Integrating conservation and development in the field: implementing ecosystem service projects

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Ecosystem services can bridge biodiversity conservation and development needs, but there is little information available on how conservation organizations implement such projects. We documented 103 ecosystem service projects – from 37 countries – implemented by The Nature Conservancy (TNC) and the World Wildlife Fund (WWF). These projects commonly involved traditional conservation tactics, such as land purchase and restoration, but also adopted new approaches, such as targeting working landscapes, using new financial tools, and drawing new funding and partners from the corporate sector. We identified nine specific project types, characterized by consistent combinations of tools and activities. TNC and WWF used project types differently; TNC focused more on land purchase, whereas WWF concentrated more on developing markets. Both organizations showed some alignment of project type with socioeconomic conditions. For example, land purchases were used in countries with relatively secure property rights, while access to clean water or food was targeted when these human needs were unmet.

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There is a crucial need to align conservation and development, as emphasized by the Brundtland Commission (UN 1987), the Rio Declaration in 1992, the conventions on biological diversity and climate change, and the Millennium Ecosystem Assessment (MA 2005). Conservation organizations have begun to grapple with this challenge, primarily by implementing a rapidly growing array of projects that focus on ecosystem services – the goods and services that nature provides to people (Daily *et al.* 1997). Yet, the success of conservation and development programs is plagued by the perception that it is difficult to integrate these two objectives consistently.

Ecosystem services provide a new platform for the old challenge of aligning conservation and development, but there is skepticism within the environmental community, because applying an ecosystem services-based approach to conservation is untested and risky. There are a few well-known cases where ecosystem services have brought returns for both conservation and human welfare; in the Catskills watershed, for instance, New York City's water municipality has purchased land and makes payments to landowners for changing practices to improve water quality for the city's drinking water supply (Daily and Ellison 2002; Sánchez-Azofeifa *et al.* 2007). A few reviews describe the use of particular ecosystem service finance tools (eg easements [Yuan-Ferrell *et al.* 2005; Kiesecker *et al.* 2007], forest-related markets [Landell-Mills and Porras 2002], payments to upland poor in developed countries [Gouyon 2003], and watershed payments [FAO 2004]). These examples provide some idea of what conditions are necessary for particular tools to be successful (eg payments for ecosystem services [PES]; Pagiola *et al.* 2005). However, there is still no comprehensive, global assessment of the extent to which ecosystem services are being used to support conservation and how such projects are operating under the full spectrum of social, ecological, and economic conditions worldwide.

With the growing interest in finding solutions that will benefit both conservation and society, conservation organizations have rapidly designed and implemented a number of ecosystem service projects, despite the lack of any guiding theory. One of the most basic needs is simply to catalogue what has been done. Here, we take a step toward this goal by systematically documenting a subset of the projects that The Nature Conservancy (TNC) and the World Wildlife Fund (WWF) have implemented, in which ecosystem services are used as a tool for aligning conservation and development. We describe the general infrastructure of these ecosystem service projects and their application. We identify nine different types of projects in which conservation practitioners have used the suite of tools available in consistent, distinct ways. Finally, we discuss patterns in the way TNC and WWF use different project types in various socioeconomic contexts. Because little theory exists, our analyses are largely exploratory.

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Methods

Database

We created a database of 103 ecosystem service projects, representing a subset of projects implemented by TNC (n = 55) and WWF (n = 48). We defined ecosystem service projects as any sustained effort directed toward protecting species, habitats, or community types that follows explicit conservation objectives and has the use or preservation of at least one ecosystem service as a goal or strategy. We included ecosystem services provided by both pristine and managed landscapes (eg pollination of agricultural crops by native pollinators, timber production, etc), and we identified projects by soliciting information directly from the chief executive officer of WWF and the chief scientist of TNC and by searching organization web pages. These methods allowed us to identify 340 projects, which we then contacted. The response rate was approximately 30%, so that 103 projects were included in the database. This subset of projects is arbitrary, since it is based solely on whether we received a response to our requests, and may therefore be biased. The majority of identified, but non-responding projects were in Africa.

Two observers collected project information through a series of semi-structured, open-ended interviews with project personnel (Yin 2003), who also validated database entries. The information collected included 162 project attributes describing basic project information (eg project manager, region, date started), rationale (eg goals, biodiversity targets, ecosystem service targets, targeted threats), partner and funder information (what type of funder: government, non-profit, corporate, etc, and partner/funder motivation), landscape details (eg pre- and post-project land ownership, land use, land cover, etc), finance tools used (eg rights transfers, such as easements and fee acquisitions, as well as fees, subsidies, or markets), institutional (policy) and social tools used, conservation actions encouraged (best management practices, research, protection, restoration), other implementation approaches (eg allowable human uses, ecosystem service market details), valuations and analyses completed, and monitoring programs employed (biological, economic, and/or social). For more detailed information on the attributes in the database, see Goldman *et al.* (2008). The database will also be made publicly available through the Natural Capital Project (www.naturalcapitalproject.org).

