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Money and motives: an organizational ecology perspective on private land conservation

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ABSTRACT

Analyses of institutions (rules, laws, traditions) and their relevance for conservation are increasingly common in conservation contexts. By contrast, the organizations that operate within the framework provided by institutions are less researched. We applied ideas from organizational ecology to understanding the economic strategies of private land conservation areas (PLCAs), and their sustainability. The biophysical and socioeconomic characteristics of 72 commercially-operated PLCAs in the Eastern and Western Cape Provinces of South Africa were used, via principal components and cluster analyses, to identify alternative business models. We found four distinct business models with different financial productivity and owner objectives. The most profitable models were (1) large ecotourism areas with many charismatic (megaherbivore/predator) and other (antelope) game species, expensive accommodation, and guided activities; and (2) small ecotourism areas with many charismatic game species, fewer other game species, short travel time from the nearest airport, guided activities and day visitors. The less profitable models were (3) hunting reserves, with 54% of owners seeking to generate profits but not doing so, creating a mismatch between financial objectives and financial returns; and (4) PLCAs with few game species and cheap accommodation/activities, which were similarly unprofitable although an absence of financial objectives limited mismatches to just 5%. Biophysical and socioeconomic incompatibilities between different business models make it difficult for PLCAs to change their business model if objectives are not met. Initial (and rational) choices of how to manage a natural resource can thus constrain future management options and the organization's ability to persist in a dynamic environment.

1. Introduction

Many conservation actions have come under criticism for being insufficient or ineffective, often as a result of limitations incurred by either the institutions (rules, laws, traditions) that regulate how conservation actions can be achieved or the organizations (governmental departments, businesses, societies, non-profit groups) that undertake them. Analyses of *institutions* and their relevance for conservation are increasingly common in conservation contexts [e.g. (Barrett et al., 2001)], and recognition of the importance of institutions for conservation success is widespread in both social–ecological systems analysis and conservation science [e.g. (Anderies et al., 2004; Ostrom, 1990)]. Somewhat less attention has been paid to the role of *organizations*.

The scientific community has called for an assessment of the capacity of conservation organizations to adapt to changing conditions, and an identification of the drivers of persistence in this diverse global network (Armsworth et al., 2015; Larson et al., 2014). For example, the international network of protected areas is one of the conservation community's most important means of safeguarding biodiversity, yet underfunding and competing priorities may jeopardize the ability of government organizations to effectively manage existing protected areas (Bruner et al., 2004). These challenges are not institutional, since legal frameworks and enforcement measures for the protection of nature exist; they are primarily organizational.

Given the importance of organizations for conservation, it seems strange that the existing body of theory relating to organizations has been largely ignored by conservation scientists. Of particular relevance is the field of organizational ecology, which has emerged from the application of ecological perspectives to the business environment. Organizational ecology seeks to explain how environmental (social, economic, political) conditions affect the relative abundance and diversity of organizations, and to understand the changing composition of organizations over time (Baum, 1999; Hannan and Freeman, 1977). In understanding the relative abundance and diversity of organizations, it is hypothesized that organizations become segregated into distinct clusters sharing a common "identity" when there are incompatibilities between organizational characteristics that restrict the combinations of characteristics that can emerge and persist [e.g. technological incompatibilities and transaction costs in manufacturing, construction, farming, and commercial industries; (Hannan and Freeman, 1986; Ruef, 2000)].

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In considering changes in the composition of organizations over time, organizations may have difficulty adapting their identities efficiently to meet the demands of an uncertain, changing environment. Effective adaptation can be limited by high sunk (unrecoverable) costs and legal and economic barriers of exit and entry [which impede organizations leaving or entering an industry; (Hannan and Freeman, 1977)]. Organizational ecologists have argued that organizational survival is dependent on a high degree of reliability in the provision of services/activities, and accountability in management actions (Hannan and Freeman, 1984; Hannan et al., 2004). The theory of structural inertia states that (a) organizations are often unable to adapt at an appropriate rate to emerging changes in their environment; and (b) frequent adaptation to constantly changing conditions can be maladaptive if it undermines the organization's reliability and accountability (Hannan et al., 2004; Stieglitz et al., 2015). Organizations with identities that are "matched" with current conditions will persist, while "mismatched" organizations that incur limitations in their ability to adapt appropriately will ultimately disappear (Hannan and Freeman, 1977).

Ideas from organizational ecology have significant potential for understanding the likely persistence and effectiveness of conservation organizations. In this paper we apply an organizational approach to the topic of private land conservation, which is increasingly important in global conservation efforts (Langholz and Lassoie, 2001; Stolton et al., 2014). A private land conservation area (PLCA) refers to an area that is managed for biodiversity conservation; protected with or without formal government recognition; and owned or otherwise secured by individuals, communities, corporations or nongovernment organizations (Cousins et al., 2008; Pasquini et al., 2010). A significant conservation concern is whether PLCAs will be able to effectively conserve biodiversity over suitably long time frames. This question reflects a core theme of organizational ecology: how do environmental conditions affect the relative abundance and diversity of organizations, and the ability of individual organizations to persist over time? Here we define persistence as the continued maintenance of a natural (untransformed) landcover, with at least current levels of biodiversity. Environmental conditions in this context include biophysical and socioeconomic conditions (e.g. climate and the tourism market, respectively).

