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# Factors Influencing Land Management Practices on Conservation Easement Protected Landscapes

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*The goal of this article is to investigate factors influencing conservation-oriented land management practices on land holdings with conservation easements. We report the results of a mail survey that produced responses from 251 out of a total of 518 landowners with a permanent conservation easement on their property. We predicted that landowner satisfaction with their easement and good relationships between landowners and easement holders would be positively correlated with the amount of conservation-oriented land management practices. However, we found landownership motivations to be a stronger predictor of active land management. We also found significant management differences between landowners with different easement holders. The results of this study suggest the need for increased easement holder capacity supporting targeted outreach with landowners; increased monitoring of ecological targets on easement properties; promotion of landowner participation in peer-to-peer management networks; and increased easement flexibility mechanisms by easement holders to better accommodate adaptive management.*

**Keywords** conservation easements, land management, private land conservation, private landowners, protected landscapes

Perpetual conservation easements have become one of the most commonly used land protection tools in the United States and are increasingly being implemented in other countries, where they are often referred to as conservation covenants (Fairfax et al. 2005; Pidot 2005; Pocewicz et al. 2011; Iftekhar, Tisdell, and Gilfedder 2014). A conservation easement is a contractually binding agreement, developed between a landowner and a third party, that limits how property can be used, with the overarching goal of protecting conservation targets on the land from ecologically deleterious land uses (Merenlender et al. 2004). While most conservation easements share common restrictions, such as prohibitions on land subdivision and most infrastructural development, every easement is individually negotiated between the landowner and the easement holder, and therefore the terms between easements can vary widely (Gustanski and Squires 2000). Generally conservation easements are, by design, a negative easement, meaning that they restrict certain activities but do not require landowners to perform specific management actions on their land. However, the utility of a conservation easement in providing ecosystem services to society may be

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enhanced if that land is managed in a way that improves the conservation targets the easement is intended to protect. Land management is one of the major driving factors influencing ecosystem function and, by extension, the provisioning of ecosystem services (Fürst, Lorz, and Makeschin 2011; Otieno et al. 2011). Furthermore, the absence of active land management can reduce landscape resilience, affect land cover, and decrease ecosystem function (Allen et al. 2011). For example, the lack of application of periodic prescribed fire has led to increased thicketization and rangeland degradation throughout much of our study area in Texas (Twidwell et al. 2013). Ironically, in some cases, perpetual easements may hinder land management because the static nature of the prohibitions limits the decision-making flexibility often required for adaptive management within dynamic ecosystems (Richardson 2010; Rissman et al. 2013).

Sustaining ecosystem functions that easement programs are designed to protect requires ongoing conservation land management. However, little research has examined conservation-oriented land management practices on conservation easement properties (Ernst and Wallace 2008; Pocewicz et al. 2011; Rissman et al. 2013). We define conservation land management as any human activity affecting land cover and designed to promote conservation values (van Oudenhoven et al. 2012). Examples include but are not limited to vegetation manipulation through the use of prescribed fire or mechanical or chemical treatments, protection of riparian buffers, restoration of wildlife habitat, and wildlife population management.

A 2005 survey of 215 landowners from a single county in Colorado, all of whom had participated in private land conservation programs, included only a cursory measurement of management activities reported on protected properties (Ernst and Wallace 2008). In 2008, Pocewicz et al. (2011) evaluated the effectiveness of conservation easements in protecting sagebush habitat within the Wyoming Basins ecoregion of Wyoming. The researchers used spatial analysis to measure habitat parameters and a brief mail survey asking landowners with ($n = 14$) and without ($n = 10$) conservation easements whether they had used various land management tools. The authors found that landowners with conservation easements were not significantly more likely to report using land management practices or to seek out technical assistance for management than landowners without easements (Pocewicz et al. 2011). Rissman et al. (2013) examined mechanisms incorporated into conservation easement documents in Wisconsin. They found several different potential tools for facilitating land management, including the use of management plans, retained rights, amendment clauses, and conditional use permits. However, the study concluded that the structure of many conservation easements placed significant restraints on landowners' ability to conduct adaptive management.

The goal of our article is to identify factors that are predictive of conservation land management practices on easement-protected landscapes. Based on previous research and the hypotheses presented in the following, we expect that patterns of land management on easement properties are influenced by social–ecological conditions mediated by easement constraints. Specifically, we are interested in how landowner satisfaction with their conservation easement, easement holder/landowner relations, grantor versus successive generation landownership, landownership motivations, easement holder institutional differences, and landowner residency on conservation easement lands affect management actions. In order to examine these issues, we propose six hypotheses.