Identifying project types

We identified ecosystem service project types by grouping sets of projects with similar attributes. We used the 82 project attributes that were present in more than five ecosystem service projects to identify nine project groups using a hierarchical clustering (average linkage) algorithm. To identify specific project attributes that were important in shaping the clustering, we used classification tree analysis. We verified that projects were statistically more similar within, rather than between, the hierarchical levels of the classification tree using an analysis of similarity (ANOSIM) on groups formed at each node of the tree (eg terrestrial versus marine projects, global R = 0.241, P = 0.001). All analyses were done in S-Plus or R statistical packages.

Exploring project context

Having identified different types of projects, we explored several hypotheses regarding the choice of project type. Each project was applied in some social, economic, political, and environmental context, and it is possible that this context influenced the design of the project. We identified several theories in the literature or from common knowledge that suggested how project design may be influenced by the project's socioecological context, leading to the following hypotheses:

Hypothesis 1: All ecosystem service projects will be implemented in countries with relatively secure property rights.

Hypothesis 2: Project types that use property rights as a financial tool will be implemented in countries that have more secure property rights than project types that use other financial tools.

Hypothesis 3: Project types that target watershed services (eg water quality, soil retention, carbon sequestration) will be implemented in countries with poorer drinking-water quality than project types that target other ecosystem services.

Hypothesis 4: Project types that target the provision of food as an ecosystem service will be implemented in countries with a greater food shortage than project types that target other ecosystem services.

Hypotheses 1 and 2 were addressed using data on property rights security obtained from The Heritage Foundation's Economic Freedom Index (Beach and Kane 2008). We used data on rural and urban water sources from the World Health Organization and UNICEF, compiled by the World Bank (World Bank 2007a), to address Hypothesis 3. These data identified the percentage of the rural or urban population that did not have access to improved water in 2004. Hypothesis 4 was addressed using data from UNICEF (2006) on child malnutrition rates, defined as the percentage of children under the age of 5 who weighed less than 2 standard deviations of the international reference population mean weight for that age group. We made the assumption that child malnutrition rates were higher in

