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THE SOCIOLOGY OF LANDOWNER INTEREST IN RESTORING FIRE-ADAPTED, BIODIVERSE HABITATS IN THE WILDLAND-URBAN INTERFACE OF OREGON'S WILLAMETTE VALLEY ECOREGION

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Abstract.—In many parts of the world, the combined effects of wildfire, climate change, and population growth in the wildland-urban interface pose increasing risks to both people and biodiversity. These risks are exemplified in western Oregon's Willamette Valley Ecoregion, where population is projected to double by 2050 and climate change is expected to increase wildfire risk. Restoring elements of the region's historic fire-adapted prairie, savanna, and woodland habitats may help to reduce future wildfire risk and help conserve the region's threatened biodiversity. We report on a mail survey (n = 939) examining the socio-demographic factors influencing private landowners' likelihood of restoring fire-adapted habitats in the future. We found that newer landowners, landowners with a liberal political ideology, and landowners who have experienced wildfire are more likely to restore fire-adapted habitats in the future than their long-time owner, conservative, or inexperienced counterparts. However, experience with wildfire ceased to be a significant influence when we controlled for underlying landowner motivations for owning their property. Our findings can help planners and scientists

better understand and account for the effects of a dynamic human population's influence on landscape patterns, structures, and composition.

1.0 INTRODUCTION

Urbanization and altered fire regimes increase society's wildfire risks and pose a major threat to biodiversity. These threats will likely be exacerbated by global climate change (Gude et al. 2008, Running 2006, Westerling et al. 2006). Projecting the effects of future climate change on local landscapes is important in a wide array of land-use planning and policy contexts (Ahern 2001, Lempert et al. 2003). Understanding the likely impacts of human land-use and management decisions in the wildland-urban interface (WUI) is a necessary component of developing planning models and creating policies that maximize socio-ecological landscape resilience in the context of multiple uncertainties (Lempert et al. 2003). In this paper, we report on the initial results of sociological research developed to help inform a coupled natural and human systems model. That model investigates how climate change, land use, management decisions, and wildfire may interact over the next 50 years in the WUI of western Oregon's Willamette Valley Ecoregion.

Oregon's Willamette Valley Ecoregion (WVE) encompasses nearly half (the lower elevations) of the 11,500 sq. mi. Willamette River Basin, the majority of which is privately owned. WVE is home to approximately 2 million people or roughly two-thirds of Oregon's population (Baker et al. 2004). The WVE population is expected to increase to nearly 4 million people by 2050; although it is likely that most of the population increase will be incorporated in Oregon's urban areas, most projections agree that exurban and WUI areas will continue to grow as well (Hulse et al. 2002, Hulse et al. 2004, Lane Council of Governments

2006). At the same time, climate change is expected to increase wildfire risk by leading to warmer and potentially wetter winters coupled with hotter and drier summers, increasing seasonal fuels growth during an extended growing season.

The combination of increased summer temperatures and reduced snow pack with increased fuel loading would lead to extended droughts, which make fuels more burnable (Millar et al. 2007). Many forest and woodland habitats that today occupy much of the non-agricultural and non-developed areas of the WVE carry high fuel loads that contribute to increased fire risk in the region. By contrast, historic prairie, savanna, and woodland habitats of the Pacific Northwest were more resilient to wildfire. Higher-frequency, lower-intensity ground fires prevented succession to the types of conifer forests that now dominate the western Cascades and Coast Range ecoregions (Agee 1993). In 1850, those fire-adapted habitats occupied nearly half of the WVE (Hulse et al. 2002); today, more than 90 percent of these habitats have been degraded or converted to other land uses and forest types (Baker et al. 2004, Noss et al. 1995).

The loss of these habitats has made them critical conservation targets as they are home to some of the WVE's most threatened biodiversity (Oregon Department of Fish and Wildlife 2006). Restoring prairie, savanna, and woodland habitats presents an opportunity to minimize the conjoined risks of climate change and urbanization by reducing wildfire risk and enhancing key conservation targets in the WVE.

