Conservation Easements: Biodiversity Protection and Private Use

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Abstract: *Conservation easements are one of the primary tools for conserving biodiversity on private land. Despite their increasing use, little quantitative data are available on what species and habitats conservation easements aim to protect, how much structural development they allow, or what types of land use they commonly permit. To address these knowledge gaps, we surveyed staff responsible for 119 conservation easements established by the largest nonprofit easement holder, The Nature Conservancy, between 1985 and 2004. Most easements (80%) aimed to provide core habitat to protect species or communities on-site, and nearly all were designed to reduce development. Conservation easements also allowed for a wide range of private uses, which may result in additional fragmentation and habitat disturbance. Some residential or commercial use, new structures, or subdivision of the property were permitted on 85% of sampled conservation easements. Over half (56%) allowed some additional buildings, of which 60% restricted structure size or building area. Working landscape easements with ranching, forestry, or farming made up nearly half (46%) of the easement properties sampled and were more likely than easements without these uses to be designated as buffers to enhance biodiversity in the surrounding area. Our results demonstrate the need for clear restrictions on building and subdivision in easements, research on the compatibility of private uses on easement land, and greater public understanding of the trade-offs implicit in the use of conservation easements for biodiversity conservation.*

Keywords: biodiversity protection, conservation easement, land trust, land use, private-land conservation, The Nature Conservancy, working landscape

Concesiones para Conservación: Protección de Biodiversidad y Uso Privado

Resumen: *Las concesiones para conservación son una de las herramientas primarias para la conservación de biodiversidad en tierras privadas. No obstante que su uso ha incrementado, existen escasos datos cuantitativos sobre las especies y hábitats que se busca proteger con las concesiones para conservación, cuánto desarrollo estructural permiten o que tipos de uso de suelo permiten. Para atender estas lagunas de conocimiento, encuestamos a personal responsable de 119 concesiones para conservación establecidas entre 1985 y 2004 por el mayor concesionario sin fines de lucro, The Nature Conservancy. La mayoría de las concesiones (80%) trataban de proporcionar hábitat para proteger especies o comunidades in situ, y casi todas estaban diseñadas para reducir el desarrollo. Las concesiones para conservación también permitieron una amplia gama de usos privados, lo que puede resultar en fragmentación y perturbación de hábitat adicionales. En 85% de las concesiones para conservación muestreadas se permitía algún uso comercial o residencial, nuevas estructuras o la subdivisión de la propiedad. Mas de la mitad (56%) permitió la construcción de edificios adicionales, de*

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los cuales 60% restringió el tamaño de la estructura o la superficie construida. Las concesiones en paisajes de trabajo con ganadería, silvicultura o agricultura comprendieron casi la mitad (46%) de las concesiones muestreadas y tuvieron mayor probabilidad de ser designadas como amortiguamientos para enriquecer la biodiversidad en el área circundante que las concesiones sin estos usos de suelo. Nuestros resultados demuestran la necesidad de restricciones para la construcción o subdivisión en las concesiones, de investigar sobre la compatibilidad de los usos privados en terrenos concesionados, y de mayor entendimiento público de las ventajas y desventajas implícitas en la utilización de concesiones para conservación para la conservación de biodiversidad.

Palabras Clave: comodato, concesiones para conservación, conservación en tierras privadas, paisaje de trabajo, protección de la biodiversidad, The Nature Conservancy, uso de suelo

Introduction

Private, working landscapes surrounding nature reserves are critical for conservation of biodiversity and maintenance of ecosystem processes (Knight 1999; Groves et al. 2000). Privately owned land tends to be more productive, more mesic, and lower in elevation than public land in the United States (Scott et al. 2001) and can provide connectivity and buffer public nature reserves (Wright 1998). Some or all of the habitat for 85% of federally listed endangered species is found on private land (U.S. General Accounting Office 1994). To ensure that private lands contribute to conservation, land trusts and government agencies are increasingly relying on conservation easements (Fairfax et al. 2005). Conservation easements are typically voluntary agreements with private landowners in which land trusts or government agencies acquire and hold interests in property in order to restrict land use, in most cases permanently (Gustanski & Squires 2000; Lippmann 2004). In return private landowners may receive a payment and/or reduction in taxes (Byers & Ponte 2005). Despite the increasing acreage and public investment in conservation easements, little is known about the ecological and sociological outcomes of easements at the local or landscape scale (Merenlender et al. 2004; Yuan-Farrell et al. 2005).

