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CONTRIBUTED PAPER

The diverse socioeconomic contributions of wildlife ranching

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Abstract

The expansion of wildlife ranching has been broadly linked to conservation benefits, job creation, and economic contributions. However, a more nuanced understanding of the socioeconomic contributions of wildlife ranching accounting for the enterprise diversity in the sector remains a major limitation to assessing its potential to contribute to sustainable development. We assessed several important socioeconomic contributions of diverse wildlife-based business models, defined by their main revenue-generating activities, within the South African wildlife ranching industry, and the financial viability of these models. Owners and managers of privately-owned wildlife ranches and conventional agricultural farms (for comparative purposes) were interviewed in the Eastern Cape (112 ranches; 24 farms) and Limpopo provinces (152 ranches; 4 farms). We used a hierarchical clustering analysis to delineate six wildlife ranching business models. These included three more specialized models: ecotourism, trophy hunting, and wildlife breeding, and three more mixed models: mixed hunting (i.e., both meat and trophy hunting), mixed wildlife-agriculture, and trophy hunting-game meat. In general, ecotourism-focused ranches employed more people in total and per hectare (median = 23 jobs; 0.008/ha), and a higher proportion of women and skilled employees (41% and 45% of employees, respectively) than the other ranching models (median = 7–21 jobs; 0.002–0.005/ha) and conventional agriculture (median = 12 jobs; 0.004/ha). Trophy hunting-focused ranches employed the second highest number of people per hectare (0.006) although on average, a third of these jobs were seasonal.

Trophy hunting ranches tended to be more profitable (median profit margin = 33%) than ecotourism (−10%), wildlife breeding (0%) and mixed-hunting (12%) ranches, though ecotourism ranches showed very high variability (interquartile range = −32% to 14%). These findings advance our understanding of the distinct socioeconomic contributions of diverse wildlife ranches, which benefits policy discourse and implementation surrounding the industry, promoting improved industry sustainability and inclusive growth.

KEYWORDS

business models, diversification, game ranching, socioeconomic contributions, wildlife economy

1 | INTRODUCTION

Protected area expansion strategies remain the mainstay of biodiversity conservation, despite facing shortcomings that include a failure to meet socioeconomic objectives, and high resource requirements from state budgets for maintenance and establishment of these areas (Lindsey et al., 2018; Venter et al., 2014; Venter et al., 2017; Watson et al., 2014; Zafra-Calvo et al., 2019). The substantial investment by state authorities required for protected area expansion signals a need for additional strategies to safeguard important biodiversity areas, especially in the wake of the COVID-19 pandemic which left many African state protected areas with severe budget shortfalls and an inability to effectively protect biodiversity (Lindsey et al., 2020). In many regions, the majority of land is privately owned, including land of biodiversity importance (Capano et al., 2019). One potential conservation strategy relevant to private and communal land is wildlife ranching, which can achieve conservation and development outcomes (Taylor et al., 2020). Wildlife ranches rely on wildlife for commercial purposes, such as ecotourism, two forms of recreational hunting: trophy and meat, meat sales, and live sales of game animals (Krug, 2001; Taylor et al., 2020). Although wildlife ranches are increasingly proposed as a land use to achieve (often ancillary—Taylor et al., 2021) conservation and socioeconomic outcomes, our understanding of their contributions in these domains is limited (Cousins et al., 2008; Holechek & Valdez, 2018; Krug, 2001).

Several factors have driven differing scales of wildlife ranching expansion across sub-Saharan Africa. Legislative changes have been a major enabling factor. Notably, user rights over wildlife have been granted to private and community landowners in several southern African countries, including South Africa, Namibia, Zambia, and Zimbabwe, making wildlife ranching a viable land use (Lindsey, Havemann, et al., 2013; Taylor et al., 2016; Taylor et al., 2020). This is particularly true in areas that are marginal for cultivation, or where livestock diseases like sleeping sickness and foot-and-mouth disease are prevalent (Child et al., 2012; Lindsey, Barnes, et al., 2013; Scoones et al., 2010; van Schalkwyk et al., 2010). Private conservation models outside of southern Africa have not developed similarly, mostly due to legislative differences (notably, the restrictions of wildlife user rights), negative public perceptions of consumptive wildlife uses, stronger competition from other land uses, and a lack of appropriate wildlife economy markets (ALU, 2021).

In Southern Africa, existing evidence suggests that the expansion of wildlife ranching has had a net positive impact on biodiversity. In South Africa, the abundance of wildlife species on private land has increased dramatically (Taylor et al., 2021). Private areas allow for the persistence of megaherbivores, predators, and vulnerable species more than livestock farming does (Clements et al., 2019) and conserve significantly more natural land cover and biodiversity intactness than unprotected areas (Parker et al., 2020; Shumba et al., 2020), including on low-lying, productive land which complements the protected area estate (De Vos & Cumming, 2019; Gallo et al., 2009). Namibian, Zambian, and Zimbabwean ranches (largely communal) also protect significant and diverse populations of wildlife, including vulnerable species (Chidakel & Child, 2022; Lindsey, Barnes, et al., 2013; Taylor et al., 2016). Nevertheless, the conservation contributions of wildlife ranches are sometimes contested, partly due to differences in land uses and management of ranches, which can vary greatly and be influenced by biophysical and sociopolitical contexts (De Vos & Cumming, 2019; Gooden & 't Sas-Rolfes, 2020; Shumba et al., 2020).

Presenting wildlife ranching as a sustainable conservation model requires fair consideration of its impacts on people and the economy, and much contestation of wildlife ranches relates to the socioeconomic and equity trade-offs and value-conflicts in the establishment and management of these ranches (Gooden & 't Sas-Rolfes, 2020). The conversion of farms to wildlife ranches

is criticized for causing greater barriers to land access by farm dwellers and issues of identity and belonging, in case studies from post-Apartheid South Africa (Spierenburg, 2020). Similar case studies have criticized some subsectors of ranching for providing fewer jobs than those available on farms pre-conversion to ranches (Spierenburg & Brooks, 2014), and several concerns have related to social-justice outcomes of agrarian reform and restitution (Kamuti, 2018a, 2018b).

Broader-scale quantitative evidence however generally suggests a different picture. Wildlife ranching in South Africa and Namibia is reportedly more profitable, and provides more jobs and non-salary benefits, than livestock farming on private land (Lindsey, Havemann, et al., 2013; Nuulimba & Taylor, 2015; Taylor et al., 2020; Taylor et al., 2021). Similarly, Zambian wildlife ranches produce higher revenues per unit area than state game management areas (Lindsey, Barnes, et al., 2013). While Zambian private ranches provide fewer social benefits than the adjacent national park (Chidakel & Child, 2022), the reverse is true around Kruger National Park, where private wildlife ranches produce greater economic benefits and more jobs (Chidakel et al., 2020), both through direct income and through multiplier effects (Chidakel et al., 2020).

For policy-makers, neither broad-scale aggregated evidence (which may hide important trade-offs and differences), nor case-study evidence (which is not generalizable), is sufficient. Rather, policies must be informed at a level that is generalizable across cases, but still accounts for context-sensitivity. Since land-management strategies vary across different wildlife-based activities (Clements et al., 2022), we argue that analyzing key socioeconomic contributions at business-model level could greatly improve policy development.

In this paper, we identify wildlife-based business model typologies, based on ranches' main revenue-generating activities, and determine several important, contested socioeconomic contributions of these models, as well as their financial viability of these models, within the wildlife ranching industry in South Africa. South Africa provides a useful focus given the large extent of wildlife ranches in the country, the sector's long history and the diversity of revenue-generating activities (Taylor et al., 2016; Taylor et al., 2020). We first determine the main business models that delineate South Africa's wildlife ranching industry. We then analyze several socioeconomic contributions of different business models, including their investments in land, revenue generation, and operating expenditure, and the quantity, quality, and equality of jobs they provide, in contrast to conventional agricultural farms. We also investigate the sustainability of different business models, as indicated by financial viability.