Population growth, like that expected for the WVE, is often credited with contributing to changing perceptions and attitudes about natural resource management and land use (Graber 1974, Nelson 2002, Nielsen-Pincus in press, Wilson 1997, Wulfhorst and Nielsen-Pincus 2003, Yung et al. 2003). Socio-demographic characteristics such as length of residence and political ideology are often interpreted to reflect attitudinal differences and differences in sense of place. Convention assumes that newcomers are more likely to have beliefs and attitudes associated with the values of amenities rather

than the traditional values of production activities (Green et al. 1996, Jones et al. 2003, Nielsen-Pincus et al. 2010). Competing liberal and conservative political ideologies (see Theodori and Luloff 2002, Wilson 1997) are exhibited in debates about designating wilderness areas, about forest management, and about property rights (Bassett 2009).

The associations among length of residence, political ideology, and environmental concern are well explored, but their influence on the perceptions and attitudes about natural resource management and land use is not uniform (Graber 1974, Smith and Krannich 2000, Van Liere and Dunlap 1980). More specifically, the associations of length of residence, political ideology, and private landowners' inclination to restore fire-adapted habitat have not been explicitly explored (Fisher and Bliss 2008), and it is unclear whether the environmental attitudes often associated with newcomers and liberal political ideology apply to land management activities that serve multiple goals such as reducing fire risks and conserving biodiversity.

Experience with wildfire may also be an important factor in landowner decisions to mitigate wildfire hazard or risk. Those landowners who have experienced wildfires may be more likely to see wildfire as an extreme threat to themselves and their property (Abt et al. 1990). The duration of this effect is unclear, however (Brenkert-Smith et al. 2006). Others have found a negative relationship between experience and perceptions about wildfire risk and mitigation programs (Hall and Slothower 2009, Winter and Fried 2000), potentially reflecting the influence of familiarity (i.e., resulting in lower perception of risk) or an attitude of acceptance and futility.

In this paper, we examine socio-demographic influences on landowner interest in restoring fire-adapted habitats. We report results from mail survey data of landowners in two WUI study areas of the WVE. Specifically, our objective was to determine the influence of length of residence, political ideology, and experience with wildfire on the likelihood that landowners will express interest in conducting ecological restoration to reduce fire

hazard and increase biodiversity. We examined these socio-demographic influences while controlling for underlying landowner motivations for owning their property. We discuss these landowner characteristics and identify future research that may improve coupled natural and human systems modeling in the context of wildfire hazard mitigation and ecological restoration based on better understanding of landowner influences on landscape change.

2.0 METHODS

We conducted two mail surveys of private non-industrial property owners in two WUI study areas in western Oregon (Lane and Linn Counties). The two questionnaires were designed and implemented using a modified Tailored Design Method (Dillman 2000). Both surveys queried respondents about the land uses and land cover types on their property, their motivations for owning their property, their perceptions of fire risk, value orientations, and demographics. The two surveys then differed in one section. The *Land Management Survey* (LMS) queried respondents about general land use and management strategies they were likely to employ in the near future (e.g., thinning forests, restoring sensitive ecological habitats, developing homes or home sites). The *Forest Management Survey* (FMS) asked respondents about specific forest management strategies they were likely to employ in the near future (e.g., fuels management, restoration of fire-resistant forest types, and timber production). While the two surveys were qualitatively different from each other, they covered many of the same conceptual topics at different levels of specificity.

Sampling for the two surveys was based on geographic information system parcel data from the two respective counties. Nontimber industrial, commercial, and government tax lot owners, and owners of tax lots smaller than 2 acres, were excluded from the sample, leaving a sample frame of mainly non-industrial private landowners (Oregon's rural residential zoning has stipulated a minimum lot size of 2 acres since 1974). The sample frame was then stratified by county, parcel size (<10 acres, 10-50 acres, and >50 acres), improvement value of the parcel (zero, <\$212,000, and

≥ \$212,000—the median improvement value for the two study areas), and the presence of at least an acre of oak, as classified by several spatial classifications of vegetation for the study areas. The strata were designed to target a diversity of potential respondents according to property size, real estate value, and selected vegetative cover types.

We then randomly selected property owners from each stratum and randomly assigned these selected property owners to the LMS and FMS surveys. LMS questionnaires were sent first. In addition to returning the questionnaire, respondents were asked to return a postcard with an ID number if they were interested in volunteering for the FMS questionnaire. FMS surveys were sent approximately 2 months later to the randomly assigned property owners and to those LMS respondents who volunteered for the FMS survey by returning the postcard.

