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LETTER

Cultural Ecosystem Services in Protected Areas: Understanding Bundles, Trade-Offs, and Synergies

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Abstract

The concept of ecosystem services (ES) provides a potentially useful tool for decision-making in natural area management. Provisioning and regulating ES often occur in "bundles" that are cohesive because of coprovisioning or codependence. We asked whether individual preferences for cultural benefits also define service bundles. Data from a large survey of visitor preferences (n = 3,131 respondents) from all 19 South African National Parks indicated five bundles of cultural ecosystem services: (1) "natural history," (2) "recreation," (3) "sense of place," (4) "safari experiences," and (5) "outdoor lifestyle." Trade-offs and synergies between bundles of services depended on the ecosystem providing them and on alignment between demand for services and the supply of particular service bundles in specific ecosystems. Our results show that identifying demand for multiple services can both help us to understand why people visit and value protected areas, and better inform the management choices that influence service provision.

Introduction

Over the last 50–60 years, Conservation Biology has worked through several different framings of the relationships between people and nature. The observation that natural areas supply ecosystem goods and services (ES) to people has provided a useful link between ecosystems and human well-being (De Groot *et al.* 2002; MA 2005). The practicalities of quantifying and modeling this link are still, however, a work in progress (Carpenter *et al.* 2009; Seppelt *et al.* 2011; Reyers *et al.* 2013; Mace 2014). Explicitly connecting change in ecosystems to human well-being requires a comprehensive approach that considers both tangible and intangible benefits (Russell *et al.* 2013).

Many tangible ecosystem benefits are readily quantified through economic measures, such as the costs of water purification or the market values of food and fuel. Intangible benefits, or cultural ecosystem services (CES), are harder (but not impossible) to measure using approaches that recognize the difficulties of aggregating human values and deliberately maintain a plurality of perspectives and epistemologies (Chan *et al.* 2012b; Satz *et al.* 2013). Assessments of CES now cover topics such as recreation (e.g., Driver & Knopf 1977; Chan *et al.* 2006), culture and heritage (e.g., Tengberg *et al.* 2012; Nahuelhual *et al.* 2014), sense of place (e.g., Trentelman 2009; Ardoin *et al.* 2012), and mental health (e.g., Bratman *et al.* 2012; 2015), and promise to contribute to more resilient strategies for ecosystem management (Chan *et al.* 2012a). So far, however, incorporation of CES into decision-making—from landscape management to international policy—has been minimal in comparison to more tangible ES, such as food provision and climate regulation,

despite continuous recognition of the value of CES and the instrumental role they play in securing public support for the protection of ecosystems (Daniel *et al.* 2012; Wolff *et al.* 2015). Satz *et al.* (2013) discuss a wide range of reasons for why CES are often ignored in decision-making processes, including problems such as the marginalization of rural communities whose decisions may be heavily influenced by cultural values, the difficulties (incommensurability) of comparing economic and cultural values, the interconnected nature of different benefits, failings in deliberative processes, and the perception that CES are "luxury goods" relative to more tangible benefits.

Research on ES has recognized that different services often occur together in "bundles" (Cumming & Peterson 2005). Service bundles have previously been described as cohesive because of either coprovisioning (one ecosystem provides several services) or codependence (one service requires another) (Bennett *et al.* 2009). For example, tangible ES, including some CES (tourism, deer hunting, nature appreciation, summer cottages, and forest recreation), have previously been quantified and compared directly from maps to explore the concepts of clustering in ES and ES bundles (Raudsepp-Hearne *et al.* 2010). There is, however, a third way of describing service bundles, which has not been considered in great depth: that is, based on the preferences of stakeholders (Martín-López *et al.* 2012; Klain *et al.* 2014). Bundles defined by user preference are particularly relevant in the context of cultural services, where understandings of human perceptions of the environment can benefit support for and resilience of environmental policy and strategies (Martín-López *et al.* 2007; Asah *et al.* 2014) and can improve CES indicator quality (Hernández-Morcillo *et al.* 2013).

Analysis of ES bundles is important for making decisions about trade-offs between multiple services more effective and financially defensible (Nelson *et al.* 2009), but has focused primarily on the supply of provisioning and regulating services (e.g., Maes *et al.* 2012; Qiu & Turner 2013), or recreational aspects of cultural services (Raudsepp-Hearne *et al.* 2010; Turner *et al.* 2014; Queiroz *et al.* 2015). The idea that potentially antagonistic bundles of human preferences may exist has been explored in the literature on tourist travel motivations (e.g., Bieger & Laesser 2002; Dolnicar & Grun 2007), with several examples for natural areas (Uysal *et al.* 1994; Tao *et al.* 2004; van der Merwe & Saayman 2008), but has only recently been considered under the ES framework (Burkhard *et al.* 2012; Wolff *et al.* 2015).