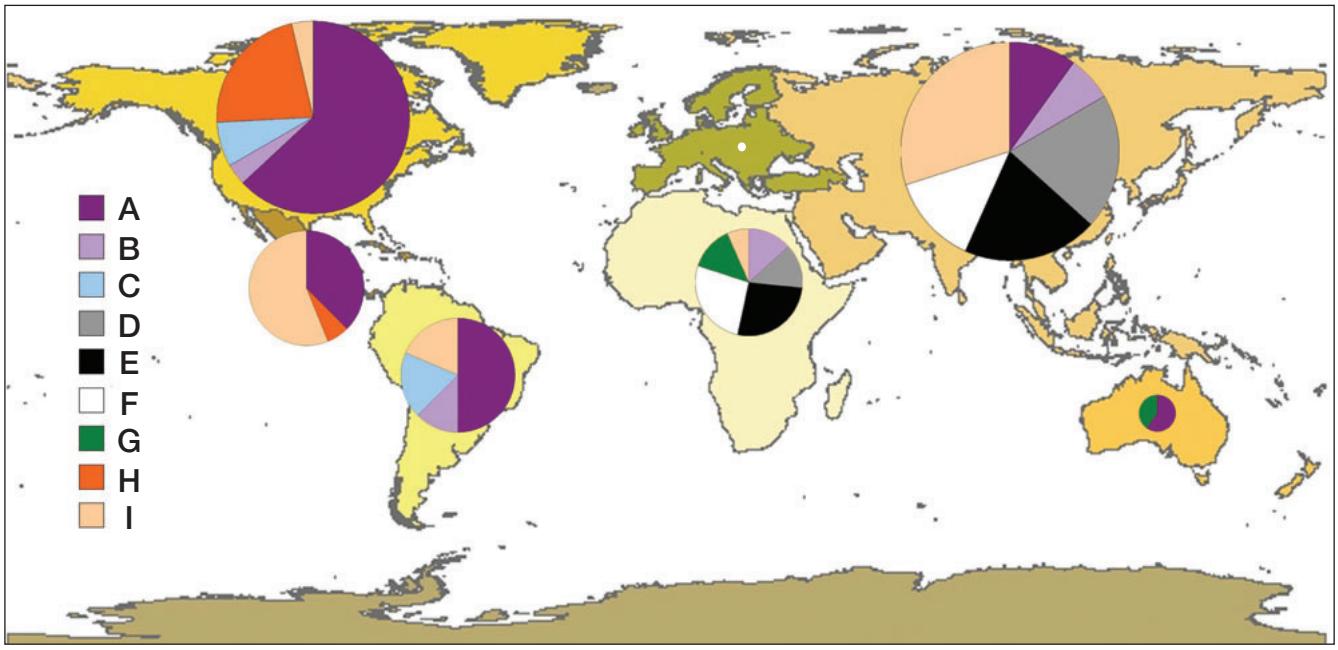

Figure 1. *Application of ecosystem service approaches in seven major global regions. The size of each pie chart is proportional to the total number of projects included in our analysis from that region. The small white dot in Europe represents a single project. The approaches correspond to those described in Table 1; A = Government Acquisition on Private Lands, B = Frontier Markets for Water from Public Lands, C = Industry Payments on Private Lands, D = Fees for Food from Public Lands, E = Frontier Markets for Food (NTFPs) from Public Lands, F = Frontier Markets on Private Lands, G = Non-Industry Payments on Private Lands, H = Integrated Coastal Conservation, I = Fees for Fish.*

the countries with more severe food shortages. All context data were at national levels, although most projects were implemented at subnational scales, so there is a clear but unavoidable mismatch in scale. To explore the influence of the organizations' missions and geographical coverage on project design, we assessed the above hypotheses separately for TNC and WWF.

Given the exploratory nature of these analyses, we did not apply any statistical analyses, but looked to see whether broad patterns in the data suggested agreement with the hypotheses. The sample size in each case was 119, because projects implemented in more than one country were considered separate projects.

Results

General patterns

Ecosystem services have been used to motivate conservation across the globe (Figure 1). As previously mentioned, we systematically documented 55 and 48 projects conducted by TNC and WWF, respectively. The majority of projects were from Asia (30 projects) and North America (27 projects), but all continents except Antarctica were represented by at least one project. Ecosystem service projects have been used to abate all major types of threat to biodiversity, although most target habitat destruction (Figure 2a). Encouragement of best management practices was the most commonly used conservation approach (Figure 2b). However, nearly half of the projects in our database focused on protection of species, habitats, or landscapes. Overall, most funders were non-profit organizations (Figure 2c). Project funding levels ranged from US$1000 to US$1 billion (n = 67 projects), with the most common level of funding falling between US$100 000 and US$1 million (Figure 2d). Projects were implemented on both converted (56%) and native (45%) landscapes and, in most cases (61%), ownership did not change hands during the project.

Discrete project types

We identified combinations of project attributes that were consistently used together, leading to the classification of project types (Table 1). For example, several projects used taxpayer dollars to buy land or easements to protect private lands, providing fish, or promoting soil conservation, or water-related services. These constitute the "Government Acquisition on Private Lands" project type (see Panel 1 for examples). The nine different project types can be differentiated by seven key attributes or eight project branches (pre-project land use is the defining characteristic for two branches; Figure 5) that classify projects to types with 85% accuracy (15% misclassification). Given that the project groups were defined using a multivariate cluster analysis, we were surprised that the regression tree classified the projects so well, using only seven single variables, with variation in each completely defining the split at each node. We used these key attributes, along with others that we highlighted qualitatively,

to describe the types of projects identified by classification analysis (Table 1).

The name given to each project type was based on its most common attributes, and those that best distinguished it from other types. For example, "Frontier Markets for Water from Public Lands" and "Frontier Markets for Food from Public Lands" both involved water-related services, but water was targeted much more often by the projects in the former category. Similarly, project types that involved "markets for" a service were not necessarily selling that service, but used some kind of market to provide that service. For example, the "Frontier Markets for Water from Public Lands" type used carbon and certified timber markets to enhance forest management, resulting in improvements in water services.