Under U.S. state law, conservation easements can be created to protect a wide range of resources including land with agricultural, historical, natural, cultural, or scenic values. In the United States local and state land trusts hold conservation easements on over 2.5 million ha (6.2 million acres), and government agencies and national nonprofit organizations also have sizable holdings under easement (Land Trust Alliance 2006). Easements are a particularly popular tool for reducing development and land conversion, and may be tailored to address other threats to biodiversity (Byers & Ponte 2005).

Because easements are designed to meet a variety of objectives beyond restricting development and can permit a range of commercial activities, they exist along a gradient between areas protected from all uses and areas that permit intensive land use. Critics have commented anecdotally on particular excesses of residential or commercial development on easement properties that are clearly in conflict with conservation purposes (Stephens & Ottaway 2003). Negative public response has accompanied private economic use (including timber harvest) on some conservation easements (Reiterman 2005). Although it was not implemented, a congressional report recommended removing the federal income tax deduction for easements on land with the donor's personal residence, arguing that a personal residence "makes it difficult to determine whether a significant public benefit or conservation purpose is served by the contribution" (Joint Committee on Taxation 2005).

Remarkably, the extensive debate about easements has been conducted with little data on conservation easement agreements, especially on a national scale. Merenlender et al. (2004) suggest that many easements allow several houses to be built on a property, but they do not provide data on residential use. Crehan et al. (2005) address residences on land trust easements in Georgia and report that 38 of 56 easements (68%) permit residences and 7 (13%) allow some subdivision of the property. Conservation easement purposes and restrictions related to water, development, forest management, ecosystem and rare species protection, extraction, and recreation were reported in a survey of 82 large (over 400 ha [1000 ac]) working forest easements in the United States, but the extent or intensity of allowed residential or commercial use was not quantified (Block et al. 2004). Ecological monitoring could provide important information on species and habitat persistence on conservation easements, but these data are also generally limited. For instance, working forest easements have a range of ecological monitoring from no monitoring to some properties with substantial monitoring of water quality and forest change (Block et al. 2004). An earlier study found little quantitative ecological monitoring of easements in the San Francisco Bay Area (Bay Area Open Space Council 1999).

We were interested in determining how conservation easements have been structured to protect biodiversity. In particular we examined the relationship between the purposes of conservation easements, the species and habitats

of conservation concern on easement lands, the threats conservation easements aim to abate, and allowances for residential and commercial uses. We focused on easements to protect biodiversity, examining conservation easements established by The Nature Conservancy. The Nature Conservancy is the largest nonprofit holder of conservation easements in the United States with 1.3 million ha (3.2 million acres) (Kiesecker et al. 2007), which represents a substantial proportion of nonprofit-held easements.

We conducted an intensive survey of 119 easements in eight states to characterize conservation easement attributes and evaluate concerns about easement effectiveness.

First we asked, what are the conservation purposes and conservation targets of these easements, and what threats to biodiversity do the easements aim to address? We expected easement purposes to be focused on biodiversity conservation, the mission of The Nature Conservancy, but to be variable because easements are individually negotiated for each property. More specifically, we expected easements that protect core habitat for conservation targets to have tighter restrictions on development because core areas may be more sensitive to disturbance, whereas buffer areas often allow for multiple uses (Noss & Cooperrider 1994; McLaughlin 2002). Because development is an increasing threat to habitat on private land (Wilcove et al. 1998), we expected respondents to indicate that easements are primarily designed to reduce development and to address a range of other threats (Byers & Ponte 2005).

Second we asked, what is the extent and intensity of permitted residential and structural development and how have these uses changed over time? We hypothesized that recently negotiated easements have more specific restrictions on permitted development and subdivision given lessons learned from early, more general easement agreements (Byers & Ponte 2005) and due to increased public scrutiny of easement allowances. The types of development might be different for easements on privately and publicly owned land because of differing priorities of private landowners and public land managers.

Third we asked whether ranching, forestry, farming, recreation, or other commercial uses are allowed on easements and whether these practices are associated with additional permitted structures. Protected-area networks typically include working landscapes as buffers for core protected land given the potential incompatibility of extensive human use and core habitat protection (Possingham et al. 2006). Our survey allowed us to test whether working landscapes are more likely than other types of easements to serve as buffers. We also expected management plans to be more commonly applied to working landscape easements because easement holders want to reduce the potential impacts of those uses on natural resources with an adaptive management approach (Block et al. 2004). Ours is the first systematic analysis of biodiversity protection, development restrictions, and commercial use on conservation easements based on a national data set.

