

policy

Payments for Ecosystem Services: Will a New Hook Net More Active Family Forest Owners?

Tricia G. Knoot, Mark Rickenbach, and Kara Silbernagel

Payments for ecosystem services offer the potential to financially benefit landowners in exchange for active forest management. Given their nontimber focus, such payments might be particularly attractive to those owners who do not participate in typical forestry programs. To investigate, we surveyed “nonparticipating” Wisconsin landowners to assess their interest in possible payments for ecosystem services. Our design experimentally compared the effects of ecosystem service type (carbon storage, water, and wildlife) and program sponsorship (government and market) on landowner interest. We also tested the effects of increasing program requirements (no requirements, written plan, required practices, and required inspections). Findings indicate that 42% had some interest under no requirements. This portion dropped to 18% with requirements that resemble how payments might work in practice. Under “real-world” requirements, reliance on a forester in future decisions and the importance of a forest-based income were significant explanatory factors. Findings suggest that program requirements are key in shaping landowner willingness.

Keywords: payments for ecosystem services, family forest owners, forest policy, policy design

Family forests provide innumerable ecosystem services. These lands yield services ranging from wildlife habitat and forest products to biodiversity conservation and carbon sequestration, which directly benefit the estimated 10.4 million family forest owners in the United States (Butler 2008) as well as the broader society (Stein et al. 2005, Robles et al. 2008, Kline et al. 2009). Optimal provisioning or even modest gains in the ecosystem services that family forests provide can

depend on active and adaptive forest management, in which intentional planning takes into consideration continual and emerging threats, such as invasive species, tree pests and disease, climate change, and wildfire risk (Chornesky et al. 2005, Chazdon 2008). However, by key metrics, most family forest owners in the United States are passive managers: just 4% have a written management plan, and only 14% have received advice about their woodlands (Butler 2008).

A passive approach or poor implementation of forest practices can result in forest degradation, such as the spread of invasive species, reduced quality of wildlife habitat, or poor residual forest conditions. For example, observers have identified the lack of active forest planning and management on private family forests and its ecological and economic consequences (Nyland 1992, Erickson et al. 2002, Knoot et al. 2009). Policy responses, designed to foster active and sustainable forest management, have included technical assistance, education, cost-share, and property tax incentives with mixed results (Kilgore and Blinn 2004, VanBrakle et al. 2013, Butler et al. 2014). In the case of financial incentives (i.e., cost-share and property tax programs), such programs have had limited appeal (Greene et al. 2007, Maker et al. 2014). For example, only 6% of family forest owners nationally have participated in at least one cost-share program (Butler 2008). Although most of these programs have evolved a broader focus beyond timber and new nongovernmental opportu-

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nities have emerged (e.g., forest certification), an emphasis on timber production remains a main goal in many cases because of its tangible value in the marketplace and the industries it sustains (Kilgore et al. 2007a).

Payments for ecosystem services (Engel et al. 2008, Jack et al. 2008), in which landowners may be paid to provide nontimber, environmental benefits, would seem to offer a potentially viable alternative or complement to existing approaches (Moore et al. 2013). Notably, such payments might better align with landowner interests and objectives such as wildlife habitat and environmental quality (Bengston et al. 2011). At the same time, payments for ecosystem services include many of the same requirements that existing programs have in terms of compliance and oversight (e.g., management plan, monitoring, and others) that might have an impact on landowner participation. In this study, we investigate a key policy question: *What is the potential of payments for ecosystem services to expand the number of landowners who actively manage their woodlands?* We surveyed “nonparticipating” Wisconsin family forest owners—those not already enrolled in a land management incentive program—to assess their willingness to participate in hypothetical payments for ecosystem services arrangements, both generically and under potential program requirements.

Ecosystem Services and Landowners

Traditional forest management and its associated market opportunities often yield additional public benefits (i.e., positive externalities). For example, timber harvesting can improve forest health and yield financial returns that incentivize maintaining forest cover. In general, though, nonmarket ecosystem services are undersupplied or declining (Lant et al. 2008). Recognition of the public, nonmarket benefits that family forests provide is emerging, and clear policy and market signals may increase provisioning. Payments for ecosystem services are one incentive-based policy tool that might foster increased provisioning (Engel et al. 2008, Jack et al. 2008). Regardless of the particular ecosystem service of interest, payment arrangements work on the premise that if monetary value is attached to a public good or an environmental externality, positive and negative, and if production and consumption are attributable and measurable, a

market can be established. Two examples are illustrative. Carbon markets seek to reduce the amount of carbon in the atmosphere by paying landowners to store more carbon in plants and soils (Lippke and Perez-Garcia 2008, Bigsby 2009). In addition, water utilities may avoid capital investments by shifting aspects of water management to land management practices that could potentially reduce the effects of storm flows, nutrients, and other pollutants (Ford et al. 2011). Both examples reflect potential win-win situations that yield important environmental outcomes that can benefit landowners and society.