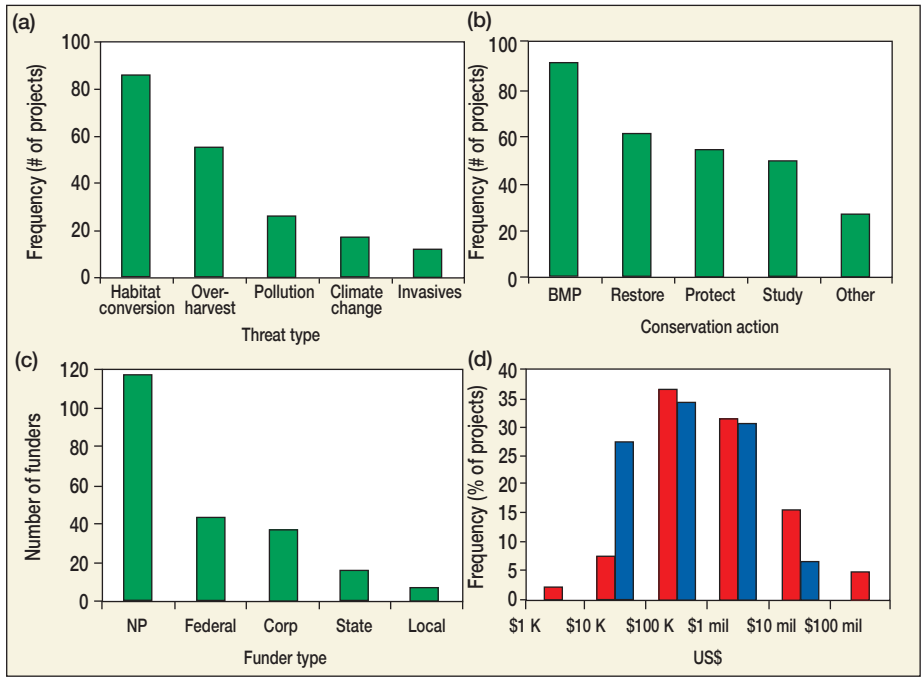

Figure 2. *General patterns in ecosystem service project design. (a) Number of projects addressing major threats to biodiversity. (b) Number of projects using different conservation actions (BMP = best management practices). (c) Number of funders from different sectors (NP = non-profit/non-governmental organization; Corp = private, for-profit corporation). Two funding sources are not shown: one academic and one private landowner. (d) Number of projects with different ranges of funding (bars are placed between the numbers, indicating the endpoints of the range being represented). Red and blue bars represent funding for TNC and WWF projects, respectively.*

Several different project types used markets as the key finance tool. We called three of these types "frontier" markets, because they targeted lands that were experiencing primary habitat conversion (mostly forest clearing) at the initiation of the project. "Frontier Markets on Private Lands" was the only project type that partnered primarily with corporate entities (Table 1; Panel 1). This project type, together with "Frontier Markets for Food from Public Lands", were only applied outside the Americas (Figure 1).

Project types were not applied equally around the world (Figure 1), nor were they applied equally by the two organizations (Table 1). TNC more frequently used project types that involved property rights transfer as the financial tool. Moreover, only TNC used "Industry Payments on Private Lands", whereas WWF mainly used project types that involved food provision.

Pairing financial tools with property rights

Hypotheses 1 and 2: Property rights

Ecosystem service projects were implemented in countries covering almost the entire range of property rights security, as defined by The Heritage Foundation's Property Rights Index (index range = 10–90 on a scale of 0–100). TNC and WWF work under considerably different conditions, with WWF implementing projects in countries characterized by, on average, less secure property rights (Figure 6a). However, we found that both organizations tended to implement projects using property rights transfers as the key financial tool in countries with more secure rights (Figure 6a).

Providing services to address food and water security

Hypothesis 3: Water quality

Ecosystem service-based projects were implemented in countries where 0–74% of the rural population live without access to improved water. Drinking water conditions are generally better in urban areas, with 0–36% of urban populations living without improved water. WWF worked in those countries where, overall, drinking water conditions were worse (Figure 7). Examination of TNC projects suggested that watershed services were targeted more often in countries with poorer drinking water conditions (red symbols in Figure 7), while WWF projects did not follow this pattern (blue symbols in Figure 7).

Hypothesis 4: Food provision

Child malnutrition rates in countries where ecosystem service projects had been implemented ranged from 2–47% (Figure 6b). Again, WWF worked under more severe conditions, sponsored projects in countries with more than double the average child malnutrition rate (blue symbols in Figure 6b). Projects designed by both organizations targeted food services more often when

Table 1. Characteristics of ecosystem service project types identified by classification tree analysis