In this paper, we report on several socio-demographic measures from the two surveys, including length of residence, political ideology, and experience with wildfire. First, length of residence was measured by asking respondents how many years they have lived in the study area. Length of residence responses were then dummy-coded to newcomer (1, respondents whose length of residence was less than 10 years) and old-timer (0, respondents whose length of residence was greater than or equal to 10 years). Political ideology was measured on a 7-point scale ranging from extremely liberal to extremely conservative, with a midpoint of neutral and an eighth option for *other*. Responses were dummy-coded to liberal (1) and not liberal (0). Third, experience with wildfire was measured through a series of questions that asked respondents to indicate when, if ever, they had experienced fear or discomfort from wildfire, evacuated their homes, or suffered losses from wildfire. Experience responses were dummy-coded as experienced (1, those who indicated any experience with wildfire) and inexperienced (0, those who indicated no experience with wildfire). Fourth, we measured landowner goals and objectives with 17 items using a 4-point Likert-type response scale

ranging from not important (1) to very important (4). We used SAS 9.1 (SAS Institute, Cary, NC) to identify the underlying motivations of landowner goals and objectives for their property. We conducted an exploratory factor analysis of all 17 items using a principal components method and a varimax rotation and output factor scores to represent the results of the factor analysis (Table 1). These four sets of measures are our independent variables (i.e., resident status, political ideology, past experience with wildfire, and underlying landowner motivations).

For the dependent variable, we created an index from responses to 11 items that addressed landowners' inclination to restore fire-adapted habitats. Respondents were asked how likely they were to engage in activities such as restoring native prairie habitats or converting existing forest habitat types to oak savanna or woodland in the next 10 years.

The index was measured on a probabilistic scale ranging from 0 to 100, where low values indicate the landowner is extremely unlikely and high values indicate the landowner is extremely likely to engage in restoration of fire-adapted habitats. Cronbach's alpha for the index measured 0.86, indicating adequate consistency of responses among items within the index.

We then developed two analysis of variance models. The first model tested for the effects of being a relative newcomer, holding a liberal political ideology, and having experience with wildfire, and interactions among those factors on the inclination to restore fire-adapted habitats. The second model tested for effects of the same factors as the first model while including the underlying landowner motivation factor scores as covariates. Finally, we compare group means for each socio-demographic group using Tukey's HSD test.

Table 1.—Item distributions and factor loadings for 17 landowner goals and objectives^a.

Goals and Objectives	% Very important	Mean ^b	Main factor loadings
1. Amenities			
Personal enjoyment	70	3.54	0.78
Peace and quiet	69	3.51	0.76
Maintain or improve scenic beauty	41	3.07	0.77
Reduce fire risks	40	3.01	0.50
Improve wildlife habitat	29	2.73	0.62
Conduct ecological restoration	13	2.08	0.57
2. Forest Management			
Manage forest health	26	2.59	0.77
Timber production	15	1.84	0.79
Reforestation of cleared land	13	1.91	0.81
3. Home and Family			
A place to live	75	3.49	0.59
A place to raise my family	36	2.39	0.75
A place for my extended family to live	19	2.10	0.74
4. Farming			
Provide income	21	2.13	0.60
Agricultural production	17	1.95	0.87
Raise stock	16	1.91	0.74
5. Development			
Land as a financial investment	32	2.76	0.78
Residential development	8	1.48	0.72

^a Items are listed under the descriptive factor titles for five factors, which together contributed to 65 percent of the total variance in the landowner goal and objective items (factor loadings less than 0.50 are suppressed, as is one substantial cross loading for A place to live, which also loads on Amenities at 0.58).

^b Responses range from not important (1) to very important (4).

3.0 RESULTS

We received 651 and 281 completed and returned LMS and FMS questionnaires, respectively, from randomly selected respondents, and 82 returned FMS questionnaires from respondents who volunteered to participate in the FMS questionnaire after receiving the LMS questionnaire. Final response rates to the two surveys were 40 percent and 49 percent, respectively. Of the 1,014 respondents, 71 were excluded from further analysis due to missing data on more than half the measures we analyzed and 4 were excluded because they appeared as outliers in a multivariate distributional analysis, for a final total of 939 respondents used in the analysis. We report results in the following order: (1) respondent socio-demographic characteristics, (2) characteristics of the underlying landowner motivation measures and factor results, and (3) ANOVA results.