*H1. Landowner satisfaction with their easement.* Landowners expressing more satisfaction with their conservation easement will be more likely to engage in conservation management practices (Kabii and Horwitz 2006; Ramkissoon, Smith, and Weiler 2013). With few exceptions, each conservation easement prescribes a unique set of rules governing the land use restrictions and retained rights of the encumbered property. Some landowners may feel more constrained by their easement regulations than others. A perceived lack of autonomy may lead to dissatisfaction or frustration with restrictions prescribed in the conservation easement, causing landowners to engage in less active management.

*H2. Easement holder/landowner relationship.* Landowners who have a positive relationship with their easement holder will be more likely to conduct pro-environmental land management practices on their easement properties than landowners who do not. Rissman and Sayre (2012) concluded that social networks created between easement landowners and easement holders promoted increased management on conservation easement protected lands, partially as a result of landowners' increased access to financial incentives and land management resources. Social exchange theory posits that when two entities have a strong, positive interdependent relationship, they are more willing to engage in a continuing reciprocity (Cropanzano and Mitchell 2005). In this case, reciprocity includes assistance, such as technical guidance, that encourages landowner engagement in management practices that achieve conservation goals.

*H3. Grantor versus successive landownership.* Landowners who originally conveyed the conservation easement (i.e., grantor landowners) will be more engaged in pro-conservation land management actions than landowners who either bought or inherited land with a conservation easement already in place (successive landowners). The value–belief–norm theory of environmentalism (VBN) posits that personal moral norms are strong drivers of individual inclinations of pro-environmental behavior (Stern 2000; López-Mosquera and Sánchez 2012). Given that grantor landowners have already exhibited pro-environmental behavior through the act of conveying the easement, we expect that they will continue to exhibit such behavior by managing the land to achieve conservation goals (Stern 2000). By contrast, successive generation landowners may be less invested in the protection ideals outlined by the easement and therefore may be less likely to invest in management inputs designed to promote easement goals.

*H4. Landownership motivations.* We hypothesize that landowners owning property for amenity purposes (e.g., recreation or hunting/fishing) will manage their property differently than owners primarily interested in production or land as an investment (Haggerty and Travis 2006; Cross et al. 2011; Petrzelka, Malin, and Gentry 2012). Previous studies have shown landowner views about their property affect land use, management preferences, land cover, and ultimately ecosystem processes (Gosnell et al. 2006; Sorice et al. 2012; Abrams and Bliss 2013). Because of this, we expect that management actions will closely track landownership motivations.

*H5. Easement holder institutional differences.* Increased decision-making flexibility and fewer bureaucratic hurdles presented by easement holding entities will translate into increased proconservation management activity on easement properties. Flexibility in making easement management decisions is affected by easement holder polices and may vary widely between easement holding organizations (Rissman et al.

2013). Most easements owned by nongovernment organizations (NGOs) and local or state agencies are designed on a case-by-case basis where landowners negotiate their retained rights with the easement holder; management plans are often built into the easement instrument and variance requests to conduct management outside the contractual restrictions may be accommodated with few bureaucratic hurdles (Rissman 2010; Rissman et al. 2013). In contrast, most easement programs managed by federal agencies use standardized easement restriction guidelines.

*H6. Landowner residency on easement land.* Easement lands owned by full-time property residents will be more actively managed than those owned by weekend residents or absentee landowners. Previous research has shown that weekend residents and absentee landowners are more likely to own land for amenity rather than production purposes, less likely to depend financially on their land, less likely to be engaged in land management, and less likely to contact natural resource professionals (Ma et al. 2012; Abrams and Bliss 2013; Petrzelka, Ma, and Malin 2013).

## Methods

The study population included all identifiable landowners in Texas whose property was protected by a perpetual conservation easement in 2011. Using information provided by the Texas Land Trust Council, an organization that tracks conservation easements throughout the state, we identified every known easement-holding organization, private and public, operating in Texas ($n = 33$), along with the number of conservation easements held by each of them. To develop the landowner contact database, we contacted all of these easement-holding institutions to request their assistance in identifying potential landowner participants. Ultimately, we identified 518 landholdings with permanent easements held by 33 organizations. Sixteen of these easement holding organizations directly provided contact information for 409 landowners. Another 16 organizations, holding 89 conservation easements, declined to provide landowner contact information. However, in Texas, conservation easements are attached to property deed records and are available in county record offices. By searching these public records for the grantee names (i.e., the easement holder), we were able to obtain contact information for 69 of the 89 landowners associated with these organizations. Finally, one land trust, representing 20 landowners, did not wish to provide member contact information but instead participated in the study by concomitantly sending survey items, provided by us, directly to its members.