Assessing the likely persistence of a PLCA requires cognizance of the motives, besides biodiversity conservation, behind its establishment and maintenance. An international assessment of PLCAs found motives to vary widely, including philanthropy, quality of life, business, and acquiring governmental financial incentives (Stolton et al., 2014). Many PLCAs have developed fund-generating activities such as ecotourism and hunting (Langholz and Lassoie, 2001; Stolton et al., 2014). The motive underlying these activities is sometimes to offset PLCA costs, with other PLCAs stating profit generation to be an important objective in-and-of-itself (Langholz et al., 2000; Pasquini et al., 2010). Understanding the ability of such PLCAs to achieve their objectives therefore requires an assessment of the efficacy of PLCAs in generating profits.

In Latin America and sub-Saharan Africa in the 1990s, 59% of surveyed PLCAs were profitable (Langholz, 1996). Financial models suggest that ecotourism has the potential to generate a greater return on investment than hunting in some southern African countries, while both activities fare poorly in others (Absa Group Ecomonic Research, 2003; Barnes and de Jager, 1996; Barnes, 2001). Consumptive uses of wildlife, such as meat sales and hunting, have nonetheless become important industries in southern Africa (Bond et al., 2004; Novelli et al., 2006).

Within the ecotourism industry, forest reserves in eastern Africa attracted fewer visitors than savanna game parks (Bayliss et al., 2014). Megaherbivores and large carnivores were the most popular species for international visitors to South Africa, though local visitors were more interested in smaller, rarer species and scenery (Lindsey et al., 2007). "High-end, low-volume" (high price per visitor, low number of visitors) ecotourism on private land has become a significant industry within southern Africa, targeting international tourists from high income countries (Bond et al., 2004; Magole and Magole, 2011). South Africa also supports a strong domestic tourism market, with demand for "low-end" (affordable) ecotourism opportunities (Bond et al., 2004). Visitor numbers to PLCAs are therefore not a function of ecological attributes alone, but also other biophysical as well as socioeconomic characteristics of the PLCA, including affordability, accessibility, and available facilities (Bayliss et al., 2014; De Vos et al., 2016). The availability of educational experiences such as guided tours can further influence the quality of visitor experience (Kerley et al., 2003).

Assessing the profitability of a PLCA therefore requires consideration of the adopted business model, as defined by available features and activities, both biophysical and socioeconomic. Organizational ecology defines an organization's identity according to its structural features and patterns of activity (Hannan and Freeman, 1977); a PLCA's business model can be considered analogous to its identity. In organizational ecology, biophysical and socioeconomic incompatibilities between different organizational characteristics are interpreted as driving segregating processes that create distinct clusters, or business models, with different identities. Such incompatibilities are likely to be evident on PLCAs between certain combinations of biophysical and socioeconomic characteristics. For example, PLCAs that rely on large carnivore species to attract tourists are unlikely to support large-scale hunting operations because of unsustainable stresses on the game population and potentially negative feedback from non-hunting guests. PLCAs that offer a high-end, low-volume safari experience may not concurrently cater for high quantities of day visitors that would detract from this exclusivity. Similarly, PLCAs that are far from airports and cities are unlikely to attract high volumes of day visitors.

In this paper we focus on two questions relating to the organizational ecology of PLCAs. First, do distinct PLCA business models exist, and why? For the reasons outlined above, we anticipate that biophysical and socioeconomic segregating processes will exist in the PLCA industry and that distinct clusters of PLCAs will be characterized by business models that reflect these incompatibilities. Second, if PLCA business models are indeed discontinuous, what proportion of PLCAs adopting different business models matches current environmental conditions? For those PLCAs for which profit is an important objective, a match between business model and current conditions is demonstrated by a match between financial objectives and profitability. Organizational ecology suggests that PLCAs should incur structural inertia as a result of segregating processes and barriers of exit and entry. This prediction would be supported if we were to observe PLCAs with financial returns that do not match financial objectives, reflecting an inability to adapt effectively to current conditions. Observed mismatches must be interpreted with some caution because of the role of temporal variation; knowledge of thresholds in how long owners would be willing to finance losses is important for assessing the likely long-term persistence of mismatched PLCAs, as many PLCA land owners report additional income sources (Langholz, 1996; Langholz et al., 2000; Pasquini et al., 2010) that may buffer mismatches. We test our predictions using PLCAs in the Western and Eastern Cape Provinces of South Africa that generate revenue from visitors, and relate our findings to conservation organizations and natural resource management more generally.

2. Methods

2.1. Study region

The Western Cape Province is 130,000 km^2 in extent and is characterized by the Fynbos, Nama-Karoo, Succulent Karoo and Thicket biomes. The Eastern Cape Province is 169,000 km^2 in extent and is characterized by the Fynbos, Grassland, Nama-Karoo, Savanna, Succulent Karoo and Thicket biomes.

With 79% of South Africa's land in private hands (Department of Rural Development and Land Reform, 2013), privately owned land has become an important part of the national conservation effort (Bond et al., 2004). PLCAs in South Africa include "Private Nature Reserves" that are legally gazetted under the Protected Areas Act (Act 57 of 2003); "Biodiversity Agreements" that have legal status by virtue of a legally binding contract, and "Conservation Areas" that are not legally recognized, but receive some form of protection by the landowners and are managed at least partly for biodiversity conservation (Cadman, 2010).