In protected areas where profit generation influences conservation success and depends on tourist numbers (Mayer *et al.* 2010; Clements *et al.* 2016), understanding human preferences is especially relevant. If cultural service bundles exist, then park managers may have to choose between providing a balance of service bundles or favoring a particular bundle (Rodriguez *et al.* 2006). In either case, the starting point for recognizing trade-offs and choosing strategies is to describe the relevant bundles of CES.

We used a large data set of tourist interviews from South African national parks to test (1) whether tourist demands for CES fall into distinct categories and hence, whether CES can be captured in distinct "bundles" with different recipient groups; and (2) whether trade-offs and synergies between these bundles emerge within ecosystems with different characteristics.

Methods

Data collection

Data were collected between February 2013 and May 2015 by means of tourist questionnaires distributed to all gates and reception desks of the 19 South African national parks (SANParks) (Figure 1). In addition, research assistants visited all parks on sampling trips to encourage visitors to complete the self-explanatory questionnaires at campsites, restaurants, and picnic spots. The sample population was limited to adults of 16 years or older. The survey comprised a brief explanation about the research, questions on demographic details of the respondents, and 30 Likert-type questions asking visitors to rate their appreciation of different aspects of protected areas on a five-point scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree). These questions were indicators of six subcategories of cultural ES (MA 2005): aesthetic ($n = 7$), cultural and heritage ($n = 2$), education ($n = 2$), recreation ($n = 11$), social ($n = 4$), and spiritual and religious ($n = 4$) (Table 1). Other subcategories were excluded from the study, as they were found too difficult to translate into indicator questions.

Data analysis

After capture, all years of data were pooled. The total sample included responses from 4,093 individuals, from which 3,131 complete responses were retained for analysis. Analysis consisted of two stages. We first investigated demand for CES in protected areas by subcategory through assessment of the services most appreciated (i.e., ticked "strongly agree") by visitors to the national parks.

Second, to understand the patterns of service demand by individual visitor and park, we assessed correlations between appreciation of services in an exploratory