However, payments for ecosystem services schemes could impose significant expectations on the landowner, with potentially high transaction costs; however, such impacts depend on the design and context of the particular scheme (Engel et al. 2008, Jack et al. 2008, Farley and Costanza 2010). Notably, such arrangements may require, beyond a commitment to sustainable forestry, both additionality and accountability (Patterson and Coelho 2009). Additionality reflects the fact that payments will be given only for service provisioning beyond what the ecosystem would produce in the absence of management (i.e., status quo). That is, landowners will only get paid if they can produce more of the ecosystem services through active forest management. Accountability, also described as conditionality (Tacconi 2012), although potentially complex in application, ensures that the service provisioning can be measured, documented,

and independently verified (Engel et al. 2008). In practice, additionality and accountability could require, at a minimum, a contract that outlines the financial and legal aspects, a written management plan that prescribes practices that provision the ecosystem service, monitoring protocols that measure yield against predetermined benchmarks, and an independent verification process, all of which may impact levels of interest by those (i.e., sellers and buyers) able to participate in such schemes.

Focused research on payments to family forest owners for ecosystem services is limited, but instructive. Kline et al. (2000a, 2000b) investigated payments to maintain riparian buffers in Oregon for endangered species and water quality and found financial aspects key to understanding interest by landowners. Those owning land for timber management were unlikely to participate, whereas those with diverse landownership objectives and with higher age, income, and educational attainment were more likely to participate. Langpap (2004) focused on endangered species habitat, asking Oregon and Washington landowners to participate in a hypothetical incentive program that required a management plan and specific harvest practices that might reduce timber income. Langpap (2004, p. 384) showed slightly different results, reporting that likely participants

...are younger, have acquired their property more recently, own more woodland, and are interested in conservation and providing wildlife habitat....

Management and Policy Implications

Payments for ecosystem services offer the potential to increase the number of landowners who actively manage their woodlands. In seeking to understand what factors might explain the interest of Wisconsin landowners who do not participate in a forestry program, three implications emerged:

1. A substantial portion of landowners currently not in a forestry incentive program are potentially interested in payments for ecosystem services. Even when accounting for the “real-world” practices of such programs—written management plan, forestry practices, and inspections requirements—nearly one-fifth were somewhat or very likely to participate.
2. In developing payments for ecosystem services, landowners will focus on what they have to do, not what they are expected to produce (e.g., carbon storage, water quality, or others). Policymakers would do well to consult landowners, particularly those who do not currently participate in a separate program, to design programs that are conducive to the widest range of landowners.
3. Landowners having a forester as an “influential peer” were more open to pursuing a payment opportunity, as were those most interested in deriving income from their land. Such payments for ecosystem services could modestly expand active forest management, but other engagement strategies are still needed.

More recent studies continue to explore the potential effects of landowner incentive program parameters, in combination with landowner characteristics and related factors, on landowner interest in existing forest incentive programs (Kilgore et al. 2008, Butler et al. 2014) and those designed to promote specific ecosystem services. As an example, Matta et al. (2009) presented Florida landowners hypothetical payments for conserving biological diversity and found that extended tree rotations and increased buffer widths decreased willingness, but invasive species removal and prescribed burning were neutral. They also found that several demographic variables were significant and generally consistent with the studies described above. Markowski-Lindsay et al. (2011) shifted focus from biodiversity and habitat to carbon sequestration. They found that a mix of program requirements (e.g., contract length, additionality, and others), demographics (e.g., younger and higher educational attainment), and at least one belief about climate change (i.e., “trees help climate change”) were predictive of greater willingness to participate in a hypothetical carbon market premised on the now defunct Chicago Climate Exchange (2009). However, overall interest was low at 2–4%. In addition, unlike previous studies, Markowski-Lindsay and her colleagues control for property tax incentive program participation, but it was not a significant predictor of willingness. A similar study was conducted in the Lakes States region by Miller et al. (2012), in which they found that payment amount (i.e., higher payments increased interest), program requirements (i.e., negative impact of contract length), and demographic characteristics, attitudes, and parcel attributes had an impact on landowner interest in a hypothetical carbon market trading program. Additional studies exploring landowner interest and willingness to participate in current forestry programs, emerging carbon markets, and other hypothetical incentive programs consistently highlight the potential importance of program design (Kilgore et al. 2007b, Fletcher et al. 2009, Layton and Siikamäki 2009, Wade and Moseley 2011), parcel characteristics (Layton and Siikamäki 2009, Lindhjem and Mitani 2012), and landowner characteristics, experiences, and attitudes (Kilgore et al. 2007b, Layton and Siikamäki 2009, Lindhjem and Mitani 2012, Thompson and Hansen 2013).

