The Size, Concentration, and Growth of Biodiversity-Conservation Nonprofits

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Nonprofit organizations play a critical role in efforts to conserve biodiversity. Their success in this regard will be determined in part by how effectively individual nonprofits and the sector as a whole are structured. One of the most fundamental questions about an organization's structure is how large it should be, with the logical counterpart being how concentrated the whole sector should be. We review empirical patterns in the size, concentration, and growth of over 1700 biodiversity-conservation nonprofits registered for tax purposes in the United States within the context of relevant economic theory. Conservation-nonprofit sizes vary by six to seven orders of magnitude and are positively skewed. Larger nonprofits access more revenue streams and hold more of their assets in land and buildings than smaller or midsized nonprofits do. The size of conservation nonprofits varies with the ecological focus of the organization, but the growth rates of nonprofits do not.

Keywords: nongovernmental organization, industrial organization, conservation planning, firm size distribution, conservation finance

The way in which an organization is structured determines how effectively it can allocate available resources to meet its objectives (Chandler 1990). The principle also extends to a collection of organizations; the way the collection is structured determines how effectively the summed actions of its constituent organizations allocate available resources. For example, the way in which an industry is configured determines how efficiently it will employ limited resources to meet societal demands for products—an issue that provides the rationale for antitrust laws (Scherer and Ross 1990, Cabral 2000).

These economic principles apply just as readily to organizations active in biodiversity conservation as to for-profit businesses in other sectors. Indeed, understanding the implication of organization structure for conservation effectiveness was recently identified as one of the scientific research topics with the greatest potential to improve the practice of biodiversity conservation globally (Sutherland et al. 2009). However, this topic has received very little study to date. In the present article, we discuss these ideas, focusing on the role played by nonprofit organizations (henceforth *nonprofits*) active in biodiversity conservation.

Nonprofits have critical roles to play in efforts to conserve biodiversity. Locally, these organizations take responsibility for on-the-ground delivery of conservation through habitat management and restoration. They also take the lead in mobilizing public concern about biodiversity through education and outreach. At state and national levels, nonprofits provide an important check and counterweight to public agencies and the political appointees who lead them, while also making up much of the shortfall in conservation spending by state and federal governments (Shaffer et al. 2002, Lerner et al. 2007, Fishburn et al. 2009). Internationally, nonprofits provide a conduit for channeling funds for conservation from a donor base in more affluent countries to poorer nations where biodiversity is richest and most imperiled (Brooks et al. 2006, Halpern et al. 2006). In so doing, nonprofits take on a role that many national governments struggle to fulfill, and they offer greater flexibility than what is available to multilateral institutions.

Like the biodiversity it is charged to protect, the suite of organizations within the conservation-nonprofit sector is rich and diverse (Sutherland et al. 2009). However, given its central role in protecting biodiversity and the numerous writings about the priorities on which conservation organizations should focus (Margules and Pressey 2000, Moilanen et al. 2009), surprisingly little is known about how the conservation-nonprofit sector is structured and how effectively it fulfills the many and varied responsibilities it must bear.

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In the present article, we discuss the relevance of theories of the firm from the field of industrial organization to nonprofits active in biodiversity conservation. We then review empirical patterns in the sizes, concentrations, and growth rates of nonprofits aiming to conserve different elements of biodiversity. The data we present are not sufficiently resolved to provide a direct test of some relevant economic theories. At the same time, the patterns that we observe suggest that certain lines of theoretical work may be more applicable than others to conservation nonprofits.

Three previous data analyses on US nonprofits provided important precursors and complements to the empirical data that we present. Czech and colleagues (1998) showed that, from a sample of 632 conservation nonprofits in 1996, a greater number of organizations were active in the conservation of more-charismatic taxonomic groups. Albers and Ando (2003) examined 1211 land trusts in the United States in 1998 in a bid to determine whether state-level variation in the number of land trusts was efficient. Although it was groundbreaking, their analysis had some important shortcomings. First, they focused only on the number of land trusts and neglected the size variation. They also did not differentiate among land trusts on the basis of different conservation objectives and left out many other types of nonprofit active in biodiversity conservation. Finally, their predictions were static and lacked consideration of how nonprofits grow and evolve. The third study, by Straughan and Pollak (2008), presented more-comprehensive data on environmentally oriented nonprofits in the United States through 2005. Straughan and Pollak (2008) relied on the National Center for Charitable Statistics classification system, the National Taxonomy of Exempt Entities (NTEE), to identify nonprofits that emphasized environmental issues. This classification is too coarse to distinguish organizations active in biodiversity conservation; it categorizes them alongside others working on, for example, the advocacy of renewable-energy technologies and groups coordinating recycling programs.

Theoretical background

In this section, we describe theoretical background that could provide foundations for studying nonprofit organization.

Nonprofit size and concentration. We focus much of our discussion on one of the most basic decisions that nonprofits face—namely, how large they should be. Organization size is accepted to be the most "readily available statistical proxy for… administrative complexity" in studies of industrial organization (Chandler 1990, p. 15). Size-based questions are common to all conservation nonprofits. For example, managers face decisions about how many staff to hire, when to open new offices and programs, or whether to acquire and take on the management of new nature reserves. The size of a nonprofit is partly determined by how much of a given conservation target it tries to deliver (e.g., how many individuals of a focal species, how big a nature reserve to establish to protect a particular habitat type) as well as how many different conservation targets it tries to protect (e.g., how many different species or habitat types). A nonprofit's size also depends on how many conservation activities it manages in house and how many it relies on partners to provide. For example, relevant decisions would be whether a national nonprofit should pass management responsibilities for a reserve to a local organization (Sutter et al. 2009), how large of an in-house science program a conservation nonprofit requires (Cleary 2006, Higgins et al. 2006), or how involved a foundation should become in directing on-the-ground conservation efforts (Lehmer 1999, Delfin and Tang 2006).