Methods

Sampling

In 2005 we conducted a survey to collect detailed information on 119 conservation easements established by The Nature Conservancy in eight states. The states were selected to represent diverse geographies and varied approaches to the use of conservation easements. Ten to 11 easements established in each time period, 1985–1994 and 1995–2004, were randomly selected from each state to ensure a sufficient sample of older easements. States with fewer than 10 easements per decade included all existing easements for that time period, resulting in a total of 47 easements from 1985 to 1994 and 72 easements from 1995 to 2004. Conservation easements were selected from the following states (number of easements included in parentheses): California (21), Florida (19), Maryland (10), Michigan (10), New Hampshire (16), Texas (17), Washington (6), and Wyoming (20). The Nature Conservancy staff person most familiar with each easement answered detailed survey questions about the easement, its conservation context, targets, purposes, uses, and monitoring. Over 92% of the easements in our random sample were monitored or acquired after January 2002, which means that the responses of conservation professionals are based on recent experience with the property, either through monitoring or property assessments that accompany a new acquisition. Respondents relied heavily on the easement documents, in particular on the easement itself, and in some cases on the easement documentation report or monitoring reports. Our survey did not directly incorporate the property knowledge of landowners or land managers. All surveys were conducted between January and August of 2005. Survey instruments, survey data, and additional information on sampling design can be found online at http://conserveonline.org/workspaces/TNC Easement Study.

Important Terminology

We define the following terms associated with biodiversity conservation easements to clarify their use in our survey and analysis: *conservation purpose*, *conservation target*, *conservation threat*, *buffer*, *development restrictions*, *building envelope*, *development rank*, *surrounding land use*.

We asked survey respondents to describe both the conservation purposes stated in the easement document

and additional programmatic purposes from supplemental documents. For easement donors to receive federal tax benefits, easements must meet the standards for charitable deductions, which include having a qualified conservation purpose. The Internal Revenue Service describes four qualified conservation purposes: public outdoor recreation or education; protection of a relatively natural habitat of fish, wildlife, plants, or similar ecosystem; the preservation of open space including farmland and forest land either for public scenic enjoyment or pursuant to governmental conservation policy; and preservation of an historically important land area or certified historic structure (Treasury Regulation § 1.170A-14(d)(1)-(5) 2001).

A conservation target is a species or natural community of conservation concern that represents the diversity of life in an ecosystem (Parrish et al. 2003). For each conservation target, respondents were asked to indicate whether the easement provided connectivity for that target, served as a buffer (defined below), or provided core habitat on-site. Respondents could mark more than one choice and were asked to indicate which of these three (connectivity, buffer, and core) were the primary and secondary roles of the easement in protecting each conservation target.

Conservation threats are defined as land use or other anthropogenic disturbances at the local or landscape level that can negatively affect conservation targets.

We considered lands with conservation purposes and functions that include enhancing biodiversity protection in surrounding core habitat areas buffers. We asked respondents whether buffers were an overall purpose for the easement and whether the easement served as a buffer for specific conservation targets. Easements that served a buffer purpose were all within 3.2 km (2 miles) of another protected area.

Development restrictions on subdivision and new structures are typically explicit in easement documents. Easements may restrict the number, type, building size, or building envelope (defined below) of permitted new structures.

Easements may define a building envelope—typically a small area that can have new buildings—to minimize potential impacts on on-site resources. In some easements larger zones such as a "base of operations zone" for a ranch of several thousand hectares are designated to concentrate activity in a particular area within a much larger landscape. Both small building sites and larger zones were included as building envelopes.

A development rank was assigned to categorize the number and type of new structures permitted by each easement: 0, no new structures; 1, nonbuilding structures only; 2, cabins, picnic shelters, or sheds only; 3, ranching-related structures only; 4, one residence with outbuildings; 5, an education, management, or research station; 6, a residence with outbuildings plus ranching-related structures or a cabin; 7, two or more new residences. Development rank did not include structures already in place when the easement was established.

Surrounding land use was defined as the most extensive land use within a 24-km (10-mile) radius around each property. Land uses were ranked on a scale from 1 to 5: 1, wilderness; 2, rural with minimal land use; 3, rural with commercial timber, grazing, or agriculture; 4, rural residential; 5, residential subdivision.

Analyses

Analyses to summarize data and test associations among easement purposes, conservation targets, conservation threats, and residential and commercial uses were performed in JMP (version 5.0, SAS Institute, Cary, North Carolina). We summarized survey data on easement purposes, conservation targets, and conservation threats. Statistical analyses of easement purposes relied on the combined total of stated and additional purposes. Using a chi-square analysis, we tested the hypothesis that The Nature Conservancy is more likely to limit residences or commercial uses on properties providing core habitat for any target. Odds ratios (OR) are presented for chi-square tests and logistic regressions. The odds ratio is the probability of a categorical variable being a "yes" divided by the probability of that variable being a "no" (Agresti & Finlay 1997). Easement establishment date was included in statistical tests as a continuous variable.

