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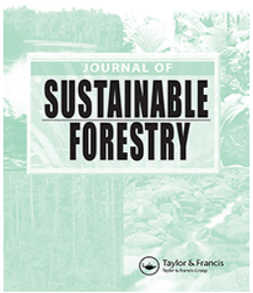

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Western Oregon forest landowner beliefs about the outcomes of mandatory riparian buffer regulations

Chad M. Kooistra [a], Cassandra Moseley[a], Heidi Huber-Stearns[a], and Stacy Rosenberg[b]

[a]Institute for a Sustainable Environment, University of Oregon, Eugene, OR, USA; [b]Department of Forest Ecosystems and Society, Oregon State University, Corvallis, OR, USA

ABSTRACT

Research about nonindustrial private forest (NIPF) landowners' perspectives on voluntary conservation-based programs continues to proliferate. However, there is a gap in understanding NIPF landowner perspectives about the social and ecological outcomes of mandatory conservation-based regulations. We sent questionnaires to Oregon NIPF landowners to understand their beliefs about potential outcomes of proposed state regulations that strengthen mandatory riparian buffer habitat protection requirements. Factor analysis and multiple regression techniques revealed the most important variables that influence those beliefs. Overall, respondents believed that the socioeconomic outcomes were negative and the ecological outcomes were neutral or slightly positive. Respondents with more conservative political attitudes who owned larger properties were more likely to believe that the outcomes would be negative. As the importance of maintaining property for future generations and increasing timber productivity increased, respondents believed the potential outcomes would be increasingly negative. As the importance of improving water quality, increasing carbon storage, and improving recreational use on the property increased, respondents believed that the outcomes would be increasingly positive. We discuss management and policy implications, including communication strategies aimed at engaging with NIPF landowners to highlight the purpose and potential outcomes of forest and riparian management regulations.

KEYWORDS

Private forest landowners; conservation policy; forest policy outcomes; landowner motivations; political orientation; riparian buffers; landowner beliefs

Introduction

Sustainable forest management requires balancing social and ecological considerations across landscapes and landowners. In the U.S., this involves the 11 million nonindustrial private forest (NIPF) landowners who own more than half of the 750 million acres of forest land (Butler et al., 2016). Moreover, this intersection of social and ecological issues is particularly relevant in forested riparian areas, which provide a range of ecosystem services for people and provide habitat for many terrestrial and aquatic wildlife species (Prugh, Hodges, Sinclair, & Brashares, 2008). Voluntary and incentive-based conservation policies are increasingly popular mechanisms to encourage private landowners to adopt activities that meet conservation goals in both forests

CONTACT Chad M. Kooistra chadk@uoregon.edu; chadkooistra@gmail.com Research Associate, Institute for a Sustainable Environment, University of Oregon, 130 Hendricks Hall, 5247 University of Oregon, Eugene, OR 97403-5247, USA.

and riparian areas (Ma, Butler, Kittredge, & Catanzaro, 2012). However, mandatory regulations and policies are also an important component of achieving sustainable forest management and such policies exist in all 50 states (Ellefson, Kilgore, & Granskog, 2007). Local municipalities and private landowners are required to comply with state and federal regulations, yet the viability of these regulations depends to some extent on their reception by landowners. This underscores the importance of considering the social aspects of mandatory policies across the diverse landscape of landowners (Quartuch & Beckley, 2014).

Public support for land management policies and conservation activities is influenced by people's beliefs about the outcome of those policies or activities (Dayer, Stedman, Allred, Rosenberg, & Fuller, 2015; Vogt, Winter, & Fried, 2005). Although many studies continue to examine the factors that influence landowner support for various policies, limited research has investigated factors that specifically influence people's beliefs regarding policy outcomes (Dayer et al., 2015). Understanding the factors that influence beliefs about the potential outcomes of conservation-based policies can help shape communication and other strategies to foster support for those policies across landowners.

As such, this study investigated NIPF landowner beliefs about the potential outcomes of proposed regulations in Oregon that strengthen riparian buffer rules protecting sensitive habitat under state law. The research was guided by the following question: How do NIPF landowner characteristics influence their beliefs about the potential social and environmental outcomes of strengthening mandatory riparian buffer regulations? We thus sent western Oregon NIPF landowners questionnaires to measure their beliefs about the potential outcomes of the new rules and to identify the factors that influence those beliefs.

Landowner perspectives toward conservation policy

Buffers along riparian areas are frequently recognized for their value in protecting ecologically sensitive areas (Prugh et al., 2008). Landowners of forested riparian areas appear to be acutely aware of the importance of protecting watersheds and may be more supportive of riparian policy tools than non-riparian owners (Janota & Broussard, 2008). These owners are typically conscious of their role in protecting water systems and their collective responsibility to protect aesthetics, water quality and fish and wildlife habitat (Dutcher, Finley, Luloff, & Johnson, 2004). Overall, support for riparian buffers among the general public and forest landowners tends to be fairly high (Kenwick, Shammin, & Sullivan, 2009).

Although voluntary and incentive-based conservation programs tend to be preferred by landowners, mandatory regulations are common and support for those policies appears to be influenced by many of the same factors as voluntary measures (Poudyal, Moore, & Young, 2015). One factor consistently revealed in research about support for conservation policies and activities is landowner beliefs about the potential outcomes of the policies and activities (*e.g.*, Stern, 2000). If people believe that a policy is likely to result in favorable social and ecological conditions, they are more likely to support that policy (Dayer et al., 2015; Vogt et al., 2005). Therefore, it is important to understand the factors that influence beliefs about conservation policies.

Beliefs about riparian buffers on NIPF lands encompass social and ecological dimensions. For example, Armstrong and Stedman (2012) found that landowners are more willing to implement riparian buffers if they believe the buffers will result in positive outcomes, such as improved habitat and increased property values. Other outcomes commonly associated with beliefs and attitudes about conservation policies include impacts to profits for those who derive income from activities connected to their land, property aesthetics, water quality, general environmental attitudes or worldview, and perceived level of restriction placed on the landowner's activities (Armstrong & Stedman, 2012; Corbett, 2002; Olive & McCune, 2017; Tian, Poudyal, Hodges, Young, & Hoyt, 2015). Depending on the importance of these aspects to landowners, their beliefs about these potential policy outcomes are likely to influence their attitudes toward the policy.