When scaling up to a whole sector, the counterpart to discussions regarding the size of individual nonprofits concerns the optimal number and concentration of nonprofits. The concentration of nonprofits is a measure of how much of the overall responsibility for supplying conservation benefits falls on a handful of large organizations. Discussions regarding when and how nonprofits should cooperate or compete with one another (Mace et al. 2000, Bode et al. 2011) can be viewed as being about the pros and cons of concentration of the nonprofit sector. Debates over whether the planning of conservation activities should be aggregated to larger spatial scales in order to internalize externalities (Erasmus et al. 1999, Rodrigues and Gaston 2002, Strange et al. 2006, Kark et al. 2009) or whether decentralized governance of biodiversity and ecosystem services is preferable (Berkes 2007, Somanathan et al. 2009) also provide a close analogue to nonprofit-sector-concentration discussions in public conservation policy.

Economic theories predicting the size and concentration of nonprofits are built from supply- and demand-side considerations. On the supply side, theories of firm size in general, and of nonprofit size in particular (e.g., Lakdawalla and Philipson 2006), start from an assumption that the average cost of supplying a unit of output (here, a unit of biodiversity-conservation gain) is a U-shaped function of the overall quantity produced. The average-cost curve describes the minimum possible cost associated with a nonprofit delivering a given level of conservation benefit (figure 1). The average-cost curve comprises two elements: One (the dark gray curve in figure 1) includes the costs primarily determined by the biophysical processes involved in supporting a particular element of biodiversity. These pure production costs of biodiversity will depend on the particular conservation target being prioritized. For example, if the nonprofit is trying to conserve genetic diversity within a focal species *in situ*, the size of the operation required might be set by the spatial scales over which local adaptation plays out, which will be very different for different species. In turn, this focus will generate a cost curve very different from one faced by an organization that aims, say, to conserve a functioning wetland habitat. In general, pure production costs are assumed to decrease with nonprofit size initially (figure 1). For example, more hands-on management techniques are

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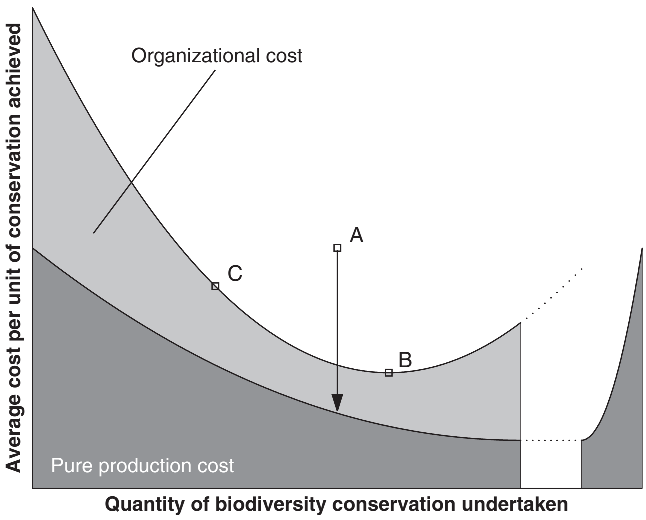

Figure 1. Theoretical relationship between the amount of conservation activity undertaken by a biodiversity-conservation nonprofit (a measure of nonprofit size) and the average cost per unit of biodiversity improvement produced when the nonprofit is configured efficiently given its current size. This average-cost curve comprises two parts. First, there are pure production costs due to spatial economies of scale in the underlying ecological production function and due to fixed costs of conservation being averaged over an increasing amount of conservation gain. Second, there are organizational costs—the costs involved in running an organization that can deliver on these improvements in biodiversity. Organizational costs are characterized by larger organizations' being able to exploit efficiency savings by allowing staff to specialize in particular tasks but are also characterized by rising internal transaction costs. Point A represents a nonprofit that is not configured effectively given its size. The arrow indicates the cost component commonly focused on in conservation-planning studies. Point B marks the point of lowest average cost or the **minimum efficient scale** ***for the organization. Point C signifies a position at which the nonprofit is operating on the average-cost curve but at which the nonprofit is smaller in size than what is suggested by the minimum efficient scale.***

needed in order to maintain species in postage-stamp-size reserves than in larger and more-functional habitat fragments (Armsworth et al. 2011). Eventually, the pure production costs of protecting another unit of biodiversity could increase again, after all low-hanging fruit have been picked and only the most difficult conservation targets remain to be tackled (figure 1; Ando et al. 1998).

The second cost component (the light gray curve in figure 1) is determined by the internal limitations of the organization itself. Once again, by increasing in size, very small organizations can operate more cost effectively, by allowing staff to specialize and, for instance, by being able to support separate human-resources, accounting, and legal departments or other business units. On the other hand, if an organization becomes too large, its ability to access information and to communicate it internally weakens, incentives faced by staff may diverge, and internal transaction costs increase (Alchian and Demsetz 1972, Arrow 1974, Williamson 2005). Although particular management structures exist to reduce such costs (e.g., multidivisional forms like the state chapters that make up The Nature Conservancy [TNC]), they cannot be avoided altogether. To date, organizational costs have been ignored in almost all studies in which the importance of accounting for costs in conservation planning was advocated (Naidoo et al. 2006, Wilson et al. 2009).