Research Questions

The reviewed work highlights the range of landowner characteristics that have been found to be associated with landowners' willingness to participate in various incentive programs. In addition, recent studies emphasize the potential influence of program design on participation (Layton and Siikamäki 2009, Wade and Moseley 2011). In this study, we continue this latter line of inquiry concerning program design and its potential to impact the number of family forest owners actively managing their land. In terms of program design, we expand on previous studies in two ways.

1. Instead of investigating a single ecosystem service, land-use practice, or one institutional configuration, we consider three possible candidate services (bird habitat, carbon sequestration, and water quality) and two institutional configurations (a government program and a private market mechanism).
2. We also investigate the cumulative effects of different program requirements related to additionality (i.e., planning and forestry practices) and accountability (i.e., on-site inspections) on willingness to participate. In doing so, we follow the approach of Kilgore et al. (2007b) in assessing the interest of Minnesota family forest owners in forest certification. Forest certification can be seen as a prototype or model for how ecosystem service payment schemes might work in practice.

Methods

Study Area

The focus of this study is Wisconsin. Statewide statistics indicate that there are nearly 350,000 family forest owners owning 9 million acres (62% of the state's forests) (Nelson 2010). In Wisconsin, land cover ranges from mixed agricultural and forestland in the southern part of the state to dense forest across most of the northern part (Perry 2014). The state's timber and paper industries are critical to the state's economy and leaders nationally. In 2012, the wood and paper product sectors were found to employ more than 56,000 workers, who generate goods and services valued at \$16 billion (Wisconsin's Office of the Governor 2012).

Wisconsin family forest owners, like those nationwide (Butler 2008), control the majority (57%) of forestland in the state

(Perry 2014) and thus are important suppliers of the state's wood-using sectors. Yet amenity values, particularly hunting and recreation, are the primary reasons for landownership (Rickenbach et al. 2013). More than 30,000 family forest owners (owning roughly 2 million acres) participate in the state's forest property tax incentive program, the Managed Forest Law program (MFL); nearly all of these lands are certified by the American Tree Farm System and the Forest Stewardship Council (Nelson 2010). Conversely, most privately owned forestland in Wisconsin is not enrolled in the forest property tax incentive program. Thus, the purpose of our study is to investigate factors that may influence landowners' interest in a hypothetical ecosystem service incentive program, focusing on those unenrolled “non-MFL” family forest owners in Wisconsin.

We conducted a multiwave mail survey (Dillman et al. 2008) in spring 2010 that included three full mailings (i.e., cover letter, questionnaire, and prepaid return envelope), one postcard, and a \$2 preincentive enclosed with the first full mailing. The sample, totaling 1,651 landowners, was drawn from a target population of all private landowners owning ≥ 10 acres and < 500 acres of forestland. The sample was screened to exclude MFL-enrolled lands and prior program enrollment. No centralized property owner database exists for Wisconsin, and obtaining samples from all 72 counties was cost-prohibitive. Therefore, sample names were pulled from property tax records, which identify parcel size and MFL enrollment status, in 28 randomly selected counties proportional to the area of private non-MFL family forests in each county.

Each survey recipient was randomly assigned to receive one of six questionnaire versions. Each questionnaire version presented one hypothetical ecosystem service provisioning alternative and was the product of three different services (i.e., carbon storage, water quality, and bird habitat) and two institutional arrangements (i.e., government and market). All six versions were identically phrased except in describing the type of hypothetical ecosystem service and institutional arrangement and in substituting references in questions related to these services or arrangements (Table 1). In describing the two different institutional arrangements, the market-based opportunity was characterized as depending on market exchanges, where the landowner would receive payments by an individual or organization, and a third

Table 1. Frequency and percentage distribution of respondents by questionnaire type ($n = 547$), representing the viable sample for analysis.