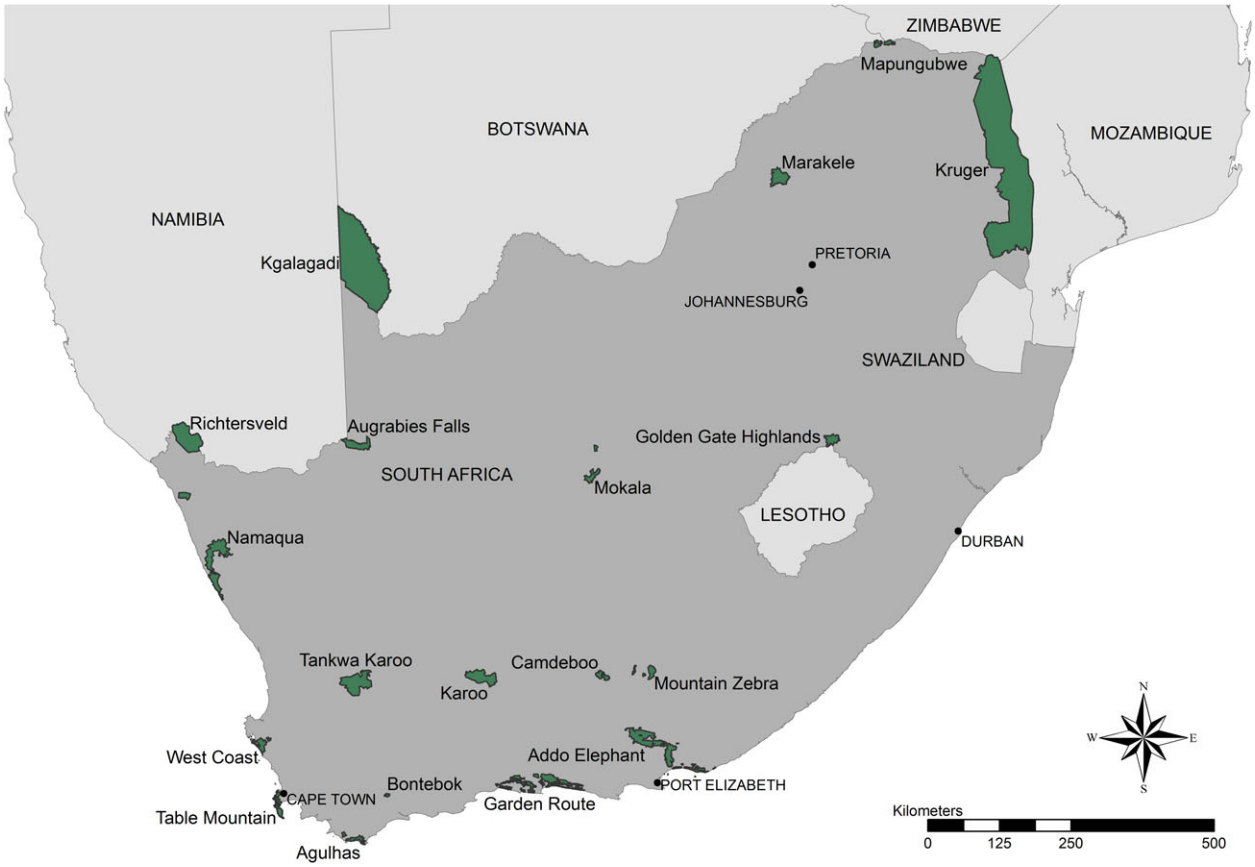

Figure 1 Map of South African national parks from which data originated: Addo Elephant NP ($n = 171$), Agulhas NP ($n = 120$), Augrabies Falls NP ($n = 115$), Bontebok NP ($n = 130$), Camdeboo NP ($n = 118$), Garden Route NP ($n = 276$), Golden Gate Highlands NP ($n = 145$), Kruger NP (North: $n = 141$; South: $n = 325$; private: $n = 53$; and unspecified: $n = 75$), Karoo NP ($n = 112$), Kgalagadi NP ($n = 177$), Mapungubwe NP ($n = 104$), Marakele NP ($n = 139$), Mokala NP ($n = 94$), Mountain Zebra NP ($n = 152$), Namaqua NP ($n = 37$), Richtersveld NP ($n = 131$), Table Mountain NP (Boulders Beach: $n = 76$; Cable Way: $n = 88$; Cape Point: $n = 91$; and Silvermine: $n = 145$), Tankwa Karoo NP ($n = 57$), and West Coast NP ($n = 59$).

factor analysis (R "Stats" package, *factanal* function, and varimax rotation), interpreting survey responses (i.e., 1–5) as numerical interval data. Factor analysis is a powerful statistical procedure capable of uncovering the structure in service demand (i.e., bundling survey questions that vary together) without enforcing a priori ideas about the clustering of visitor preferences. We used visual (scree plot) and analytical (parallel analysis) methods to determine the number of factors to extract (seven), and after inspection of meaningfulness, the first five were retained for interpretation. We calculated Spearman's rank correlation coefficients of factor loadings to assess trade-offs and synergies between factors, and Bartlett factor scores to investigate patterns in tourist preferences in different parks. Demographic predictors of factor scores were assessed with two-way ANOVA's followed by post-hoc Tukey tests (R "multcomp" package). All analyses were performed in R version 3.2.2 (R Core Team 2014).

Results

Demand for individual cultural ecosystem services

Demographic characteristics of respondents were well balanced (see Supplementary Information, Figures S1–S4 and Table S1). Respondents were generally very positive in their responses to survey statements, recording high mean and median responses for nearly all services (Table 1). "Relaxation" received highest mean response ($\mu = 4.59$), closely followed by "refreshing the spirit" ($\mu = 4.52$). The statement gauging the importance of "feeling closer to God" in protected areas generated a strongly bimodal response distribution ($\mu = 3.45$, $\sigma = 1.47$). Service demand was further spread over all subcategories of CES (Figure 2). The top quintile of most highly demanded services ($n = 6$) comprised four different subcategories (spiritual

Table 1 Mean and median responses of protected area visitors to preference statements on cultural ecosystem services. Responses were recorded on a five-point Likert scale