Although the importance of beliefs about policy outcomes is consistently demonstrated, research about landowner attitudes toward conservation policies is far more abundant than research specifically examining factors that influence beliefs about policy outcomes. Therefore, we examined literature regarding landowner attitudes toward conservation policies to identify the factors most likely to influence beliefs about policy outcomes. We found that there were three main categories of factors most likely to influence landowner beliefs about policy outcomes (Figure 1). The first category describes landowner's motivations or goals for owning and managing their land. The second category consists of other landowner characteristics like land tenure and past participation in voluntary conservation activities. The third category is sociodemographic variables. Next, we discuss each of these categories in more detail and how we expect each factor to influence beliefs about riparian buffer policy outcomes.

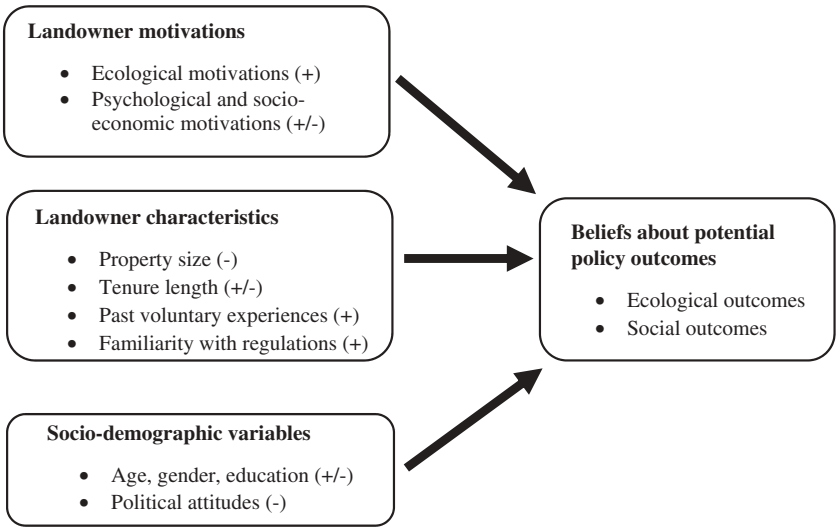

Figure 1. Conceptual model for determining the factors most likely to influence landowner beliefs about potential outcomes from riparian conservation policy.

Note, after each factor a "+" indicates that the factor is expected to lead to beliefs that policy outcomes will be more positive and a "-" indicates that the factor is expected to lead to beliefs that policy outcomes will be negative. A "±" indicates that the expected direction is variable.

Landowner motivations

Perhaps the most consistent finding in research about the factors that affect NIPF landowner attitudes and support for mandatory and voluntary programs is that landowner motivations and goals are highly likely to affect NIPF landowners' perspectives on various conservation-oriented programs and policies (Armstrong & Stedman, 2012; Janota & Broussard, 2008; Rabotyagov & Lin, 2013). NIPF landowners are a diverse group of people with varying motivations for land ownership and management activities. They value their land for social, ecological, and economic reasons (Bourke & Luloff, 1994; Janota & Broussard, 2008; Kline, Alig, & Johnson, 2000; USDA, 2015).

A large body of literature has applied econometric methods to understanding NIPF landowner decision-making, often with the assumption that landowner activities are driven by the intent to maximize income or revenue (Amacher, Conway, & Sullivan, 2003). Landowners primarily motivated by income and long-term financial investment, especially related to timber harvest, are likely to support private forest policies if the economic incentives and compensations of an activity are likely to lead to profit (Janota & Broussard, 2008; Johnson, Alig, Moore, & Moulton, 1997; Rabotyagov & Lin, 2013). NIPF owners with primarily timber-related objectives tend to be less supportive of policies and regulations with environmental goals (Hairston-Strang & Adams, 1997; Kline et al., 2000). Therefore, we expect that landowners whose income depends more on their forests are likely to have more negative beliefs about the outcomes of riparian buffer regulations that could affect their earning potential.

Despite the focus on NIPF landowner's economic motivations, other research has found that economic motivation is less important for the majority of NIPF landowners than other motivations, such as land stewardship and conservation, connection to nature, aesthetic preferences, carbon storage, and passing along a legacy to future generations (Kline et al., 2000; Song, Aguilar, & Butler, 2014; Tian et al., 2015). Prominent motivations for many landowners revolve around environmental goals, including the maintenance and improvement of fish and wildlife habitat, water quality, and biodiversity (Ma et al., 2012; USDA, 2015). As such, mandatory regulations may be more acceptable to landowners motivated by a worldview that promotes environmental goals (instead of economic gain) through stewardship ethics and a sense of social responsibility (Poudyal et al., 2015; Quartuch & Beckley, 2014). We expect landowners with stronger ecological motivations for how they manage their land to believe the outcomes of the riparian conservation policy will be more positive than landowners with weaker ecological motivations.

Prominent social motivations for owning and managing forest land include leaving a legacy for future generations, enhancing aesthetic qualities of the property, and providing recreational opportunities. NIPF landowners may be less supportive of a policy or program if it is perceived to lead to an increased burden on future generations (Kelly, Germain, & Mack, 2016). However, if future generations are expected to benefit from conservation actions through environmental, social, or economic means, landowners are likely to be more supportive (Janota & Broussard, 2008; Johnson et al., 1997; Song et al., 2014). Therefore, we expect that socially-oriented motivations (*e.g.*, leaving a legacy) could have mixed effects on landowner beliefs about the potential outcomes of conservation-based regulations.

Landowner characteristics

Owners of larger properties (40+ ha) tend to be more interested in participating in voluntary incentive-based conservation programs than smaller acreage owners (Ma et al., 2012; Song et al., 2014). However, larger acreage owners may be more concerned about negative impacts of policies than smaller acreage owners, especially if more of their income relies on forest resource utilization (Johnson et al., 1997; Rabotyagov & Lin, 2013). Landowners of larger areas are also more likely to oppose mandatory compliance programs and are more concerned about losing property rights than smaller-acreage owners (Poudyal et al., 2015). Therefore, we expect that as property size increases, landowner beliefs about the outcomes of the proposed mandatory regulations will be increasingly negative.