	Ecosystem service					
	Carbon storage		Bird habitat		Water quality	
Institutional arrangement	No.	%	No.	%	No.	%
Government	85	16	106	19	93	17
Market	81	15	91	17	91	17

party organization would help the landowner enter the market, oversee the process, and verify compliance. In contrast, the government arrangement was described as a voluntary government incentive program, in which the landowner would receive payments from the public and the government agency would be responsible for technical assistance, oversight, and compliance (for an example of a questionnaire, see Rickenbach et al. 2013)

We assessed landowner likelihood to participate in the hypothetical schemes under four potential levels of requirements, which were cumulative in nature, from a scheme with no requirements (i.e., general willingness) to one including a required written management plan, specific forestry practices, and inspection. Unlike previous work, we do not consider specific payment levels. In terms of the financial benefits for participating in the hypothetical program, the questionnaire states, “Any economic costs of participating in this market would be fully covered by the payments that you would receive.” In essence, landowners are offered a “no-loss” situation with unspecified return for participation. Other questionnaire items sought information on landowner demographics, reasons for landownership, tenure characteristics, and management experiences. We recognize that payment level probably influences program interest (Kilgore et al. 2008, Layton and Siikamäki 2009, Miller et al. 2012). Follow-up studies involving an assessment of landowner willingness to participate as related to payment levels, program requirements, and landowner characteristics may help isolate potential interactions between factors influencing participation that were beyond the scope of this study.

Questionnaire design and item development were informed by previous studies conducted by the authors and review of questionnaires on forest certification (Perera et al. 2007, Mercker and Hodges 2008). Of most relevance in our design was our review

of a study conducted in neighboring Minnesota (Kilgore et al. 2007b). Both landowners and foresters pretested and reviewed early drafts of the survey materials to help assess the reliability and validity of the survey questions.

We received 1,064 completed questionnaires (response rate = 64.4%). For the purpose of our analysis, only 594 responses were eligible because of missing values. We compared characteristics of respondents with missing values for this analysis with those used for analysis and found no differences in terms of landholding size and the importance of timber income as a reason for landownership. However, those with missing values were older, had longer tenure of ownership and lower income, and were less likely to consult a forester or a family member. This suggests that our sample may not be representative of all non-MFL Wisconsin family forest landowners, but our sample may represent a segment of landowners who may be younger, may be newer to landownership, and are more likely to consult a forester or a family member about their woodlands. Our analysis is thus instructive in that it helps to define the characteristics associated with those landowners who might consider payments for ecosystem services and therefore can provide insights into efforts to reach a specific segment of landowners.

Data analysis entailed the development and evaluation of four explanatory models using logistic regression. Independent variables that were selected for inclusion in the models were a series of landholding, landowner, and management characteristics, reflecting variables found to influence landowner behavior as described in the reviewed literature above (Table 2). The binary response variables reflected expected participation and were based on an initial 4-point scale (Table 3). Those who indicated they were “somewhat” or “very” likely to participate were coded as “willing,” whereas those who indicated “not likely” or “never” were coded as “not willing” to participate. The

likelihood to participate was evaluated for four requirement levels: (1) no requirements (i.e., general willingness), (2) written management plan, (3) specific forestry practices, and (4) inspection (Table 3). The increasing requirements are additive (i.e., practice requirement includes plan; inspection includes practices and plan). Statistical analysis was conducted using SAS/STAT software (version 9.3), and significance is reported at $P < 0.10, 0.05,$ and 0.01 .

Results

Explanatory Variables

Landowners in this study own, on average, 58 acres of woodlands (Table 2), which was 59% of their total ownership (mean = 98 acres, SD = 92 acres). Nearly 70% of landowners acquired their properties since 1980, whereas about the same portion report visiting their land at least twice per month. Twenty-six percent reported having a forest management plan (only 4% of landowners described the plan as a written plan as opposed to an unwritten plan), and 12% identified income from forest products as either somewhat or very important (8 and 4%, respectively). Two binary variables characterize landowner decision support: 44% of landowners indicated that other family members would be either very or extremely important (i.e., influential) in their decision to participate in a future program, and 19% indicated that a forester (public or private) had similar status. Respondents’ mean age was 57 years. Nearly two-thirds (64%) have completed some college, whereas only 9% had not completed high school or a GED. The median income category was \$50,000–74,999, but income skewed slightly toward higher incomes with 43% in categories above and 35% in those below the median category.