Survey statement	Indicator variable	Mean response (± SD)	Median response
Aesthetic			
Looking at big mammals	Big mammals	4.43 (± 0.72)	5—Strongly agree
Sitting, enjoying the view	View	4.38 (± 0.70)	4—Agree
Looking at birds	Birds	4.11 (± 0.94)	4—Agree
Looking at flowers	Flowers	3.72 (± 1.02)	4—Agree
Looking at reptiles	Reptiles	3.52 (± 1.09)	4—Agree
Trying to identify plants	Plants	3.38 (± 1.10)	3—Neutral
Looking for and or listening to frogs	Frogs	3.06 (± 1.13)	3—Neutral
Cultural and heritage			
The experience reminds me of my childhood	Childhood	3.48 (± 1.21)	4—Agree
It helps me to understand my culture and or history	Culture and history	3.31 (± 1.11)	3—Neutral
Educational			
Learning more about nature	Learning	4.25 (± 0.75)	4—Agree
Doing guided tours	Guided tours	3.18 (± 1.16)	3—Neutral
Recreational			
I enjoy camping	Camping	3.85 (± 1.26)	4—Agree
Doing game drives	Game drives	4.11 (± 0.99)	4—Agree
Cooking or braaing	Cooking	3.89 (± 1.05)	4—Agree
Taking photographs	Photography	4.39 (± 0.82)	5—Strongly agree
Hiking or climbing	Hiking/climbing	3.72 (± 1.09)	4—Agree
Reading and/or writing	Reading/writing	3.52 (± 1.10)	4—Agree
Driving off road, four wheel driving, or dirt biking	Off-roading	3.28 (± 1.32)	3—Neutral
Swimming, surfing, or doing other watersports	Swimming	3.09 (± 1.26)	3—Neutral
Boating or canoeing	Boating	2.98 (± 1.24)	3—Neutral
Sunbathing	Sunbathing	2.51 (± 1.24)	2—Disagree
Fishing	Fishing	2.33 (± 1.26)	2—Disagree
Social			
It is a way to spend time with my family friends	Family/friends	4.24 (± 0.90)	4—Agree
Hanging out at the campsite or chalet	Hanging out	3.40 (± 1.19)	4—Agree
Talking to other visitors	Talking	3.31 (± 1.00)	3—Neutral
Having a party with my friends	Partying	2.59 (± 1.30)	3—Neutral
Spiritual and religious			
It refreshes my spirit	Spirit	4.52 (± 0.71)	5—Strongly agree
It makes me feel closer to God	God	3.45 (± 1.47)	4—Agree
It helps me to relax	Relaxation	4.59 (± 0.67)	5—Strongly agree
I like to get away from modern conveniences	Away	4.09 (± 0.97)	4—Agree

and religious, recreational, aesthetic, and social) (MA 2005).

Bundles of cultural ecosystem services

Exploratory factor analysis identified five bundles of CES that cumulatively explained 35.3% of variance in survey responses, with low cross-loadings between bundles. All but four CES loaded strongly (factor loading>0.35) and uniquely or semiuniquely on one bundle ("learning" loaded strongly on two bundles) (Table 2).

The first CES bundle contained biodiversity and natural history-type services ("learning" and all aesthetic values except "big mammals" and "enjoying the view") and explained 9.3% of total variation in survey responses. One social service ("partying") was strongly negatively correlated to this bundle. Women and older people scored significantly higher on this bundle than men and younger people (Figure S5a). The second bundle also explained 9.3% of variation and identified strong synergies between most recreational activities ("boating," "swimming," "sunbathing," "partying," "hiking," "fishing," and "off-road driving"). This bundle showed evidence of a trade-off with "bird-watching" and was strongly associated with women, younger people, and people visiting from North America (Figure S5b). The third bundle explained 7.4% of variation in responses and revealed synergies between a combination of services