Land ownership tenure can have variable effects on attitudes toward conservation policies and programs (Ma et al., 2012). On the one hand, length of ownership tends to increase investment in a property, which could affect how people view policies that may impact their investment. Alternatively, longer-term owners consider policy impacts at a longer temporal scale and could be more likely to support policies that ensure sustainability. For example, longer-term owners have also shown more interest in managing for aesthetic purposes and carbon sequestration (Tian et al., 2015). Thus, it remains important to investigate the influence of tenure length on beliefs about mandatory conservation policy outcomes.

Past experiences with a management program could also shape one's attitude toward engaging in similar programs in the future (Ouellette & Wood, 1998; Dayer, Stedman, Allred, Rosenberg, & Fuller, 2015). Considering that the goals of the proposed rule changes investigated in our study are similar to many voluntary conservation-based programs, we expect people who have participated in voluntary programs in the past to have more positive beliefs about the outcome of the proposed regulations than people without past volunteer experience. In contrast, lack of knowledge and familiarity is a barrier to participation in conservation programs (Kelly et al., 2016; Shandas, 2007). Greater familiarity with rules can lead to more positive perceptions (Hairston-Strang & Adams, 1997). Thus, we expect that familiarity with stream buffer regulations will positively influence beliefs about the outcomes of those policies.

Sociodemographic variables

The effects of sociodemographic variables – especially gender, age, and education – have been found to vary in studies about landowner perspectives on forest conservation measures (Janota & Broussard, 2008; Song et al., 2014; Tian et al., 2015). Thus, we have no specific predictions for these three variables. However, one's political orientation is likely to have an impact on views toward mandatory riparian regulations for several reasons. Political attitudes are a strong predictor of value orientations toward forests, where people identifying as more "socially liberal" tend to have more biocentric values toward forests than people identifying as conservative (Steel, List, & Shindler, 1994). NIPF landowners are typically more "socially conservative" than the general public (Bourke & Luloff, 1994). Thus, we expect that NIPF owners in our study with more conservative political attitudes are likely to have more negative beliefs about proposed riparian buffer rules outcomes than landowners with a liberal orientation.

Methods

Study context

More than 6 million acres of private forest land in Oregon are owned and managed by approximately 43,000 NIPF landowners who manage 4.05 or more hectares (10 or more acres) (Butler et al., 2016). The Oregon Forest Practices Act (FPA) was initially passed in 1971 to ensure sustainable use of natural resources in Oregon, particularly though harvest rules aimed at habitat protection and ensuring resources for future harvest. Many provisions have been added to the FPA over the years to protect aquatic and terrestrial habitats. Riparian areas have been the focus of many regulation changes since the 1980s meant to enhance protection of water quality as well as fish and wildlife habitat through buffers that restrict harvest and other activities. These riparian rules have been strengthened several times to comply with federal water protection laws, including the addition of a "Protecting Cold Water" (PCW) standard adopted by the Oregon Department of Forestry (ODF) and Oregon Department of Environmental Quality (DEQ) to align with federal Clean Water Act requirements.

The ODF and DEQ began a Riparian Function and Stream Temperature study in 2002 to evaluate how well riparian rules under the FPA met water quality standards, particularly in small- and medium-sized fish-bearing streams on state and private lands. This research found that FPA rules did not meet the desired standards due to human activity that resulted in unacceptable water temperature increases in streams where *Oncorhynchus* spp. fish (*e.g.*, salmon, steelhead, and bull trout, or SSBT) are found (Groom, Dent, & Madsen, 2011; Groom, Dent, Madsen, & Fleuret, 2011). Based on an Oregon Board of Forestry recommendation in 2012, ODF began considering potential rule changes aimed at increasing shade and minimizing human-related stream temperature increases in streams with SSBT. The proposed rule change focused on enhanced timber harvest restrictions in riparian buffers along SSBT streams in western Oregon by (a) increasing the size of streamside buffers, (b) allowing for some tree removal in streamside buffers but requiring a certain percentage of trees to be left within this area, and (c) allowing for smaller buffers on the north side of streams. During and after the survey was administered, ODF (through a special committee) engaged in a series of stakeholder meetings, public outreach, and other consultation efforts which led to amendments in the details of the rule changes. The amended rules still adhered to the three main general implications described above and were approved in April 2017 and implemented in July 2017. The details of the proposed and implemented rule changes are extensive and beyond the scope of our research.[1]

Our research aimed to understand NIPF landowner perspectives by surveying NIPF landowners about their opinions of the proposed rule change. Results presented in this article focus on understanding landowners' beliefs about the expected outcomes of the proposed rule change. Other aspects of the study can be found in the technical report (Rosenberg & Moseley, 2016).

Sampling

The geographic scope of our study corresponds to areas where the proposed ODF stream buffer regulations would potentially affect landowners, including 17 counties in the Western Cascade, Interior, Coast Range, and South Coast ecoregions of western Oregon (see Figure 2). We focused on landowners who – due to their property type, size and

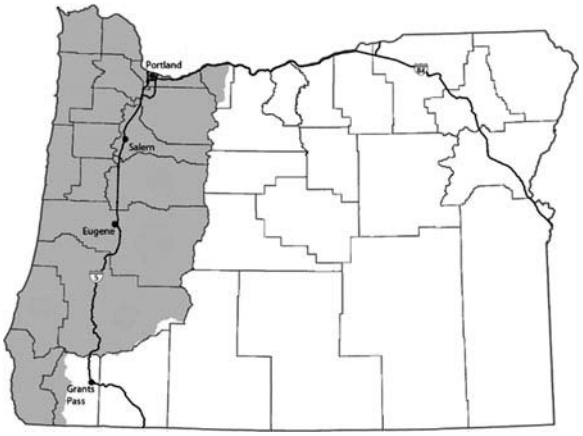

Figure 2. Map of study site (shaded area) (created by Nathan Mosurinjohn with the Institute for a Sustainable Environment).

location – were most likely to be affected by the proposed rule changes to specify the scope of our study and provide the most pertinent feedback to the ODF.