Instead, an entirely different set of costs have preoccupied conservation scientists (Margules and Pressey 2000, Naidoo and Iwamura 2007, Underwood et al. 2009, Wilson et al. 2009, Fuller et al. 2010)—namely, those incurred if conservation organizations fail to allocate the resources available to them effectively, given their existing organizational size and structure (e.g., determining whether more-cost-effective choices of sites exist than those currently being managed as nature reserves). Inefficiencies of this type are represented in figure 1 by nonprofits sitting somewhere above the average-cost curve (point A), which, when other factors are ignored, suggests missed cost savings of a size indicated by the length of the vertical arrow.

A simple recommendation regarding nonprofit size might be that, as well as aiming to be configured internally in such a way as to hit the average-cost curve, nonprofits should aim to be of such a size that they hit this curve at or near its minimum point (the *minimum efficient scale*, point B in figure 1). At this point, a nonprofit achieves the greatest bang for its buck in terms of conservation gain delivered per dollar spent. When competitive, for-profit industries are studied, a common prediction in theories of firm size is that firms will be located at or near their minimum efficient scale (Scherer and Ross 1990). However, the outcome for nonprofit sectors is less clear, because competition between nonprofits may not be as intense and may not respond as closely to the cost effectiveness of production (Alchian and Demsetz 1972).

Demand-side considerations also need to be taken into account when considering the structure of nonprofit sectors. Existing models are focused on nonprofits competing for support from a limited donor base by seeking to match their activities to donors' priorities in order to attract funding (Economides and Rose-Ackerman 1993, Bilodeau and Slivinski 1997, Aldashev and Verdier 2010). In biodiversity conservation, this may mean that nonprofits will site their activities in locations that are most highly valued by donors (Ando and Shah 2010) or will prioritize taxa, ecosystems, or threats in which donors are particularly interested (Czech et al. 1998).

The closest analogy in industrial-organization theory to nonprofit sectors is widely held to be monopolistic competition (Economides and Rose-Ackerman 1993, Aldashev

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and Verdier 2010), in which businesses compete to supply related but differentiated products. With a monopolistic-competition model, the supply-side story at which one might arrive by studying cost functions for individual nonprofits—namely, that individual firms should aim to be at their minimum efficient scale—may not describe the actual, or even the desirable, behavior of the conservation-nonprofit sector as a whole. With free entry into the nonprofit sector, monopolistic competition could lead to a situation in which nonprofits occupy a position more like point C in figure 1, where the industry supports a larger number of more-specialized nonprofits than is dictated by the minimum efficient scales of biodiversity production (Bilodeau and Slivinski 1997). In this situation, reallocating responsibilities for conserving biodiversity to a smaller number of larger nonprofits could reduce the overall costs of conservation. However, having more small nonprofits than would be cost effective may actually prove to be a more socially desirable outcome, because any consideration of sector-wide efficiency must also include the benefits of supporting a diversity of nonprofits (Cabral 2000). Maintaining a greater number of differentiated nonprofits could increase the overall amount of resources available to support conservation by matching the heterogeneous demands of donors more closely (Bilodeau and Slivinski 1997, Aldashev and Verdier 2010, Ando and Shah 2010). The ability of a diversity of nonprofits to meet more closely the heterogeneous demands for public goods is touted as one of their key advantages over government provision (Weisbrod 1986, James 1990).

Donors would somehow have to tie donations closely to the efficient production of a unit of conservation gain in order for the competition among nonprofits for limited donor support to lead them toward the average-cost curve (and either point B or point C on it). Current initiatives within the nonprofit sector are intended to allow donors to reward the cost effectiveness of provision by nonprofits (Ozdemir et al. 2010) but are limited by the challenges involved in measuring a unit of output—particularly for organizations with less “tangible” goals (e.g., policy advocacy; 6 and Forder 1996). However, for this approach to work, it would also require that donors' choices reflect a desire to maximize the unit improvement per dollar donated in some aspect of biodiversity. Some writings on nonprofits suggest instead that donors are actually purchasing personal satisfaction from the act of donating to some public good rather than seeking to purchase improvements in the good itself (Andreoni 1989, Kahneman and Knetsch 1992), which could mean they have a reduced incentive to identify efficient providers of the public good to which to donate.

The growth of nonprofits. A distinct body of theory is focused on the growth of nonprofits, and size and concentration are viewed as outcomes of a growth process. There is a compelling argument for basing any theory of conservation nonprofits on patterns of growth, because environmental nonprofits constitute one of the fastest-growing nonprofit sectors in the United States while still being one of the smallest nonprofit sectors (Blackwood et al. 2008).

Growth theories start from an assumption not of efficiency and competition as driving industry structure but rather from a null model that the observed patterns are the outcomes of chance events alone. An important null model of industry growth was suggested by Gibrat in his hypothesis that the growth rate of firms was independent of their size (Sutton 1997). This growth dynamic would lead to the distribution of firm sizes within an industry converging to a log-normal distribution through time. Indeed, many growth processes converge to broadly similar, positively skewed distributions (Ijiri and Simon 1977). The distributions of firms from many sectors, including nonprofits (Wilding et al. 2004, Blackwood et al. 2008, Brockington and Scholfield 2010), have proven to be strongly positively skewed, with a few very large firms responsible for the lion's share of activity (Scherer and Ross 1990).

There have been attempts to unify stochastic-growth theories with efficiency considerations. For example, in the Jovanovic model, a process is assumed by which new entrants gradually learn the scales over which they can operate efficiently (Jovanovic 1982). The model predicts that new entrants will have higher exit rates than incumbents, but if they survive, they will have faster growth rates. Harrison and Laincz (2008) applied the Jovanovic growth model to the US nonprofit sector and used it to highlight the high net-entry (entry-minus-exit) rates of environmental nonprofits.