2.2. Sample PLCA selection

A list of commercially-operated PLCAs in the Eastern and Western Cape Provinces of South Africa was compiled using the South African Protected Area Database. This list was augmented by the list of PLCA managers interviewed by Baum (2016), as well as online searches using keywords such as private, game, nature and reserve. We included sites that met the PLCA definition and provided diversity in size, geographical location, ecology (richness and type of vegetation, game, megaherbivores and large carnivores), legal status, facilities and activities. Sample PLCAs were selected randomly from this list. Managers and owners of selected PLCAs were contacted by telephone, and interviews were arranged. Semi-structured interviews were undertaken with owners/managers of 72 PLCAs between April 2014 and February 2015. Interview duration ranged from 1 to 3 h.

2.3. Data collection

The four categories of information obtained during interviews and from additional sources are detailed in Table 1.

2.3.1. PLCA specifications

Information on PLCA ownership, names of included farms, legal status, age and location was obtained.

2.3.2. Owner objectives

The conservation and financial motives of the PLCA owner were assessed by asking each owner/manager to rate protecting nature and profit generation as PLCA objectives on a Likert scale from one (not important) to five (very important). In order to identify potential financial thresholds, owners/managers were asked (a) if an external income source contributed to funding the PLCA and (b) what actions would be taken in hypothetical situations where they did not achieve their financial objectives for the PLCA in the next 5, 10, and 20 years. These actions were thereafter grouped into "no action" (finance the PLCA from external income sources), "sell the PLCA" or "try to adapt" (e.g. change the land use, sell game). When managers were interviewed, if they stated that they were unable to answer these questions then the owner was contacted.

2.3.3. Finances

Owners/managers were asked whether the PLCA made an operating profit or loss in the 2013/2014 financial year, where an operating profit is a positive EBITDA figure (Earnings Before Interest, Tax, Depreciation and Amortization). Respondents from 69 PLCAs answered this question. 52 PLCAs further provided an EBITDA value for the 2013/2014 financial year. EBITDA (hereafter referred to as "earnings" or "profitability") is obtained from a business' income statement and is a commonly used metric for comparing profits between businesses because it eliminates the effects of financing and accounting decisions and collections of assets. Current market value for each PLCA property was calculated from the local municipality general valuation rolls for 2013. A general valuation

Table 1
Details and sources of data obtained for each PLCA. Square brackets indicate characteristic names referred to in the results.

Data type	Details	Source
PLCA specifications	Ownership details	Interview with owner/manager
	Names/numbers of farm portions comprising the PLCA	
	Age since opened to the public	
	Legal status (gazetted, stewardship agreement, informal)	
	GIS boundaries from South African cadastral farm boundary data	AfriGIS
Owner objectives	Likert scale ranking of the importance of (a) protecting nature and (b) profit generation as a PLCA objective	Interview with owner/manager
	Other income source (Y/N)	
	Actions to be taken if financial objectives not met in the next 5, 10, 20 years (categorical)	
Finances	Operating profit made in the 2013/2014 financial year (Y/N)	Interview with owner/manager, and reference to the PLCA income statement and game counts, local municipality general valuation roll (2013), North West University
	[profitability] Earnings for the 2013/2014 financial year	
	[ROI] Return on investment	
	[property value] Sum of land and improvement (infrastructure) valuations for each farm portion comprising the PLCA	
	[game value] Total value of game on each PLCA	
PLCA characteristics		
Biophysical	[size] Size (ha)	GIS data, see GIS boundaries
	[chari_game] Number "charismatic" game species (megaherbivores and large carnivores)	Interview with owner/manager
	[other_game] Number of "other" game species (equids and bovids)	
	[land_cover] Land cover diversity	South African National Land Cover Dataset
	[elev_var] Elevation range (masl)	Shuttle Radar Topography Mission Digital Elevation Data Version 4
Accessibility	[travel_time] Travel time to nearest airport (minutes)	Google Maps
Affordability	[price] Average daily price of visit (South African Rands)	Interview with owner/manager
Infrastructure	[bed_no] Number of beds available	
	[cat.v.sc] Importance of restaurant/catering vs. self-catering facilities	
	[stay.v.day] Importance of overnight vs. day visitor facilities	
Activities	[guide.v.self] Importance of guided vs. unguided activities	
	[eco] Proportion of revenue generated from ecotourism	
	[hunt] Proportion of revenue generated from hunting	
	[game_sales] Proportion of revenue generated from game sales	
	[farm] Proportion of revenue generated from farming	
Market	[int.v.loc] Importance of international vs. national visitors	

roll is a legal document produced every 4 years according to The Municipal Property Rates Act 6 (2004), which assigns a market value to all properties in a municipality, accounting for both the land and the infrastructure. We calculated the current game value for all PLCAs according to game count data, using average game auction prices for each species sold in South Africa in 2013 (The Unit for Environmental Science and Management, North West University). Due to the diversity of counting techniques used and the diversity of habitats, no visibility correction factors were assigned to count data. Furthermore, we excluded smaller antelope species that are notoriously difficult to count. Game data were therefore likely to be undervalued across PLCAs, but sufficient for relative comparisons between PLCAs. South African Rands were converted to United States Dollars using an average of the daily South African Reserve Bank exchange rate for the 2013/2014 financial year (1 USD = 10.00 ZAR). Return on investment (ROI), a performance measure used to compare the efficiency of different businesses, was calculated by dividing earnings by the sum of property and game values. The average 2013 South African bond yield was obtained from the South African Reserve Bank, to compare ROI with a risk free rate of return (RFR: 7.7%).