Respondents tended to be long-time residents. Average length of residence was approximately 24 years and only 261 respondents (approximately 28 percent) indicated that they had resided in the study area for less than 10 years. Respondents also tended to be conservative (median response to the political ideology question was 1 point right of neutral). After political ideology was dummy-coded to liberal or not liberal, only 263 respondents (approximately 28 percent) self-reported a liberal political ideology; 676 respondents self-reported a conservative or other political ideology. Finally, 534 respondents (approximately 57 percent) indicated some experience with wildfire, whether discomfort from smoke, fear, evacuation, or suffering personal or property loss. The most common experiences reported were discomfort and fear (46 percent and 30 percent, respectively); evacuation and sustaining personal or property loss were the least reported experiences (6 percent and 5 percent, respectively).

In general, the most important goals and objectives landowners identified for their properties were related to providing amenities and living on their property, with more than two-thirds of respondents indicating that a place to live, personal enjoyment, and peace and quiet were very important. Only about 40 percent of

respondents indicated that maintaining and improving scenic beauty and reducing fire risks were very important goals (Table 1). Less than one-third of respondents indicated that improving wildlife habitat, managing forest health, providing income, or timber and agricultural production was a very important goal.

Factor analysis indicated five relevant dimensions in the landowner goals and objectives data (eigenvalues > 1.0), which together contributed 65 percent to the total variation in the data. We renamed each factor to reflect the underlying motivations of that dimension: (1) amenities, (2) forest management, (3) home and family, (4) farming, and (5) development. The amenity factor was strongly loaded on by seven items related to management objectives such as ecosystem restoration and scenic beauty. Also loading on this factor were several items related to receiving individual gratification. Three items loaded heavily on the forest management dimension, all related to production forestry: timber, forest health, and reforestation. Three items also loaded heavily on the home and family dimension, which included goals for providing a place for family and extended family. Agricultural and livestock production goals loaded most heavily on the farming dimension, which was also heavily loaded on by *provide income*. Last, only two items had loadings greater than 0.5 on the development dimension: *residential development* and *land as a financial investment*. *Provide income* loaded on the development dimension at just under 0.5. Only one item, *a place to live*, loaded heavily (≥ 0.5) on more than one factor, loading at 0.58 and 0.59 on the amenities and home and family dimensions, respectively.

Respondents exhibited a relatively low individual inclination to restore fire-adapted habitats (mean index likelihood is 28.6). Less than a quarter of respondents (22 percent) exhibited a likelihood above the index mid-point, indicating that fewer than a quarter of respondents were more likely than not to restore fire-adapted prairie, savanna, or woodland habitats on their property in the long-term. Being a newcomer, holding a liberal political ideology, and having experience with wildfire all significantly increased respondents' inclination to restore fire-adapted habitats; interactions

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among these variables were not significant (Table 2, top panel). Relative newcomers exhibited a 28-percent greater likelihood, the politically liberal exhibited a 36-percent greater likelihood, and those with wildfire experience exhibited a 20-percent greater likelihood than their long-time, conservative, or inexperienced counterparts, respectively.

In the presence of underlying landowner motivations, however, experience with wildfire did not significantly affect respondents' inclination to restore fire-adapted habitats (Table 2, bottom panel). Being a newcomer and holding a liberal political ideology maintained their effect, resulting in 20-percent and 12-percent greater likelihoods of restoring fire-adapted habitats, respectively, even after controlling for the effects of all the other variables in the model. Landowners with high amenity and forest management motivations are significantly more likely, while those with greater focus on their property as a place of residence are less likely, to restore fire-adapted habitats.

4.0 DISCUSSION AND CONCLUSIONS

We examined the inclination of landowners in the Willamette Valley Ecoregion to restore fire-adapted habitats with the goals of reducing wildfire hazards and restoring habitat types of conservation value. Our results indicate that socio-demographic variables do play a role in understanding landowners' inclination to manage their land for both fire-hazard reduction and habitat conservation. While less than a third of our respondents were newcomers to the region or reported a liberal political ideology, both of these factors were associated with a significantly greater inclination to engage in ecological restoration. We also found that those effects remained significant after controlling for landowner motivations for owning their property.

Our findings support previous research about the influence of newcomers and political ideology on attitudes toward land management, sense of place, and environmental beliefs (e.g., Graber 1974, Nielsen-Pincus et al. 2010, Van Liere and Dunlap 1980, Yung et al. 2003). We also find that controlling for underlying landowner motivations removes the

Table 2.—Results of two analysis of variance models testing the effects of residential status, political ideology, and experience with wildfire on landowner inclination to restore fire-adapted habitats.