ODF provided a database of landowners, addresses, and spatial information of Oregon properties that were zoned as forest lands and a separate SSBT GIS dataset. The SSBT dataset for Western Oregon was overlaid with the forest land GIS data and properties outside the SSBT area were excluded. We then selected landowners who owned least 4.05 ha (10 acres) on a single property but less than 2,023 cumulative hectares (5,000 acres) of forest zoned property within a 60-ft buffer of a SSBT stream. This resulted in a list of 15,271 total land parcels in the dataset. We then randomly selected 5,000 land parcels from this list, excluded all government properties and banks, and removed all duplicate names. Owners of the first 1,200 land parcels on this final list were used for the original mailing sample.

We used a modified version of the Dillman Tailored Design Method (Dillman, Smyth, & Christian, 2014) and provided each selected landowner the option of completing the questionnaire online or returning a paper version. During May and June 2016, a pre-notification postcard was sent to the selected sample (n = 1,200) that explained general information about the questionnaire and provided an online option using Qualtrics software. We then sent a letter with the written questionnaire that explained additional details, a reminder postcard to non-respondents, and finally a 2nd letter and questionnaire to non-respondents.

Of the 1,200 original landowners selected, 179 were not valid. Due this high number of unusable addresses, we mailed an additional 179 questionnaires in July and August of 2016. The final total sample size was 1,172 households (after accounting for 28 unusable addresses). We received responses from 540 landowners. The majority (85%, n = 459) of respondents completed the paper version of the questionnaire. However, nearly 20% of the 540 respondents indicated that they did not own 10 or more forested acres and thus did not complete the questionnaire. Several landowners also completed both a paper copy and online version. After removing duplicates and incomplete questionnaires, there were 441 completed questionnaires resulting in a 38% response rate (441/1,172 = 37.63%).

We did not contact non-responders for a non-response bias check. However, respondents' sociodemographic characteristics (see Table 1) reflect characteristics of NIPF landowners in Oregon (Butler et al., 2016; Butler & Leatherberry, 2004; Hairston-Strang & Adams, 1997; Johnson et al., 1997). NIPF landowners tend to be older, educated males with more conservative political views compared to the general population in Oregon (US Census Bureau, 2010). We expect our findings to be representative of western Oregon NIPF landowners.

Table 1. Questionnaire items measuring dependent (beliefs about the potential outcomes of the proposed rule changes) and independent variables (landowner goals/motivations and other landowner characteristics).

Variable and items	Measurement scale
Beliefs about the potential impacts of the proposed rule changes*	1 = Strongly disagree
Q: Thinking about the proposed rule change as a whole, how much do you agree or disagree with the following statements about the potential impacts of the streamside buffer statements?	2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree 77 = Don't know
The proposed rule change will benefit salmon, steelhead, and bull trout	
The proposed rule change will reduce my profits	
The proposed rule change will improve the aesthetics of my property	
The proposed rule change will improve water quality	
The proposed rule change is the right thing to do for the environment	
The proposed rule change adds unnecessary red tape to forest management	
Landowner motivations/goals	1 = Not important
Q: When you undertake land management activities, how important are the following goals?	2 = Somewhat important 3 = Important 4 = Very important 77 = Don't know
Activity will improve wildlife and/or fish habitat	
Activity will increase timber productivity	
Activity will improve water quality	
Activity will protect scenic views and vistas	
Activity will provide income	
Activity will maintain/improve property for future generations	
Activity will improve property value	
Activity will improve recreational use	
Activity will ensure I comply with applicable laws and regulations	
Activity will increase carbon storage	
Past participation in voluntary programs	1 = Yes
Q: Have you participated in a voluntary conservation program in the last five years [(e.g., Environmental Quality Incentives Program (EQIP), Conservation Reserve Enhancement Program (CREP), Healthy Forests Reserve Program (HFRP), Forest Stewardship Program (FSP)]?	2 = No 77 = Don't know
Familiarity with current riparian buffer rules	1 = Yes
Q: Are you familiar with current streamside buffer rules for small and medium fish-bearing streams?	2 = No
Property size (acres owned)	Respondents wrote in
Q: How many acres is this property?	the number of acres
Tenure (years owned)	Respondents wrote in
Q: How many years have you owned this property?	the number of years
Percent income from forest activities	1 = 0%
Q: What percent of your income is from forest management activities on this property?	2 = 1 – 25% 3 = 26 – 50% 4 = 51 – 75% 5 = 76 – 100%

*This is the dependent variable used in regression analysis. All other variables in this table were treated as independent variables in regression analysis.

Questionnaire items

Tables 1 and 2 show the specific items and measurement scales included in the questionnaire. The focus of this research presented here was understanding landowner's beliefs about the potential outcomes of updated riparian buffer regulations and the factors that influence those beliefs. We did not measure landowner support for proposed riparian buffer policies. Before asking respondents about their beliefs regarding the potential outcomes of the streamside buffer changes, respondents were told that the proposed rule change: (a) generally increases the size of streamside buffers, (b) allows for some tree removal in streamside buffers but requires a certain percentage of trees to be left within this area, and (c) allows for smaller buffers on the north side of streams. Next, beliefs about the potential outcomes of the proposed changes were assessed by asking respondents' level of agreement with six statements about various socioeconomic and ecological outcomes of the proposed rule changes.

Respondents were asked to rate the importance of various social, economic, and ecological goals when undertaking management activities on their property. These items were intended to capture the most common motivations for property ownership and management of NIPF lands (Armstrong & Stedman, 2012). We also asked if the landowner had participated in a voluntary conservation program in the past 5 yr and if they were familiar with current streamside buffer rules for fish-bearing streams in western Oregon.

Lastly, characteristics of the landowner and their property, including sociodemographic information, was collected. Respondents were asked to identify: the size of their property (in acres), the number of years they owned the property, and the percent of their income they received from forest management activities on their property. Sociodemographic information collected included gender, age, education level, and political attitudes.

Table 2. Sociodemographic questionnaire items.