2 | METHODS

2.1 | Study sites

South Africa's wildlife ranching sector has grown rapidly since the proclamation of the Game Theft Act of 1991, which allowed full devolution of user rights over wildlife to landowners (Taylor et al., 2016). Wildlife ranches cover 14%–17% of South Africa's total land area, exceed coverage of the state protected areas (Taylor et al., 2020), and contain an estimated 4.6–7.3 million herbivores (Taylor et al., 2021).

This study focused on wildlife ranches in Limpopo and Eastern Cape Provinces (Appendix A), as a large proportion of ranches occur in these two provinces (50% and 8% of all South African ranches, respectively) (Taylor et al., 2016). These provinces represent South Africa's poorest two provinces, suffering high levels of unemployment, and corruption, and low levels of service delivery, education, and income (Limpopo Provincial Treasury, 2019; Pasmans & Hebinck, 2017). Wildlife ranches undertake a range of revenue-generating activities, which are defined in Appendix H.

2.2 | Data collection

We interviewed landowners/managers of wildlife ranches in the Eastern Cape (February to March 2021) and Limpopo (June 2021) as part of the Sustainable Wildlife Economies Project (SWEP). The survey was codesigned and implemented by the South African National Biodiversity Institute (SANBI), the Department of Forestry, Fisheries and Environment (DFFE), the United Nations Development Programme, Stellenbosch and Rhodes Universities, and private wildlife industry associations. Questions relevant to this study are detailed in Appendix B. The survey received ethical clearance from the Rhodes University Ethics Committee (2021-2810-5892), and adhered to principles of anonymity, confidentiality, and informed consent.

To recruit participants, a video conveying the study's purpose was circulated through private wildlife industry association networks. Managers and landowners who were interested in participating then contacted the survey coordinators. Participants also provided contact details of other wildlife ranchers who could participate, who were subsequently contacted.

TABLE 1 The socioeconomic variables that were compared across wildlife ranches and sample sizes per variable.

Socioeconomic variable	Description	Total sample size (*n*)
Total revenues	Revenues in 2019/2020 financial year	67
Total operating expenditures	Operating expenditures in 2019/2020 financial year	68
Quantity of jobs*	Total number of jobs	136
Quantity of jobs: Labor intensity per unit of operating expense*	Total number of jobs per million ZAR of operating expenditure in 2019/2020 financial year	132
Quantity of jobs: Labor intensity per unit of land*	Quantity of jobs per hectare of land	58
Equality of jobs: Gender*	Female employees as proportion of total employees	136
Quality of jobs: Security*	Permanent employees as proportion of total employees	136
Quality of jobs: Salary*	Skilled employees (>5000 ZAR/month) as proportion of total employees	136
Viability: Operating profit margin	Operating profit (revenue minus operating costs) divided by total revenue × 100	39

Note: Starred (*) variables also included conventional agriculture farms in their samples.

Surveys were conducted on 112 wildlife ranches and 24 conventional agriculture farms in the Eastern Cape, comprising 758,015 ha. In Limpopo, 156 surveys, comprising 862,034 ha, were conducted, including four conventional agriculture properties. Conventional agricultural farms were defined as farms where livestock farming or cultivation comprised >90% of their revenue.

The surveys of Limpopo wildlife ranches included additional questions on ranch financials, which were not included in the Eastern Cape surveys. Follow-up surveys with 24 initial wildlife ranch participants from the Eastern Cape who had agreed to be reinterviewed were thus conducted from February to March 2022 to collect this additional data. Stratified random sampling was used to select a subsample of participants from the initial sample of 112 wildlife ranch participants from the Eastern Cape. The original sample was stratified per business model, based on a preliminary analysis of business models from the Eastern Cape data only (Clements et al., 2022). Six properties per business model were randomly selected after disregarding some participants in the initial randomly selected sample due to participants being unavailable or unwilling to answer another survey. The follow-up survey received ethical clearance from the University of Cape Town (FSREC 009–2022).

To determine ranch business models, data were collected on the types of revenue-generating activities that were practiced on the ranch and the relative proportion of total revenue contributed by these activities. The percentages of foreign visitors were also obtained, as foreign visitors to ranches usually pay higher prices than local visitors (Clements et al., 2016).

A summary of collected socioeconomic data is provided in Table 1. Respondents were asked to provide their ranch size, and total revenues and operating expenditure (running costs) for the financial year 2019/2020 (pre-pandemic) to assess their income and expenditure in the economy. Operating profit margin [(revenue – running costs)/revenue × 100] was used to compare the financial viability of business models. Finally, information on job quantity, quality, and equality was obtained. The proportion of permanent (compared to seasonal) employees and the proportion of skilled employees (earning >5000 ZAR monthly) were calculated as two metrics for job quality through job security and higher compensation, respectively, and the proportion of women was used as a metric of job equality due to ongoing discrimination toward women in the workplace (Block et al., 2018; Gammarano, 2020). The job metrics for different wildlife-based business models were compared with those for conventional agriculture properties. An open-ended question was asked about non-salary benefits provided to employees on ranches.

2.3 | Statistical analysis

Ranches were first categorized into distinct business models. Building on previous studies assessing ranch business models (Clements et al., 2016; Clements et al., 2022), a principal component (PC) analysis of business model characteristics was performed, followed by a hierarchical agglomerative cluster analysis using Euclidean distance and Ward linkages (R package: vegan; functions: rda, vegdist, hclust; Borcard et al., 2011; Oksanen et al., 2022; Ward, 1963). A Mantel-based comparison was used to identify the number of distinct clusters (R package: cluster; functions: daisy and silhouette) (Maechler et al., 2015). We included 164 properties which had complete business model data: 90 from Limpopo and 74 from the Eastern Cape. Business model characteristics included the proportion of total revenue generated by different activities and the proportion of foreign visitors. The six most common activities which generate revenue

on wildlife ranches, were used to delineate the different business models, including wildlife breeding and live sales, trophy hunting, meat hunting, meat sales, ecotourism, and agriculture (including livestock and/or cultivation) (see definitions in Appendix H). Identified business models were compared using the mean (± standard error) values of the business model characteristics.

Due to the nonlinearity of data, Kruskal–Wallis tests, followed by Wilcoxon post-hoc tests, were used to compare the socioeconomic contributions of wildlife ranches (Table 1). The exception was the quantity of jobs, which was compared across business models using a generalized linear model with Poisson error distribution (R package: car; Fox & Weisberg, 2019), because it is useful for modeling count data. Sample sizes for different business models varied across analyses as some respondents did not answer all questions (particularly regarding financial information), which in some cases resulted in insufficient sample sizes for a given business model. Sample sizes are reported for each result. Conventional agriculture was included as a separate business model in the job comparisons, as these contributions are often compared in the literature.

To determine the most common types of non-salary benefits received by wildlife ranch employees, we performed inductive thematic coding of non-salary benefit responses from 191 ranches (Kiger & Varpio, 2020). We revisited these codes, grouped similar ones into themes and placed uncommon themes into the "other" category. A Chi-square test of independence was used to test for significant difference in the frequency of the two most common benefit themes across business models.

Some outliers were excluded from figures, but not from datasets and analyses, for better readability. All excluded outliers are described in figure captions. Summary metrics are reported as the median and interquartile range (IQR = Q1–Q3), unless otherwise specified. All statistical analyses were conducted using R (version 4.1.3) (R Development Team, 2022) at a significance level of $\alpha = 0.05$. To correct for multiple comparisons, sequential Bonferroni corrections were performed (Rice, 1989).