We evaluated the extent and intensity of residential and structural development permitted on the sampled easements. To test the effect of easement size and establishment date on the likelihood of residential use at the time of the survey, we used multinomial logistic regression. Easement allowances for permitted development were quantified by a development rank, the number of new permitted buildings, the presence of a building envelope or building size restrictions, and the ability to subdivide. Size of the property under easement, easement establishment date, state, surrounding land use, easement purpose of promoting compatible grazing, easement purpose of protecting historic values, and acquisition type (purchased or donated) were included in an ordinal regression model to explore how well these variables explain an easement's development rank. We report Kendall's tau-b as a measurement of association for ordinal regressions with development rank as the dependent variable. Values of Kendall's tau-b range from 1, indicating the strongest positive relationship, to –1, indicating the strongest negative relationship (Agresti & Finlay 1997). We performed a linear regression to examine the influence of property size on building envelope size. We used logistic regression to examine the influence of easement establishment date on the likelihood of the easement prohibiting subdivision of the property.

We summarized the frequency of ranching, recreation, farming, forestry, lodging, and other uses that bring an economic return to the landowner. We used logistic regression to test our hypothesis that recent easements are more likely to allow these land uses. We tested the hypothesis that easements with commercial uses are more likely to allow residences and have a higher number of new structures with logistic regression, including easement size as a covariate in the model. Whether easements with ranching are more likely to have residences than non-ranching easements and whether working landscapes in general are more likely to serve as buffers to enhance biodiversity in the surrounding area were examined with chi-square analysis. We assumed that easements with commercial land uses would be more likely to have a management plan, and we tested this with a chi-square analysis.

Results

Easement Purposes, Conservation Targets, and Conservation Threats

Survey respondents identified 24 types of conservation purposes stated in the easements themselves or supplied from supplemental documents. Each easement had multiple purposes. Purposes common to 10% or more of the easements were primarily ecological (Table 1).

Other less common purposes included protecting unique resources such as a cliff or geothermal feature (seven easements), fostering landowner or community relations (five), natural water and nutrient retention with rights to flood, flow and store water on the property (three), satisfaction of mitigation requirements (two), and cultivating relationships with donors (two). All but 5 of the 119 sampled conservation easements identified biodiversity targets, with a total of 376 targets reported. Targets included important habitats such as freshwater tidal wetlands, oak (*Quercus* ssp.) woodlands, and short-grass prairie; populations of migratory wildlife; and endangered or threatened species such as the Florida panther (*Puma concolor* ssp. *coryi*), Black-capped Vireo (*Vireo atricapillus*), and slender Orcutt grass (*Orcuttia tenuis*).

When asked whether the easement served a primary or a secondary role in providing core habitat, buffer habitat, or landscape connectivity for up to five targets per easement, respondents indicated that easements primarily provided core habitat (258 targets) rather than buffer habitat (60 targets) or landscape connectivity (88 targets). The majority (80%) of easements provided core habitat as either a primary or a secondary role for at least one target. Contrary to our expectations, easement lands that served as a core property for conservation targets were no less likely than easement lands that served only a buffer or connectivity role for designated targets to have residences ($\chi^2 = 0.80$, $p = 0.3727$) or commercial uses ($\chi^2 = 2.38$, $p = 0.1231$). The five easements without targets listed were excluded from this analysis.

Conservation targets were reported to have declined in 6 of 114 easement properties (5%) since the easement's creation. The eight targets that declined in six easements were the green sea turtle (*Chelonia mydas*), northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*), overwintering Redhead Duck population (*Aythya americana*), a coastal spit and red fescue community (*Festuca rubra*), a freshwater marsh, the South Fork Shoshone river drainage, and an American beech-southern magnolia-white oak/ironwood/eastern hornbeam-American holly forest (*Fagus grandifolia-Magnolia grandiflora-Quercus alba/Carpinus caroliniana/Ostrya virginiana-Ilex opaca* var. *opaca*). Riparian areas on two other easements were reported to be negatively influenced by invasive species and third-party all-terrain vehicle use.

Nearly all (98%) of the easements addressed either development or fragmentation threats, in addition to other major conservation threats (Fig. 1). Almost half (44%) of

Table 1. The number and purpose of conservation easements ($n = 119$) identified by The Nature Conservancy staff based on easement documents and supplemental project documentation.