Variable/item	Measurement scale
Gender	0 = Male
Q: What is your sex?	1 = Female
Age	Respondents wrote in their age in years
Q: What is your age (years)?	
Education	1 = Less than high school degree
Q: What is the highest level of school you have completed?	2 = High school degree or equivalent
	3 = Some college, no degree
	4 = Associate's degree (2yr)
	5 = Bachelor's degree (4 yr)
	6 = Master's degree or professional degree
	7 = Doctorate degree
Political orientation	1 = Very conservative
Q: Please rate whether you consider your political attitudes to be more conservative or more liberal in nature.	2 = Somewhat conservative
	3 = Neither conservative or liberal
	4 = Somewhat liberal
	5 = Very liberal

Data Analysis

Data from the paper and online versions of the questionnaire were combined into one dataset and analyzed in SPSS (v. 24). Tests for basic descriptive frequencies, measures of central tendency and dispersion, and normality were conducted for each of the variables described above. Principal components analysis using oblique (*i.e.*, direct oblimin) rotation was used to identify latent constructs among the items used to measure beliefs about outcomes from the policy change and landowner motivations/management goals, respectively. We computed composite indices using the mean of all items that loaded ≥ |0.50| onto a factor with at least a | 0.10| difference between any cross-loading on other factors. We retained the indices and used them in regression analysis if Cronbach's α ≥ .80 for that index.

We used ordinary least squares (OLS) hierarchical (*i.e.* blockwise entry) linear regression to explore the influence of landowner motivations and other characteristics on beliefs about the outcome of the proposed rule changes. Sociodemographic variables were entered as the only independent variables in the first model (*i.e.*, block 1). The variables measuring landowner motivations and other landowner characteristics were added in the second model (*i.e.*, block 2). This order controls for sociodemographic variables and accounts for any shared variability between those variables and the main predictors (*i.e.*, landowner motivations and other characteristics). Tolerance scores ranged from 0.384 to 0.907 and VIF scores ranged from 1.103 to 2.607, which are in a range indicating multicollinearity is likely a nonissue (Field, 2013).

Results

The majority (75%) of respondents were males, their average age was 68 years, and the median education level was an associate's degree (Table 3). Fifty-two percent of respondents identified as having conservative political attitudes and 25% indicated their political attitudes were liberal.

Table 3. Sociodemographic characteristics of respondents.

Variable	n	% of respondents	Mean/Median/Range
Gender			
Male (0)	291	75	
Female (1)	96	25	
Age	371		$\bar{x}$= 68; Median = 68 Range = 31–101
Education			
Less than H.S. degree (1)	7	2	
H.S. degree or equivalent (2)	65	16	
Some college, no degree (3)	86	22	
Associate's degree (4)	43	11	Median = 4 (Associates degree)
Bachelor's degree (5)	119	30	
Master's or prof. degree (6)	51	13	
Doctorate degree (7)	29	7	
Political orientation			
Very conservative (1)	86	23	
Somewhat conservative (2)	108	29	Median = 2
Neither (3)	86	23	(Somewhat Conservative)
Somewhat liberal (4)	57	15	
Very liberal (5)	38	10	

Note: The number in parentheses behind each response option is the code given in SPSS for analysis

Table 4. Landowner and property characteristics of respondents.

Variable	n	% of respondents	Mean/Median/Range
Property size	409		$\bar{x}$= 102.39 ha (253 ac) Median = 32.37 ha (80 ac) Range = 0.40–2,023.43 ha (1–5,000 acres)
Tenure (years property owned)	414		$\bar{x}$= 37; Median = 31 Range = 1–160 yr
% of income from forest management activities			
0% (1)	242	59	
1–25% (2)	135	33	Median = 1
26–50% (3)	12	3	
51–75% (4)	10	2	
76–100% (5)	11	3	
Familiarity with current streamside buffer rules			
Yes (1)	278	66	
No (2)	145	34	
Participation in voluntary conservation program			
Yes (1)	67	17	
No (2)	325	83	

Note: The number in parentheses behind each response option is the code given in SPSS for analysis

The median property size reported by respondents was 32.37 ha (80 acres) with an average tenure of 37 yr (Table 4). Nearly 60% of respondents indicated that no portion of their income is derived from forest activities on their property, and fewer than 10% of respondents indicated that 25% or more of their income is derived from forest activities. The majority (83%) of respondents had not participated in a voluntary conservation program and two-thirds indicated being familiar with current streamside buffer rules in Oregon.

The most important motivations for management activities included maintaining property for future generations, complying with laws and regulations, improving water quality, and improving fish and wildlife habitat (Table 5). Increasing carbon storage,

Table 5. Descriptive results and factor analysis for items measuring the importance of landowner motivations.

Ownership Motivations (Management activity will …)	n 'Don't Know	n	Mean	SD	% Not Important[a]	Factor Loading 1	2	3
Ecological/legacy (α = .77)		411	3.00	0.67				
Maintain property for future generations	4	403	3.46	0.74	2	**.61**		
Comply with applicable laws and regulations	11	385	3.07	0.94	8	**.65**	-	-
Improve water quality	16	369	3.00	0.87	6	**.67**	-	-
Improve wildlife and/or fish habitat	13	385	2.96	0.94	8	**.68**	-	-
Increase carbon storage	97	269	2.10	1.06	39	**.75**	-	-
Economic (α = .65)		407	2.83	0.85				
Improve property value	7	393	2.92	0.99	12	-	**.69**	.42
Provide Income	10	386	2.78	1.14	21	-	**.77**	-
Increase timber productivity	12	380	2.74	1.14	21	-	**.77**	-
Views/Recreation (α = .47[b])		387	2.31	0.89				
Protect scenic views	13	365	2.41	1.11	27	-	-	**.84**
Improve recreational use	10	373	2.19	1.02	31	-	-	**.61**

Note: Items measured on a 4-point scale; 1 = Not important, 2 = Somewhat important, 3 = Important, 4 = Very important
The n column represents the number of respondents who provided a response other than 'Don't know'
[a]Represents the percent of respondents who responded with a rating and selected 'not important'
[b]Spearman-Brown rho = .31; Kendall's tau_b = .27; Pearson r = .31; see Eisinga et al. (2013) for criteria when selecting reliability measures for two-item scales.

improving recreational use, and protecting scenic views were among the least important motivations.

Factor analysis results for landowner motivations resulted in three factors. However, the Cronbach's α for each factor was below .80 and the items in each factor were not always conceptually relevant to one another (see Table 5). Thus, we did not create composite indices for landowner motivations. We retained each individual item measuring different motivations for use in regression analysis which also helped interpret the regression findings more carefully.