Empirical observations

An assessment of how effectively the conservation-nonprofit sector is structured is beyond the reach of a single study. As a first and necessary step in this direction, we sought to describe the current configuration of the biodiversity-conservation-nonprofit sector in the United States. We built a data set detailing attributes of the nonprofits active in biodiversity conservation and registered for tax purposes within the United States. We used a searchable database (GuideStar, *www.guidestar.org*) of the annual tax returns of nonprofits with an annual grant income of over $5000. The data are based on Internal Revenue Service (IRS) 990 forms, which are required from nonprofits with an annual revenue of over $25,000. Taken together, these conditions mean that we will miss the very smallest nonprofits. The database was initially accessed between October 2006 and July 2007. Additional data were collected from the database in 2009 for a subset of the original sample. The financial records obtained cover the period of 2004–2007, with some minor variation in the precise dates covered, because of organizations' accounts' being reported for slightly different financial years.

To construct the full data set, we made an initial list of candidate nonprofits for inclusion using the NTEE system and combined this with keyword searches to identify additional nonprofits not included in the relevant NTEE categories (see Straughan and Pollak 2008 for a related

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discussion). We then filtered this list to retain only those nonprofits with a strong focus on biodiversity conservation in their mission statements or that reported major recent programs in biodiversity conservation. We did this by examining the public benefits reported by the organizations to justify their tax-exempt status and, where necessary, by referring to the organizations' Web sites for further clarification. We eliminated a small number of nonprofits whose financial records were incomplete in the database. The final sample comprised 1743 organizations. Our data set is not comprehensive and should be considered a sample, albeit one that is much larger than those considered in previous studies on biodiversity-conservation nonprofits (Czech et al. 1998, Albers and Ando 2003, Brockington and Scholfield 2010).

In an important advance over previous studies, we recorded the particular biodiversity-conservation focus reported by each organization (table 1). We classified organizations based on where they try to conserve biodiversity, including both the spatial extent of their conservation objectives and whether they work in terrestrial, marine, or freshwater ecosystems; how they try to conserve biodiversity (*ex situ* versus *in situ* methods); and what elements of the biota they focus on, which differentiates nonprofits focused on the conservation of animals or plants, vertebrates or invertebrates, and particular taxonomic classes for which there was sufficient replication to allow a comparison (mammals, birds, fish, reptiles). When it was possible, nonprofits were assigned to one of the discrete categories shown in table 1 on the basis of their mission statement and the description of their conservation programs. When an organization had programs that could be classified in two or more bins, we included them in a separate category. The one exception to this rule is that we combined nonprofits with specific programs in invertebrate conservation but not vertebrate conservation ($n = 8$) with those having specific programs targeting both groups ($n = 11$) to maintain an adequate sample size for statistical analyses. The more resolved the conservation focus was, the smaller the sample sizes involved were (table 1).

There are many ways to measure the size of an organization. We did so using the assets held by the nonprofit (which includes land and buildings, as well as endowments) and the annual flow of revenue into the organization (which includes membership dues, donations, government grants, and interest on endowments). When reporting their assets and revenues, the organizations are required by the IRS to combine amounts from within and outside the United States. We converted all amounts to 2007 equivalents in US dollars, using the Consumer Price Index (*www.bls.gov/CPI*).

As well as reporting on the size and growth of individual organizations, we also examined the degree of concentration in the sector. We rely on a commonly used statistic to summarize the concentration of a particular industry called the *C4 ratio*, which measures the percentage of the overall sector accounted for by the four largest firms (Scherer and Ross 1990). For comparison, we also report the proportion of assets and revenue managed by the largest 5% of organizations.

For three specific questions, we subsampled nonprofits from the full data set. To determine how the business models followed by nonprofits of different sizes varied, we examined more detailed, itemized tax returns for a stratified random sample of 30 small, medium, and large nonprofits. We found the 200 smallest nonprofits as measured by assets and revenues and sampled 30 at random from the intersection of these sets. We repeated this procedure for 200 nonprofits surrounding the median-size and largest organizations. We determined the proportion of assets held by each nonprofit in this subsample as financial assets (e.g., cash endowments) versus physical assets (land and buildings) and the number of different revenue sources obtained by the nonprofits identified on the IRS 990 form (e.g., gifts and grants, membership dues, interest on endowments, sales of inventory).

To examine the growth patterns of nonprofits and whether the relative sizes of nonprofits are consistent through time, we randomly sampled a subset of 100 nonprofits for which we collected data on assets and revenue from 2004 through 2007. The growth rates of these nonprofits were not normally distributed, and we relied on nonparametric statistics to analyze them.

To test whether the growth rates of nonprofits varied with their conservation focus, we randomly sampled nonprofits with programs focused on a particular element of biodiversity (e.g., marine conservation) for which an annual growth rate could be estimated for the period of 2004–2007 until a balanced design was obtained for each area of activity. In most cases, 20 nonprofits were selected per category (e.g., 20 focused on marine conservation, 20 on freshwater conservation, 20 on both), with the exception of the vertebrate–invertebrate distinction and different taxonomic classes, where only 10 were collated because of the small number of organizations within these classifications.

Variation in the size of individual nonprofits. Our sample of 1743 nonprofits active in biodiversity conservation managed combined assets worth \$19.1 billion and annual revenues totaling \$6.32 billion in the first reporting year covered by the data (2004). The median-size nonprofit had assets worth \$0.74 million and an annual revenue of \$0.52 million.