2.3.4. PLCA characteristics

We quantified a range of PLCA characteristics (biophysical-, accessibility-, affordability-, infrastructure-, activities- and target market-related) that could be used to distinguish different business models. Size was determined from farm boundary data, the numbers of "charismatic" game species (megaherbivores and large carnivores) and "other" game species (equid and bovid species) were counted using species lists, and a Shannon diversity index was used to calculate the abundance and diversity of natural landcover types in each PLCA as a metric for vegetation aesthetics (De Vos et al., 2016). The standard deviation in elevation (masl) was used as a metric of topographical aesthetics, where a higher value illustrates greater diversity in elevation. Accessibility was measured as shortest travel time (in minutes) to the nearest international or national airport using Google Maps (De Vos et al., 2016). Affordability was calculated as average daily cost to visitor, between the most expensive accommodation with a full day of activities and the cheapest available option (either accommodation with no activities or a day's activities with no accommodation). Number of available beds was determined. Activities were quantified by the proportional contribution to total revenue in the 2013/2014 financial year. Ecotourism represented the proportion of revenue generated from people visiting the PLCA to undertake ecotourism activities (including payments for entrance, activities, food and accommodation). Such activities included game- and nature-viewing drives and walks; game interaction opportunities; horse riding, quad biking and off-road driving; events and functions; and environmental education/volunteering programmes. Hunting represented the proportion of revenue generated from people visiting the PLCA in order to hunt or observe a hunt (including payments for accommodation, hunting fees and animals hunted). Game sales and farming represented the proportions of revenue generated from the sale of live game and venison, and stock farming or small-scale agriculture, respectively. We did not have a quantitative measure of the importance of restaurant/catering facilities compared with self-catering facilities; the importance of guided ecotourism activities compared with unguided ("self") activities; or the importance of international visitors compared with national ("local") visitors. Therefore, for each of these three metrics, owners/managers were asked to rate the importance of each attribute to achieving their objectives, on a Likert scale from one (not important) to five (very important). Relative importance was then calculated as the importance of the attribute (e.g. restaurant) divided by the sum of the importance of both attributes (e.g. restaurant plus self-catering).

2.4. Statistical analyses

A principal component analysis was performed to explore correlations between PLCA characteristics [Table 1; R package: vegan; function: rda (Borcard et al., 2011; Oksanen et al., 2015)]. Prior to performing the principal component analysis, data were transformed where necessary to meet the assumptions of normality and all data were scaled. Three non-trivial components were identified (see results) using the broken-stick method (Jackson, 1993), and are hereafter used to represent PLCA characteristics. A linear model was performed to assess whether PLCA characteristics were significant predictors of earnings [R package: stats; function: lm]. Number of years commercially-operated ("age") was included as a predictor, to control for its potential influence on earnings. Predictor variables were examined for multicollinearity to avoid correlation among covariates. Plots of fitted and observed values and residuals were examined for deviations from the assumptions of homogeneity and normality. The adjusted coefficient of determination was used to assess model fit.

In order to assess whether PLCA characteristics were discontinuous, we performed an hierarchical agglomerative cluster analysis on PLCA characteristics, employing Euclidean distance and Ward linkages [R packages: vegan and stats; functions: vegdist and hclust (Oksanen et al., 2015; Ward, 1963)]. We used a Mantel-based comparison as well as mean silhouette width to determine the number of distinct clusters [R package: cluster; functions: daisy and silhouette (Maechler et al., 2015)].

Differences between the distinct PLCA business models identified by the cluster analysis (see results) were described by comparing differences in (a) mean principal component scores and (b) mean values of the original 16 PLCA characteristics. We assessed whether there was a significant difference in the earnings, property value, game value and ROI between PLCAs adopting distinct business models. Comparisons were made using ANOVA and t-tests, and Kruskal–Wallis H and Wilcoxon signed rank tests, for normally and non-normally distributed characteristics, respectively. For each business model, differences in the number of PLCAs reporting protecting nature and generating profit to be important objectives (Likert scale rating > 3) vs. unimportant (Likert scale rating ≤ 3) were assessed using Fisher's exact test. To assess whether the type of interviewee influenced objectives, we performed a Fisher's test to assess whether the proportion of managers, managing-owners and owners interviewed differed between business models, and whether these three interviewees differed in their rating of profit as an important vs. unimportant objective. Statistical analyses were performed in the statistical programme R (R Development Core Team 2013) at a significance level of $\alpha = 0.05$. Sequential Bonferroni corrections were used to correct for multiple comparisons (Rice, 1989).