Purpose	*Easement document*	*Additional project documents only*	*Total*
Retain property and habitat undisturbed in a natural condition	119	0	119
Prevent uses that would impair, degrade, or interfere with conservation values	94	0	94
Protect aquatic, marine, or wetland habitat and communities	47	14	61
Contribute to connectivity of surrounding protected areas	16	11	27
Accommodate educational or scientific activities	21	3	24
Provide public access, services, or scenic enjoyment	21	3	24
Protect habitat for animal migration routes	18	6	24
Prohibit certain further development activities, fragmentation	17	6	23
Protect endangered species	10	13	23
Buffer habitat or natural landscape feature	10	11	21
Provide for restoration activities	13	3	16
Promote compatible or heritage grazing	12	2	14
Protect historic value (i.e., land uses, structures)	5	7	12

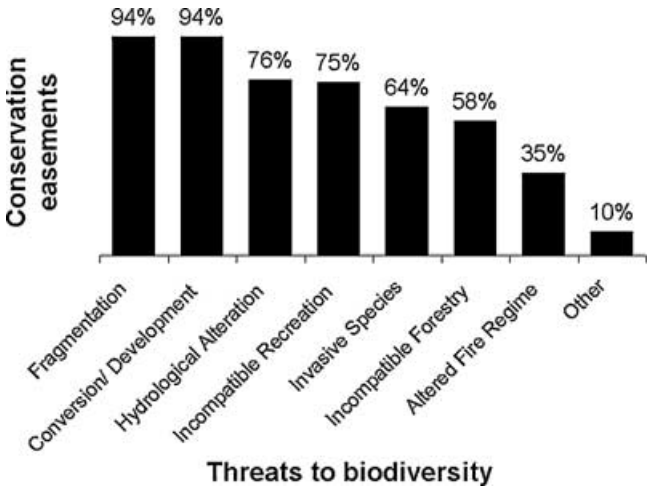

Figure 1. Conservation threats that the 119 sampled conservation easements aim to abate, as indicated by survey respondents from The Nature Conservancy. Respondents could indicate multiple threats for each easement.

the easements were reported to be in a project area with increasing development or fragmentation threat.

Residences and Structures

Fifty-two (44%) of surveyed easements had one or more residences at the time of the survey. Thirteen percent of easements were the site of the landowner's primary residence, 22% had the landowner's secondary residence, and 17% had a residence for the landowner's employees. Residences were more likely to occur on larger easements (log ha, $p = 0.0011$, OR = 86.02) and recently acquired easements (year easement established, $p = 0.0122$, OR = 9.24), and there was a significant date*log hectare interaction term ($p = 0.0022$, OR = 774.38) and a whole-model p value < 0.0001. Only 26% of the easements established between 1985 and 1994 had residential dwellings, whereas 56% of the easements established between 1995 and 2004 had residential dwellings. An additional 16 easements did not have a residence at the time of the survey but permitted a residence in the future.

Development rankings indicated a range of uses and intensities of new permitted structures. One easement allowed development but did not include enough information on rank. No new structures were permitted on over one-third of easements (rank 0, 38%), whereas other easements permitted only nonbuilding structures such as an observation platform, dam, or bat gate (rank 1, 6%); one or more cabins, picnic shelters, or sheds (rank 2, 5%); ranching-related nonresidential structures such as barns and outbuildings (rank 3, 8%); one new residence with outbuildings (rank 4, 12%); a future education, research, or management station (rank 5, 5%); or one residence with outbuildings and an additional nonresidential structure such as a ranching improvement or cabin (rank 6, 6%). One-fifth of easements permitted two or more new residences (rank 7, 20%).

The type of future permitted development on public land or land owned by a nonprofit group ($n = 19$) was different from on land owned by private individuals or corporations ($n = 100$) in that none of the easements on public or nonprofit land permitted future development of a cabin or any ranching-related structures (development ranks 2, 3, and 6). For land owned by private individuals or corporations, the development rank was positively correlated with both easement size ($p < 0.0001$, Kendall's tau-b = 0.33) and establishment date ($p = 0.0286$, Kendall's tau-b = 0.18). State, surrounding land use, easement purpose of compatible grazing, easement purpose of protecting historic values, and acquisition type (donated or purchased) did not contribute significantly to the resulting ordinal regression model.