Model 1 – Socio-demographic Factors Only			
Main Effects	b	t-value	
NA – New arrival (residence <10 yrs)	6.9	4.1***	
Lib – Liberal political ideology	8.4	5.0***	
Exp – Experience with wildfire	4.5	3.0**	
Interaction Effects			
NA * Lib	-	<0.1	
NA * Exp	-	0.5	
Lib * Exp	-	<0.1	
Intercept	21.9		
N	918		
Model R-Squared	0.06		

	Group Means	% Difference	t-value
New arrival (1), n=261	34.1	27.8%	4.1***
New arrival (0)	26.7		
Liberal (1), n=263	35.4	35.6%	5.0***
Liberal (0)	26.1		
Experience (1), n=534	31.0	20.1%	3.0**
Experience (0)	25.7		

Model 2 – Socio-demographic Factors and Underlying Landowner Motivations			
Main Effects	b	t-value	
NA – New arrival (residence <10 yrs)	5.6	3.6***	
Lib – Liberal political ideology	3.5	2.2**	
Exp – Experience with wildfire	-	1.4	
Covariate Effects			
Amenities	7.7	10.6***	
Forest Management	5.5	8.0***	
Home and Family	(2.2)	(3.2)**	
Farming	-	(1.5)	
Development	-	0.8	
Intercept	25.0***	19.7***	
N	918		
Model R-Squared	0.22		

	LS Means	% Difference	t-value
New arrival (1), n=261	33.4	20.1%	3.6***
New arrival (0)	27.8		
Liberal (1), n=263	32.4	12.1%	2.2***
Liberal (0)	28.9		
Experience (1), n=534	31.6	6.8%	1.4
Experience (0)	29.6		

p<0.01; *p<0.001.

positive effect of experience with wildfire on interest in restoring fire-adapted habitats. We suggest that experience with wildfire heightens one's evaluation of the threat (Abt 1990), but that response is mediated by other factors including landowner goals and objectives for the property, which is consistent with the findings of Hall and Slothower (2009) and Vogt et al. (2005).

Our findings suggest that socio-demographic trends are likely to play a role in shaping the future landscape as more new residents move into the WUI or as political tendencies in the region swing one way or another. Given the projected population doubling for Oregon's Willamette Valley Ecoregion in the next 50 years, the nearly one-third greater likelihood that new residents and those with liberal political ideologies will restore fire-adapted habitats could have substantial effects at the landscape scale. In regions like the WVE, this type of information can help planners, stakeholders, and scientists consider the effects of continued demographic change on the landscape in long-term planning and modeling efforts (Baker et al. 2004, Hulse et al. 2009).

Specific decisions by individual landowners to restore fire-adapted habitats are undoubtedly related to a wide diversity of dynamics (e.g., Bright and Burtz 2006, Martin et al. 2007, Nelson et al. 2005, Vogt et al. 2005, Winter and Fried 2000). For example, responsiveness to financial incentives and sensitivity to property-rights concerns are two constructs that are relevant to the Willamette Valley Ecoregion. Conservation programs are available in the region to restore oak and prairie habitats; however, some landowners are wary of these programs due to concerns about potential property-rights challenges if threatened or endangered species make use of these habitats (Fisher and Bliss 2008). Further understanding of landowner characteristics associated with differing land management tendencies could help explain how sensitive the landscape will be to the policy environment, sociological trends, or feedbacks from biophysical changes that may result from a changing climate.

Understanding the broad sociological influences on landowners' inclination to restore fire-adapted and biodiverse habitats is an important component of understanding the potential for habitat restoration in the WVE. Long-term socio-demographic trends combined with the growing demand for livelihoods in the WUI will influence the pattern, structure, and composition of the landscape in the future. While landowners' decisions to undertake specific land-use and management actions are influenced by their motivations for owning their property and a variety of other factors (Koontz 2001), examining potential consequences of future sociological trends provides a useful means to explore potential changes in people's relationship to their land. When scaled across the multitude of individual landowners, these trends may shape the nature and magnitude of risk to both human and biological values on any future landscape. Understanding these dynamics at the scale of both individual land parcels and the landscape as a whole is critical both for climate-adaptation planning and for developing simulation models that adequately represent the interactions of human, ecological, and physical systems in human-dominated landscapes. Our modeling effort is only a first step to considering the long-range threats of climate, urbanization, and wildfire.

5.0 ACKNOWLEDGMENTS

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