3. Results

PLCA characteristics (represented by three non-trivial principal components) were significant predictors of profitability ($r^2 = 0.38$, $F = 8.89$, $p < 0.001$, Table A.1). Two combinations of characteristics resulted in high profitability: (1) a large size, high number of charismatic and other game species, expensive accommodation and activities, the importance of a restaurant, guided activities, and international visitors or (2) a small size, high number of charismatic game species but low number of other game species, low topographical diversity, short travel time, the importance of guided activities and day visitors, and revenue generated by ecotourism as opposed to hunting and game sales (Fig. 1; Table A.1).

Four distinct business models were identified (Fig. A.1). All PLCA characteristics differed significantly between business models except land cover diversity and the proportion of revenue generated from farming (Table A.2). "Hunting" reserves (18% of sample) were

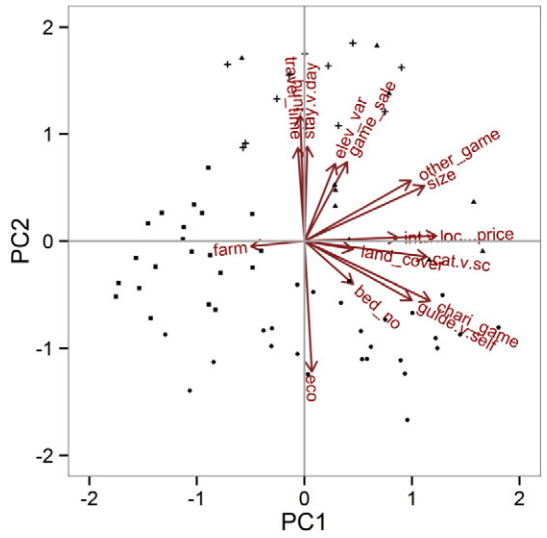

Fig. 1. Biplot depicting the relative scores of 16 PLCA characteristics on the first two principal components. Data points indicate the scores of 72 PLCAs, with shapes corresponding to the four identified clusters (+ hunting; ■ budget; ▲ big game stay, ● big game day). Refer to Table A.2 for mean (±SE) scores of each characteristic for each PLCA business model cluster. Profit increased with principal component one ($\beta = 2.38 \pm 0.51$, $t = 4.65$, $p < 0.001$) and decreased with principal component two ($\beta = -1.89 \pm 0.56$, $t = -3.37$, $p = 0.002$).

characterized by a large size, no charismatic game species, but large numbers of other game species; a low quantity of catered, intermediately-priced accommodation; a large proportion of revenue from hunting, followed by game sales; and the importance of international visitors (Fig. 1; Tables A.1 & A.2).

"Budget" reserves (29%) were categorized by a small size, no charismatic game species and few other game species; cheap self-catering accommodation; the majority of revenue from unguided ecotourism; and the importance of local, overnight visitors (Fig. 1; Tables A.1 & A.2).

"Big game stay" reserves (17%) were the largest PLCAs with the greatest topographical diversity, supporting multiple charismatic ("big") game species and a large number of other game species. Expensive catered accommodation was on offer; with a large proportion of revenue generated from guided ecotourism and a smaller proportion from game sales and hunting. Overnight visitors were important (Fig. 1; Tables A.1 & A.2).

"Big game day" reserves (36%) were characterized by small size, low topographical diversity, multiple charismatic game species, an intermediate number of other game species and a short travel time. They offered intermediately-priced accommodation and activities and a restaurant; and the majority of revenue came from guided ecotourism. Both day and overnight international visitors were important (Fig. 1; Tables A.1 & A.2).

Profitability differed between business models ($K = 13.57$, $p = 0.004$; Fig. 2), as a result of big game day reserves generating higher earnings than hunting and budget reserves. There was no difference in profitability between hunting and budget reserves. Big game stay reserves did not differ in profitability from budget, hunting or big game day reserves. While big game stay reserves generated, on average, the second highest earnings, there was substantial variation in earnings.

Property and game values differed between business models ($K = 29.32$, $p < 0.001$; $K = 25.16$, $p < 0.001$, respectively; Fig. 2). Big game stay reserves were characterized by greater property values than hunting and budget reserves, and big game day reserves were characterized by greater property values than budget reserves. Hunting, big game stay and big game day reserves supported game populations of higher value than budget reserves. ROI differed between business models ($K = 9.59$, $p = 0.02$; Fig. 2), with big game day reserves generating a larger ROI than budget and hunting reserves. Big game day reserves were the only business model with a median ROI comparable to the RFR.

Protecting nature was rated an important objective on 83% of PLCAs, and this proportion did not differ significantly between business models (*Fisher's exact* $p = 0.12$). While the relative number of owners, managing-owners and managers interviewed differed between business models, there was no difference in the relative number of owners, managing-owners and managers that rated profit generation as an important vs. unimportant objective (Table A.3). The proportion of PLCAs that rated profit generation as an important objective differed between business models (*Fisher's exact* $p = 0.004$). Just 43% of budget reserves rated profit generation as an important objective, significantly fewer than hunting (92%, *Fisher's exact* $p = 0.004$), big game stay (91%, *Fisher's exact* $p = 0.016$) and big game day (79%, *Fisher's exact* $p = 0.011$) reserves. The red box in Fig. 3 (pane 1) indicates PLCAs that stated profit