Easements had a wide range of permitted new structures, building envelope sizes, and building size restrictions for new buildings (Table 2). States varied in the proportion of easements that allowed new buildings and that included building size or building envelope area restrictions for new buildings (Fig. 2). Over time, easements became more likely to permit new buildings ($p = 0.0374$, OR = 3.89) and more likely to have a building envelope or building size restriction on new buildings ($p = 0.0002$, OR = 16.23). Although these restrictions have become more common, over the past 5 years (2000–2004) one-third (33%) of the easements that permit some new buildings still have no building envelopes or building size restrictions for those structures. Building envelope size was roughly proportional to easement property size, although two easements allowed for significantly larger envelopes than similarly sized properties (Fig. 3). Most easements (67%, $n = 80$) prohibited the property from being subdivided, and over time the proportion of easements

Table 2. Allowances for new structures and restrictions on building size or building envelope for the subset of easements that include these restrictions.

	Median	*Range*
Approximate number of new structures allowed ($n = 119$)	1	0–15
Building envelope (ha) ($n = 29$)	4 (10 acres)	0.8–299 (2–734 acres)
Easement area in building envelope (%)[a] ($n = 29$)	1.6	<0.1–48.1
Total size of permitted buildings (m^2) ($n = 23$)	325 (3,500 ft^2)	18–2973[b] (192–32,000 ft^2)

[a] *Typically a small area that can have new buildings.*
[b] *This 3268-ha easement allows for eight residences of 372 m^2 (4000 ft^2) each.*

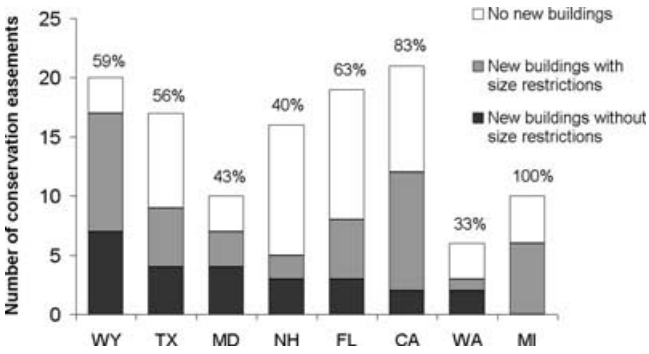

*Figure 2. Conservation easements (*n = *119) divided into three categories of building restrictions for each state (WY, Wyoming; TX, Texas; MD, Maryland; NH, New Hampshire; FL, Florida; CA, California; WA, Washington; and MI, Michigan): no new buildings (development rank 0 or 1), building size and/or area (building envelope) restrictions on new buildings, and no building size or area restrictions on new buildings. Numbers above bars are the percentage of easements with new buildings that also had a building size or area restriction.*

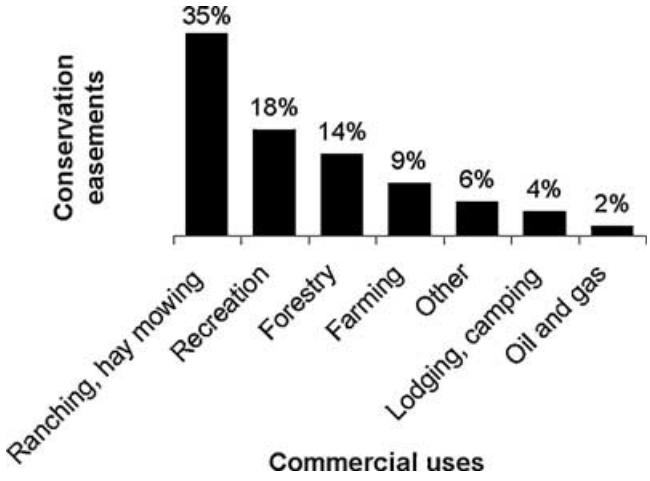

Figure 4. The percentage of sampled easements with each type of commercial use. Of the 119 sampled easements, 63 had one or more commercial use. The oil and gas use was one of several write-in responses under the "other" category in the survey. Horse stables, an agricultural office, mining without surface disturbance, a shellfish operation, and dog breeding were also in the other category.

that prohibited subdivision increased ($p = 0.0021$, OR = 8.33).

Working Landscapes

Half of the easements (53%) allowed for some type of commercial land use such as ranching, recreation, forestry, farming, or lodging and camping (Fig. 4). Of the 119 sampled easements, 56 had no commercial uses, 34 had one commercial use, and 29 had two or more commercial uses. There was no change in the likelihood of easements having any type of commercial use over time. Easements with commercial uses tended to be larger (log ha, $p = 0.0009$, OR = 1058.63), but the existence of residences ($p = 0.9777$) and the number of permitted structures ($p = 0.6447$) did not contribute significantly to the logistic model.