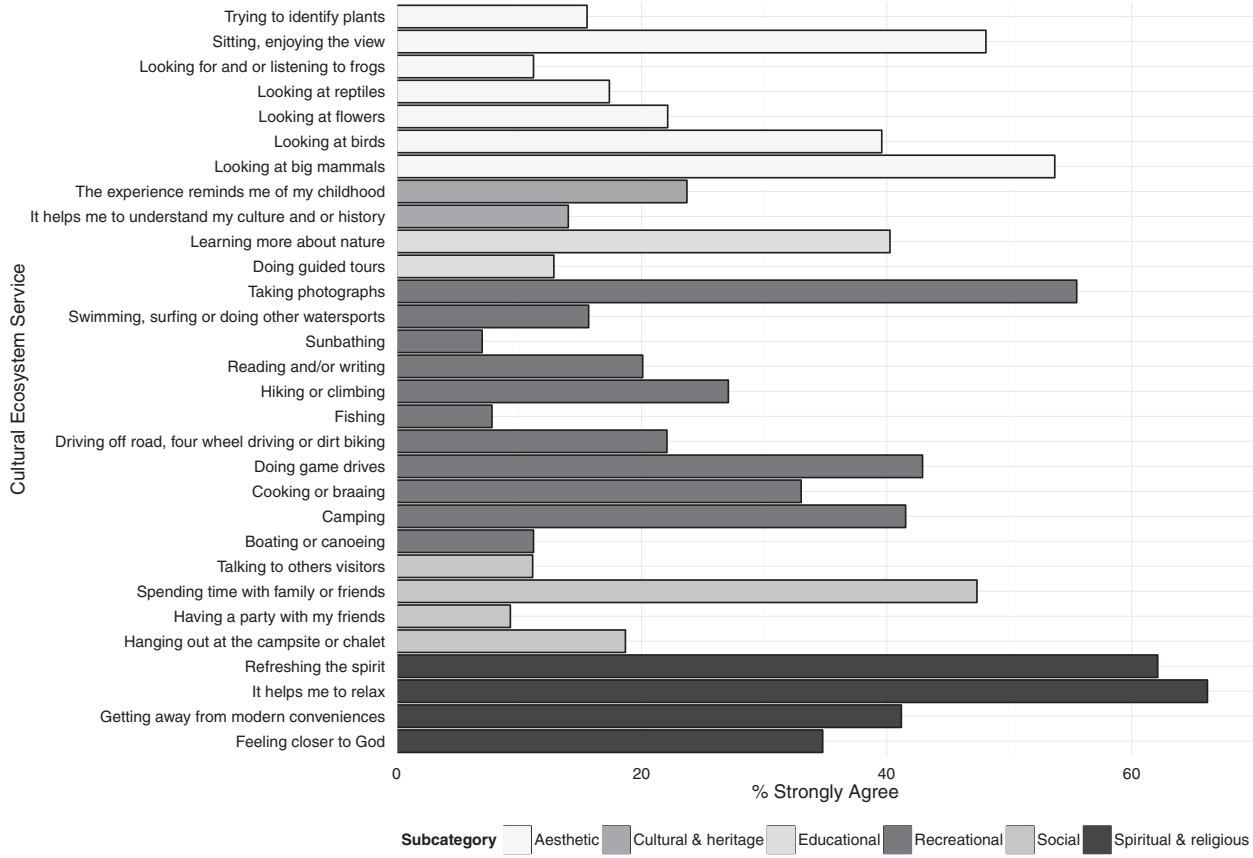

Figure 2 Most highly demanded cultural ecosystem services by subcategory, as defined in the Millennium Ecosystem Assessment (MA 2005). Service demand is distributed over all subcategories, with five of six categories receiving high rates of service demand (>40% strongly agree).

that concern visitors' emotional connections to these ecosystems, which, in conjunction, might be understood as sense of place. This bundle highlights several clusters of intangible benefits, such as psychological ("refreshing the spirit," "relaxation," and "feeling closer to God"), socio-cultural ("spending time with family and friends" and "reliving childhood memories"), and experiential ("camping" and "getting away from modern conveniences"). This bundle did not involve strong trade-offs and was associated with women, middle-aged people, South Africans, and Africans in general (Figure S5c). Fourth was a bundle explaining just 5.5% of variation in survey responses, but with a very clear and unique interpretation: enjoying a "safari experience." Indicator variables loading strongly onto this bundle were "viewing big mammals," "doing game drives," "taking photographs," and "learning." "Feeling closer to God" was negatively correlated with this bundle. This bundle was associated with women, younger people, Europeans and North Americans, and visitors during school holidays (Figure S5d). The last bundle of CES included strong relationships between sedentary, low-key activities ("cooking," "reading/writing," and "hanging out at the campsite or chalet"). This bundle explained 3.8% of variation and reflected the value of protected areas in providing a space for enjoying an "outdoor lifestyle." Men, people with less formal education, and South Africans scored higher on this bundle (Figure S5e).

Trade-offs and synergies between bundles of services

Correlations of factor loadings between bundles were mostly negative, with the strongest trade-off existing between natural history and recreation ($\rho = -0.583$, $P<0.001$) (Table 3). Other trade-offs with recreation existed with safari experiences ($\rho = -0.507$, $P<0.01$) and "sense of place" ($\rho = -0.410$, $P<0.05$). Natural history was further positively correlated with safari experiences ($\rho = 0.371$, $P<0.05$), but negatively with an outdoor lifestyle ($\rho = -0.478$, $P<0.01$).