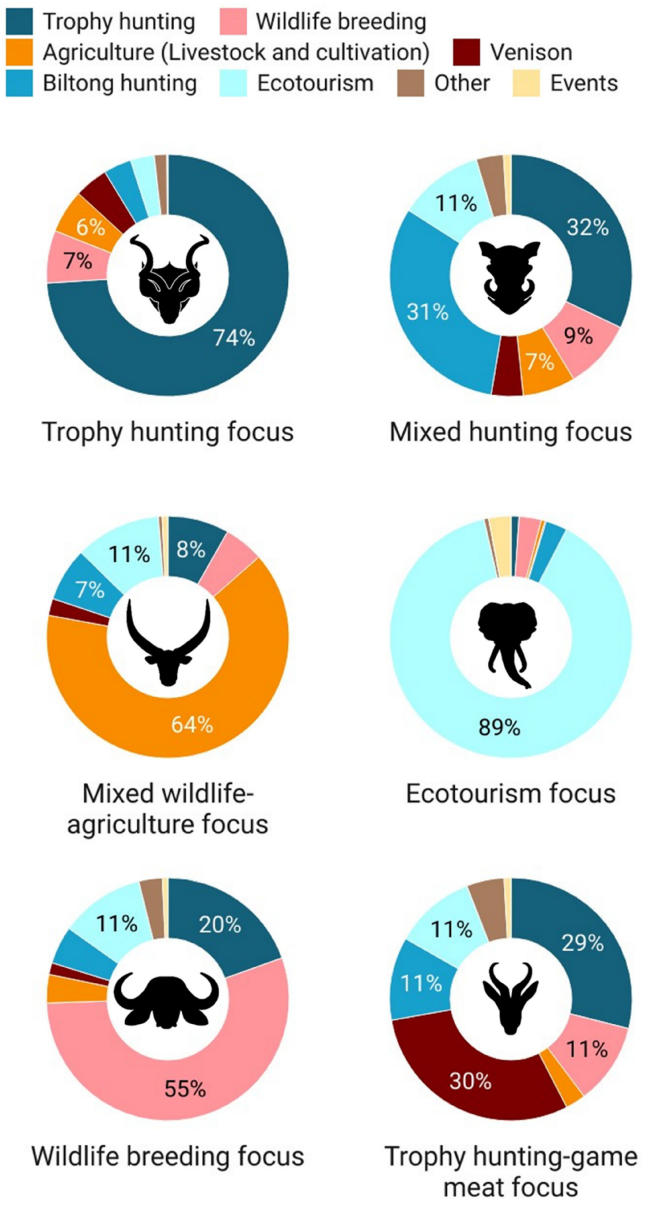

FIGURE 1 The six wildlife ranching business models, differentiated by iconic animals commonly associated with each model. The colors represent the relative proportions of revenue generated by eight different activities for each model on average.

3 | RESULTS

3.1 | Six distinct wildlife ranching business models

The most common revenue-generating activities on wildlife ranches were trophy hunting (72% of properties), wildlife breeding and live sales (67%), and ecotourism (63%). Livestock farming was practiced on 29% of properties, while cultivation was practiced on 12%. The proportion of foreign visitors to ranches varied from 0 to 100% and was 50% (± 3% SE) on average.

Two PCs explained almost half of the variation across wildlife ranches in the proportions of revenue generated by different activities and the proportion of foreign visitors (Appendix D; Appendix E). Six distinct business models were evident (Appendix D; Mantel $r = 0.58$, $n = 164$).

Ecotourism-focused ranches (16% of properties) earned an average of 89% of their revenue from ecotourism, with just over half of their clients on average being foreign (Figure 1; Appendix C). Agriculture was rarely practiced, and livestock and game meat (venison) production were practiced on only a few properties. Trophy hunting-focused ranches (22% of properties) earned

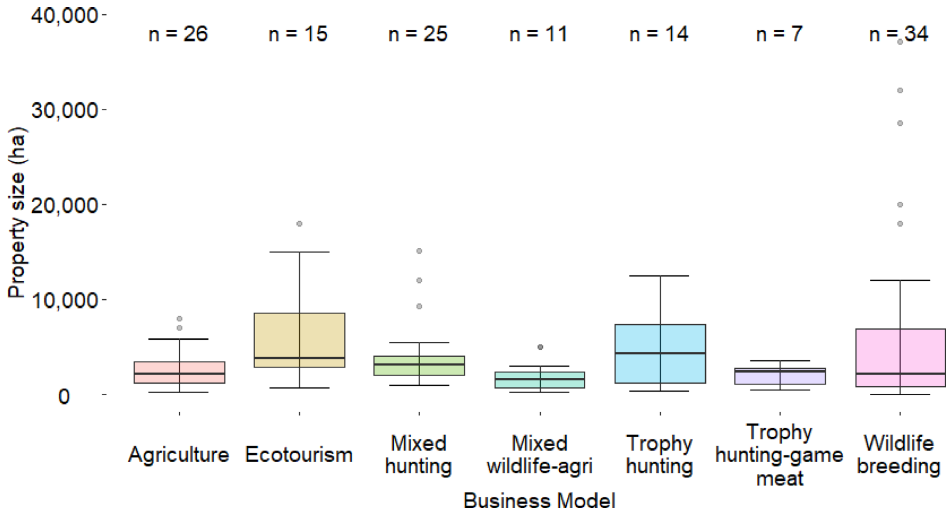

FIGURE 2 The range of sizes in hectares (ha) of conventional agricultural farms and wildlife ranches across business models, with sample sizes provided above bars.

three-quarters of their revenue from trophy hunters, 92% of whom were foreign. By contrast, trophy hunting-game meat-focused ranches (7% of properties) generated revenues from a more mixed set of activities, earning on average just under a third of their revenue from game meat, another third from trophy hunting, and receiving their remaining revenue across all other wildlife-based activities (although agriculture was rare) from an almost equal local to foreign client base. Similarly, mixed hunting ranches (18% of properties) had diverse revenue-generating activities, with the majority earned in almost equal parts by meat hunting and trophy hunting from a mostly local client base. Wildlife breeding-focused ranches comprised 25% of all properties, with breeding and live sales contributing to 55% of their revenue, followed by trophy hunting and ecotourism. Mixed wildlife-agriculture ranches (12% of properties) on average earned two-thirds of their revenue from agriculture (mostly livestock farming), with the remainder earned from local clients engaging in other wildlife-based activities.

On conventional agriculture properties, 92% of properties surveyed generated most (>90%) of their revenues from livestock. The remainder of revenue was mainly generated from cultivation of crops or fodder.

3.2 | Economic contributions of wildlife ranches

Ranch size did not differ significantly between business models ($x^2 = 9.49$, df = 6, $p = .15$), due to high variability of ranch sizes within the wildlife breeding, ecotourism, and trophy hunting models (Figure 2). Trophy hunting-focused ranches tended to be the largest (median = 4300 ha; interquartile range (IQR) = 1181–7375 ha), closely followed by ecotourism-focused ranches (median = 3800 ha; IQR = 2800–8511 ha). Mixed wildlife-agriculture ranches had the smallest median size of 1500 ha (IQR = 676–2400 ha).

Business model significantly influenced ranch financials for the year 2019/2020, including total revenue ($x^2 = 11.2$, df = 3, $p = .01$), revenue per hectare ($x^2 = 13.62$, df = 3, $p = .003$), operating expenses ($x^2 = 13.8$, df = 3, $p = .003$), and operating expenses per hectare ($x^2 = 17.06$, df = 3, $p < .001$; Figure 3).

Trophy hunting-focused ranches earned the highest annual revenue (median = 4,500,000 ZAR; IQR = 2,250,000–7,225,000 ZAR). Ecotourism-focused ranches earned the second-highest revenue (median = 3,250,000 ZAR; IQR = 1,625,000–25,500,000 ZAR), while mixed hunting ranches earned the lowest (750,000 ZAR; IQR = 217,500–2,000,000 ZAR). Ecotourism earned the highest revenue per unit area (median = 1878.32 ZAR/ha; IQR = 942.99–5781.43 ZAR/ha), while mixed hunting earned the lowest (median = 325.00 ZAR/ha; IQR = 130.44–577.99 ZAR/ha).

Annual operating expenses were highest for trophy hunting-focused ranches (median = 3,800,000 ZAR; IQR = 3,150,000–5,725,000 ZAR) and lowest for mixed hunting ranches (median = 1,250,000 ZAR; IQR = 500,000–2,050,000 ZAR). Ecotourism-focused ranches had the highest expenditure per unit area (median = 1984.56 ZAR/ha; IQR = 364.03–4721.44 ZAR/ha), while mixed hunting ranches had the lowest (median = 366.38 ZAR/ha; IQR = 231.25–557.16 ZAR/ha).