Dependent Variables

The four dependent variables reflect the increasing commitment associated with participation in payments for ecosystem services (Table 3). In the absence of specific requirements, 42% of respondents indicated that they were either somewhat or very likely to participate (i.e., “willing”) (Figure 1; Table 3). These landowners owned 45% of the woodland area in the sample. Respondents’ willingness decreased to 36% (40% of area) when a written management plan was required. Adding cumulative practice and inspection requirements further reduced will-

Table 2. Descriptive statistics for explanatory variables used in logistic regression models (n = 547).

Explanatory variables	Mean	SD	Levels	%
Continuous				
Woodlands owned (ac)	58	57		
Age (yr)	57	12		
Ordinal, treated as continuous				
Decade land required	4.2	1.5	1. Before 1960	8
			2. 1960s	6
			3. 1970s	17
			4. 1980s	20
			5. 1990s	30
			6. 2000s	19
Visit periodicity	2.0	1.2	1. Once or twice per week	45
			2. Once or twice per month	26
			3. Once or twice every 3 months	15
			4. Once or twice per year	9
			5. Less than once per year	5
Importance of forest income	1.7	0.8	1. Not at all important	51
			2. Somewhat important	37
			3. Very important	8
			4. Extremely important	4
Educational attainment	3.1	1.2	1. Grade 11 or less	5
			2. High school graduate or GED	31
			3. Some college	25
			4. College graduate	22
			5. Graduate or professional school	17
Income	4.2	1.9	1. <\$25,000	11
			2. \$25,000–\$34,999	12
			3. \$35,000–\$49,999	12
			4. \$50,000–\$74,999	23
			5. \$75,000–\$99,999	15
			6. \$100,000–\$149,999	16
			7. ≥\$150,000	12
Binary				
Management plan (written or otherwise)			Yes	26
			No	74
Family influential in decision*			Yes	44
			No	56
Forester influential in decision†			Yes	19
			No	81

*Percentage of respondents indicating that a family member would be either very or extremely important to consult about participation.

†Percentage of respondents indicating that a forester (public or private) would be either very or extremely important to consult about participation.

ingness to 24% (26% of area) and 18% (20% of area), respectively.

Model Results

All four models explaining landowner willingness to participate in a hypothetical payment for ecosystem services arrangement were highly significant ($P < 0.01$) and were similar in their explanatory power (max-rescaled $R^2 = \approx 0.20$) (Table 4). Inspection of model fit parameters (e.g., variance inflation factors and tolerance) indicated that multicollinearity was not an issue for any of the models. Details on each model's results are presented below.

General Willingness. Six variables were significant in explaining general willingness (i.e., no program requirements) to participate (Table 4). Both the importance of forest income and a forester as influential

in decisionmaking had the expected positive effect on willingness and were highly significant ($P < 0.01$). Dummy variables to distinguish among the three ecosystem services were significant ($P < 0.05$) and indicate an ordered preference: water quality > bird habitat > carbon storage. We found that landowner age and income were modestly significant ($P < 0.1$), with age having a negative effect on willingness to participate and income as having a positive effect. Notable nonsignificant explanatory variables were the dummy variables for institutional arrangement (i.e., government versus market), woodland area, and educational attainment.

Plan Requirement. With the addition of a written management plan requirement, both dummy variables distinguishing among the three ecosystem services ceased being sig-

nificant. A forester as influential in decision-making remained highly significant. Forest-derived income, age, and annual income remained significant ($P < 0.05$). The presence of any kind of management plan was not significant ($P = 0.1308$).

Required Practices and Inspection.

The two remaining models that explain willingness under practice and inspection requirements had similar results. Only two explanatory variables were significant in both: the reliance on an influential forester as a consultant on future decisions and the importance of forest-derived income as a reason for landownership; however, we note that the number of respondents willing to participate under these requirements also decreased, which can have an impact on our statistical power to detect effects. The influential forester is highly significant ($P < 0.01$) in both models, whereas the importance of forest income is highly significant ($P < 0.01$) in the practices model and modestly significant ($P < 0.1$) when inspections are required. The presence of a management plan, written or mental, is not significant.

Discussion

Not surprisingly, increasing requirements decreases the pool of potentially interested landowners: 42% of respondents were at least somewhat interested under no requirements, whereas this portion was 18% when requirements resembling how payments for ecosystem services might actually work were imposed (i.e., plan, practices, and inspection) (Table 3; Figure 1). In explaining this willingness, model findings indicate that the number of significant factors becomes fewer as requirements grow. Initially, six parameters were significant (Table 4), whereas under all requirements just two remained: the reliance on a forester as a consultant on future decisions and the importance of forest-based income as a reason for landownership. Based on the article's focus and these findings, two topics deserve further discussion: designing payments for ecosystem services and expanding active forest management by family forest owners.