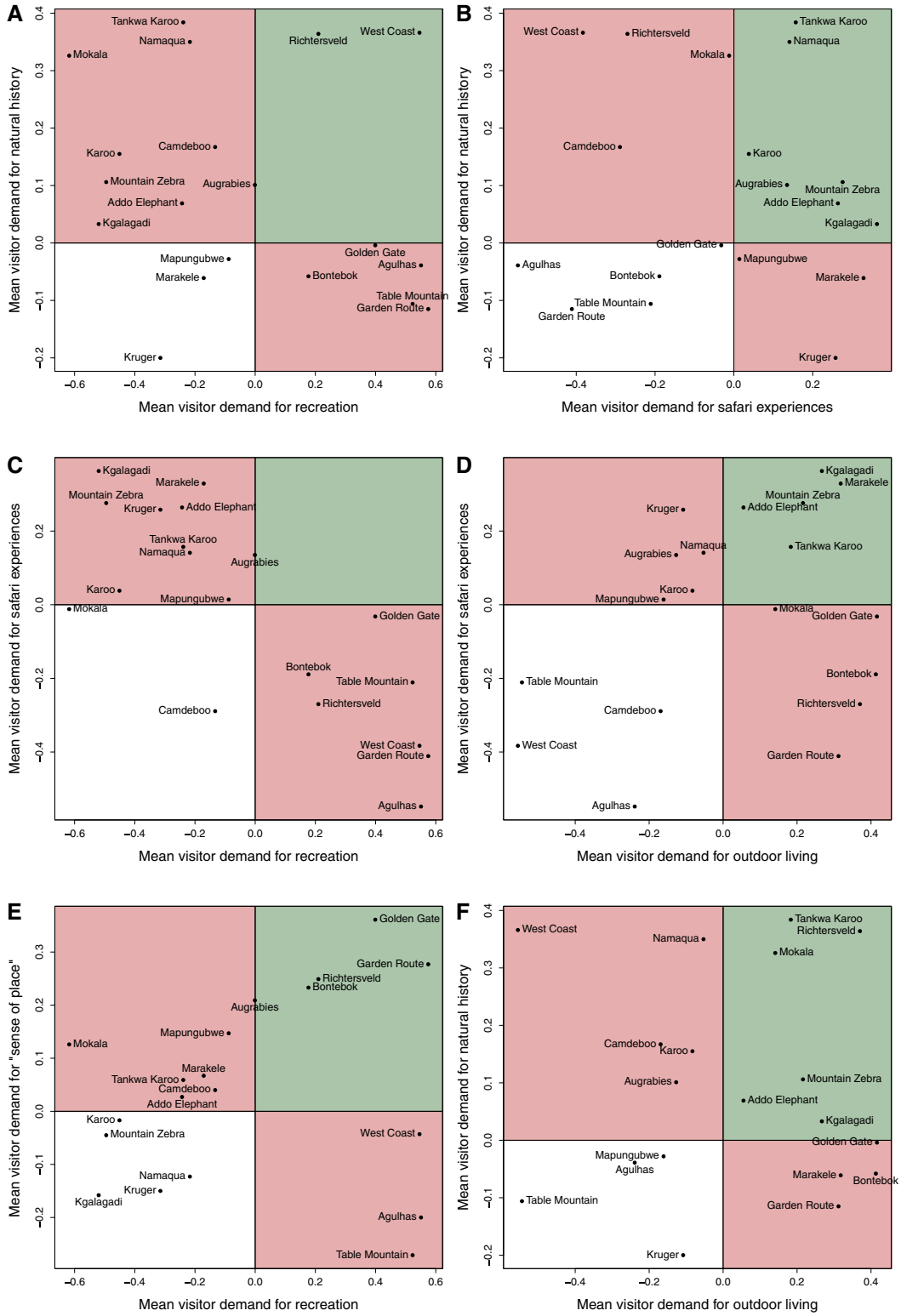

Figure 3 Trade-offs and synergies between bundles of cultural ecosystem services in South African national parks. Mean park scores on service bundles are calculated from pattern matrix of tourist preferences. Parks in green shading exhibit synergies between particular bundles; parks in the red tradeoffs.

Table 2 Loadings of individual cultural ecosystem services on bundles (factors) of ecosystem services

Indicator variable	Bundle 1: natural history	Bundle 2: recreation	Bundle 3: sense of place	Bundle 4: safari experience	Bundle 5: outdoor living
Flowers	**0.760**	0.089	0.084	0.141	0.061
Plants	**0.750**	−0.030	0.108	0.116	0.089
Birds	**0.632**	−0.149	0.124	0.258	0.041
Frogs	**0.574**	0.139	0.092	0.153	0.011
Learning	**0.474**	−0.080	0.223	**0.415**	−0.044
Reptiles	**0.354**	0.122	0.062	0.263	−0.063
Boating	0.116	**0.781**	0.083	0.049	0.024
Swimming	−0.019	**0.738**	0.124	0.064	0.058
Sunbathing	−0.072	**0.600**	0.040	0.030	0.119
Partying	−0.166	**0.508**	0.059	0.031	0.192
Hiking/climbing	0.217	**0.446**	0.258	0.099	−0.005
Fishing	0.149	**0.453**	0.078	0.099	0.160
Off-roading	−0.029	**0.368**	0.063	0.202	0.180
Spirit	0.188	−0.051	**0.661**	0.180	−0.030
Relaxation	0.062	0.012	**0.562**	0.225	0.057
Away	0.136	0.069	**0.462**	0.111	0.068
Family/friends	−0.056	0.185	**0.460**	0.087	0.182
God	0.086	−0.051	**0.447**	0.112	0.217
Camping	0.091	0.157	**0.434**	0.018	0.288
Childhood	0.167	0.188	**0.388**	0.010	0.136
Big mammals	0.160	0.009	0.140	**0.619**	0.039
Game drives	0.158	0.066	0.057	**0.509**	0.116
Photography	0.173	0.073	0.097	**0.409**	0.046
Cooking	0.056	0.165	0.287	0.141	**0.639**
Hanging out	−0.050	0.267	0.222	0.103	**0.441**
Reading/writing	0.269	0.126	0.167	0.081	**0.354**
View	0.244	0.140	0.260	0.333	0.209
Guided tours	0.082	0.303	0.059	0.322	−0.026
Culture and history	0.320	0.127	0.221	0.125	0.046
Talking	0.132	0.195	0.098	0.167	0.153