3.3 | Profitability of different business models

Net profit was highest, by a large margin, for trophy hunting-focused ranches (median = 1,650,000 ZAR; IQR = 925,000–2,000,000 ZAR; Figure 3). There was no

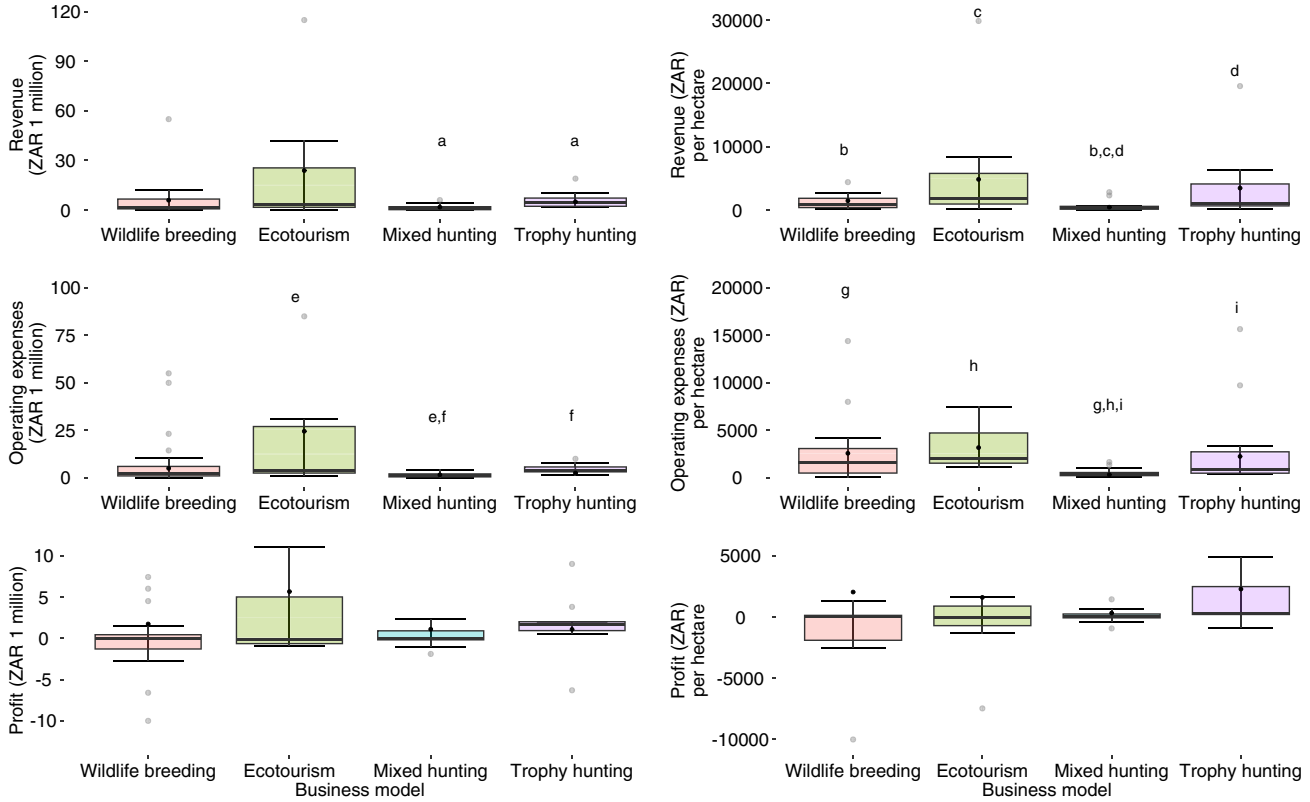

FIGURE 3 Comparisons across business models of (1) total revenue, (2) revenue per hectare, (3) total operating expenditure, (4) operating expenditure per hectare, (5) net profit, and (6) profit per hectare, for the 2019/2020 financial year. Corresponding letters above bars show significant differences between business models (a, $p = .01$; *b*, $p = .004$; c, $p = .017$; d, $p = .025$; e, $p = .03$; f, $p = .008$; g, $p = .02$; h, $p = .001$; i, $p = .046$). Two outliers were excluded: panel (2) wildlife breeding ranch with revenue of 133,333 ZAR/ha and panel (6) wildlife breeding ranch with profit of 82,377 ZAR/ha.

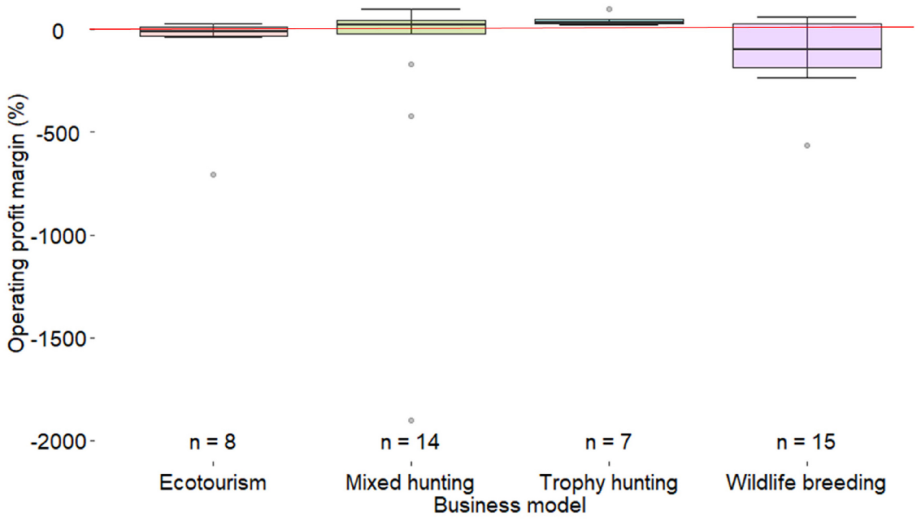

FIGURE 4 The operating profit margin (%) of some wildlife ranch business models for the 2019/2020 financial year. Sample sizes of business models are below each boxplot.

significant difference in profit among business models however ($x^2 = 6.43$, df = 3, $p = .09$), likely due to great variation within the ecotourism-focused and wildlife breeding models (Figure 3), with some ecotourism ranches turning particularly large profits. Business model also did not explain significant variation for profit per hectare, though the difference was close to significant and trophy hunting tended to show higher profit margins than the other models ($x^2 = 7.44$, df = 3, $p = .06$).

TABLE 2 The quantity, quality, and equality of jobs provided by different wildlife ranch business models, compared with conventional agricultural farms.

	Business model						
	Agriculture	**Wildlife breeding**	**Ecotourism**	**Mixed hunting**	**Mixed wildlife-agriculture**	**Trophy hunting**	**Trophy hunting-game meat**
Total jobs	12 (4–16)	13 (6–20)	23 (11–87)	8 (7–11)	7 (6–13)	21 (15–27.5)	10 (5–25)
Jobs/ha	0.004 (0.002–0.007)	0.005 (0.003–0.008)	0.008 (0.004–0.016)	0.002 (0.002–0.004)	0.003 (0.002–0.020)	0.006 (0.003–0.010)	0.006 (0.004–0.008)
Jobs /million ZAR of operating expenditure	–	4.00 (2.34–9.44)	5.00 (3.22–5.79)	7.20 (3.88–10.8)	–	5.48 (3.67–10.90)	–
Female employees (%)	17 (6–33)	25 (13–30)	41 (33–52)	29 (14–40)	33 (16–38)	29 (23–33)	33 (30–42)
Permanent employees (%)	100 (46–100)	100 (76–100)	100 (100–100)	100 (86–100)	100 (76–100)	68 (55–85)	100 (75–100)
Skilled employees (%)	0 (0–10)	33 (20–49)	45 (25–73)	19 (0–33)	0 (0–5)	26 (5–33)	0 (0–20)

Note: Values indicate median values with interquartile ranges (IQR = Q1–Q3).

By contrast, operating profit margins did differ significantly between business models ($x^2 = 10.34$, df = 3, $p = .02$), being highest for trophy hunting-focused ranches with a median of 33.24% (IQR = 29.5%–47.8%; Figure 4). Ecotourism ranches had the lowest operating profit margin, with a median of −9.87% (IQR = −32.22% to 14.02%). Pairwise comparison tests revealed trophy hunting ranches had significantly higher operating profit margins than ecotourism ($p < .01$) and wildlife breeding ranches ($p = .04$).

