = 524)
< 10 min	52.9%	24%	20.1%
10–19 min	28.5%	27.1%	15.3%
20–30 min	11.9%	27.2%	24.8%
> 30	6.8%	21.7%	38.9%

[a] U.S. Census population includes ages 20–34.

Table 4
Linear regression results for acceptance of timber management.

	County ($p = .000$, $F = 11.64$, $R^2 = 0.341$)			*State ($p = .000$, $F = 11.17$, $R^2 = 0.382$)*			*CNNF ($p = .012$, $F = 1.99$, $R^2 = 0.245$)*		
	B	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Commodity/Util.	**0.527*****	0.066	0.420	**0.669*****	0.073	0.537	**0.585*****	0.167	0.402
Ecosystem/Amen.	**0.297*****	0.090	0.151	**0.312*****	0.105	0.147	0.065	0.222	0.027
No cutting	−**0.128****	0.050	−0.124	−0.032	0.058	−0.031	−0.043	0.134	−0.035
Preserve nature	0.005	0.046	0.006	0.024	0.056	0.026	0.115	0.114	0.112
Gender (male)	−**0.250***	0.129	−0.084	−0.049	0.141	−0.016	**0.706****	0.325	0.190
Age	−0.002	0.004	−0.029	0.002	0.004	0.024	−0.009	0.009	−0.084
Education (< HS)									
High school	−0.058	0.304	−0.024	−0.647	0.496	−0.252	−0.430	0.652	−0.139
Some college	−0.258	0.317	−0.086	−0.535	0.506	−0.171	−0.200	0.675	−0.053
2 year degree	−0.300	0.325	−0.089	−0.338	0.515	−0.097	−0.294	0.710	−0.073
4 year degree	−0.301	0.312	−0.105	−0.679	0.505	−0.223	−0.179	0.712	−0.051
Graduate degree	−0.304	0.321	−0.094	−0.438	0.507	−0.140	0.035	0.720	0.009
Distance from _forest (< 10 min)									
10–19 min	0.147	0.113	0.057	0.113	0.148	0.044	0.052	0.284	0.014
20–30 min	0.022	0.159	0.006	**0.415*****	0.150	0.155	−0.052	0.242	−0.017
> 30 min	−0.058	0.292	−0.009	**0.450*****	0.172	0.143	0.087	0.243	0.027
Seasonal resident (year-round)									
> 6, < 12 months	−0.207	0.216	−0.042	−0.006	0.230	−0.001	0.066	0.443	0.012
3–6 months	0.122	0.305	0.017	0.497	0.307	0.075	0.006	0.505	0.001
< 3 months	−0.585	0.498	−0.051	−0.180	0.448	−0.019	−0.987	0.923	−0.089

*$P \leq .10$, ** ≤ 0.05, *** ≤ 0.01; bold font highlights significant models and variables.

itself rather than the management goals. For CNNF, only the *Commodity/Utilitarian* factor was significant. *Distance* was a significant, positive predictor in three of the four state forest management models, contrary to earlier research where Dwyer et al. (1993) found that greater distance had a negative impact on people's perceptions of forests. This may be because respondents to our survey are less aware of what is happening on state forests, do not use state forests as often as they use their county forests, or are less invested in economic issues associated with state forests; that is, those who live further away may simply be less invested in more conflict-prone forest management issues. The nearness of county forests versus state could also impact this finding: county forests were < 19 min from 81.4% of the respondents, while only 51.1% of respondents lived that close to a state forest. However, a greater proportion of respondents were further from CNNF, and *Distance* was not significant in any of the CNNF models. In the county wildlife management model, residents who lived on their property for fewer than 3 months annually had a significant and positive relationship with management acceptance. Combined with other similar findings in Wisconsin (e.g., Simoni and Floress, 2015), it may be worthwhile to investigate the issue of seasonality as an alternative to the more traditionally measured binary variable “absentee landowner”.

While the factor analysis results were consistent across forest types, the regression models for CNNF were somewhat different than county and state; only two of the four models were significant, and in both of those models gender (being a woman) had a positive impact on management acceptance. When it was significant in county and state models, gender had a negative impact. It may be that state and county forests are more identifiable units – with signage, well-marked and

Table 5
Linear regression results for acceptance of fire management.