Nonprofit size varied by six or seven orders of magnitude when it was measured by revenue or assets, respectively, ranging from a few hundred or thousand dollars to billions of dollars (figure 2). This size variation demonstrates the limitations of studying the biodiversity-conservation-nonprofit sector using only the number of nonprofits (Czech et al. 1998, Albers and Ando 2003). Restricting our attention to a randomly sampled subset of 100 nonprofits for which we collected data spanning four years and correlating organization size at the start and end of this time period revealed that the relative sizes of the nonprofits were

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Table 1. Classification of biodiversity-conservation nonprofits based on their conservation focus and indices of concentration for nonprofits sharing a particular conservation focus.

Focus category	Number nonprofits with this focus	Subcategories within focus category	Number nonprofits in each subcategory	Assets		Revenue	
				Percentage held by the biggest four	Percentage held by top 5%	Percentage held by the biggest four	Percentage held by top 5%
Geography	1481	Intrastate	889	18.3	63.4	16.7	56.3
		State	178	49.5	64.6	37.4	50.7
		Interstate	162	47.2	59.5	34.4	47.7
		United States	68	66.0	58.7	57.9	48.0
		International	184	77.3	88.2	58.5	75.8
Realm	1383	Terrestrial (T)	692	34.3	68.0	30.7	60.8
		Freshwater (F)	55	66.3	60.8	38.0	30.8
		Marine (M)	68	79.0	74.1	58.1	51.0
		TF	405	41.2	69.24	35.8	61.6
		TM	66	84.2	71.0	73.5	63.2
		FM	21	91.8	68.6	85.4	68.2
		TFM	76	89.4	89.4	81.0	81.0
Conservation situation	1018	*Ex situ*	240	41.0	62.5	33.3	52.6
		In situ	744	52.7	79.7	46.4	74.4
		Both	34	85.2	56.0	84.7	56.0
Kingdom	580	Animal	436	35.5	72.0	25.9	66.9
		Plant	92	69.7	73.2	46.9	50.6
		Both	52	60.7	52.5	58.6	51.5
Vertebrate status	331	Vertebrate	312	40.6	74.4	36.7	73.1
		Invertebrate or both	19	95.2	67.3	87.3	38.6
Taxonomic class	290	Mammals	76	73.3	73.3	68.6	68.6
		Birds	91	67.8	70.9	75.8	77.3
		Fish	83	76.2	78.8	67.6	70.5
		Reptiles	11	92.6	60.8	85.3	48.4
		Mammals and birds	14	97.5	55.9	96.7	61.0
		Mammals and fish	15	87.1	34.8	75.4	30.9

consistent through time (assets, Pearson's $r = .93$, $p < .001$, $n = 100$; revenue, $r = .74$, $p < .001$, $n = 100$).

Although the large majority of the studied nonprofits were small- to medium-size operations, a few control a disproportionate share of overall conservation financing. The C4 ratio of nonprofits in our sample was 33% when it was measured by assets and 24% when it was measured by revenue. By way of comparison, for-profit sectors are characterized by a range of concentration patterns; some appear much more concentrated than this and others much less so (Scherer and Ross 1990). Among the conservation nonprofits, one organization alone—TNC—controls more than 25% and 16% of overall assets and revenues, respectively. To put that into context, TNC has an annual revenue that exceeds the gross national income of some countries while still representing only a small fraction (0.3%–6.6%) of the annual revenue enjoyed by a Global Fortune 500 company.

The distribution of nonprofit sizes, based on assets, did not differ significantly from log-normal (Anderson–Darling normality test, $A = 0.6304$, $p > .05$). The distribution of sizes based on revenue, however, differed significantly from log-normal, even after we accounted for heavy tails by removing the 10 largest and 10 smallest organizations from the data set ($A = 1.5621$, $p < .001$). As one would expect, the two measures of nonprofit size (assets and revenue) were strongly correlated (Spearman's rank correlation $r_s = .81$, $p < .001$, $n = 1743$; figure 2).

By comparing a stratified sample of large, medium, and small nonprofits, we found that the business model followed by nonprofits and the opportunities available to them depend on their size. The larger nonprofits in our study held on average 55% of their overall assets in land or other physical capital, whereas the corresponding percentages for small- and medium-size nonprofits were just 0% and 6%, respectively, with these organizations being significantly

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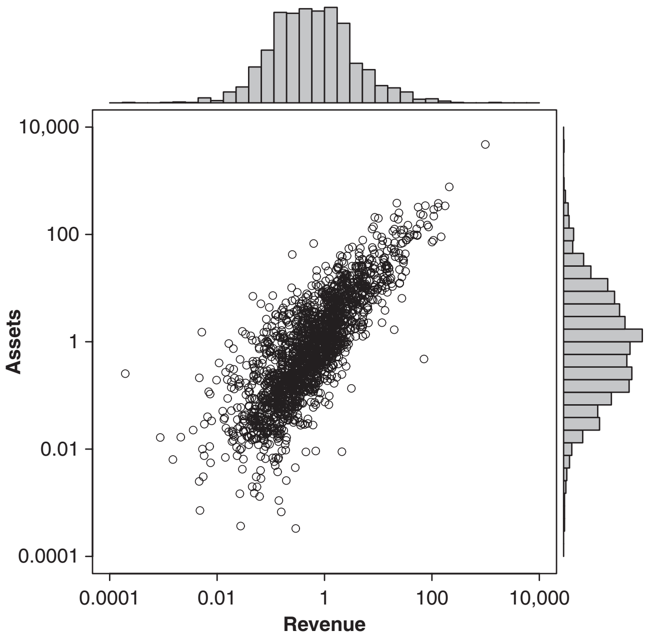

Figure 2. Asset holdings and annual revenues of nonprofits active in biodiversity conservation that are registered for tax purposes within the United States (in millions of 2007 US dollars).

more reliant on their financial assets (Kruskal–Wallis test, $H(2) = 24.3$, $p < .001$). Revenue streams were also better diversified for larger nonprofits; larger nonprofits accessed more than twice as many sources of revenue as did small nonprofits and 30% more revenue sources than medium-size nonprofits ($H(2) = 40.4$, $p < .001$).