Initial land cover	System type	Land owner	Finance tool	Action	Partners	Who pays for ecosystem services?	Initial land use	Final land use	Targeted ecosystem services[2]	Main NGO[3]	Cluster[4]	Ecosystem service project type
Converted	T and M[1]	Private	Rights transfer	Restore	Non-profit	Non-profit Taxpayer	Recreation Sustainable fishing Unsustainable fishing	Recreation Reserve	Water Soil Fish	TNC (100%)	H (6, 2)	Integrated Coastal Conservation
	Terrestrial			Protect		Taxpayer Non-profit	Sustainable grazing	Reserve	Water Recreation	TNC (81%)	A (37, 13)	Government Acquisition on Private Lands
			Markets	Research		Industry Domestic Non-profit	Other crops Commodity crops Subsistence farming Sustainable grazing Selective logging	Other crops Reserve Other use Commodity crops Subsistence farming	Water Soil Fish Recreation	TNC (100%)	C (5, 3)	Industry Payments on Private Lands
				Best management practices		Taxpayer Domestic Non-profit	Subsistence farming Sustainable grazing Nature reserve Residential development Primary forest clearing	Subsistence farming Sustainable grazing Reserve Specialty crops Residential development	Food Water Recreation Medicine Other cultural	WWF (100%)	G (5, 4)	Non-Industry Payments on Private Lands
					Corporate	Industry Domestic Taxpayer	Primary forest clearing Subsistence farming Residential development	Subsistence farming Sustainable agriculture Reserve	Food Timber Other cultural Medicine Water	WWF (100%)	F (5, 5)	Frontier Markets on Private Lands
		Government			Non-profit	Industry Non-profit	Primary forest clearing Subsistence farming Selective logging	Sustainable agriculture Reserve Recreation	Water Recreation Carbon Timber	TNC (57%)	B (6, 6)	Frontier Markets for Water from Public Lands
Native						Domestic Non-profit	Primary forest clearing Residential development Commercial development Commodity crops Recreation	Sustainable timber Reserve Recreation Subsistence farming	Food Recreation Water Medicine Timber	WWF (60%)	E (10, 6)	Frontier Markets for Food (NTFPs)[6] from Public Lands
			Fees			Domestic Non-profit	Recreation Nature reserve Residential development Selective logging Subsistence farming	Recreation Subsistence farming Sustainable agriculture Reserve Sustainable grazing	Food Water Recreation Other Cultural Other	WWF (100%)	D (6, 5)	Markets for Food from Public Lands
	T and M					Domestic	Unsustainable fishing Sustainable fishing Recreation	Reserve Sustainable fishing Recreation	Fish Water Recreation Other cultural Food	WWF (78%)	I (20, 21[5])	Fees for Fish

Notes: [1]Terrestrial and marine. [2]Only the five most frequently targeted services are listed. [3]NGO most commonly using the prescription (% of projects implemented by that NGO). [4]Cluster letters correspond with the letters in the classification tree in Figure 5 (number of projects in approach, number of countries in approach). [5]One project is applied in several countries, allowing the total number of countries to be greater than the total number of projects. [6]NTFP = non-timber forest products. When food is a service being provided from native landscapes, it is usually in the form of bushmeat or other NTFPs.

hunger levels (as represented by child malnutrition) were high (Figure 6b), although this pattern is stronger for TNC projects.

Discussion

Ecosystem service projects diversify the conservation toolbox

TNC and WWF have implemented ecosystem service projects in 37 countries worldwide (Figure 1). Although encouraging best management practices is the most common conservation approach applied through ecosystem service projects, classic conservation approaches, such as restoration and preservation, are also very common (Figure 2b). Goldman *et al.* (2008), working with a subset of the TNC projects taken from the same database, found that ecosystem service projects addressed the same threats, and used protection-based approaches with the same frequency, as traditional biodiversity conservation projects. In addition, the level of funding secured by ecosystem service projects (Figure 2d), espe-

Panel 1. Case examples of two discrete ecosystem service project types

"Government Acquisition on Private Lands" – cluster A

In general, projects that fall within the type "Government Acquisition on Private Lands" use the provision of water and recreation opportunities to motivate governments or non-profit organizations to fund the purchase or easement of rights on converted, private lands and turn them into protected reserves. This is a very common project type (Table 1), and one such project has been established in the USA by TNC. Along the Cosumnes River in California (Figures 3, 4), TNC, the US Federal Government (specifically, the Bureau of Land Management [BLM]), and Ducks Unlimited are working to restore the river's natural floodplain and hydrology for biodiversity conservation and the improvement of water quality and supply, flood control, and recreational opportunities. The area is dominated by ranchlands, and this project has used a combination of taxpayer dollars (through BLM) and non-profit funds (through TNC and Ducks Unlimited) to purchase private lands or easements. Preservation is the main goal, but some parts of the landscape have been maintained as ranchland, where improved management practices have led to sustainable grazing. Recreation and education are also encouraged in the project area, delivering additional benefits to the local community.

Figure 3. *Valesin Forest in Cosumnes River Preserve, CA. Grazed until 1998.*

"Frontier Markets on Private Lands" – cluster F

In a very different approach, WWF has designed several projects that aim to improve the conservation value of converted, private lands by using markets to encourage best management practices. This is the only project type we identified where corporate partners are commonly involved. One project of this type was initiated in 2004 in Portugal, Spain, Morocco, and Tunisia. In these countries, cork oak (*Quercus suber*) is a major forestry species, used mainly to produce wine corks, representing a US$1.9 billion per year industry. Cork oak is native to this region, but its cultivation for cork products is largely unsustainable and, in many areas, is less profitable than agriculture and urban development. As a result, the extent of cork oak woodlands continues to dwindle. WWF has partnered with the Forestry Stewardship Council (FSC) to improve the profitability of sustainable cork production from native oak by strengthening the certified cork niche market. The project encourages companies to obtain FSC certification and promotes FSC-certified corks to wine makers and consumers, in the hope that a profitable market for certified products will ensure the long-term persistence of cork oak woodlands and the cultural heritage tied to these landscapes.