The study was conducted using a multiphase mail survey, administered using a Dillman's mail survey protocol (Dillman 2000), which was modified by substituting a second reminder postcard for the third survey questionnaire in the fifth mailing. The survey was initiated in September 2011 and was terminated 4 months after the first mailing. The five mailings included a presurvey notification letter (day 1), the survey questionnaire and cover letter (day 7), a reminder/thank you postcard (day 14), a replacement questionnaire (day 28), and a final reminder/thank you postcard (day 42).

The survey questionnaire contained 78 questions addressing four primary areas of inquiry, including land management activities on conservation easement properties, easement-specific issues, property rights orientations, and landowner demographics. This article reports on the section of the survey focused on land

management conducted on conservation easement properties. Survey participants were also invited to provide written comments about their conservation easements at the end of the questionnaire, some of which are used for illustrative purposes in the discussion. In addition, to test for nonresponse bias, an abbreviated one-page questionnaire including six attitudinal and demographic indicator questions was sent in March 2012 to all landowners who did not respond to the survey.

Survey data were entered into Microsoft Excel and analyzed using STATA 12.0 (StataCorp. 2011). Statistical analyses included descriptive statistics for demographic data, $t$ tests and chi-squared ($\chi^2$) tests for nonresponse bias analysis, and principle components analysis (PCA) to group related variables into functional indices. Logistic regression models were used to test our six hypotheses.

### *Development of Dependent Variables Used for Regression Analyses*

Survey participants were asked about their use of 14 common land management practices. Each practice was coded as a binary variable indicating that the respondent had either used the practice or not. We used PCA to group related variables into indices. Cronbach's $\alpha$ was used to determine internal reliability for each subscale.

### *Development of Independent Variables Used for Regression Analyses*

Independent variables used in the regression models included reasons for landownership, whether or not the landowner was the original grantor of the conservation easement, landowner's level of satisfaction with the conservation easement, landowner's level of satisfaction with the relationship with the easement holder, category of easement holder (nongovernmental, state/local agency, or federal agency), and residency on the easement property (Table 1). Demographic control variables included landowner's age, years of education, and length of easement property ownership. The size of the easement (in acres) was log transformed to normalize the distribution, and the transformed data were used in the models in order to control for the effect of property size differences on management decisions.

In order to reduce the number of explanatory variables in the regression models, some independent variables were developed as latent indices using principal components analysis. The first, measuring landowner's reported satisfaction with their conservation easement (CE Satisfaction), was developed from a series of three issues: (1) If I had the opportunity, I would consider granting further conservation easements on additional land that I own; (2) I am happy to abide by the terms and conditions of the conservation easement on my land; and (3) given the option, I would *not* terminate the conservation easement on my property. The resulting index variable ($\alpha = 0.8287$) was created from ordinal data that were derived using a 7-point response scale (1 = *strongly disagree*, 4 = *neutral*, 7 = *strongly agree*) for each of the three issues.

In order to test the effects of landownership motivations on management, a second group of indices were developed using PCA from a set of 14 questions asking respondents about their reasons for owning their easement properties. Survey participants were asked to rank, according to a 7-point response scale (1 = *not at all important*, 4 = *moderately important*, 7 = *very important*), how important each of the following reasons were for owning their conservation easement property: place to relax, enjoy the outdoors, manage wildlife, non-hunting or fishing recreation,

**Table 1.** Independent variables used in regression models

| Variable labels | Variable descriptions |
|---|---|
| *Landownership motivations* | |
| Farmer/rancher | PCA index variable representing farming and/or ranching as primary reason for CE landownership |
| Hunting/fishing | PCA index variable representing hunting and fishing as primary reason for CE landownership |
| Investment | PCA index variable representing financial investment as primary reason for CE landownership |
| Lifestyle/recreation | PCA index variable representing non-consumptive recreation as primary reason for CE landownership |
| Grantor landowner | Landowner granted the easement. Binary single item variable; 1 = yes, 0 = no |
| *Satisfaction* | |
| CE Satisfaction[a] | PCA index variable representing landowner satisfaction with their CE |
| CE Relationship[a] | Ordinal response to survey question, "I have a good relationship with the organization that holds my conservation easement" |
| *CE owning institutional characteristics* | |
| Federal government[b] | Easement holder is a federal government agency |
| State/local government[b] | Easement holder is a state or local government agency in Texas |
| *Landowner/landholding characteristics* | |
| Weekend resident[c] | Binary single item variable; landowner self-reports using CE property as weekend residence |
| Absentee landowner[c] | Binary single item variable; landowner self-identifies as an absentee landowner of CE property |
| CE size | Size of CE in acres, data log transformed for normalization |
| Length of easement property ownership | Response to survey question, "How long has the conservation easement property been in your family?" (years). Continuous single item variable |
| Age of landowner in 2011 | Landowners age in 2011. Continuous single item variable |
| Years of education | Landowners number of years of education. Continuous single item variable |

*Note*. The term conservation easement is abbreviated "CE."