Variation in nonprofit size with conservation focus. In previous studies, it has been hypothesized that the size of conservation nonprofits will vary with their ecological focus. For example, Albers and Ando (2003) suggested that there could be taxonomic signals in organization size, because some groups of organisms would require more-coordinated conservation activity and may also attract greater donor support. Here, we tested whether such a systematic pattern exists, using all of the nonprofits in our sample that could be suitably classified (table 1).

The nonprofits whose mission and programs were broader in scope (i.e., they tried to provide more different types of conservation benefit) tended to be larger. For example, nonprofits active in terrestrial, marine, and freshwater conservation were nearly three times the size of those focused on just one realm (figure 3b). Similarly, organizations with specific programs protecting the needs of both animal and plant species had assets that were two to three times the size of those specializing in the conservation of only one kingdom (figure 3d). The same was true when the geographic focus of a nonprofit was analyzed. Nonprofits with a larger geographic reach (national or international) tended to be bigger—a pattern that was clearer when it was measured by revenues rather than assets, with revenues to national and international nonprofits being two to three times those received by organizations in the other categories (figure 3a).

Nonprofits that attempted to conserve biodiversity using *ex situ* methods were almost twice the size of those running *in situ* conservation programs (figure 3c). The biggest nonprofits active in *ex situ* conservation included zoos and aquaria, which operate substantial estates in or near metropolitan areas. The operation of these facilities may impose particular average-cost structures (figure 1) that could explain the larger size of these organizations.

Although the resolution of the data limits what we can test, we found no evidence that the taxonomic focus of conservation nonprofits influences their size. Specifically, there were no significant differences in the size of nonprofits between those seeking to conserve animals and those seeking to conserve plants (figure 3d), between those seeking to conserve vertebrates and those seeking to conserve invertebrates (figure 3e), or among those seeking to conserve different taxonomic classes (figure 3f).

A final point of interest is that the nonprofits active in freshwater conservation were less than half the size of those working in marine or terrestrial systems (figure 3b). This size difference warrants further exploration to assess (a) whether organizations focused on freshwater conservation can operate more effectively at smaller sizes; (b) whether the growth or consolidation of nonprofits focused on freshwater biodiversity would allow more biodiversity to be protected per dollar spent; or, alternatively, (c) whether less cooperation and consolidation of organizations focused on terrestrial and marine conservation would offer efficiency savings.

Concentration of nonprofits with conservation focus. How concentrated one would conclude biodiversity-conservation nonprofits to be depends on how narrowly one defines the focal sector. For instance, examining the C4 ratios for organizations working internationally (a focus of many conservation debates—e.g., Mace et al. 2000, Myers et al. 2000, Halpern et al. 2006), one would conclude that the sector appears to be relatively concentrated (table 1). But if one focuses on the many organizations that work at more-local scales, then one would conclude the sector is quite diffusely distributed. Similarly, a focus on terrestrial biodiversity conservation would only lead to the conclusion that the sector is less concentrated than if one looks at organizations that work in freshwater or marine environments (table 1).

In estimating the degree of industry concentration, C4 ratios respond to the size and number of organizations operating in the defined sector. However, the relationship is not simple. For example, the subset of conservation nonprofits focused on *in situ* conservation appears more concentrated than those adopting *ex situ* approaches, despite the organizations pursuing *in situ* conservation's being more numerous and smaller in size on average.

The amount of the sector accounted for by a fixed percentage of organizations (e.g., the largest 5% of nonprofits;

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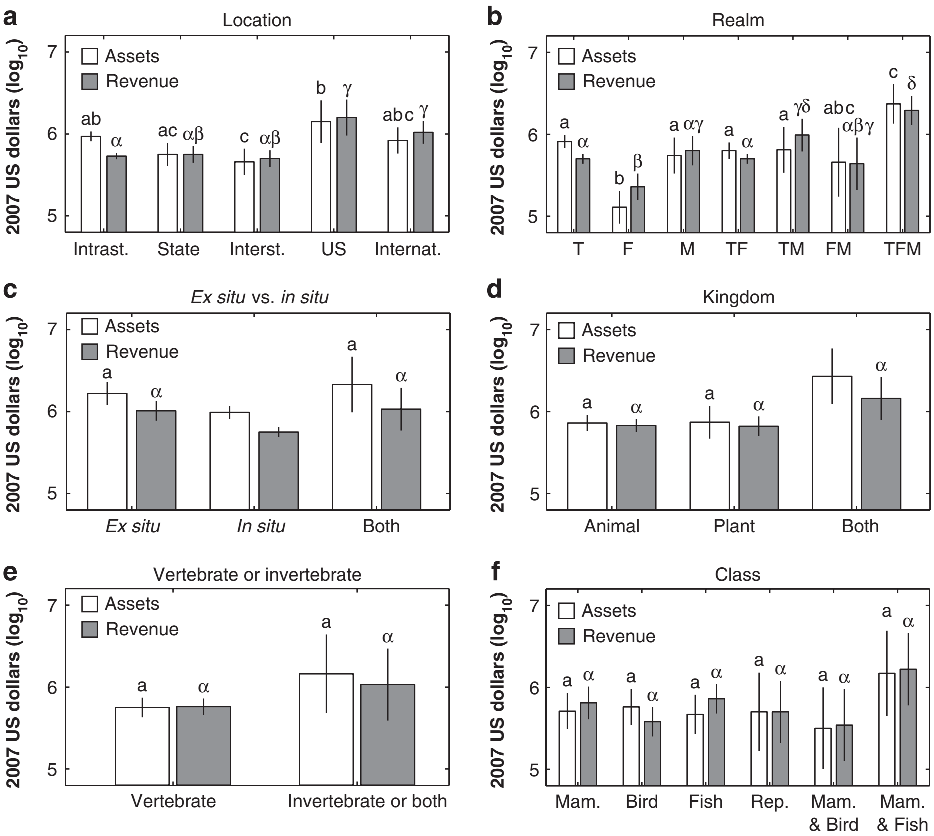