	*County ($p = .000$***, $F = 4.29$, $R^2 = 0.160$)*			*State ($p = .000$***, $F = 4.43$, $R^2 = 0.197$)*			*CNNF ($p = .216$ $F = 1.26$, $R^2 = 0.245$)*		
	B	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Commodity/Util.	**0.225*****	0.057	0.235	**0.280*****	0.066	0.282	0.283**	0.133	0.233
Ecosystem/Amen.	**0.319*****	0.077	0.212	**0.394*****	0.095	0.233	0.111	0.190	0.056
No cutting	0.005	0.043	0.007	**0.186*****	0.053	0.228	0.003	0.108	0.003
Preserve nature	0.045	0.040	0.068	−0.029	0.050	−0.040	0.137	0.099	0.160
Gender (male)	−0.023	0.111	−0.010	−0.184	0.127	−0.075	0.459*	0.243	0.148
Age	**0.007****	0.003	0.106	**0.008****	0.004	0.110	0.013	0.008	0.149
Education (< HS)									
High school	0.072	0.263	0.038	0.619	0.0448	0.305	−0.073	0.570	−0.030
Some college	−0.074	0.274	−0.032	0.669	0.457	0.268	0.075	0.585	0.023
2 year degree	0.054	0.280	0.021	**0.843***	0.465	0.309	−0.079	0.590	−0.024
4 year degree	0.036	0.269	0.016	0.606	0.456	0.251	0.158	0.609	0.053
Graduate degree	−0.153	0.277	0.582	0.698	0.458	0.282	0.229	0.616	0.074
Distance from _forest (< 10 min)									
10–19 min	0.003	0.098	0.001	0.153	0.134	0.075	−0.017	0.260	−0.006
20–30 min	−0.003	0.138	−0.001	0.182	0.135	0.086	0.081	0.218	0.031
> 30 min	0.280	0.252	0.054	**0.394****	0.155	0.158	0.119	0.221	0.045
Seasonal resident (year-round)									
> 6, < 12 months	−0.022	0.187	−0.006	−0.205	0.207	−0.053	−0.316	0.349	−0.067
3–6 months	0.266	0.263	0.049	−0.094	0.277	−0.018	−0.555	0.427	−0.105
< 3 months	−0.542	0.430	−0.061	0.359	0.405	0.047	−1.011	0.853	−0.109

*P ≤ .10, ** ≤ 0.05, *** ≤ 0.01; bold font highlights significant models and variables.

Table 6
Linear regression results for acceptance of wildlife management.

	County ($p = .000^{***}$, $F = 5.38$, $R^2 = 0.193$)			*State ($p = .000^{***}$, $F = 4.52$, $R^2 = 0.200$)*			*CNNF ($p = .038^{**}$, $F = 0.$, $R^2 = 0.208$)*		
	B	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Commodity/Util.	**0.471*****	0.073	0.374	**0.416*****	0.079	0.352	**0.454*****	0.158	0.338
Ecosystem/Amen.	**0.237****	0.100	0.120	**0.273****	0.113	0.135	−0.090	0.192	−0.041
No cutting	0.092	0.056	0.089	**0.152****	0.063	0.155	0.023	0.115	0.020
Preserve nature	−0.019	0.051	−0.022	−0.052	0.060	−0.060	**0.218****	0.106	0.231
Gender (male)	−0.157	0.144	−0.052	**−0.269***	0.152	−0.092	**0.608****	0.279	0.178
Age	−0.001	0.004	−0.015	−0.003	0.005	−0.032	−0.003	0.009	−0.027
Education (< HS)									
High school	−0.353	0.339	−0.142	−0.688	0.535	−0.283	0.045	0.599	0.016
Some college	−0.427	0.353	−0.141	−0.676	0.546	−0.227	0.241	0.060	0.069
2 year degree	−0.426	0.362	−0.126	−0.365	0.556	−0.112	0.228	0.616	0.061
4 year degree	−0.242	0.347	−0.084	−0.505	0.545	−0.174	0.415	0.630	0.129
Graduate degree	−0.132	0.358	−0.041	−0.214	0.547	−0.072	0.744	0.659	0.219
Distance from _forest (< 10 min)									
10–19 min	0.043	0.126	0.017	0.085	0.160	0.035	−0.043	0.267	−0.012
20–30 min	−0.029	0.179	−0.008	0.189	0.162	0.075	−0.021	0.244	−0.007
> 30 min	0.273	0.324	0.0403	0.229	0.185	0.076	0.095	0.230	0.032
Seasonal resident (year-round)									
> 6, < 12 months	0.386	0.241	0.078	0.027	0.247	0.006	−0.370	0.377	−0.072
3–6 months	−0.235	0.339	−0.033	0.342	0.331	0.055	−0.572	0.434	−0.098
< 3 months	**0.917***	**0.554**	**0.079**	0.578	0.484	0.063	−1.171	0.851	−0.113

*P ≤ .10, ** ≤ 0.05, *** ≤ 0.01; bold font highlights significant models and variables.

discrete boundaries, and sometimes fee-pay stations – and people are not fully aware when they are on national forest land as Dwyer (2002) noted in other research and which has been an anecdotal complaint among land managers.

5. Conclusions and recommendations

Natural resource management agencies have often been critiqued for the perspective, “if the public only knew what we know, they would agree with us; how can they be taught that what we are doing is right?” (p73, Daniels and Walker, 1996). It's possible that at least part of that statement is true: Northwoods residents may not know what is happening on the forests in general, let alone be able to assess the types of management strategies with which they agree (or not). Much of the current research on public forest attitudes pertains to a specific issue or planning process or general forest values rather than overarching knowledge of the mission of various types of public forests and how missions translate into management actions.