[a]Ordinal responses based on Likert scale: 1 = *strongly disagree*, 2 = *disagree*, 3 = *slightly disagree*, 4 = *neutral*, 5 = *slightly agree*, 6 = *agree*, 7 = *strongly agree*.

[b]NGO is reference category.

[c]Landowner self-reports using CE property as a full-time residence is reference category.

financial investment, sell for profit someday, operate a farm or ranch, hay or forage production, mineral extraction, livestock production, earn a profit, crop cultivation, operate a hunting enterprise, and recreational hunting or fishing.

The derived variables were used to create multinomial logistic regression models examining factors influencing land management on easement properties. Modeling results are reported using the $p$ value and the percentage change in odds, rather than the $\beta$ coefficient, to provide a more intuitive model interpretation. To avoid the elimination of marginal variables that could aid further research efforts, statistical significance was determined at $p < .10$, rather than the more traditional value of $p < .05$.

## Results

Of the 518 surveys sent to potential participants, 18 were returned due to incorrect addresses; therefore, the effective sample size was 500. Of these, 273 were returned; 251 were useable and 22 were either incomplete or from participants who indicated that they did not wish to participate in the survey. This translates into a 50% useable response rate (251 of 500) from the original sample. In addition, of the 227 nonresponding landowners who were sent an abbreviated questionnaire, 47 (21%) completed and returned it.

### *Respondent Profiles*

While 98% of respondents were Texas residents, we received completed questionnaires from five landowners residing in four additional states (Louisiana, Ohio, Colorado, and Florida). Most of the survey respondents were male (83%), well educated (mean years of formal education = 16.4, $SD = 3.2$), and were, on average, in their sixties ($M = 62$ years, range = 35–88, $SD = 11.2$), mirroring trends reported in other studies of conservation easement landowners (Ernst and Wallace 2008; Farmer et al. 2011). Additionally, 82% of the respondents were the original grantor of the conservation easement. Nearly half (45%) of respondents were absentee landowners of their easement properties, and 36% lived on their property full-time and 19% used their easement property as a weekend residence. The median size of easement property was 350 acres ($M = 1384$ acres, range = 1.3–30,000 acres, $SD = 3407.6$), and the mean length of ownership within the family was 38 years (range = 1–165 years, $SD = 43.1$). The majority of respondents (61%) did not generate any of their annual household income from their easement property, 34% reported earning 1–25% of their annual income from their CE land, and only 5% relied on their easement property for more than 25% of their annual income.

Returned survey questionnaires included easements held by 23 of the 33 identified easement-holding entities in Texas. The 10 easement-holding entities not represented in our response sample were all small, holding 16 conservation easements in total (3% of our population sample) between them. Sixty-one percent of respondents' easements were held by an NGO, 23% by a federal agency, and 16% by either a state or local government agency.

Using $\chi^2$ tests and $t$ tests, we compared survey respondents ($n = 251$) with those landowners who returned the abbreviated non-response survey ($n = 47$). Of the six survey items used in the nonresponse survey, we did not find any statistically significant differences between the survey respondents and nonrespondents for five of the six items (age, easement granting landowner, frequency of interaction between landowner and easement holder, residency on easement property, and willingness to comply with easement terms). However, when asked to react to "Given the option, I would terminate the conservation easement on my property," nonrespondents were

significantly ($p < .001$) more likely to agree with that statement. This suggests that the nonrespondents may, on average, have been less satisfied with their conservation easements.

### *Principal Components Analysis*

The dependent variables used in our regression models were developed using principal components analysis. Results of the PCA analysis (Table 2) revealed four separate indices: wildlife, range, water, and timber, which were named according to overarching management goals.

Two of the indices had $\alpha$ scores less than 0.700; the "range" subscale ($\alpha = 0.6802$) was accepted for subsequent analysis but the "water" subscale $\alpha$ score (0.6144) was considered unacceptably low and the two associated components were analyzed separately. Social science norms generally prefer $\alpha$ scores above 0.700 (UCLA Academic Technology Services 2012), but lower $\alpha$ scores are frequently viewed as adequate (Cortina 1993; Clark and Watson 1995).

In addition to the dependent variables, some of the independent variables used in the regression models, specifically those related to landownership motivations, were also derived using PCA. Analysis identified four index variables (Table 3), all of which had $\alpha$ scores $>0.700$.