On average, respondents believed that the social impacts of regulatory outcomes would be fairly negative and that ecological impacts would be neutral or slightly positive, though several noticeable trends emerged (Tables 6 and 7). For most items measuring beliefs, at least 30% of respondents selected either the "don't know" or "neutral" options, and 45% selected either "don't know" or "neutral" for the item about the rule impacting landowner profits. Nearly 60% of respondents agreed that the proposed regulations would add unnecessary "red tape" to forest management and 32% agreed that the proposed rule change would reduce their profits. Responses about the environmental benefits of the proposed regulations were fairly evenly distributed. More people agreed than disagreed that the proposed rule change would benefit fish. More people disagreed than agreed that

Table 6. Respondent agreement with items measuring beliefs about potential outcomes of riparian buffer changes.

		Percent of Respondents					
Item	n	'Don't know'	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The proposed rule change adds unnecessary red tape to forest management	402	9	8	9	16	27	31
The proposed rule change will reduce my profits	397	15	10	13	30	17	15
The proposed rule change will benefit salmon, steelhead, and bull trout	408	14	14	13	25	25	9
The proposed rule change will improve water quality	404	13	13	21	23	23	7
The proposed rule change is the right thing to do for the environment	401	11	16	20	24	20	9
The proposed rule change will improve the aesthetics of my property	400	13	17	27	28	13	3

Table 7. Descriptive results and factor analysis for items measuring beliefs about potential outcomes of riparian buffer changes.

Item[a]	n	Mean	SD	Factor Loading
The proposed rule change adds unnecessary red tape to forest management[b]	367	3.72	1.26	.69
The proposed rule change will reduce my profits[b]	336	3.15	1.23	.69
The proposed rule change will benefit salmon, steelhead, and bull trout	350	3.04	1.23	.90
The proposed rule change will improve water quality	350	2.91	1.19	.92
The proposed rule change is the right thing to do for the environment	356	2.85	1.24	.91
The proposed rule change will improve the aesthetics of my property	349	2.52	1.06	.80
Factor	404	2.75	.99	
Cronbach's α=0.90				
Eigenvalue (% of variance explained)			4.08 (68.04%)	
Kaiser-Meyer-Olkin Measure			0.880	

[a]Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree
[b]Item is reverse-coded for factor analysis and regression analysis only (i.e. not for mean calculations)

the proposed rule would improve water quality as well as aesthetics and that it is "the right thing" to do for the environment. Only 16% of respondents agreed that the proposed rule change would improve the aesthetics of their property.

The six items measuring beliefs about potential outcomes of the rule changes fit well onto one factor (Cronbach's α = .90) for an overall measure of respondent's beliefs about the potential outcomes of the proposed policy. This index for beliefs was used as the dependent variable in regression analysis.

The first regression model included only sociodemographic variables (Table 8). Although the variable measuring political attitudes was the only significant predictor (β = .460, $p < .001$), the first model still explained 22% of the variance in beliefs about the outcomes of the proposed policy. The second regression model (*i.e.*, the full model) added landowner motivations and other characteristics to sociodemographic variables included in the first model. The change in R^2 was statistically significant ($p < .001$) between the first and second models and the second model explained 47% of the variance in respondent's beliefs about the potential outcomes of the proposed policy. The variables measuring respondents' age, gender, and education were not significant predictors (α = .05) in either of the two models.

Table 8. Results of linear regression for influence of predictor variables on beliefs about the outcomes of the proposed riparian buffer rule change.

Variable	b	SE b	β	*t*	*p*
Model 1					
(Constant)	1.140	0.487		2.343	0.02
Age	0.007	0.006	0.08	1.168	0.244
Gender	0.089	0.179	0.034	0.500	0.618
Education	0.034	0.047	0.053	0.731	0.466
Political orientation	0.364	0.056	**0.469**	**6.507****	**<0.001**
Adjusted R^2 (SE of the estimate)	0.224 (0.898)				
F- statistic	13.268**				
R^2 *change*	0.242				
Model 2 (full model)					
(Constant)	1.62	0.528		3.075	0.003
Age	0.001	0.006	0.014	0.222	0.824
Gender	0.094	0.155	0.036	0.607	0.544
Education	0.072	0.041	0.112	1.774	0.078
Political orientation	0.193	0.052	**0.249**	**3.694****	**<0.001**
Tenure (years owned)	0.002	0.003	0.059	0.843	0.400
Property size (acres owned)	0.001	0.001	**−0.164**	**−2.368***	**0.019**
Percent income from forest activities	−0.050	0.080	−0.048	−0.630	0.530
Familiarity with current riparian buffer rules	0.217	0.146	0.088	1.491	0.138
Past participation in voluntary programs	−0.226	0.148	−0.097	−1.523	0.130
Maintain property for future generations	−0.232	0.102	**−0.166**	**−2.271***	**0.025**
Comply with applicable laws/regulations	0.046	0.072	0.042	0.640	0.523
Improve water quality	0.206	0.103	**0.181**	**2.008***	**0.046**
Improve wildlife and/or fish habitat	0.113	0.092	0.108	1.239	0.217
Increase carbon storage	0.136	0.066	**0.136**	**2.056***	**0.041**
Improve property value	0.074	0.076	0.069	0.983	0.327
Provide Income	−0.111	0.064	−0.123	−1.733	0.085
Increase timber productivity	−0.155	0.061	**−0.179**	**−2.562***	**0.011**
Protect scenic views	0.015	0.069	0.016	0.218	0.828
Improve recreational use	0.154	0.068	**0.151**	**2.269***	**0.025**
Adjusted R^2 (SE of the estimate)	0.472 (.741)				
F- statistic	8.990**				
R^2 *change*	0.289**				

*$p < .05$, **$p < .001$.

In the full (*i.e.*, second) model, political orientation was the strongest predictor of beliefs about the outcomes of the policies (see Table 8). Property size and five of the items measuring different landowner motivations for managing their land were also significant predictors of beliefs. Respondents with more conservative political attitudes and who owned larger properties were more likely to believe that the potential outcomes of the rule change would be negative. As the importance of maintaining property for future generations and timber productivity increased, respondents believed the potential outcomes would be more negative. As the importance of improving water quality, increasing carbon storage, and improving recreational use on the property increased, respondents believed that the outcomes would be increasingly positive.