Designing Payments for Ecosystem Services

There are numerous ecosystem services around which a provisioning arrangement might be developed through public programs, private ventures, or some hybrid (Kline et al. 2009). In this study, the specific ecosystem service was a significant factor in

Table 3. Likelihood to participate, frequency, and area distributions, in a hypothetical ecosystem service scheme under four requirement levels; requirements are cumulative ($n = 547$).

Requirements	Description	Respondents				Acres owned by respondents			
		Somewhat or very likely to participate		Never or not likely to participate		Somewhat or very likely to participate		Never or not likely to participate	
		No.	%	No.	%	No.	%	No.	%
None	Generic willingness	228	42	319	58	14,461	45	17,423	55
Plan	Written management plan prepared by a professional forester is required	198	36	349	64	12,642	40	19,242	60
Practices	Same as plan requirements, add possible harvesting, treeplanting, and invasive species removal requirements	130	24	417	76	8,384	26	23,500	74
Inspection	Same as practices requirements, add on-site inspection requirement	101	18	446	82	6,358	20	25,526	80

Requirement levels: binary dependent variables for logistic regressions are "somewhat" and "very" likely to participate versus "never" and "not likely to" participate.

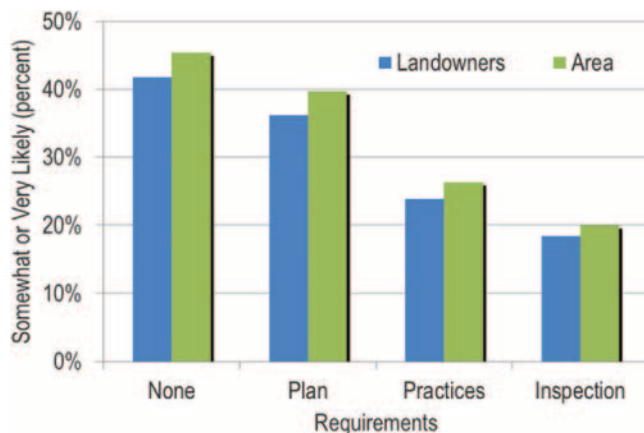


Figure 1. Likelihood to participate, by landowner count and area owned, in a hypothetical ecosystem service scheme under four requirement levels; requirements are cumulative ($n = 547$). Data presented numerically in Table 3.

explaining willingness in the absence of program requirements. Specifically, we found that water quality was preferred over bird habitat, which, in turn, was preferred over carbon sequestration. Although additional research is needed, these three ecosystem services can be divided along several dimensions that might explain preferences. For example, water quality may be a more concrete and tangible benefit to human health and well-being than either bird habitat or carbon sequestration. In addition, carbon sequestration is closely linked to a contentious political issue (i.e., global warming), whereas bird habitat may be sufficiently vague as to be apolitical (at least in the study region); however, such assertions require further study in our region. However, such interpretations align with findings from a study of the perceptions of landowners in Texas, in which they found landowners to more favorably view incentive programs that encourage management to improve water yields or wildlife habi-

at than those that encourage management aimed to increase carbon sequestration (Olenick et al. 2005). In addition, studies suggest limited interest by landowners in participating in carbon markets (Fletcher et al. 2009, Markowski-Lindsay et al. 2011) or at least a high degree of uncertainty (Miller et al. 2012). Thus, in designing a landowner incentive program, attention to the type of ecosystem service of focus may be important in attracting landowner interest.

Once minimal program requirements are specified, such as the requirement of a management plan, landowner interest decreases, and the specific ecosystem service is no longer a significant factor. However, we note the potential loss of statistical power in detecting an effect once our number of willing participants decreases. Nonetheless, this suggests that while some environmental attributes and services are viewed more positively, their contribution to landowners' ultimate decision to participate may be min-

imal once program requirements are considered. Indeed, once we assessed the influence of adding additional requirements, such as in the "inspection" model (Table 4), a landowner's economic interest and his or her reliance on a professional forester in future decisionmaking are the key explanatory factors detected. In this, ecosystem services provisioning may be functionally similar to forestry's recommended operating procedures in which a landowner works with a forester to cocreate a management plan. Ecosystem service arrangements that include multiple requirements may simply alter "production" toward a new "supply chain."