**Table 2.** Rotated factor loading results of PCA analysis of conservation easement land management practices with Cronbach's $\alpha$ measuring internal scale reliability

| Management practice | Wildlife $\alpha = 0.7644$ | Range $\alpha = 0.6802$ | Water $\alpha = 0.6144$ | Timber $\alpha = 0.7598$ |
|---|---|---|---|---|
| Census wildlife | **0.5912** | −0.0175 | 0.2916 | 0.0289 |
| Supplemental food | **0.7102** | 0.0585 | 0.3299 | 0.3299 |
| Supplemental water | **0.6600** | 0.0648 | 0.3597 | −0.0896 |
| Selective buck/doe harvest | **0.8352** | 0.0418 | −0.0523 | −0.0523 |
| Control feral hogs | **0.6185** | 0.2234 | −0.1516 | −0.1516 |
| Use prescribed fire for brush control | 0.3174 | **0.5721** | 0.0512 | 0.0901 |
| Mechanical brush control | 0.2008 | **0.5462** | 0.2808 | −0.0358 |
| Chemical brush control | 0.0692 | **0.6485** | −0.0327 | 0.0590 |
| Chemical invasive control (other than brush) | 0.0064 | **0.7371** | 0.0291 | 0.1630 |
| Reseed rangelands with native grasses/forbs | 0.2481 | **0.4955** | 0.4110 | 0.0451 |
| Use riparian buffers | 0.0682 | 0.0350 | **0.7279** | 0.2345 |
| Control soil erosion | 0.2112 | 0.2379 | **0.6825** | 0.0561 |
| Reforest for $CO_2$ sequestration | 0.0496 | 0.1504 | 0.0829 | **0.8548** |
| Restore forests with native tree species | 0.0301 | 0.0135 | 0.0717 | **0.8826** |
| Eigenvalue | 4.28 | 1.98 | 1.60 | 1.17 |

*Note*. Boldfaced values indicate variables that load on a specific factor.

**Table 3.** Results of PCA analysis of landownership motivations with Cronbach's α measuring internal scale reliability

| Landownership motivations | Lifestyle/ recreation $\alpha = 0.7058$ | Investment $\alpha = 0.7866$ | Farming/ ranching $\alpha = 0.8417$ | Hunting/ fishing $\alpha = 0.7002$ | Overall mean response score[a] |
|---|---|---|---|---|---|
| Place to relax | **0.7985** | −0.0808 | 0.0134 | 0.0674 | 6.07 |
| Enjoy the outdoors | **0.8574** | −0.1222 | 0.0831 | 0.0344 | 6.39 |
| Manage wildlife | **0.6517** | 0.1471 | −0.1340 | 0.3232 | 5.76 |
| Non-hunting/ fishing recreation | **0.6425** | −0.0166 | −0.1762 | −0.0982 | 4.82 |
| Financial investment | 0.0066 | **0.8120** | 0.1605 | 0.2195 | 4.12 |
| Sell for profit someday | −0.1223 | **0.8376** | −0.0641 | 0.1855 | 3.15 |
| Operate farm/ ranch | 0.0380 | 0.0905 | **0.8546** | 0.2226 | 4.00 |
| Hay/forage production | −0.0184 | 0.0782 | **0.8544** | −0.0226 | 2.95 |
| Mineral extraction | −0.0138 | 0.3880 | **0.4762** | −0.0818 | 2.03 |
| Livestock production | −0.0315 | −0.0771 | **0.8384** | 0.2690 | 3.42 |
| Earn a profit | −0.2836 | 0.4636 | **0.5533** | 0.2676 | 3.45 |
| Crop cultivation | 0.1172 | 0.4476 | **0.5195** | −0.1993 | 2.16 |
| Operate hunting enterprise | −0.0195 | 0.2359 | 0.2356 | **0.7996** | 3.10 |
| Hunting/ fishing (recreational) | 0.2618 | 0.1997 | 0.1968 | **0.7390** | 4.71 |
| Eigenvalue | 2.48 | 1.68 | 4.07 | 1.00 | |

*Note*. Boldfaced results indicate variables that load on a particular factor.

[a]Mean response scores based on Likert scale: 1 = *not at all important*, 2 = *unimportant*, 3 = *somewhat unimportant*, 4 = *moderately important*, 5 = *somewhat important*, 6 = *important*, 7 = *very important*.

### *Regression Models*

The results of five regression models are presented in Table 4. These models explore how the variation in responses for the land management variables can be explained by 12 independent variables as predicted by our six hypotheses.

The first two hypotheses predicted that landowners expressing more satisfaction with their easement [*H1*] and the relationship with their easement holder [*H2*] would be more likely to conduct management on easement properties. The study produced only limited evidence to support those predictions. Satisfied landowners were 68% more likely to conduct range management practices on easement properties than dissatisfied landowners. In addition, landowners who were satisfied with their easement holders were 28% more likely to implement management practices that reduce soil erosion than landowners whose relationship with the easement holder was less satisfactory. However, the study did not produce any additional corroboration that landowner satisfaction with their easement and with their easement holder influenced the degree to which they applied conservation-oriented land management.