3.4 | Employment across different business models

The number of employees on wildlife ranches differed between business models ($x^2 = 2336.9$, df = 6, $p < .001$; Appendix F) as did the number of employees per unit of area ($x^2 = 16.67$, df = 6, $p = .01$; Table 2). Ecotourism-focused ranches provided more jobs and jobs per hectare than all other business models, closely followed by trophy hunting. Mixed wildlife-agriculture and mixed hunting ranches had the least employees in total and per hectare, respectively. The three more specialized wildlife models (ecotourism, trophy hunting, wildlife breeding) provided more jobs than agricultural farms, while the three more mixed models (mixed wildlife-agriculture, mixed hunting, trophy hunting-game meat) provided fewer. Labor intensity (per million ZAR operating costs) was not significantly different across business models ($x^2 = 1.94$, df = 3, $p = .58$).

The equality of jobs differed by business model (Table 2). Female employees as a proportion of total jobs provided on wildlife ranches in 2019/2020 varied significantly, as explained by business model ($x^2 = 18.03$, df = 6, $p = .006$). Ecotourism-focused ranches employed the highest proportion of women, significantly more than wildlife breeding ranches ($p = .04$) and conventional agricultural farms ($p = .03$). All wildlife business models employed a greater proportion of women than agricultural farms.

In terms of job quality, the trophy hunting-focused model was the only model with a median proportion of permanent jobs lower than 1. The proportion of seasonal employees was marginally non-significant across business models ($x^2 = 12.62$, df = 6, $p = .05$). The proportion of seasonal female employees followed a similar trend to the proportion of total seasonal employees per business model in 2019/2020. The proportion of female seasonal employees did not differ significantly across business models (Chi-square = 6, df = 5, $p = .307$). The proportion of seasonal employees was highly variable across properties for agriculture farms, in contrast to the low variability across ecotourism-focused and wildlife breeding ranches.

Across all business models, ecotourism-focused ranches employed the highest proportion of skilled employees (Table 2). Two business models had a median of 0 skilled workers employed on ranches: mixed wildlife-agriculture (IQR = 0–5%) and trophy hunting-game meat models (IQR = 0–19%). Agricultural farms also employed a median of 0 skilled workers (IQR = 0–10%). Significant variation in the proportion of skilled employees working on wildlife ranches was explained by business model ($x^2 = 36.86$, df = 6, $p < .001$). Pairwise comparison tests revealed that ecotourism employed significantly more skilled employees than agriculture ($p < .001$) and mixed wildlife-agriculture ($p = .01$). Wildlife breeding ranches also employed significantly more skilled employees than agriculture ($p < .001$) and mixed wildlife-agriculture ($p = .01$).

3.5 | Non-salary benefits

For non-salary benefits provided to employees on wildlife ranches, eight main themes emerged: housing, food (including game meat), rates, transport, uniforms, financial insurance, gratuities, and upskilling. These benefits occurred on ranches across all wildlife business models. Conventional agriculture farms also offered all non-salary benefits, except gratuities. Trophy hunting and mixed hunting-focused business model respondents provided the greatest variety of non-salary benefit types as they were the only business models that had respondents providing all nine themes of benefits. The most common non-salary benefits were housing (provided by 83% of all respondents) and food (provided by 75% of respondents) (Appendix G). No association was found between business model and food and housing benefits provided by individual properties across business models ($x^2 = 1$, df = 6, $p = .99$).

4 | DISCUSSION

This study distinguished six wildlife-based business models in South Africa's main wildlife-ranching provinces, including three specialized models and three with a greater diversity of revenue-generating activities. Specialized, service-oriented business models (e.g., trophy hunting and ecotourism) tended to occur on larger ranches, generate more revenue and create more and better-quality employment than mixed-activity, production-oriented models (e.g., meat hunting and sales) and conventional agriculture. Models that were

focused on extractive use (e.g., trophy hunting and mixed models) provided the greatest variety of non-salary benefits. Taken together, these nuanced findings have important implications for how we understand and manage for the socioeconomic contributions of wildlife ranches.

4.1 | Socioeconomic contributions

While some studies (e.g., Taylor et al., 2020) have found that wildlife ranches provide more jobs than agricultural farms, others argue differently (e.g., Cloete & Rossouw, 2014). We show the full picture is more nuanced. Service-oriented, specialist wildlife models (trophy hunting and ecotourism) provide far more jobs than conventional agriculture. By contrast, job quantity was comparable between agricultural farms and the more mixed and production-oriented wildlife models. Importantly, all wildlife business models employed more women than conventional agriculture farms, indicating the potential for wildlife ranches to improve female empowerment in rural regions, thereby contributing to Target 22 of the Global Biodiversity Framework and Sustainable Development Goal 5.

Ecotourism-focused ranches employed the most female employees, also providing the highest-paying jobs. Although ranches have previously been criticized for providing insecure, temporary jobs (Spierenburg, 2020), the vast majority of jobs were permanent across all wildlife ranches except those focused on trophy hunting. The latter is likely due to the seasonal nature of trophy hunting. Taken together, the quality employment created by wildlife ranching could be packaged into Environmental, Social and Corporate Governance (ESG) indicators for impact investors looking to expand the positive impacts of wildlife-based land-uses.

Increasing salaries and female employment in the transition from livestock to game ranching may bear the cost of disrupting community bonds and connections to the land associated with commons-based cattle farming (Achieng et al., 2020). However, increasing transformation of the industry through initiatives to capacitate and capitalize new market entrants (see, e.g., DFFE, 2020) may help to mitigate such negative implications.

Non-salary benefits for wildlife ranch employees are also important to consider for improving employees' well-being and by others (Sims-Castley et al., 2005; Taylor et al., 2016). It would be useful for future studies to estimate the value of the non-salary benefits summarized in this paper, as has been done for example for game meat contributions in Namibian conservancies (Naidoo et al., 2016). Besides on-ranch jobs, wildlife ranching also provides off-ranch jobs to multiple sectors, especially community, social, and personal services (Rossouw & Cloete, 2014). These community benefits can reinforce the positive social impacts of ranches. However, case studies of conservancies in Southern Africa show the importance of including communities in decision-making processes for them to feel that benefits from wildlife-based activities are not "hand-outs" (Kreuter et al., 2010).

Looking beyond jobs, our results show that wildlife ranches contribute positively to the economy through the high costs of running these ranches, supporting previous studies (Chiyangwa, 2018; Cloete & Rossouw, 2014). These contributions also vary by business model. Trophy-hunting ranches have the highest running costs on average, with some ecotourism ranches incurring particularly high running costs. These are both service-oriented models, with ecotourism in particular carrying additional costs such as guides, trackers, chefs, accommodation, food, beverages, and transport for clients (Taylor et al., 2016). These models also often rely on foreign visitors (Appendix C), who expect more high-end, luxury experiences. While more diverse models (e.g., mixed hunting) may also offer ecotourism or hunting, the nature of these activities (and thus the costs) differ due to different expectations from a more local clientele.

Specialized models can also have higher barriers to entry, given that they require larger property sizes, and more wildlife and infrastructure (Clements et al., 2016). Their large sizes demonstrate the potential for these models to contribute to the Global Biodiversity Framework's target on protecting 30% of land by 2030, potentially as other effective area-based conservation measures (OECMs) (Marnewick et al., 2021). By contrast, the smaller sizes of mixed-model ranches, particularly wildlife-agriculture mean they can be more accessible for new entrants into the wildlife economy, of relevance for South Africa's intention to expand and improve racial inclusion in the sector.

4.2 | Sustainability of socioeconomic contributions

Many policy questions revolve around the sustainability of wildlife-based land uses, which considers both their socioeconomic contributions and profitability, as well as their resilience in times of change. Diversification of revenue-generating activities seems a double-edged sword in this regard. Mixed models tend to be less profitable with lower socioeconomic contributions than specialized models. However, mixed models can also be more resilient to shocks since they are less reliant on a single (often international tourist-oriented) revenue stream (Clements et al., 2022).