National forest planning over the next decade will provide ample opportunities for studying public involvement in decision making as a result of the 2012 planning rule and 2015 operating directives (USDA, 2015a). Similarly, forest planning at the state level in Wisconsin and other states requires public involvement. It would be worthwhile to identify the extent to which stakeholders for a given forest understand the administrative agency and its mission, broadly writ, before formal planning processes begin. The social and community benefits of forests are emphasized in multiple-use statutes. For national forests, the Principles of Public Participation from the 2015 directives in the Forest

Table 7
Linear regression results for acceptance of recreation management.

	County ($p = .000^{***}$, $F = 4.85$, $R^2 = 0.177$)			*State ($p = .000^{***}$, $F = 6.15$, $R^2 = 0.253$)*			*CNNF ($p = .332$, $F = 1.12$, $R^2 = 0.162$)*		
	B	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Commodity/Util.	**0.389*****	**0.068**	**0.332**	**0.316*****	0.069	0.293	0.200	0.135	0.166
Ecosystem/Amen.	**0.384*****	**0.093**	**0.209**	**0.601*****	0.100	0.325	0.186	0.188	0.095
No cutting	0.040	0.052	0.042	**0.101***	0.055	0.113	−0.024	0.112	−0.024
Preserve nature	0.049	0.048	0.062	0.036	0.053	0.045	0.186	0.104	0.219
Gender (male)	−0.066	0.134	−0.024	−0.044	0.134	−0.017	0.402*	0.240	0.131
Age	−0.005	0.004	−0.060	0.001	0.004	0.014	−0.009	0.008	−0.097
Education (< HS)									
High school	0.047	0.317	0.020	−0.553	0.472	−0.248	−0.020	0.565	−0.010
Some college	−0.082	0.329	−0.029	−0.563	0.482	−0.207	0.196	0.575	0.062
2 year degree	−0.122	0.338	−0.039	−0.384	0.490	−0.128	0.146	0.594	0.043
4 year degree	−0.145	0.325	−0.054	−0.573	0.481	−0.217	0.159	0.582	0.054
Graduate degree	−0.016	0.334	−0.005	−0.407	0.483	−0.150	0.334	0.605	0.109
Distance from _forest (< 10 min)									
10–19 min	0.005	0.118	0.002	**0.261***	0.141	0.116	−0.055	0.243	−0.018
20–30 min	−0.045	0.166	−0.013	**0.381*****	0.143	0.165	−0.006	0.213	−0.002
> 30 min	−0.259	0.303	−0.041	**0.501*****	0.163	0.183	0.035	0.212	0.013
Seasonal resident (year-round)									
> 6, < 12 months	0.331	0.225	0.072	−0.043	0.219	−0.010	−0.186	0.363	−0.040
3–6 months	0.273	0.318	0.042	0.479	0.292	0.084	−0.265	0.437	−0.051
< 3 months	0.0835	0.519	0.078	0.380	0.427	0.045	−0.627	0.790	−0.069

*P ≤ .10, ** ≤ 0.05, *** ≤ 0.01; bold font highlights significant models and variables.

Service Handbook (1909.12, Chapter 40) laid the foundation for fostering inclusive approaches to forest management rather than relying upon traditional approaches – like public comment periods and publishing announcements – required by statutes. As an initial step to promoting a collaborative relationship that can last over time and cover a broad range of issues, planning processes, and actions, more resources could be invested to establish baseline information of knowledge stakeholders have about national forests, similar to what Shields et al. (2002) completed for the 2000 FS Strategic Plan revision. State forests could complete similar inventories, though counties may not have the resources to do so.

In the 5 years since our survey was conducted, there has been increased focus by the US Forest Service on "all lands" management: sharing responsibility and resources for management across ownership and organizational boundaries (e.g., Charnley et al., 2017; Floress et al., 2018), and interest in incorporating social science information throughout the planning, implementation, and evaluation cycle has become more salient to national forest managers (e.g., USFS, 2018). In the meantime, this study provides insights for forest managers at different administrative agencies. We have a better idea of what factors are associated with management acceptance, though not what respondents knew about the different types of forests, purposes of forests, and management agencies. While these questions may be addressed in studies of collaborative planning processes (e.g. Dockry, 2015) or collaborative learning (e.g. Blatner et al., 2001), they are not commonly asked in surveys on public forests, or at least they haven't been published. Future research should include such questions so the extent to which knowledge about a public forest's mission and management goals impacts acceptance of different types of management can be determined. Future research with the primary goal of exploring how ecosystem and commodity attitudes are related and the extent to which they are seen as compatible or conflicting goals for forest management in different contexts would be also be of interest. Expanding upon the comparison of attitudes related to types of public forests within a given landscape or region will help define their similarities and differences, offering opportunities for managers across types of forests to learn from what is going well on other forests and potentially modify their own approaches.

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