Figure 4. *Oak restoration in the Cosumnes lower floodplain, CA. Annual crops until the mid-1990s.*

cially from corporations, supports the idea that an ecosystem service focus can attract substantial amounts of revenue from the private sector (Wunder 2007; Goldman *et al.* 2008).

Discrete project types exist

Beyond documenting the "state of the art" in ecosystem service approaches to conservation, we looked at whether the two organizations implemented projects in consistent, distinct ways that could be classified as "project types". We were able to identify nine different project types (Table 1; Figure 5; see Panel 1 for examples). Some pairings are not surprising (eg the use of property rights transfers on private, but not public, lands). Other findings, such as the lack of any purely marine project types, warrant further study.

We identified four project types aimed at environmental improvement of managed landscapes together with continued economic production and a focus on food provision: "Markets for Food from Public Lands", "Frontier Markets for Food (Non-Timber Forest Products or NTFPs) from Public Lands", "Frontier Markets on Private Lands", and "Non-Industry Payments on Private Lands" (Figure 5, clusters D, E, F, G; Table 1; Panel 1). These project types, combined with others that targeted converted lands (Table 1), reveal an emphasis on working landscapes – landscapes that are traditionally underserved by projects that only target biodiversity conservation. Working landscapes often harbor a substantial fraction of biodiversity (Tilman *et al.* 2002) and represent important opportunities for harmonizing conservation and development (Folke *et al.* 1996). Targeting these areas is becoming increasingly important, given that over 40% of Earth's land surface is now used for agriculture or as pasture, a proportion that is likely to increase (Foley *et al.* 2005).

Although some project types did involve new tools for conservation, we found a surprising prevalence of old tools as well. The project type used in the greatest num-

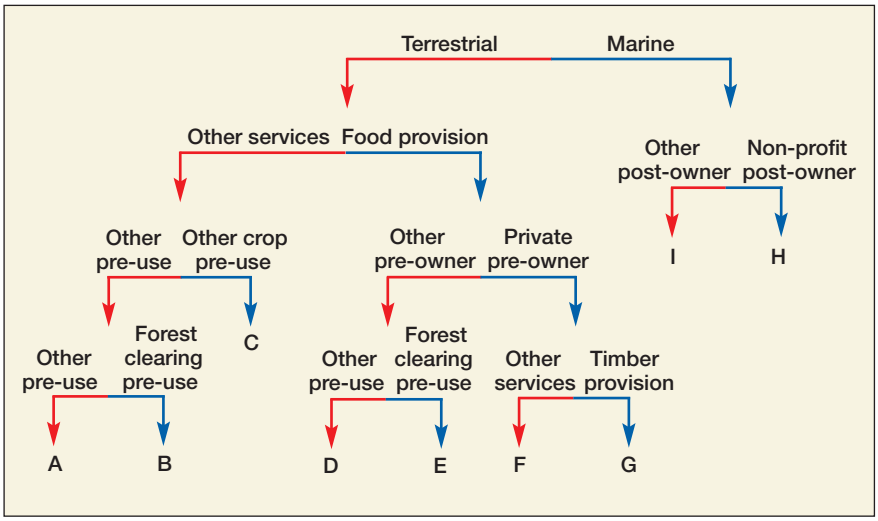

Figure 5. *Classification tree identifying groups of ecosystem service projects with similar attributes. Words on the tree identify the key attributes that define each split of the tree. For example, projects in type "I" were in a marine system, where the owner at the end of the project was not a non-profit group. "Pre-" and "post-" prefixes refer to attributes before and after project implementation, respectively. For example, "post-owner" refers to the type of land ownership after the project was implemented.*

ber of projects (37) was "Government Acquisition on Private Lands" (Table 1; Panel 1). Projects of this type used public or non-profit funds to purchase ownership rights or easements to protect private lands, a fairly classic approach to conservation (Kiesecker *et al.* 2007). Despite fears within the conservation community that such approaches will be abandoned because of a focus on ecosystem services, we found such methods being applied broadly in ecosystem service projects.

The implementation of project types varied across geographic regions and between organizations, with TNC and WWF each using distinct sets of project types. Those that rely on property rights transfers to acquire land or easements were favored by TNC, whereas WWF most often used market-based approaches. Rights-based approaches were much more commonly used in the Americas, while market-based methods were prevalent in Africa and Asia (Figure 1). WWF also showed a greater focus on the provision of food as a key ecosystem service, while TNC usually concentrated on water-related services (Table 1). Our findings suggest that each organization has a larger suite of tools at their disposal than they are currently using. Is it their missions and their histories, or the socioeconomic characteristics of their geographical ranges that influences their preferences for particular project types?