Landowner motivations that did not influence beliefs about the riparian buffer policy outcomes were motivations to comply with applicable laws/regulations, improve wildlife or fish habitat, improve property value, provide income, and protect scenic views. The other landowner characteristics and sociodemographic variables that did not significantly influence beliefs were age, gender, education, tenure, percent income earned from forest activities, familiarity with current riparian buffer rules and past participation in voluntary programs.

Discussion

Our research aimed to understand how NIPF landowner characteristics influence their beliefs about the potential outcomes of mandatory riparian buffer regulations on lands with SSBT streams. We found that respondents' beliefs about the potential outcomes of the proposed riparian buffer rules were stronger regarding the negative outcomes (*i.e.*, adding unnecessary "red tape" to forest management and reducing landowner profits) than they were about the positive outcomes (*i.e.*, benefiting SSBT, improving water quality, doing the "right thing," and improving property aesthetics). Regression analysis helps interpret these findings by considering the impact of different landowner characteristics on beliefs about the potential policy outcomes.

A substantial finding in our study was that the item measuring political attitudes was the strongest predictor of beliefs about the potential outcomes of the proposed rule change. Landowners who identified as having more politically conservative attitudes were more likely to believe that the potential outcomes of the proposed rule changes would be negative compared to landowners reporting more liberal political attitudes. There are several plausible explanations for this finding.

The relationship between political attitudes and beliefs about policy outcomes in our study could reflect negative attitudes toward the government more broadly, and particularly government intervention in private land management. People with politically conservative attitudes are generally less likely to support government intervention in environmental or conservation management issues (Jost, Federico, & Napier, 2009; Konisky, Milyo, & Richardson, 2008; Leiserowitz, 2006; Steel et al., 1994). The degree that landowners trust the government's intentions related to the policy changes and the government's ability to effectively administer and enforce the riparian buffer policies may lead to negative attitudes about specific conservation policy especially pertaining to their own property (Brook et al., 2003).

In our study, it is likely that these underlying attitudes toward government intervention affected landowner beliefs about the potential outcomes of riparian conservation policy.

Although we did not ask respondents about their beliefs regarding the effectiveness of current riparian buffer regulations, the prevalence of neutral and "don't know" responses regarding beliefs about outcomes of the proposed regulation changes suggest that many people are unaware or unable to assess the impacts and effectiveness of different policies. Taken together, our findings about the influence of political attitudes on beliefs about conservation policy outcomes and the fact that many landowners in our study were uncertain about the potential outcomes of the new policy, could suggest that political attitudes served as a proxy for lack of information or knowledge about the policy and its potential outcomes.

Although many studies do not discuss the political attitudes of NIPF landowners, our study illustrates the importance of considering how political attitudes and the ideologies behind them, affect landowner perceptions of conservation policies. For instance, if people feel their ideologies are compromised during political processes, their attitudes toward the political system become even more important in affecting their reactions to a policy or decision. (Rudolph & Evans, 2005). In other words, it is likely that the ideology behind our respondents' political attitudes includes other factors that affect how they perceive potential outcomes from mandatory conservation policies. Many respondents agreed that the proposed rule change would add unnecessary red tape for private landowners. Concerns over impacts to property rights are common for NIPF landowners regarding regulations (Giampaoli & Bliss, 2011; Hairston-Strang & Adams, 1997) and our results show that these concerns factor in to their overall beliefs about the potential outcomes of the policy changes.

Landowners may be more likely to oppose conservation policies and programs if they feel their rights are undermined or limited (Armstrong & Stedman, 2012), especially if they are larger landowners (>100 acres) from conservative political orientations (Armstrong & Stedman, 2012; Neumayer, 2004; Poudyal et al., 2015; Steel et al., 1994). Our study found similar influences on beliefs about the potential outcomes of the proposed rule changes. NIPF landowners with larger properties are more likely to perceive a larger burden by mandatory policies restricting how they use their land simply because they have more land and thus could experience more instances where regulations affect their activities. This perceived burden likely relates to their motivations for maintaining/improving their property for future generations. That is, our study found that managing land for future generations in mind was associated with beliefs that the policy outcomes would be negative and it is likely that the concern about passing on property to future generations with more restrictions drives that relationship to some degree (Kelly et al., 2016).

Furthermore, NIPF landowners of larger properties could be more likely to gain profits from their land and thus be more concerned about future regulations on their profit earning potential (Langpap, 2004). We also found that as motivations to manage land for timber productivity increased, landowners believed that the policy outcomes would be increasingly negative. In our research, the motivation of providing income was not a significant predictor of beliefs about the policy outcomes. However, it did significantly and negatively influence beliefs when we removed increasing timber productivity from the model (not shown, $t = -2.138$, $\beta = -.151$, $p = .034$). Therefore, we expect that the variance in beliefs accounted for by income motivations was assumed in the increasing timber motivation. Previous research by Hairston-Strang and Adams (1997) found that earlier

versions of the ODF FPA Water Protection Rules did result in decreased timber harvest in riparian areas and likely had associated economic impacts from the decreased harvest for some NIPF landowners. However, the authors also reported that the majority of landowners expressed support for the policy, especially for the associated ecological objectives (*i.e.*, protecting fish and wildlife habitat). If NIPF landowners are primarily motivated by economic goals, and ecological motivations are minimally important, offering landowners economic incentives to comply with the riparian buffer harvest rule may be the most preferred and feasible option if such funds exist (Johnson et al., 1997; Poudyal et al., 2015).

The concept of political efficacy, which describes one's perception of their ability to understand and influence political processes and outcomes, provides some additional insights. Landowners with more financial dependence on a resource tend to have lower political efficacy (Giampaoli & Bliss, 2011; Raedeke, Rikoon, & Nilon, 2001). Landowners may need to feel a sense of having higher levels of control over the policy and management practices to have more positive beliefs about the potential outcomes (Brook, Zine, & De Young, 2003). NIPF landowners with economic motivations could feel especially vulnerable to potential outcomes of policies that restrict their land use decisions and thus perceive the potential outcomes of mandatory conservation policy more negatively.