The option to diversify revenue-generating strategies can buffer against economic instability in the relatively young ranching sector (Taylor et al., 2020). For ranches that focus on managing and breeding wildlife to sell, sometimes intensively (Taylor et al., 2016), crop cultivation for animal fodder is often undertaken. An option thus exists to sell fodder as an additional revenue generator. Similarly, trophy hunters do not keep the meat of hunted animals (Taylor et al., 2016), meaning it can then be sold (as seen on trophy hunting-game meat ranches). Not all business models have access to these additional revenue-generating options, however. Ecotourism-focused ranches tend not to undertake hunting or agriculture, as these may conflict with the wilderness experience preferred by the typical international ecotourist (Clements et al., 2016; Sims-Castley et al., 2005; Taylor et al., 2016). As COVID-19 showed (Clements et al., 2022), the specialized ecotourism model is constrained in terms of possible adaptation options, even if it is one of the most lucrative and provides the highest quantity, quality, and equality of jobs. This suggests that these socioeconomic contributions may be more precarious.

The volatility of the wildlife ranching industry is evidenced by the low profitability of wildlife breeding ranches; a finding that differs significantly from an assessment 6 years ago that found revenues per hectare were highest for the activity of live game sales, followed by trophy hunting (Taylor et al., 2016). Since then, there has been a notable decline in live game sales prices (Taylor et al., 2020). This volatility in profitability emphasizes the importance of longitudinal studies (Clements et al., 2016; Lescuyer et al., 2016; Von Thungen & Lanari, 2010).

4.3 | Recognizing heterogeneity in wildlife ranching business models

This study identifies heterogeneity in operations between wildlife ranching business models, and their contributions, but also heterogeneity in their responses to variable exogenous and endogenous factors across regions. Differing regulations are one important factor—outside of Southern Africa, wildlife ranches are limited in terms of user rights and other regulations, preventing them from fully specializing or diversifying within models. As shown here, this has important implications on the growth of the industry, as the ability to diversify at times, and specialize at others, allows greater economic benefits and sustainability over time. Differences in the responses of various business models are especially pertinent during system threats, including the COVID-19 pandemic, drought, recessions, political instability, and global preference changes (Clements et al., 2016).

These findings emphasize the potential for a successful wildlife ranching industry in the South African context, which is applicable to the development of the industry at large. This potential also exists in other African countries, if policymakers recognize the range of wildlife-based business models when establishing regulations, to create a supporting environment which includes key measures of adaptation for ranches and increased social and governmental support.

4.4 | Future research

While this study highlights important diversity in the ranching sector and its contributions, our categorization of ranches into six typologies overlooks within-category variation. The difference in high-end and more local ecotourism strategies is likely to be a driver of the observed variability in socioeconomic contributions and financial metrics. There is also likely to be variability between provinces (e.g., the Eastern Cape has particularly high-end operations; Clements et al., 2016; Sims-Castley et al., 2005). Similarly, wildlife breeding can occur on a spectrum from intensive to extensive, which likely influences contributions (Taylor et al., 2020). We see more wildlife breeding in Limpopo than the Eastern Cape, suggesting regional determinants. Future studies could focus on specific business models to further unpack this diversity.

A holistic assessment of the diverse socioeconomic contributions of wildlife ranches should look beyond the employment and financial metrics assessed here. Including the valuation of ecosystem services would provide a more complete view of sector-specific ecosystem contributions. The Total Economic Value framework recognizes several dimensions of value derived from the ecosystems linked to wildlife ranching, including use values (direct and indirect use), and nonuse values (existence and bequest values) (Ledoux & Turner, 2002). Multiplier Analyses (e.g., by using a Social Accounting Matrix; Cloete & Rossouw, 2014) can be used to delve into backward and forward socioeconomic linkages to consider local economic impacts like household consumption and poverty alleviation, instead of only turnover and GDP. Future studies of socioeconomic impacts could also include data from wildlife ranch employees and linked communities, to compare this to data from landowners and managers. This spectrum of approaches will allow a comparison of local socioeconomic benefits to socioeconomic benefits of wildlife ranching at broader scales. Such analyses should preferably be conducted within integrated approaches that recognize diverse values of nature to people (Pascual et al., 2023).

4.5 | Conclusions

This study is a significant step toward mainstreaming the wildlife ranching sector into conservation, agricultural, and economic policies. We delineate wildlife ranching business models based on their revenue-generating activities, providing policymakers and investors with the requisite context for understanding the potential positive socioeconomic returns when establishing programs or funds aimed at expanding the wildlife economy. Potential trade-offs must be considered, however, between maximizing contributions versus the resilience of those contributions. Taken together, our results suggest that clustering business models by activities pragmatically captures meaningful heterogeneity within the wildlife economy.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

All figures and tables in this study relate to the dataset collected via surveys, as described in the methods. As we are bound by ethical considerations of the sensitivity of the data and committed to honour the trust placed in us by respondents to keep their data confidential, we cannot post the dataset publicly. We are, however, similarly committed to transparent and open science, and anonymized data with all identifying details removed can be requested from the corresponding authors for the purpose of validating our results independently, on the condition of signing a non-disclosure agreement.

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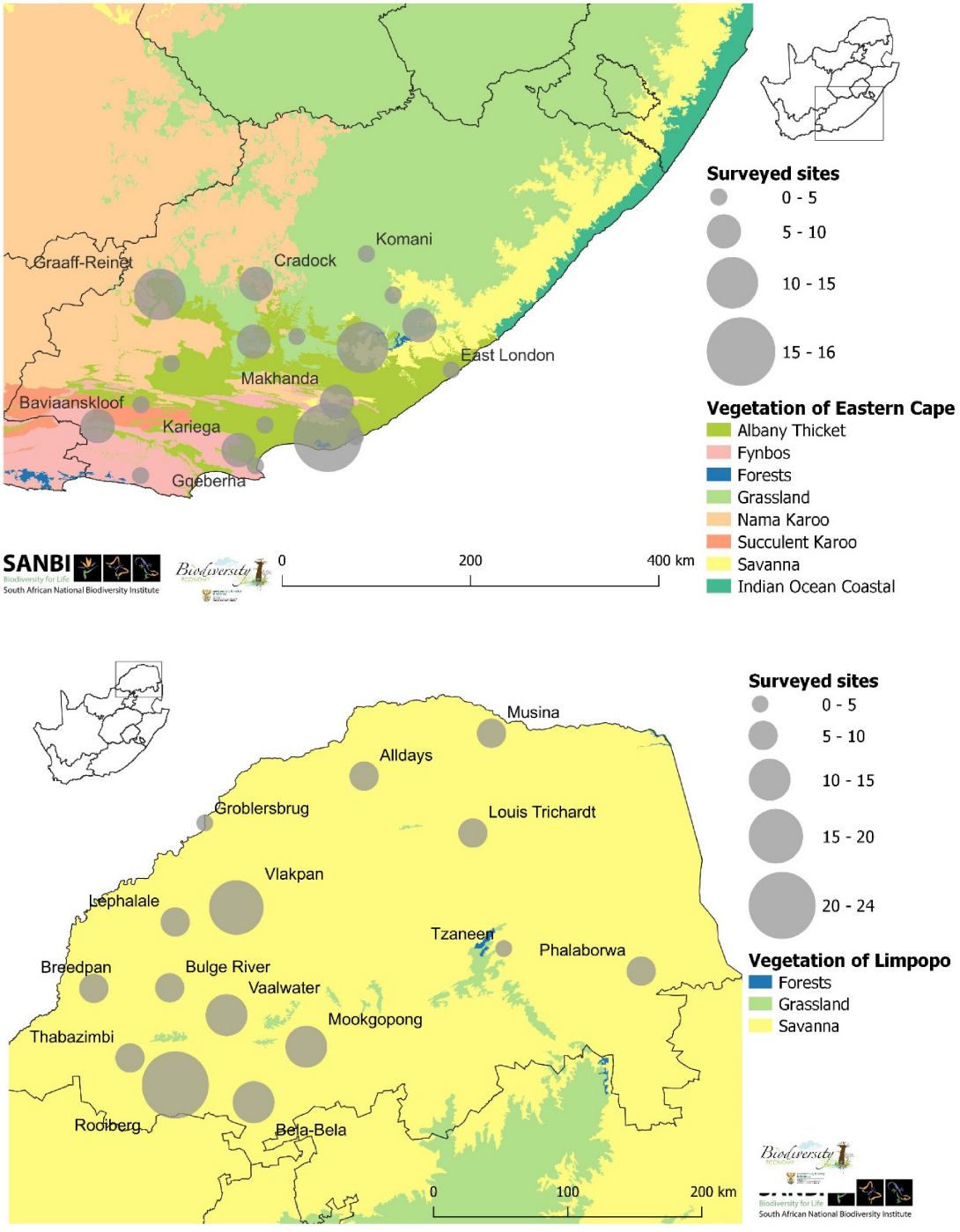
APPENDIX A

Number of privately-owned and privately-managed wildlife ranch and conventional agriculture properties surveyed during 2021 and 2022 per municipality in (A) Eastern Cape Province, South Africa and (B) Limpopo Province, South Africa. Exact property locations are withheld to protect the anonymity of survey participants (Map author: C. Wagner, Sustainable Wildlife Economy Project).