Similarly, the study did not provide widespread support for the hypothesis that grantor landowners were more likely to engage in land management than successive generation owners [*H3*]. The results indicate that grantor landowners were 145% more likely to conduct some timber management on easement lands than successive landowners, but there were no statistical differences with respect to the four other categories of conservation-oriented management actions.

The study provided evidence that ownership motivation does influence the level of engagement in various conservation-oriented land management actions [*H4*]. *Landowners motivated primarily by production* (i.e., farming and ranching) were 29% more likely to conduct range management activities, 36% less likely to manage riparian areas using buffers, and 39% less likely to be involved in timber management than those with other primary motivations for owning their land. As expected, *landowners motivated by wildlife-related recreation activities* were 25% more likely to conduct wildlife management practices on their property, but were not more likely to conduct other types of land management actions that may also benefit wildlife. In contrast, *landowners owning their easement land primarily as an investment* were 24% less likely to engage actively in rangeland management practices but they were 75% more likely to actively manage their timber resources. Although, overall, recreational landowners represented a large proportion of our study sample, the study found no evidence that this group of landowners participates in land management more than any of the other groups.

The study also produced results supporting our contention that institutional differences between easement holders affects land management actions [*H5*]. Compared to those with NGO-held easements, landowners with federally held easements were 63% less likely to conduct wildlife management but much (661%) more likely to engage in timber management. In addition, landowners with easements held by state or local agencies were 56% less likely to manage for timber than those whose easements were held by NGOs.

The study produced mixed results with respect to our final hypothesis that full-time residents would engage in increased management practices on easement lands [*H6*]. Absentee landowners were 77% less likely to manage for soil erosion, and weekend residents were 169% more likely to use riparian buffers to protect water resources than full time resident landowners.

The control variables incorporated in the regression models were in some cases associated with statistically significant patterns. The size of easement properties was found to be positively associated with soil erosion control actions and management for wildlife. In addition, the number of years of formal education was positively associated with level of engagement in practices aimed at protecting both riparian

**Table 4.** Logistic regression models of factors influencing management practices on easement properties

| Independent variables | Range management | | Wildlife management | | Riparian management | | Timber management | | Soil management | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Model $p < .031$* | | Model $p < .000$* | | Model $p < .011$* | | Model $p < .000$* | | Model $p < .0060$* | |
| | $p$ value | Percent Δ in odds | $p$ value | Percent Δ in odds | $p$ value | Percent Δ in odds | $p$ value | Percent Δ in odds | $p$ value | Percent Δ in odds |
| [H1] CE Satisfaction | **0.005** | **68.0** | 0.116 | −25.5 | 0.823 | −5.9 | 0.792 | 4.7 | 0.289 | 27.1 |
| [H2] CE Relationship | 0.417 | −8.5 | 0.619 | −5.3 | 0.266 | 20.0 | 0.236 | −12.7 | **0.091** | **28.1** |
| [H3] Grantor landowner | 0.546 | −21.6 | 0.126 | 86.7 | 0.243 | 113.5 | **0.032** | **145.5** | 0.563 | −26.9 |
| [H4] Ownership motive | | | | | | | | | | |
| Farming/ranching | **0.100** | **28.9** | 0.249 | −15.7 | **0.057** | **−36.4** | **0.001** | **−38.8** | 0.569 | 11.8 |
| Hunting/fishing | 0.432 | 5.9 | **0.002** | **25.4** | 0.456 | −7.4 | 0.428 | −5.7 | 0.380 | −7.8 |
| Investment | **0.062** | **−24.3** | 0.869 | 2.4 | 0.163 | 36.2 | **0.000** | **74.7** | 0.627 | 9.5 |
| Lifestyle/recreation | 0.892 | −2.0 | 0.447 | 12.9 | 0.470 | 17.6 | 0.969 | −0.5 | 0.777 | 5.4 |
| [H5] Easement holder | | | | | | | | | | |
| Federal government holder[a] | 0.308 | −30.5 | **0.006** | **−62.7** | 0.274 | 74.2 | **0.000** | **660.7** | 0.566 | 29.7 |
| State/local government holder[a] | 0.888 | −5.2 | 0.190 | 66.5 | 0.183 | 112.1 | **0.048** | **−55.5** | 0.224 | 95.3 |
| [H6] Landowner residency | | | | | | | | | | |
| Weekend resident[b] | 0.443 | 39.0 | 0.243 | 65.2 | **0.086** | **169.8** | 0.324 | −34.6 | 0.554 | −28.3 |
| Absentee landowner[b] | 0.855 | 6.4 | 0.947 | −2.2 | 0.532 | −26.9 | 0.718 | 13.5 | **0.001** | **−76.8** |
| Control variables | | | | | | | | | | |
| Size of easement (acres) | 0.856 | −1.6 | **0.000** | **60.9** | 0.657 | 6.1 | 0.127 | −12.7 | **0.026** | **30.4** |
| Years of education | 0.556 | 2.9 | 0.830 | −1.0 | **0.027** | **18.5** | 0.447 | −3.5 | **0.017** | **15.7** |
| Respondent age | **0.067** | **−2.4** | 0.574 | −0.8 | **0.086** | **−3.2** | 0.829 | 0.3 | **0.007** | **−4.8** |
| Length of easement property ownership | 0.950 | 0.0 | 0.590 | −0.4 | 0.542 | 0.6 | 0.794 | 0.2 | **0.057** | **−1.7** |