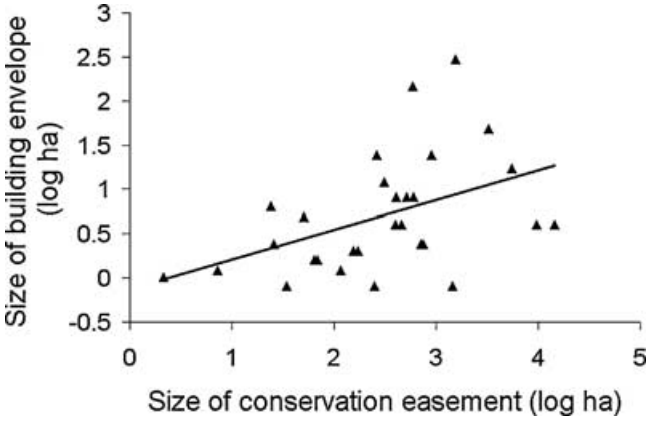

*Figure 3. Relationship between size of the conservation easement and size of the building envelope (area restriction for new permitted buildings). Size of the building envelope (log ha) = –0.1206 + 0.3392 * conservation easement size (log ha) (*n = *29,* p = *0.0089, adjusted* $R^2 = 0.20$*).*

Almost one-third (16 of 55, or 29%) of easements with ranching, forestry, or farming were established to serve a buffer function to enhance biodiversity in the surrounding area, whereas 8% (5 of 64) of other sampled easements were identified as serving a buffer function, which is a significant difference ($\chi^2 = 9.26$, $p = 0.0023$, OR = 4.76). Over three-quarters (76%) of the easements established for buffer purposes supported these traditional rural land uses.

Easements with commercial uses were significantly more likely to have management plans than easements without these uses ($\chi^2 = 5.89$, $p = 0.0152$, OR = 2.51). Management plans were in place on 71% of easements with forestry and 48% of easements with ranching.

Commercial recreation ranged from minimal activities such as seasonal hunting camps to more extensive recreational facilities. Commercial recreation is distinct from public recreation or other public access, which occurred on 26% (31 of 119) of easements. Only 19% (19 of 100) of sampled conservation easements on private land had public recreation or other public access.

Two Wyoming easements provided for oil and gas development. In these cases mineral rights were not held by the surface landowner, so oil and gas development could not be prohibited by the easement. Language regarding

the surface rights for these two easements was crafted in an attempt to minimize potential impacts on the property's conservation value.

Discussion

Nearly all sampled easements were intended to reduce habitat loss and fragmentation, the primary threat to biodiversity (Wilcove et al. 1998; Hansen et al. 2005). In accordance with this goal, almost all easements restricted development to some extent ($n = 118$). On the other hand, 85% of sampled easements allowed for a residence, new permitted structures, commercial use, or some subdivision of the property.

Over time easements have become more likely to restrict subdivision. Early easements provided land trusts with an important lesson: even without additional development, subdivision of the property can create problems because it requires a land trust to maintain relationships with multiple landowners and may fragment land management. In general, clear limits on subdivision of the property should be included in any easement.

In contrast with the trend of increasing restrictions on subdivision, easements have become more likely to allow residences. The development rank, or extent and intensity of permitted structures, on land owned by a private individual or corporation is higher for larger and more recent easements. These trends could be the result of shifting demographics among landowners seeking easements and may reflect that a growing proportion of landowners are interested in negotiating easements as strategic investments rather than from a predominantly charitable intent (McLaughlin 2002; Small 2003). As land trusts increasingly purchase large easements in which the seller maintains some opportunity for financial gain, conservation biologists will need to evaluate the trade-offs between private use and biodiversity protection. Overall, sampled easements restricted development relative to the size of the easement area. Larger easements can be expected to allow more structural development because development density will continue to be low.

A few cases stood out, however, because they allowed considerable development or lacked limitations on future development. One small (15-ha) easement on public land had a management plan but no development or commercial use restrictions. Two easements had large potential building areas with allowances for new residential and ranching buildings, a tennis court, swimming pool, and other outbuildings. Another small (2-ha) easement had half its area in a building envelope. This property was donated as trade land to generate revenue for other acquisitions, and sold with an easement to protect biological resources on the property. Future research could examine the relationship between low-density residential development often found on easement properties, and the cumulative, often nonlinear impacts on biodiversity (Maestas et al. 2003; Hansen et al. 2005).