Pairing financial tools with property rights

Given the variation in the project types being implemented by TNC and WWF in different countries, we looked at whether this was connected with the organization itself or with the socioeconomic conditions in those countries. Good governance and secure property rights were the two most important factors in the success of ecosystem service programs (eg Gouyon 2003; Pagiola *et al.* 2004; Grieg-Gran *et al.* 2006; Wunder 2007). Given the strong emphasis in the literature on the need for clear and enforceable property rights, one would expect that all ecosystem service projects would be implemented in countries with relatively secure property rights, and that project types involving property rights transfers (easements or land purchases) as a financial tool would be implemented in countries with more secure property rights than project types using other financial tools. Our findings run counter to the former expectation and support the latter. We have documented ecosystem services projects in countries with some of the poorest property rights conditions in the world (Heritage Foundation Property Rights Index = 10 on a scale from 0–100; Figure 6a). The application of this type of approach under such conditions emphasizes how broadly such methods can be used, although we recognize that the final outcome of these projects is as yet unknown.

On the whole, our findings suggest that both organizations chose financial tools in alignment with the prevailing property rights situation. Rights transfers were used more often when property rights were relatively secure (Figure 6a), as the literature suggests (Gouyon 2003; Grieg-Gran *et al.* 2006). However, market-based mechanisms were used more frequently in developing countries where institutions were generally weaker (Figures 1 and 6a). In the past, market-based approaches have delivered the best and most equitable outcomes for conservation and society in developed countries (Gouyon 2003), but they have been useful even in the absence of strong institutions. In fact, one market approach ("Frontier Markets for Water from Public Lands") was used only in Africa and Asia (Figure 1). Several market-based projects also used legal strategies, such as altering land ownership (15%), changing administration (20%) or development rights (20%), or establishing a new market cap (12%), thereby creating a stronger institutional framework in the region. By bringing new financial tools to bear on conservation issues, the ecosystem service approach may be broadening the range of social conditions under which conservation organizations can function.

Providing services to address food and water security

Ecosystem services are direct links between environmental conditions and human well-being. Conservation organizations that use ecosystem services in their work should

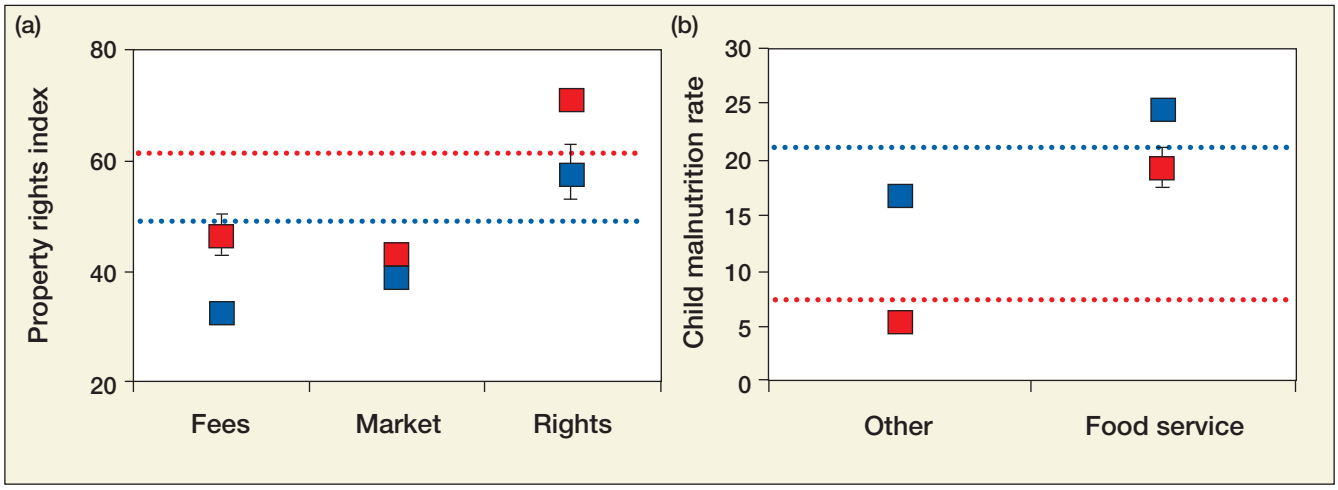

Figure 6. *Average property rights index in countries where TNC (red) or WWF (blue) used different conservation finance tools (a), and average child malnutrition rates in countries where TNC (red) or WWF (blue) targeted food provision or other ecosystem services (b). Dotted lines represent the overall average property rights index (a) and overall child malnutrition rate (b) of all projects implemented by the organization. Error bars represent standard error.*

try to make the most of this connection and design projects that address major social needs in the project region (eg in the case of child malnutrition; Figure 6b). WWF works in countries with, on average, more than double the levels of child malnutrition than those in which TNC operates, but both organizations implemented projects focusing on food provision in countries with high rates of child malnutrition. TNC also showed this pattern with water quality, implementing projects that focused on provision of clean water in countries with fewer improved water sources for both rural and urban populations (Figure 7).