Figure 3. Size variation of nonprofits active in biodiversity conservation as a function of their conservation focus and as measured by their asset holdings (white bars, roman characters) and annual revenues (gray bars, Greek characters), both log-transformed, in 2007 US dollars. The error bars represent two standard-error units. The organizations have been grouped on the basis of where they try to conserve biodiversity, including both (a) the spatial extent of their conservation objectives and (b) whether they work in terrestrial, marine, or freshwater ecosystems; (c) how they try to conserve biodiversity (*ex situ*, *in situ*, or a combination of these two approaches); and what aspect of biodiversity they aim to conserve in terms of (d) animals or plants, (e) vertebrates or invertebrates, and (f) different taxonomic classes with sufficient replication to allow a comparison. The mean sizes marked with the same letter do not differ significantly from one another (Tukey's honestly significant difference test, $p > .05$). Abbreviations: F, freshwater; Internat., International; Interst., interstate; Intrast., intrastate; M, marine; Mam., mammal; Rep., reptile; T, terrestrial; US, United States.

table 1) provides an alternative indicator of the contribution of organization size to concentration profiles, one that controls for the number of nonprofits. Generally, the variation in concentration levels with conservation focus appears more moderate with this measure than is suggested by C4 ratios. In some instances (e.g., when classifying organizations by where they do work), similar conclusions are drawn using both indicators, but in others (e.g., when classifying on the basis of an organization's taxonomic focus), very different conclusions about concentration profiles result.

Growth rates of nonprofits. We examined growth trends in conservation nonprofits by focusing on a subsample of 100 organizations. We calculated an average annual growth rate in assets and revenue across the four-year period and tested whether this was significantly greater than zero. The median annual growth rate of nonprofits based on assets was 6.6% and based on revenue was 4.4%, after controlling for inflation. However, only growth in assets was significant (Wilcoxon signed-rank test, $V = 3610$, $p < .001$, $n = 100$).

Variation in the growth rates of nonprofits. When examining variation in growth rates across organizations, we first tested Gibrat's hypothesis that growth rates are independent of firm size. We compared the growth rates of organizations between year three and year four against the size of the organizations in year one. Growth rate was not related to organization size for assets or revenue, which is consistent with Gibrat's hypothesis (Spearman's rank-order correlation for assets, $r_s = -.01$, $p = .91$, $n = 100$; for revenue, $r_s = -.01$, $p = .96$, $n = 100$). Second, we assessed the relationship between growth rate and organization age, because one might expect growth rates to slow down for older organizations as they mature and achieve a larger size, thereby contradicting Gibrat's hypothesis. Again, however, rank correlations revealed no significant relationship for assets or revenue (assets, $r_s = .01$, $p = .91$, $n = 100$; revenue, $r_s = .06$, $p = .55$, $n = 100$).

From other work, we have additional data available on the growth of the largest nonprofit active in biodiversity conservation, TNC, over a 40-year period (Fishburn et al. 2009, Davies et al. 2010). We assume that after correction for inflation, TNC's overall expenditure on land acquisition in the coterminous United States serves as an adequate indicator of the organization's size between 1960 and 2003. TNC grew in size by a factor of 10 during this period. We examined the growth of TNC over time with linear regression. To maintain statistical independence, we performed a regression analysis on the growth rate between nonoverlapping pairs of years (e.g., 1960 and 1961, 1962 and 1963) as a function of time. We found no directional change in growth rate over time (linear

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regression, $r^2 = .02$, $p = .51$, $n = 22$), which also supports Gibrat's hypothesis.

Finally, we tested for systematic variation in nonprofit growth rates with their conservation focus. We used a Kruskal–Wallis test to determine whether the focus of an organization influenced its growth rate. The only significant variation occurred in the growth of assets held by organizations pursuing *ex situ* conservation approaches, *in situ* approaches, or a combination of the two ($H(2) = 6.7$, $p = .03$), where growth was marginally faster for organizations pursuing both *in situ* and *ex situ* strategies than for other organizations (Tukey's honestly significant difference test, $p < .06$).

Conclusions

Understanding how the structure of conservation nonprofits influences their effectiveness in improving the plight of biodiversity has been identified as a priority research topic of importance to global biodiversity conservation (Sutherland et al. 2009). As a first step toward answering this question, we reviewed relevant economic theory as it would apply to conservation nonprofits. We then described current patterns in the size, growth, and concentration of conservation nonprofits in the United States. These empirical patterns do not yet suggest ways to improve the effectiveness of the conservation-nonprofit sector. However, any discussion of how conservation could be made more effective must begin from a description of how the sector is currently arranged. Following accepted practice in industrial organization, we used nonprofit size as a proxy for the complexity of organization structure (Chandler 1990). To justify this choice, we showed that conservation nonprofits of different sizes operate under different business models and have different opportunities available to them.