Given that some easement sellers will not foreclose all development options, restrictions on building size and building envelope area become especially important tools. Such restrictions were applied in 60% of the easements that allowed new buildings. Other easements specified the number and type of structures but did not limit their size. Some of the easements without building envelopes or building size limitations required case-by-case approval from The Nature Conservancy on the location of new structures. Future easements would benefit from a defined maximum limit on building envelope size, restriction of the location of the building envelope, and restrictions that limit the spatial extent of impervious cover within any building envelope.

In addition to development, other threats such as extraction of minerals or export of water may not be addressed through conservation easements if the surface landowner does not hold water rights or mineral, oil, and gas subsurface rights. Restricting water use through a tool designed to control land use has other limitations as well (King 2004). On easements with a significant likelihood of third-party mining, including oil and gas development, the anticipated impacts of these activities on the conservation values of the property will need to be considered carefully.

Easements established to buffer conservation lands were more likely than easements that did not serve as buffers to have ranching, farming, or forestry. This finding supports the concept that conservation organizations see working landscapes as important buffers for public or private nature reserves. Nevertheless, 80% of the easements in our sample aimed to maintain specific conservation targets on the property itself. Working landscapes are generally anticipated to function as buffers but may require greater scrutiny for properties providing core habitat protection (Noss & Cooperrider 1994; McLaughlin 2002).

The compatibility of human uses and biodiversity in protected areas is variable and widely debated (Naughton-Treves et al. 2005). For that reason monitoring of conservation targets is needed. In the case of easements, which are less restrictive than nature reserves, the need to monitor may be more acute. Only 20% of easements in our sample had quantitative monitoring programs. Qualitative information suggested the status of conservation targets is steady or improving on nearly all (95%) easements, but this information is subjective and may be unreliable. Ecological monitoring is limited by funding, technical expertise, staff time, and in some cases a preference for allocating resources to conservation acquisition over monitoring. There is a need for more deliberate thinking regarding the implementation of monitoring programs of variable cost, rigor, and intensity.

In an ideal world easements that allow commercial activities would have well-designed quantitative monitoring

programs and engage in adaptive management. Easement language on adaptive management is particularly important given that easements are designed to persist in perpetuity. Although some easements in our study allowed for consultation on invasive species, prescribed burning, and other resource management, the terms of most easements do not specifically allow The Nature Conservancy to actively or adaptively manage properties in undefined ways in the future. Many easement properties with forestry or ranching had land management plans, which typically allow for agreement on prescriptive forestry and ranch management operations and provide the flexibility for those prescriptions to change through regular consultation between the land manager and easement holder. Easements or associated management plans may also influence agricultural practices such as tilling and pesticide and fertilizer use. Going forward, the land trust community may need to expand existing efforts to make adaptive management a common feature of conservation easements, especially for the larger forest and ranching easements that represent substantial investments.

The purpose of an easement sets the standard for future enforcement and any amendment of the easement (McLaughlin 2006). If easement purposes are not relevant in the future, the easement may become more susceptible to legal challenges (McLaughlin 2005). We found that most easement purposes reflected ecological goals, whereas many also included education, scenic enjoyment, public access, or compatible grazing.

The Land Trust Alliance has instituted many changes to address legal challenges and concerns about valuation and taxation on conservation easements (Cheever 1996; Pidot 2005) through its revised Standards and Practices and voluntary accreditation program (Land Trust Alliance 2004). These guidelines do not directly address the extent and intensity of private uses that should be allowed on conservation easements for the protection of biodiversity and ecosystem services. Land trusts have a variety of objectives, and holding all land trusts to a standard for easement agreements designed to protect biodiversity is not appropriate. Nevertheless, the majority of land trusts aim to protect wetlands, river corridors, nature preserves, or habitat for threatened or endangered species (Land Trust Alliance 2000). In addition to voluntary measures undertaken by the land trust community, standardizing conservation easements to improve their consistency and effectiveness could involve government oversight, either at the federal or state level (Pidot 2005). Land trusts must balance the need for flexibility and landowner engagement with the need to maintain the public's confidence in land trusts and conservation easements. Additional research should evaluate when easements provide an appropriate balance of private gain and public benefit and assess easements' contributions in a regional conservation context.

It is a mistake to think of easements as nature reserves—most conservation easements involve trade-offs between biodiversity protection and development in an effort to secure some protection for private lands for a reasonable amount of investment. Our analyses suggest the need for (1) clear guidelines for building and subdivision, scaled according to property context, purpose, and size; (2) research on the compatibility of private uses on conservation easement lands, particularly for easements that protect core target habitat; and (3) increased public understanding of the protection status ensured by conservation easements.

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