As discussed above, the two organizations work under different conditions in terms of property rights, clean water sources, and child malnutrition rates. The same pattern is seen in terms of average gross domestic product per capita (TNC = US$23 831 ± $325 person^{-1} yr^{-1}; WWF = US$8839 ± $171 person^{-1} yr^{-1}; CIA World Factbook, available at www.cia.gov/library/publications/the-world-factbook/index.html) and infant mortality rate (TNC = 19 ± 0.34 deaths per 1000 live births; WWF = 39 ± 0.63 deaths per 1000 live births; UNICEF 2006). WWF also receives consistently less funding per project than does TNC (Figure 2d). Given these differences, TNC may simply have more flexibility in project design, while WWF may be constrained both by the severity of the conditions in which they operate and the poorer funding level.

Next steps

Although project design appears to be linked to key socioeconomic characteristics, we cannot rule out the possibility that these patterns are a consequence of organizational mission or past experience. We also cannot predict which project types will be more successful

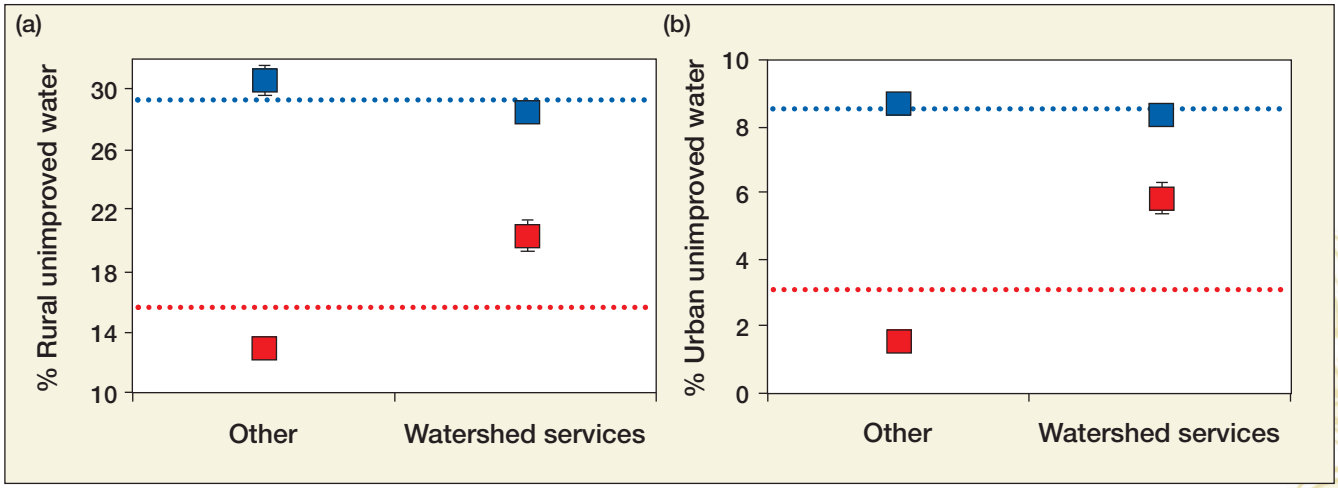

Figure 7. *Average percentage of the population with unimproved water sources in (a) rural or (b) urban areas, in countries where TNC (red) or WWF (blue) targeted watershed services or other ecosystem services. The dotted line represents the overall average percentage of the population with unimproved water for all projects in (a) rural and (b) urban areas implemented by the organization. Error bars represent standard error.*

under different conditions; only 37% of projects in the database have initiated performance or compliance monitoring. Without major improvements in monitoring efforts, our ability to further develop ecosystem service projects to deliver returns for biodiversity and society is severely limited. Future work to monitor outcomes and test the hypotheses we present here should be combined with existing operational frameworks (Knight *et al.* 2006), tools for conservation site selection (Possingham *et al.* 2000), and guidelines for ensuring fairness, equity (Wunder 2007), and benefits for those in poverty (Pagiola *et al.* 2005). This will help to create a comprehensive, science-based approach for designing projects that support conservation and development around the world.

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