From the perspective of an individual nonprofit, the relevant issue raised by our work is whether the organization is currently structured in a way that will enable it to deliver improvements in biodiversity in a cost-effective manner. Available conservation-planning tools and writings are designed to help conservation nonprofits minimize inefficiencies in resource allocation (represented by the vertical arrow in figure 1) while taking the size and structure of the nonprofit involved as given. We focused instead on whether an organization itself is configured in a way that will enable it to deliver on its individual conservation objectives cost effectively. Because organizational costs (the light gray area in figure 1) are typically ignored altogether in conservation-planning studies, nonprofits and government agencies may find their resource-allocation decisions being criticized by scientists who have only considered the pure production cost of generating a unit gain in some biodiversity indicator (see the dark gray area in figure 1).

The cost of producing a unit improvement in biodiversity in figure 1 is minimized when the nonprofit both allocates available resources efficiently (when it is on the average-cost curve) and is configured in a way that allows it to operate at its minimum efficient scale (point B in figure 1). Where this minimum efficient scale lies will likely vary with the conservation objectives of nonprofits, depending on the ecological and evolutionary processes involved. We sought evidence for such a relationship by testing for systematic variation in nonprofit size with an organization's conservation focus. Some interesting patterns emerged that warrant further examination. In particular, nonprofits focused on conserving freshwater ecosystems were found to be less than half the size of those working on terrestrial or marine conservation, but we found no evidence for some patterns hypothesized in the literature. For example, there was no evidence of a taxonomic signal in organization size. However, the number of taxa that we can consider is limited by the more obvious signal in the data—namely, that large-bodied, charismatic vertebrates attract most attention from nonprofits (Czech et al. 1998). Our ability to reveal such patterns is also limited by the resolution of the data on a nonprofit's activities that is consistently reported on IRS 990 forms, something that becomes apparent if we try to resolve the taxonomic focus of organizations further (to orders, families, genera, or species).

From the perspective of a policymaker, the relevant question is whether the conservation-nonprofit sector as a whole is structured efficiently. Although the nonprofit sector is a bottom-up movement, policymakers exercise considerable influence over it and are in no sense stuck with what they get. Ultimately, governments define the operating conditions for nonprofits through the tax code. Any revisions to its terms (e.g., regarding how societal benefits are defined or measured) would reverberate through the sector. Some authors have even called for increased application of antitrust laws to the nonprofit sector (Philipson and Posner 2009). In the United States, public agencies are often crucial partners to conservation nonprofits through their grant awards (Straughan and Pollak 2008) and cost sharing on particular conservation activities (Sutter et al. 2009). This close interdependence of biodiversity-conservation nonprofits and public agencies is such that policymakers exercise considerable influence over how the sector operates. Eschenfelder (2011) described a case study from a different nonprofit sector (social welfare) that illustrates how a government agency influenced nonprofits' entrance decisions and decisions over whether and how to integrate to form a larger, consolidated organization.

The concentration profile of conservation nonprofits is no more acute than that observed in many other sectors (Scherer and Ross 1990). However, the degree of concentration is such that the increase in coordination across the conservation sector that some authors have advocated (Mace et al. 2000) should be achievable. For example, if more cooperation in international conservation efforts is the goal, most of the sector would be impacted just by a further increase in collaboration among the four largest organizations involved (table 1).

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Our analyses of the indicators of the concentration of nonprofits active in biodiversity conservation suggest some cautionary messages. By looking within the full data set at smaller but equally meaningful ways of classifying nonprofits (e.g., international conservation nonprofits), we arrived at very different conclusions about industry concentration. In other words, the inferences that an investigator will draw about concentration within the sector are influenced by where sector boundaries are drawn. The choice of the indicator used is also important. We often found that the concentration profiles estimated by C4 ratios agreed with the conclusions that one would draw from the number and size of the organizations. Nevertheless, exceptions were evident (e.g., for nonprofits focused on *in situ* conservation). Moreover, a different choice of indicator (e.g., the largest 5% of organizations) sometimes gave different answers. Taken together, these results suggest there may be a role in concentration studies for examining more of the distribution of nonprofits sharing a particular focus than is captured by summary statistics responding only to extreme values.

Many of the theoretical studies relevant to conservation-nonprofit size are efficiency-based equilibrium theories that assume that competition between nonprofits will drive them toward their average-cost curves and minimum efficient scales. However, the simpler non-equilibrium-growth theories might be more relevant for explaining patterns in the data. Specifically, we found that the conservation nonprofits in our sample were growing. Moreover, the growth rates of conservation nonprofits did not vary systematically with their conservation focus. Finally, the growth rates did not appear to depend on the organization's size or age, which suggests perhaps that equilibrium has not been reached. Some caution is needed in the interpretation of our results here, however, because of limitations in the data. In particular, (a) we had size data spanning only four years; (b) we were not able to observe the dynamics of very small nonprofits; and (c) we have not confirmed how many nonprofits present in the initial sample exited in the intervening time (Harrison and Laincz 2009). Taken together, a possible explanation for the growth patterns that we observed is that prior to 2007 (the last year of financial accounts included), the conservation-nonprofit sector had not yet experienced *shakeout*, a stage in industry growth during which competition (for limited donor funding, in this case) becomes more intense and can shape firms' activities. Repeating our analyses after the effects of the recent downturn in economic conditions have had time to filter through to influence the behavior of nonprofits would be worthwhile to assess whether systematic variation in the growth rates of nonprofits with a conservation focus becomes more apparent.

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