Our attempt to further attribute explanatory differences by alternative institutional arrangements (i.e., government versus market), another aspect informing policy design, found no effect (Table 4). A question remains in Wisconsin concerning whether the MFL property tax incentive program has saturated interest in government-sponsored forestry incentive programs. With more than 30,000 family forest owners enrolled in the MFL, evidence of landowner discontent with the program exists (Rickenbach et al. 2005). Our data suggest that in the abstract, a certain segment of landowners not already enrolled in a government program may not hold a strong preference one way or the other.

While some requirements, such as a written management plan may only minimally deter landowner participation compared with practice or inspection requirements, it is important to understand the potential impact of multiple program requirements on program effectiveness and overall efficiency. Furthermore, future work is also needed to understand other implications of such programs, such as the perma-

Table 4. Explanatory variable estimates and model fit metrics for logistic regression models of likelihood to participate in a hypothetical ecosystem service scheme under four requirement levels; requirements are cumulative ($n = 547$).

Model parameters	df	Expected sign	Models under cumulative requirements							
			None		Plan		Practices		Inspection	
			Coefficient estimate	SE	Coefficient estimate	SE	Coefficient estimate	SE	Coefficient estimate	SE
Service (referent is bird habitat)	2	?	-0.3241†	0.1415	-0.1467	0.1432	-0.0904	0.1610	0.0769	0.1729
Compared to climate storage		?	0.3091†	0.1329	0.1569	0.1358	0.0580	0.1533	0.0527	0.1672
Compared to water quality		?	0.0214	0.0959	0.0148	0.0982	0.0132	0.1104	0.0308	0.1215
Institutional arrangement (referent is market)	1	+	0.0037	0.0042	0.0049	0.0042	0.0011	0.0047	-0.0001	0.0051
Woodland area	1	+	-0.0532	0.2260	-0.3573	0.2365	0.1426	0.2547	-0.0950	0.2891
Management plan	1	-	-0.0506	0.0797	-0.0230	0.0821	-0.0965	0.0899	-0.1365	0.0975
Decade land acquired	1	?	0.0069	0.0814	0.1018	0.0830	0.0044	0.0945	0.1171	0.1005
Visit periodicity	1	+	0.4026‡	0.1274	0.2558†	0.1297	0.3597‡	0.1389	0.2622*	0.1521
Importance of forest income	1	-	-0.0187*	0.0102	-0.0234†	0.0105	-0.0091	0.0116	-0.0093	0.0127
Age	1	+	0.0341	0.0878	0.1220	0.0901	0.0635	0.1007	0.0703	0.1111
Educational attainment	1	+	0.1092*	0.0609	0.1260†	0.0622	0.1116	0.0700	0.0583	0.0761
Income	1	?	0.2129	0.1961	0.2527	0.2009	0.0725	0.2262	0.1928	0.2463
Family influence	1	+	1.7111‡	0.2634	1.5841‡	0.2505	1.6746‡	0.2493	1.7900‡	0.2618
Forester influence	1									
Model fit metrics										
Likelihood ratio			92.6‡		88.9‡		72.4‡		67.0‡	
Maximum rescaled R^2			0.21		0.21		0.19		0.19	

* $P < 0.10$.

† $P < 0.05$.

‡ $P < 0.01$.

nence of program benefits, the role of program targeting that considers financial costs as well as service provisioning, and distributional impacts (Engel et al. 2008).

Expanding Active Forestry

An underlying focus of this study was on landowners who currently do not participate in incentive programs. This focus is premised on the belief that payments for ecosystem services might be most beneficial if they can expand active management to lands not part of a program. Most landowners in Wisconsin and across the nation, particularly those with smaller parcels, have not chosen to participate in traditional forestry incentive programs (Butler 2008). We found that landholding size, for those responding to our survey, was not a significant factor in explaining likely participation in payments for ecosystem services. However, that could easily change in practice. Landowners with smaller parcels face barriers to traditional forest management, notably limited scale economies. These barriers might be compounded in payments for ecosystem services arrangements in that monitoring and oversight may be required. Future research that focuses on understanding the perspectives of landowners with "small" landholdings around the topic of payments for ecosystem services may help illuminate new opportunities. There are segments of these landowners who may be motivated to

engage in active management if appropriately targeted (Hull et al. 2004).

Our findings suggest modest interest among non-program-participating landowners. However, this assessment does not include consideration of two factors beyond the scope of this study that warrant discussion: actual payment levels and reliance on a forester-centric structure.