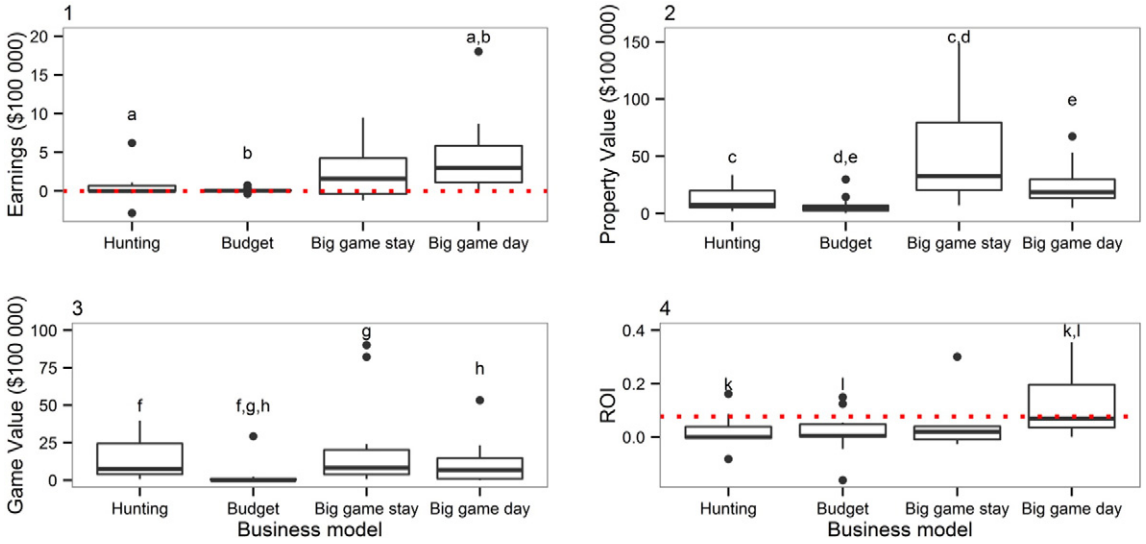

Fig. 2. Comparisons across PLCA business models of (1) earnings, (2) property values, (3) game values and (4) return on investment (ROI), for the 2013/2014 financial year. Lines, boxes, error bars, and circles show medians, interquartile ranges, minima and maxima (excluding outliers), and outliers (that deviate from the median by >1× the interquartile range), respectively. Horizontal red dashed lines indicate (1) zero profit and (4) South African 2013 average bond yield of 0.077. Corresponding letters indicate significant differences between business models (a. $W = 22$, $p = 0.002$; b. $W = 29$, $p < 0.001$; c. $W = 20$, $p = 0.007$; d. $W = 11$, $p < 0.001$; e. $W = 44.5$, $p < 0.001$; f. $W = 16$, $p < 0.001$; g. $W = 20.5$, $p < 0.001$; h. $W = 99$, $p < 0.001$; k. $W = 31$, $p = 0.01$; l. $W = 53$, $p = 0.007$). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

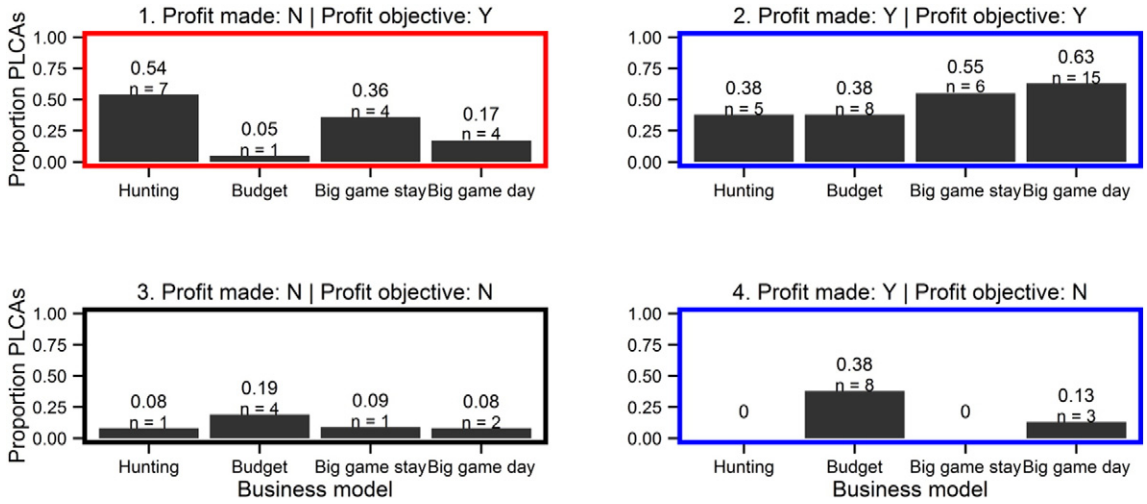

Fig. 3. Proportion of PLCAs within each business model that generated an operating profit vs. loss in the 2013/2014 financial year, and rated profit generation as an important vs. unimportant objective. Proportions and sample sizes (n) are indicated above each bar. Box colours indicate extent of mismatch between actual finances and financial objectives: match (blue: panes 2 and 4), potential mismatch long-term (black: pane 3) and mismatch (red: pane 1). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