Note: Gray shading indicates strong loading (> 0.35) of ecosystem service on particular factor (i.e., service bundle).

Table 3 Relationships between bundles of ecosystem services (factors) expressed by Spearman's rank correlation coefficients of factor loadings

	Bundle 1: natural history	Bundle 2: recreation	Bundle 3: sense of place	Bundle 4: safari experience	Bundle 5: outdoor living
Natural history	1.000				
Recreation	−0.583***	1.000			
Sense of place	0.035	−0.410*	1.000		
Safari experience	0.371*	−0.507**	−0.119	1.000	
Outdoors lifestyle	−0.478**	0.264	0.158	−0.478**	1.000

$n = 30$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Analysis of mean factor scores in individual parks revealed distinct differences of CES demands between parks. Most interestingly, three significant trade-offs between bundles of CES uncovered in the correlation matrix were found to materialize in preference patterns in South African national parks. These were between natural history and recreation (Figure 3A), between natural history and safari (Figure 3B), and between safari and recreation (Figure 3C). These trade-offs are discussed below. Other significant trade-offs did not materialize in specific parks (Figure 3D–F).

Discussion

We found that the most-valued cultural services of protected areas were spread over all CES subcategories (MA

2005). Despite the lack of agreement on what constitutes "sense of place" (Trentelman 2009; Ardoin *et al.* 2012), even this category seemed to emerge as a combination of socio-cultural, psychological, and experiential aspects recognized as dimensions of sense of place (Ardoin 2006; Lewicka 2011), illustrating the diversity and complexity of the valuation of this and other CES (Hernández-Morcillo *et al.* 2013; Hausmann *et al.* 2015).

Factor analysis identified a total of five bundles of CES in South African national parks: (1) "natural history," (2) "recreation," (3) "sense of place," (4) "safari experiences," and (5) "outdoor lifestyle," confirming that visitors to protected areas have distinct travel motivations. These bundles were largely in agreement with bundles of visitor motivations previously identified for a small subset of our park sample (Kruger & Saayman 2010) and they complement the investigation of more tangible ES for South Africa (Egoh *et al.* 2008).

Three trade-offs between CES bundles were found to materialize in our sample of South African national parks. First, most parks showed trade-offs between natural history and recreation (Figure 3A). Parks in which this trade-off was strong (Tankwa-Karoo, Namaqua, and Mokala) had negative scores for recreation and positive scores for natural history. Tankwa-Karoo and Namaqua are located in the Succulent Karoo biome, a fragile dryland Conservation International biodiversity hotspot (CEPF 2001), which could easily be damaged if high-impact recreational activities such as off-road driving or mountain biking were permitted. In the Richtersveld and the West Coast, however, these bundles were in synergy. The Richtersveld Cultural and Botanical Landscape is a UNESCO world heritage site, where high demands for natural history uncovered in our study may reflect the rich biodiversity of this region, while its longstanding tradition of communal land comanagement (UNESCO 2009) and varied activities—fishing, water sports, and four-wheel driving—underscores the identity of the park as a cultural landscape. Similar synergies were present in West Coast National Park, which is in the Cape Floristic Region, the smallest of six recognized floral kingdoms of the world and an area of extraordinarily high diversity and endemism. This park also offers a variety of recreational activities—swimming, hiking, and mountain biking, for instance—again illustrating the potential for synergies between recreation and biodiversity when managed accordingly. Interestingly, Table Mountain National Park (TMNP) as a whole did not demonstrate this synergy, despite the park's location within the Cape Floristic Region and its appointment as a World Heritage Site within this region. TMNP comprises four different managerial sections, however, which all have very different identities (Table Mountain and Cape Point are mainly hiking and scenic points, Silvermine is a recreational area popular for swimming and cycling, while Boulders Beach is home to a colony of endangered African Penguins). These section-specific characteristics may prevent the park on a whole from generating a clear demand profile (see Figure S6 for trade-offs by park section).