First, payment levels were not directly considered, but the Wisconsin context offers some insights. The state's property tax incentive program, the MFL, provides a substantial annual reduction in property tax in exchange for active forest management subject to rigorous oversight. In 2013, the average property tax on forestland not receiving special treatment (e.g., MFL, other use valuation) was \$42.70 per acre (Wisconsin Department of Natural Resources 2014). In many cases, though, forestland property tax bills can often exceed that amount. Regardless of the assessed value, MFL enrollees paid at most \$10.68 per acre (excluding a 5% yield tax on the value of timber sold) (Wisconsin Department of Natural Resources 2014). Thus, a conservative estimate of benefit is \$32 per acre per year. We might expect that interest in payments for ecosystem services is higher in locations with low property taxes, because the MFL is less advantageous (Rickenbach and Saunders 2009). Although this question was beyond the scope of our

work, future studies, particularly those focused on price points and payments, might include an evaluation of the impact of property values and the opportunity for both current enrollees and nonparticipating landowners to engage in other incentives. Several property tax programs across the nation resemble the requirements of payments for ecosystem services (Hibbard et al. 2003) and could yield useful insights.

Taking insights from existing incentive programs also may be instructive in terms of program requirements. Regardless of the specific prices, our findings indicate that accountability, additionality, and monitoring can influence landowner decisionmaking. Depending on their rigor and scope, these elements represent relatively high transaction costs compared with those for selling timber once or twice during one's tenure as a landowner, which might explain the limited interest found in this and other studies (Markowski-Lindsay et al. 2011). In short, in the absence of substantial payment levels, payments for ecosystem services could attract those landowners in existing programs, like the MFL, as opposed to incentivizing active management by nonprogram landowners. Future work is needed to better understand how payments for ecosystem services schemes may attract current program enrollees, noting that new programs may compete with existing incentives.

Second, payments for ecosystem services schemes, as hypothetically structured in our study, embody forestry's preferred modus operandi, which prescribes a path for landowner engagement that relies on professional forestry assistance. Our findings indicate that those most likely to engage in payments for ecosystem services identify the importance of a forester in the process. However, only a small portion selects that route to land management (Butler 2008). Other paths to landowner engagement that might be more attractive to some portion of landowners exist. Hujala et al. (2007, 2009) identified three different management styles among Finnish landowners, each with differing expectations of and participation in by professional foresters. Whereas just over half were categorized as preferring shared decisionmaking with a forester, the remainder, 47%, preferred more independent approaches. We found no studies with similar insights on US landowners, but different management philosophies and decision-making styles are probably present. Whether these different management philosophies are of sufficient number and potential to demand rethinking arrangements for provisioning ecosystem services is not clear. For example, landowner cooperatives and peer learning models have received considerable attention in the literature (Blinn et al. 2007, Rickenbach 2009, Schubert and Mayer 2012, Kueper et al. 2014) but have had limited broad-scale application. Thus, questions remain concerning whether there are alternative pathways to ecosystem service provisioning that may be different from programs that have been offered in the past. The existing limitations to our study also suggest the need to additionally explore the impact of various payment levels on participation, potential participation from those who were not the focus of our study (i.e., current program enrollees) and nonrespondents, and program implications (e.g., targeting, program effectiveness, and distributional impacts).

Conclusions

Conceptually, paying landowners to provide societal benefits is alluring, as it offers a mechanism by which to promote active forest management. Should such arrangements gain traction, it will be important to understand and potentially target those landowners who may be considered prime prospects, such as those placing importance on a forest-based income and those with existing relationships

to a professional forester. These prime prospects may include both those identified in this study, as well as those intentionally excluded from it (i.e., current incentive program participants). Whether these landowners provide a sufficient pool for ecosystem service provisioning at the correct scale will depend on the needs of the specific initiative. What this study does indicate, though, is that in a state with a highly successful property tax incentive program, the pool of landowners willing to develop plans and a work with a forester has probably not been exhausted should other incentives emerge.

At the same time, this study finds that specific program requirements may be disincentives for landowners. What might appeal to them needs further exploration, because it is also not clear that the scale or location of ecosystem services needs will adequately align with properties owned by those landowners considered prime prospects, particularly for critical challenges such as water quantity and quality, climate change, or the more localized needs for habitat and flood mitigation. Moreover, simply concentrating on those we know and with whom we work well will not necessarily expand the practice of forestry where it is probably most needed. Doing this, whether toward ecosystem services or simply meeting our collective goal of better forestry, will require rethinking how we create and maintain relationships with landowners and envisioning alternatives by which we bring professional expertise and decision support to them.

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