*Note*. Boldfaced results indicate significance at $p < .10$.
*Model significance measured using prob $> \chi^2$ results reported in model output.
[a]NGO is reference category.
[b]Full-time resident is reference category.

and soil resources. Statistically, age of survey respondents was negatively correlated with active management for riparian and soil resources but the trend was small. Similarly, while length of easement property ownership was negatively associated with management for soil erosion, the effect was negligible.

## Discussion

The results of this study suggest a more nuanced answer than our original hypotheses predicted. Specifically, there are many different reasons why landowners choose to conduct conservation minded management on their properties. While the study did find instances where social relationships between landowners and easement holders appear to influence management activities of landowners, motivations for owning land and institutional effects of easement holders appear to have a greater influence on conservation-oriented land management behavior.

In explaining the seemingly negligible effects of landowner/easement holder relations, lack of capacity in easement holding institutions may be preventing formation of strong social networks as demonstrated in the Rissman and Sayre (2012) case study. In areas where landowners and conservation easement organization staff work closely together, it is possible that those relationships may drive increased management on protected properties. Most easement-holding organizations in Texas have staff members that oversee compliance monitoring of easement terms as a part of their overall duties, but few have staff members dedicated to providing outreach to their conservation easement landowner partners. Easement-holding institutions, particularly those with a large easement portfolio, should dedicate staff specifically focused on easement landowner outreach that promotes increased conservation management practices on protected properties. In return for providing technical guidance, easement holders could implement appropriate ecological monitoring of conservation targets on easement-protected properties. Many current easements do not make provisions for ecological monitoring, and even those that do include monitoring of biological targets in the easement provisions rarely conduct it (Rissman et al. 2013). Other studies have demonstrated that many easement programs find it difficult to measure the success of their efforts beyond the number of acres protected and dollars raised and spent on the acquisition of easements (Alexander and Hess 2012). This so-called ''bucks and acres'' measurement does not provide any quantitative, scientifically based information to the public about the overall effectiveness of conservation easements in protecting ecosystems. Including the right for easement holders to monitor conservation targets is necessary for designing effective, adaptive easement management plans and for measuring the success of the implementation of these plans. This should be a priority for easement drafters in the future. Not only will ecological monitoring improve management, but demonstration of actual conservation accomplishments, such as improved ground cover, water quality, or increased populations of endangered species, will provide a stronger justification for continued support from funders and policymakers for easement programs (Rissman et al. 2007; Wallace et al. 2008).

This study found differences in management between properties with different easement-holding organizations. In part, this might be explained by differences in the goals of these organizations. For example, the greater engagement in timber management reported on properties with federally owned easements is likely the

product of agency programmatic goals. While federal agency easement-holding organizations in Texas included the U.S. Fish and Wildlife Service (USFWS) and the Natural Resources Conservation Service (NRCS), 54 out of 59 of the respondents included in this category were held by the NRCS. Most of these are enrolled in the Wetland Reserve Program, which includes a restoration component, often including reforestation, in the initial phase of the easement; this likely explains the higher level of timber management on these properties. Conversely, the comparative decrease in timber management on state and local agency-held easements might be due to the fact that many of these easements are located in the central part of the state, where woodland savannas are the predominant land cover and therefore many of the timber management practices measured in this study are not relevant. Inflexibility on the part of government agency easement holders may also be suppressing or preventing management actions on some easement properties, as evidenced by the decreased wildlife management reported on federally held easements (Rissman et al. 2013). However, easement-holding organizations could encourage enhanced management by incorporating mechanisms in the easement instrument that allow for more adaptive management strategies (Miller et al. 2010; Rissman 2010; Rissman et al. 2013). Several landowners expressed frustration concerning the lack of adaptive management accommodation within the framework of their easement restrictions. As one landowner commented:

> Most conservation easements I have seen and mine are not flexible enough to adapt as new best practices emerge and as we learn more about the specific property. For example, [the survey] lists some land management practices I would probably use that are not allowed by my easement.