APPENDIX B

Economic activities section of the SWEP survey which contained all questions relevant to this study. The study objectives analyzed for each main question are included in brackets after the questions.

Section 7: Economic Activities

In this final section, we will be discussing what economic activities you undertake and the number of jobs you create. We'll also be asking about how COVID has impacted your business and how wildlife ranching can become more resilient in future.

1. ***Please indicate all activities that directly generate revenues for this enterprise in the average year pre-COVID and now post-COVID and note any additional activities that aren't listed in the table.*** (Objective 1: Determining business models within the wildlife ranching industry)

   [Note—let the landowner respond verbatim and then prompt if necessary.]

General activity	Specific activity	1. Present?	2. Proportion (%) of revenue pre-COVID	2. Proportion (%) of revenue post-COVID	3. Long-term viability of activity (1 = low, 5 = high) and why?
Game and wildlife	Live sales of stud animals that are intensively managed (typically fed year-round)	☐			
Game and wildlife	Live sales of stud animals that are extensively managed (typically not fed year-round)	☐			
Game and wildlife	Live sales of general game	☐			
Game and wildlife	Trophy hunting	☐			
Game and wildlife	Trophy hunting—outfitter	☐			
Game and wildlife	Biltong (meat) hunting	☐			
Game and wildlife	Venison	☐			
Livestock (stud and commercial)	Sheep	☐			
Livestock (stud and commercial)	Cattle	☐			
Livestock (stud and commercial)	Goat	☐			
Livestock (stud and commercial)	Dairy	☐			
Cultivation	Cash crops rainfed	☐			
Cultivation	Cash crops irrigation	☐			
Cultivation	Fodder production	☐			
Cultivation	Nursery	☐			
Eco-tourism	Day visitors	☐			
Eco-tourism	Overnight visitors	☐			
Events (weddings, etc.)		☐			

General activity	Specific activity	1. Present?	2. Proportion (%) of revenue pre-COVID	2. Proportion (%) of revenue post-COVID	3. Long-term viability of activity (1 = low, 5 = high) and why?
Leasing of land to another farmer (e.g., grazing)		☐			
Timeshare		☐			
Levees from homeowners on the property (e.g., a sectional title arrangement)		☐			
Other or alternative sources of revenue (Please specify)		☐			

2. ***What is the relative proportion of each activity to the enterprise's total revenue in the average year and now post-COVID?*** (Objective 1: Determining business models within the wildlife ranching industry)

[Note—for the "other sources of revenue" please specifically ensure that if the landowner mentioned value-adding facilities or processes, such as on-site abattoirs, these contributions toward revenue are included.]

3. ***Please rank each listed economic activity according to how you perceive its likely long-term viability, where 1 = very low viability and 5 = very high level of viability.*** (Objective 4: Determining the sustainability of business models and their socioeconomic contributions)
4. ***What proportion of your visitors are foreign?*** (Objective 1: Determining business models within the wildlife ranching industry)
5. ***Would you be willing to tell us the enterprise's total revenue in the 2019/2020 financial year (March 2019 to February 2020; i.e., pre-COVID) and the current revenue in the 2021/2022 financial year?*** (Objective 2: Determining economic contributions of different business models)
6. ***Please indicate all running costs incurred by this enterprise in the average year pre-COVID, and now post-COVID. Note any additional running costs that aren't listed in the table.*** (Objective 2: Determining economic contributions of different business models)

Note—let the landowner respond verbatim and then prompt if necessary.

Running cost type	Description	6. Incurred?	7. Proportion of total running costs pre-COVID	7. Proportion of total running costs post-COVID
Maintenance	Including of infrastructure (e.g., lodges, roads, fences) and equipment (e.g., vehicles)	☐		
Lodge staff salaries	Including front and back of house, plus field guides and professional hunters	☐		
Ranch/farm staff salaries	Including maintenance workers, builders, etc.	☐		
Anti-poaching/ security	Including contracted companies, salaries and equipment	☐		

(Continues)

Running cost type	Description	6. Incurred?	7. Proportion of total running costs pre-COVID	7. Proportion of total running costs post-COVID
Game purchases	Including game stock for predators and stocking new game for genetics, breeding trophy hunting, etc. (include game transport)	☐		
Game management	Including veterinary bills, feed for game	☐		
Marketing	Local and international advertising of enterprise activities	☐		
Food and beverages	For visitors	☐		
Insurance	Including infrastructure, equipment, etc.	☐		
Agricultural input costs	Fertilizer, seeds, feed for livestock, vet bills, etc.	☐		
Fuel		☐		
Water, electricity, rates		☐		
Community engagement/ social investment	Such as school programs, clinics, etc.	☐		
Other major expenses		☐		

7. ***What is the relative proportion of each running cost incurred in the average year pre-COVID and now post-COVID?***
8. ***Would you be willing to tell us your total running costs in the 2019/2020 financial year (March 2019 to February 2020; i.e., pre-COVID) and the current costs in the 2021/2022 financial year? [Excluding depreciation, financing (loans and interest) and income tax]*** (Objective 2: Determining economic contributions of different business models)

Now we are going to ask you about how many people you employ on this property, and any benefits they may receive.

9. ***Please could you complete this table, indicating how many permanent and temporary employees you have pre and post COVID.*** (Objective 3: Determining the social contributions (quantity and quality of jobs) of different business models)

Monthly salary category	9. Number employed	10. Number of women	11. Type of non-salary benefits
<R3500 (Permanent)			
R3500–R5000 (Permanent)			
R5001–R10,000 (Permanent)			
>10,000 (Permanent)			
<R3500 (Temporary)			
R3500–R5000 (Temporary)			

Monthly salary category	9. Number employed	10. Number of women	11. Type of non-salary benefits
R5000–R10,000 (Temporary)			
>10,000 (Temporary)			

10. ***How many of these are women?*** (Objective 3: Determining the social contributions (quantity and quality of jobs) of different business models)

    Note—if you are speaking to the manager (not the owner), remind them to include themselves in this count.

11. ***Are there any non-salary benefits, such as game meat rations, upskilling programs, community services, etc. for any of these employees?*** (Objective 3: Determining the social contributions (quantity and quality of jobs) of different business models)

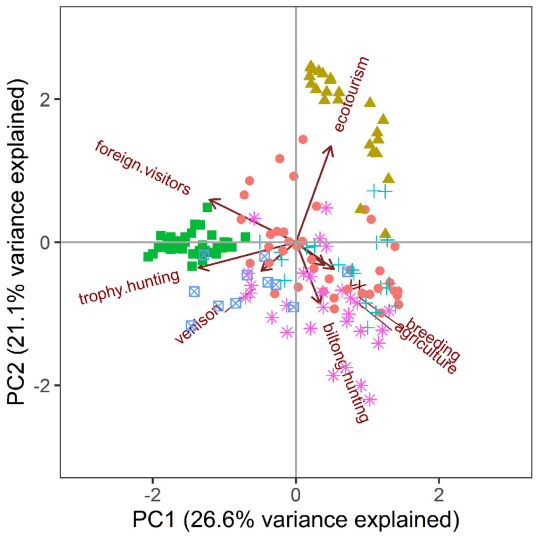
APPENDIX C

Principal component (PC) scores of seven wildlife ranch characteristics used in the cluster analysis on the first two principal components.