Second, most parks that generated high demands for safari experiences disclosed synergies with natural history, recognizing wildlife safaris as a means to observe biodiversity. Interestingly, this synergy was not found in Kruger NP, where demands for natural history were low (Figure 3B). Like Table Mountain, Kruger comprises two distinct managerial sections: the South, managed more commercially; and the North, set aside for wilderness experiences. The two areas have different biophysical characteristics that may prevent the demand for natural history from materializing in the park as a whole (see Figure S6 for trade-offs by section).

Third, trade-offs between CES demands for safari experiences and recreation were ubiquitous among all parks (Figure 3C). All of the parks that scored high on demands for safari experiences (Kgalagadi, Marakele, Mountain Zebra, Addo-Elephant, and Kruger) were parks that contained some or all of the big five (African lion, African leopard, African elephant, Black and/or White rhinoceros, and Cape buffalo). Parks of this type necessarily cannot offer a wide range of recreational activities, and invariably, these parks scored low on demands for them. Two other parks containing some of the big five (Karoo and Mapungubwe) generated low demand for safari experiences, signaling opportunities for better marketing of these services in these parks. In parks that scored high on demands for recreation (West Coast, Agulhas, Table Mountain, Garden Route, and Golden Gate Highlands), opportunities for activities are abundant due to the absence of large and/or dangerous wildlife, which simultaneously reduces the realistic availability of safari-type services and explains the low demand for those services in these areas. Safari experiences reflect the large mammal fauna of Africa, and seeing these animals in their natural habitat has parallels to other region-specific ("bucket list") services, such as seeing Komodo Dragons or scuba diving on the Great Barrier Reef.

Finally, four parks in our sample had intermediate scores on all bundles (Karoo, Camdeboo, Mapungubwe, and Augrabies), indicating that either they have distinct CES demand bundles that were not addressed by our questionnaire, or that they present opportunities for more adequate profiling and marketing.

Through a detailed multipark, multiservice approach, we were able to show that trade-offs and synergies

between bundles of CES do not only arise as a function of heterogeneous landscapes (Burkhard *et al.* 2012; Turner *et al.* 2014; Queiroz *et al.* 2015), but can be understood purely from differences in social preferences for these CES, indicating that people visiting different protected areas may seek different bundles of services. This information, in combination with the general alignment of visitor CES demands with the availability of service bundles in specific parks, has strong practical implications for protected area management, particularly where protected area viability depends on economic returns from tourism. Management actions seeking to amplify a particular kind of CES, or improve access to that CES, are more likely to achieve their goals if they align with the specific properties of local ecosystems and locally specific tourist demand. Parks with natural availability of, and thus high demands for, natural history-type CES could increase their economic viability through greater investment in educational and viewing resources, such as species lists, bird hides, and vegetation maps; while parks with greater capabilities to deliver recreational-type CES may invest in activities on offer (e.g., horseback riding and mountain bike tours) or equipment hire (e.g., fishing equipment and bicycles). When managing ecosystems purely from an ecological perspective, managers may unknowingly make choices that lead to counter-productive trade-offs for visitors (e.g., reintroducing big five species into parks that visitors appreciate for their recreational opportunities). In addition to realizing that trade-offs exist in the CES protected areas, can provide protected area managers in South Africa should be aware of the currently skewed visitor demographics (notably, ethnic composition of visitors does not match that of the nation as a whole, Supplementary Information, S1–S5) and aim to broaden the appeal of national parks for people from ethnic and socioeconomic backgrounds who are currently underrepresented in the visitor base.

Finally, our results provide a mechanism that explains why successful revenue-generation approaches in one protected area do not necessarily translate well to other areas that may have different identities and from which visitors may seek different kinds of CES. Business models for revenue generation in South African national parks must clearly be tailored to fit individual locations and customer bases.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web site:

Figure S1: Age distribution of survey population per park.

Figure S2: Origin of survey population per park. RSA, Republic of South Africa; RoA, Rest of Africa; Eur, Europe; NA, North America; SA, South America; Asia, Asia; and Oc, Oceania.

Figure S3: Gender distribution of survey population per park.

Figure S4: Education level of survey population per park. HS, high school; UG, undergraduate degree; PG, postgraduate degree; and other, other.

Figure S5: Effect of gender, formal education, age, continent of origin (n.b. "RoA," Rest of Africa; "Oc," Oceania; "Eur," Europe; "RSA," South Africa; and "N. Am," North America), and season of visit (n.b. "Peak," school holidays) on factor scores for natural history (a), recreation (b), sense of place (c), safari experiences, and outdoor lifestyle (e).

Figure S6: Trade-offs and synergies between bundles of cultural ecosystem services in the four managerial sections of Kruger National Park (KNP) and Table Mountain National Park (TMNP). Absence of clear signals of visitor demand in these parks on a whole may be explained by the great disparities between visitor types in different subsections.

Table S1: Self-reported race group of respondents.

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