The results of the study reinforce previous research that has found landownership motivation to be a significant factor driving management, even on landscapes that are already protected (Gosnell et al. 2006; Kreuter et al. 2008; Sorice et al. 2012). This study found that production, investment, and consumptive recreation-oriented (i.e., hunting/fishing) landowners were all likely to manage their land in ways that enhance their goals. In contrast, amenity landowners (those who own their properties primarily for nonconsumptive recreation) represented a large proportion of our respondents but were not more likely than landowners in the other ownership motivation groups to implement management practices that would benefit the conservation values of their land. Other studies have found that recreational landowners who are not dependent on their land for income are less likely to conduct environmental management (Lai and Lyons 2011). We suspect that many amenity-oriented landowners may be unsure how to implement land management practices that benefit recreationally valuable conservation targets. Amenity-oriented landowners will probably continue to be the landowner group that is most likely to grant easements (Brenner et al. 2013). However, future landownership transfers will include changes in ownership motivations, some of which may hinder land management actions necessary to support the original purposes of easement (Mendham and Curtis 2010). Easement holders developing outreach programs designed to encourage management on conservation easement lands should consider the variety of landownership motivations and provide targeted information to different landowner cohorts.

To enhance conservation-oriented management on easement lands, easement holders should also work closely with landowner-driven peer-to-peer learning

networks and cooperative management groups. Such social networks have been shown to increase knowledge of and management for conservation outcomes in a variety of contexts and are easily tailored for differing landownership motivations (Wagner et al. 2007; Toledo et al. 2012; Kueper, Sagor, and Becker 2013; Twidwell et al. 2013). This type of bottom-up learning approach has also been shown to foster trust between participants, encourage a sense of self-empowerment, and motivate landowners to engage in increased management (Kueper, Sagor, and Becker 2013). Finally, outreach programs need to consider landowners' residency on their easement properties. While the community-based, social capital models may work well with resident landowners who maintain strong local ties, they are generally less accessible to absentee landowners. Previous research indicates that both nonresidents and weekend residents respond well to direct mail outreach, particularly if it is followed up with a one-on-one consultation with a natural resource professional (Petrzelka, Buman, and Ridgely 2009).

While we feel that this study provides important preliminary evidence relating to natural resource management on conservation easement protected lands, there are several limitations that should be addressed in future research. First, while the study area encompassed a large state that is both ecologically and culturally diverse, it is possible that management trends observed here may differ considerably in other areas. Second, while our survey questionnaire asked landowners whether or not they have a good relationship and how often they interacted with their easement holder, our data do not provide an in-depth understanding of the exact nature of landowner easement holder relationships. In other words, a landowner may express having a good relationship with his or her easement holder despite having little to no interaction with the easement holder. Conversely, landowners may report frequent interaction between themselves and their easement holders but that interaction may not be positive. In addition, analysis of our nonrespondent survey indicated that landowners' level of dissatisfaction with their conservation easement may be underreported in our sample: a result we feel is mitigated by our overall response rate (50%). Our study design also did not provide a mechanism for capturing landowners who intentionally choose to allow plant community succession on their land without active management interventions. Finally, our methodology for measuring land management relied on the use of dichotomous response variables, which limited our ability to measure the frequency of reported management activities. Future studies should consider capturing both a broader range of management practices and a more robust temporal analysis of management. Despite the limitations of this study, understanding how protected landscapes are managed and encouraging management actions that support both the ecological functions and recreational values on easement properties are paramount to ensuring that conservation easements are effective as a long-term conservation mechanism.

In conclusion, if perpetual conservation easement programs are to be successful tools for landscape protection, both landowners and easement holders need to consider and provide for consistent, active, adaptive management that protects and enhances the integrity, function, and resilience of the ecosystem. Preservation is not enough to sustain ecosystem services provided by protected open spaces. Easement holders should carefully consider appropriate flexibility mechanisms that facilitate adaptive management actions in response to changing environmental and social conditions. In addition, conducting ecological monitoring on easement properties is necessary to determine the efficacy of an easement with respect to its stated objectives

and to guide adaptive management decisions. Finally, developing strategies promoting greater management cooperation between landowners and their easement-holding partners is critical for sustaining the ecological benefits of easement protection over the long term. To achieve this, landownership motivations of both the easement grantors and successive generations owning easement-encumbered properties need to be addressed in order to ensure that landowners are encouraged to manage their land in ways that are consistent with the stated purpose of the easement. Increasing reliance on conservation easements as a primary land protection tool necessitates the ability to accurately assess the efficacy of easements from social, economic, and biological perspectives. Particularly as the easement protection model is being implemented internationally (Fairfax et al. 2005; Pidot 2005; Iftekhar, Tisdell, and Gilfedder 2014), refining this tool so that it meets the needs of both society and the private landowners living with the restrictions is paramount.

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