generation was an important objective, but that were currently not generating a profit. 54% of hunting reserves fell within this box compared with 5%, 36% and 17% of budget, big game stay and big game day reserves, respectively. 94% of the PLCAs that were not currently achieving their financial objectives stated having another income source. If PLCAs that were not currently meeting their financial objectives did not meet these objectives within the next 10 years, 38% of owners said that they would sell and 43.5% would try to adapt their business model. Suggested adaptations included downscaling and retrenching staff, increasing hunting and game sales, breeding more exotic/valuable game, offering specials to attract more people, closing high-end ecotourism lodges and becoming a hunting operation, and removing costly predators. Suggested adaptations on 12.5% of PLCAs included changing the land use to a wind farm or livestock farm. 6% of owners said that they would take no action, and 12.5% did not know.

4. Discussion

It is evident that PLCAs in the Cape Provinces of South Africa represent a diverse industry in terms of their owners' financial motives, adopted business models, and the efficacy of these models in meeting financial objectives. Distinct clusters of PLCAs with similar characteristics are evident, and the presence of strong negative correlations between certain characteristics suggests that incompatibilities maintain these different business models. When PLCAs are small and support charismatic game (megaherbivores and large carnivores) they can generate revenue from ecotourism but not hunting or game sales. In contrast, if PLCAs are large and support charismatic game this incompatibility appears reduced. Larger PLCAs are likely to support a higher abundance of other game (bovid and equid species), allowing for multiple forms of top-down population control, such as predation, hunting and live game sales, though hunting and game sales are not intensive, comprising less than 20% of revenue. When reserves generate more than half of their revenue from hunting and game sales, large carnivores are absent, most likely because they would pose a financial liability by eating other valuable game. Low travel time increased the importance of day visitors, if combined with guided charismatic ("big") game viewing opportunities. Big game reserves that charge high rates do not target local visitors or offer self-catering facilities and unguided activities, suggesting that these reserves promote a high-end experience that precludes such options. Small reserves that do not support many game species appear unable to charge high prices, which may explain why they do not offer guided activities and catering facilities that would be costly to develop and maintain. These trade-offs provide insights into why we observe current patterns of diversity in the PLCA industry, and have notable implications for profitability.

This study provides large-sample empirical support of predictions made by earlier studies that high-end guided big game ecotourism has the ability to generate greater earnings than hunting or low-end ecotourism (Absa Group Ecomonic Research, 2003; Barnes and de Jager, 1996; Bayliss et al., 2014; Lindsey et al., 2007; Sims-Castley et al., 2005). While additional years of data would be useful to confirm this pattern, it is likely to be in part because big game reserves can accommodate three times more visitors than hunting reserves, and charge visitors four to six times more than budget reserves. With hunting reserves generally being high-end, low-volume and budget reserves being low-end, high volume, big game reserves appear to maximize earnings by being both high-end and high-volume.

Given the trade-offs between profitable combinations of ecology, size, accessibility, affordability, facilities and activities, two distinct business models (respectively, big game day and big game stay) emerge that display combinations of characteristics related positively with profitability. Charismatic game and guided activities are the only commonalities between these two business models. These characteristics can be combined with a small size, low travel time and the importance of day visitors; or with large size, many other game species, high price, catering facilities and the importance of international visitors.

It is important to consider not only profitability but also return on investment, which gives an indication of the efficiency of a PLCA in generating profits relative to what has been invested. Big game day reserves offer the only business model that, on average, generates returns that are comparable with the RFR (i.e. the return that could have been generated if the owner had invested his money in a minimal risk investment instead of a PLCA). The greater efficiency of big game day reserves compared with big game stay reserves is likely to be partially because big game day reserves are, on average, six times smaller and thus require fewer resources to manage (Langholz et al., 2000).

External income sources appear to play an important role in the maintenance of many PLCAs, supporting previous findings (Langholz et al., 2000). For owners who are not motivated to generate profits from their PLCA, particularly those that have adopted the budget business model, the persistence of these PLCAs is likely to be dependent on the continued availability of these external income sources.

Almost a quarter of PLCAs were not currently meeting their financial objectives. This mismatch between financial objectives and financial returns was particularly common among hunting reserves. With just

1 year of financial data, we cannot assess the permanence of these mismatches or the efficacy of owners in adapting their business models to eliminate them. As the success of a conservation organization is defined by its ability to conserve biodiversity long-term, adaptation of a PLCA's business model (e.g. changing from hunting to a big game reserve) would not represent a failure in persistence, provided that conservation objectives continue to be met. However, evidence of challenges associated with changing business models suggests that owners may not be able to readily adapt to a mismatch. Establishing a hunting reserve requires substantial sunk costs, including investment in a large land area and a high number of game species. Ecological and economic incompatibilities result in such a reserve being unable to concurrently generate substantial income from ecotourism, which is likely reinforced by social incompatibilities in the form of negative perceptions of many ecotourists towards hunting (McGranahan, 2011). Transitioning from a hunting reserve to a big game stay reserve would require additional property investments of $ 4.1 million (on average), creating a significant barrier to entry into this more profitable business model. Changing from a hunting reserve to a big game day reserve is unlikely to be successful, given that big game day reserves are characterized by high geographic accessibility, while hunting reserves are not. Furthermore, owners of hunting reserves may be unwilling to adopt guided big game ecotourism due to personal preferences and lifestyle choices [e.g. (McGranahan, 2011)]. Given the potential for these constraints to impede adaptation, it is important for us to consider the likely long-term persistence of mismatched PLCAs.