One option for policy-makers to help strengthen landowner beliefs about the positive outcomes of mandatory conservation-based policies is to effectively involve NIPF landowners in the policy-making process, including both those who tend to support more conservation along with those who are economically dependent on the resource, landowners of larger parcels, and those with a conservative political orientation. Genuine public involvement in policy-making can lead to a sense of ownership and improve landowner perspectives about conservation policies (Lachapelle & McCool, 2005). Participatory approaches in policy-making decisions can lead to more effective and durable policies across all stakeholders in part through psychological processes that can increase people's beliefs about the positive outcomes of a policy (Reed, 2008). Of course, many factors affect the nature and outcome of participatory policy-making processes. The point here is that increasing the ability to help shape policy outcomes among NIPF landowners who have, or perceive having, more to lose from those policies could improve landowner perspectives about those policies.

Alternatively, given the appreciation for ecological principles among many NIPF landowners, it may be more practical to focus on these economic-motivated landowners in outreach campaigns that highlight the intended ecological outcomes of the policy to speak to their values for conservation. Respondents in our study reported strong ecological motivations, like many NIPF landowners across the U.S. (USDA, 2015). It could also be useful to share with them monitoring results that document changes to water quality, habitat health, and other ecological measures. If the ecological benefits from the proposed rule are measurably positive, understanding that positive outcome could improve beliefs associated with economic motivations for landowners who also have strong ecological motivations.

Indeed, the positive relationship between several ecological motivations and beliefs about the potential outcomes suggests a promising direction for policy-makers seeking to align conservation policy with landowner motivations. Landowners who were increasingly motivated by improving water quality and increasing carbon storage believed the outcomes of the proposed policy would be increasingly positive. NIPF and agricultural

landowners are generally supportive of riparian buffers to protect water quality, especially if they rely on that land for their livelihoods (*e.g.*, agriculture or timber) (Armstrong & Stedman, 2012; Janota & Broussard, 2008). Emphasizing the benefits to water quality from proposed rule changes, beyond direct benefits to fish, could be an important communication strategy for policy-makers and land managers to gain more support among NIPF landowners for riparian conservation policies.

Carbon storage is increasingly being considered as an important ecosystem service that landowners can support through various activities such as reduced timber production. One effect of the riparian buffer regulations is that fewer trees will be harvested in riparian areas, which means these areas could have more potential for carbon storage and related activities (*e.g.*, selling carbon credits). Landowners with larger properties who are interested in earning more income and passing on their property to future generations have been shown to be more interested in carbon storage programs, though the impacts these factors on attitudes toward the program seem to vary based on landowner types, specific incentive structures, geographic region, and ecosystem types (Miller, Snyder, & Kilgore, 2012; Thompson & Hansen, 2012; Tian et al., 2015). Regardless of the nuances, our study suggests that policy-makers could consider monitoring correlations between outcomes from riparian buffer regulations with potential for carbon storage on private lands. A positive correlation could lead to landowner beliefs that the outcomes of such regulations are more positive.

Although improving recreational opportunities on their land was not a major motivation for management activities among our respondents, those who were more motivated by improving recreation tended to believe the outcomes of riparian buffers would be more positive. A plausible explanation is that landowners motivated by recreation expect outcomes of the buffer regulations to enhance their hunting and fishing opportunities due to increased cover and improved habitat and water quality for wildlife and fish species (Tian et al., 2015). In general, private lands are important places for providing recreation opportunities such as hiking, hunting, fishing, and general aesthetic enjoyment (Armstrong & Stedman, 2012; Tian et al., 2015; USDA, 2015). Therefore, land managers and policy-makers should monitor the impact of policies like riparian buffers on recreation opportunities and experiences because those impacts likely effect landowner beliefs about policy outcomes aside from the intended outcomes (in this case, improved habitat).

On another note, the item measuring the landowner motivation to protect fish and wildlife habitat did not significantly influence beliefs about the outcomes of the policy. This finding is particularly interesting given the main intent of the policy is to protect fish and wildlife habitat. Given the relatively large number of items in the regression model, particularly those measuring landowner motivations, it is likely that the variance in beliefs accounted for by the item measuring motivations to protect fish and wildlife measure is being assumed by a different motivation item, such as improving water quality. However, this could also be an indication that some landowners do not think the policy changes would be enough to substantially support the or improve the fish and wildlife population or riparian health in general either due to lack of understanding about the issue or a general lack of trust that the policy will achieve its intended outcomes.

For this and reasons described throughout this section, land managers and policy-makers should increase their communication with the public and private landowners

regarding the intended and observed impacts of riparian buffer policies. More information could lead to more informed beliefs about the outcomes of different policies for some landowners. Other landowners, such as those whose beliefs tend to be informed primarily through their political attitudes or orientation, may be less persuaded by such outreach efforts.

Understanding more about how beliefs regarding conservation policy outcomes are formed is an important step in considering how to develop and foster support for largescale conservation policies across diverse landscapes and landowners. Future research regarding landowner beliefs about mandatory conservation policy should consider including more robust measures of outcome beliefs, and key variables like political orientation, to better understand how different outreach and communication strategies can influence beliefs across different political orientations and the other factors that we found to significantly affect beliefs. Further research should also investigate how specific elements of conservation policies, such as the temporal and spatial scales of the policy and the ability to enforce the regulations, relate to landowner perspectives about the potential and measured outcomes of the policy.

Conclusion

Policy-makers and community leaders must consider a range of voluntary programs and mandatory policies to achieve conservation-based goals and promote sustainable forest management. Many landowners may be uncertain about the potential outcomes of riparian buffer policies in Oregon and underlying factors like political attitudes, landowner motivations, and other landowner characteristics significantly influence beliefs about the potential outcomes of such policies. Communications with NIPF landowners should highlight the measurable ecological benefits from various policies to increase awareness about the policy's purpose and outcomes. Outreach efforts should also highlight landowner influence on policy development, namely, focusing efforts on NIPF landowners who tend to perceive additional regulations as negative. Policy-makers and land managers seeking to understand and perhaps influence landowner beliefs about potential outcomes of conservation policies should recognize the limitations of such communication and outreach efforts and actively explore opportunities to identify and incorporate landowner perspectives that could be a barrier to successful conservation policy into future policy discussions.

Note

1. More information about the final decision and rule changes can be found at http://www.oregon.gov/ODF/AboutODF/Pages/ProposedLawsRules.aspx or http://www.oregon.gov/ODF/Documents/CoverPageAndFPAAmendedStreamWaterProtectionRules.pdf.

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ORCID

Chad M. Kooistra http://orcid.org/0000-0002-9204-2958

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