Owners' financial thresholds give us some indication as to whether mismatched organizations are likely to persist long-term, with the owners of over 80% of mismatched PLCAs stating that they would not continue to finance an unprofitable organization indefinitely. Over a third of owners stated that they will attempt to adapt if they do not manage to achieve their financial objectives in the next 10 years. Interestingly, while several big game reserve owners suggested closing high-end lodges and adopting hunting as a likely adaptation to a mismatch, no hunting PLCAs suggested adopting high-end ecotourism. Therefore, large-scale adaptation of multiple socioeconomic and ecological PLCA characteristics, as would be required for the PLCA to adopt a more profitable business model, appears limited on some PLCAs, in light of incompatibilities and barriers of exit and entry discussed above.

The segregation of PLCAs into distinct business models with different target markets (high-end vs. low-end, international vs. local, ecotourist vs. hunter) may reduce competition between PLCAs adopting different business models. With competition thought to be growing in the wildlife industry in southern Africa (Bond et al., 2004), mismatched PLCAs may influence competition in two notable ways. Firstly, if the owners of mismatched PLCAs succeed in adapting to a more profitable business model, they may increase competition within this business model. Secondly, if they are unable to adapt and thereby fail, they may reduce competition within their current business model, alleviating mismatches experienced by other PLCAs within this niche. It is also important, however, to note that tourists may favour spending time in areas in which they can accumulate multiple experiences and/or travel between nearby reserves. The presence of two or more nearby PLCAs may in fact increase overall visitor numbers, to the net benefit of both/all areas, creating a facilitation effect rather than a negative financial outcome. For example, during interviews with tourists undertaken as part of a related study (Ament et al., under review), some visitors to national parks indicated that they stayed in adjacent private areas where the quality of accommodation was higher and visited the national parks during the day. This is clearly an area in which further research on synergies and tradeoffs might benefit the industry as a whole and support the achievement of conservation objectives.

The majority of PLCAs stated that nature protection was an important objective, supporting previous studies (Langholz, 1996; Pasquini et al., 2010; Selinske et al., 2015). If management attempts to increase/achieve profitability impact negatively on the PLCA's ecological integrity, attempted adaptations could lead to harmful long-term ecological effects (Cousins et al., 2008; Kerley et al., 2003; Langholz and Lassoie, 2001; Sims-Castley et al., 2005), and failure to meet conservation objectives. For example, if hunting reserves were unable to meet their financial objectives, some owners reported “hunting more game” as a likely response. If increased hunting exceeds ecologically sustainable levels, this may ultimately result in game population collapses, altered food-webs, and reduced ability to persist as a conservation organization. The interdependencies between the PLCA's socioeconomic and ecological systems suggest that PLCAs are best considered as social-ecological systems (Berkes et al., 2000).

An understanding of the diversity and likely persistence of conservation organizations must incorporate the fact that organizations that govern or manage natural resources emerge from social-ecological interactions. The significance of this fact lies, in part, in the consideration of temporal scale. Socioeconomic processes like tourism demand and earnings can change over short time periods, while ecological processes like habitat alteration or trophic cascades generally change over much longer time scales (Cumming et al., 2015). Therefore, PLCAs with short-term financial objectives may more readily attempt to adapt their management to socioeconomic processes than to ecological processes (Cumming et al., 2015). If these adaptations are detrimental to slower-changing ecological processes, then a temporal scale mismatch arises (Cumming et al., 2006), and the PLCA becomes gradually less resilient to the larger shocks that may eventually emerge from ecological feedbacks (Cumming et al., 2015). The theory of structural inertia states that organizations that attempt to adapt too often and too specifically to current conditions can increase their risk of failure (Hannan and Freeman, 1984). For organizations in social-ecological contexts, this hypothesis appears to fit well: we propose that there is a risk that frequent and specific adaptations in response to fast-changing socioeconomic variables can result in unforeseen but detrimental changes to slow-changing ecological variables.

5. Conclusion

We have demonstrated that organizational ecology can be a useful framework with which to understand the likely persistence of conservation organizations. Identifying incompatibilities in organizational characteristics is useful in explaining observed diversity in conservation organizations. Through the theory of structural inertia, these incompatibilities and barriers of exit and entry can be used to explore the challenges encountered by organizations in adapting effectively to dynamic environmental conditions, such as changing recommendations regarding conservation actions and a changing economic climate (Armsworth et al., 2015; Larson et al., 2014). Conservation organizations are subject to varying degrees of financial constraint (Larson et al., 2014). “Rational routes to collapse” (Peterson et al., 2003) may arise when initial, rational choices of how to manage and conserve a natural resource in a given socioeconomic environment lead to inert organizational structures that are unable to adapt effectively to changing socioeconomic conditions. Attempted adaptations to overcome such constraints may hinder conservation efforts, and ultimately lead to organizational collapse, when socioeconomic and ecological processes operate at different temporal scales.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.biocon.2016.03.002.

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