Characteristic	PC1	PC2
% Foreign visitors	−0.58	0.32
Wildlife breeding	0.25	−0.20
Trophy hunting	−0.65	−0.19
Meat hunting	0.16	−0.46
Venison	−0.23	−0.21
Ecotourism	0.23	0.73
Agriculture (livestock plus cultivation)	0.19	−0.17

APPENDIX D

Biplot depicting the relative scores of seven response variables on the first two principal components (PCs), depicting the relative contributions of different revenue-generating activities to wildlife ranch overall revenues. Datapoints show the scores of 164 properties from the Eastern Cape and Limpopo provinces. Shapes and colors correspond to six identified clusters (ecotourism ▲, trophy hunting ■, venison , mixed hunting ✳, wildlife breeding •, and mixed wildlife-agriculture +).



APPENDIX E

Characteristics of revenue-generating activities across six business model clusters (mean ± SE).

	Trophy hunting focus	Mixed hunting focus	Mixed wildlife-agriculture focus	Ecotourism focus	Wildlife breeding focus	Trophy hunting-game meat focus
Number of properties	36	29	20	26	42	11
Properties in Eastern Cape (%)	72	24	75	42	17	73
Properties in Limpopo (%)	28	76	25	58	83	27
PC1	−0.65	0.16	0.19	0.23	0.25	−0.23
PC2	−0.19	−0.46	−0.17	0.73	−0.2	−0.22
% Revenue from						
Ecotourism	3.17 (±0.89)	11.34 (±2.29)	11.45 (±3.91)	88.85 (±2.51)	11.29 (±2.56)	10.82 (± 3.16)
Meat hunting	3.72 (±0.71)	31.41 (±3.98)	7.15 (±1.68)	2.88 (±1.71)	5.05 (±1.01)	11.07 (±3.44)
Trophy hunting	74.03 (±1.85)	32.07 (±3.72)	8.2 (±2.62)	1.08 (±0.78)	19.52 (±2.72)	28.91 (±7.21)
Venison	4.47 (±0.76)	4.24 (±0.8)	2.25 (±1.12)	0.15 (±0.09)	1.57 (±0.43)	29.79 (±4.66)
Wildlife breeding	7.03 (±1.19)	9.28 (±2.39)	5.3 (±1.64)	2.96 (±1.01)	54.93 (±4.18)	10.82 (±4.87)
Agriculture (livestock and cultivation)	5.83 (±1.51)	7.03 (±2.45)	64.4 (±2.66)	0.5 (±0.46)	3.79 (±1.31)	2.68 (±2.19)
Livestock	4.86 (±1.47)	6.38 (±2.22)	56.65 (±4.84)	0.5 (±0.46)	1.74 (±1)	2.64 (±2.18)
Cultivation	0.97 (±0.62)	0.66 (±0.52)	7.75 (±3.69)	0	2.05 (±0.94)	0.05 (±0.05)
Events	0.11 (±0.09)	1.0 (±0.71)	0.75 (±0.55)	2.96 (±1.26)	0.71 (±0.5)	0.91 (±0.91)
Other	1.69 (±1.13)	3.62 (±1.91)	0.5 (±0.34)	0.62 (±0.58)	3.14 (±1.32)	5.0 (±4.52)
% Foreign visitors	92.08 (±1.55)	17.38 (±3.13)	35.1 (±8.51)	52.27 (±7.63)	41.64 (±5.71)	51.36 (±8.37)

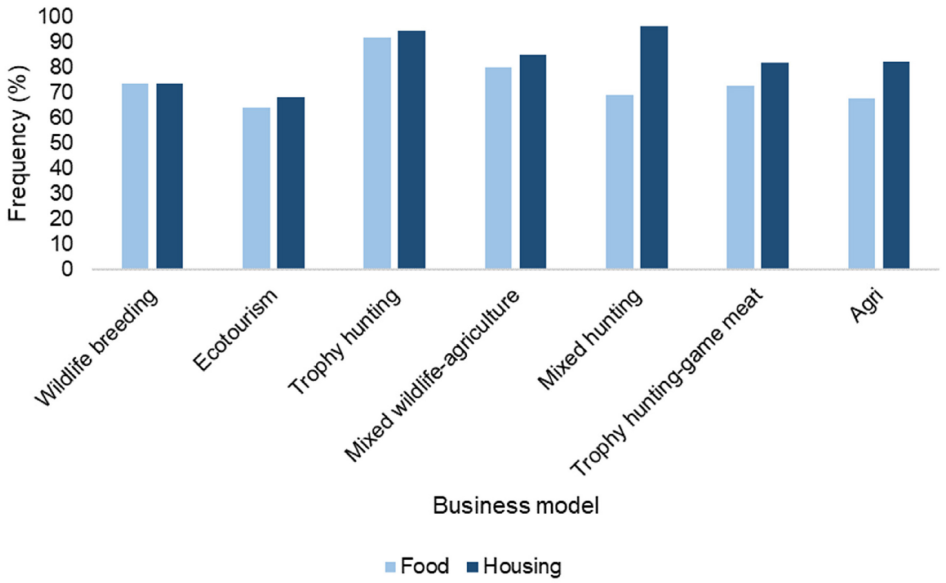
APPENDIX F

Pairwise comparison results of generalized linear model (GLM) with total jobs in 2019/2020 as a response variable and business model as the explanatory variable. *p* values are shown in the top row of each business model while *Z* ratio values are at the bottom of each row. Bold *p* values signify a significant amount of variation in the model.

	Agriculture	Breeding	Ecotourism	Mixed wildlife	Mixed-wildlife agriculture	Trophy hunting	Trophy hunting-game meat
Agriculture	–	–	–	–	–	–	–
Breeding	**<.0001** −5.58	–	–	–	–	–	–
Ecotourism	**<.0001** −31.46	**<.0001** −26.30	–	–	–	–	–
Mixed wildlife	.96 −0.98	**<.001** 4.44	**<.0001** 24.65	–	–	–	–
Mixed-wildlife agriculture	**.02** −3.2	.74 1.52	**<.0001** 18.81	.4 −2.03	–	–	–
Trophy hunting	**<.0001** −15.96	**<.0001** −10.21	**<.0001** 13.85	**<.0001** −13.03	**<.0001** −9.13	–	–
Trophy hunting-game meat	.14 −2.57	.78 1.44	**<.0001** 15.57	.66 −1.64	.13 1.00	**<.0001** 7.84	–

APPENDIX G

The frequency (%) of provision of the two most common non-salary benefits (food and housing), on conventional agricultural farms and different wildlife ranch business models.



APPENDIX H

Definitions of wildlife-based business models and related wildlife-based activities on private wildlife ranches in South Africa.

Term	Alternative terms	Definition
Consumptive use	Extractive use	Activities which involve the killing of wildlife, usually for food or body parts.
Conventional agriculture	Conventional farming	Agriculture involving either cultivation of crops, raising of livestock, or both.
Ecotourism	Nonconsumptive use	Nature-based, nonconsumptive activities which commercialize wildlife, for example, game drives, photographic safaris, birdwatching, hiking, and bush walks (Taylor et al., 2020).
Game meat	Venison	Meat obtained from a game animal, usually antelope.
Live game sales	–	The sale and relocation of live game species (usually large herbivores or predators), either at wildlife auctions, or through direct transactions between wildlife ranchers, wildlife capture businesses, conservation authorities, etc. (Taylor et al., 2020).
Meat hunting	Biltong hunting; a form of recreational hunting	Hunting of wild ungulate species, usually by local (domestic) hunters to obtain game meat (including biltong, which is dried meat). Trophies (e.g., hides, skulls) may also be kept but "trophy" animals are not specifically targeted (this would be trophy hunting, where much higher-value animals are the target). This is a cultural activity in southern Africa (Taylor et al., 2020).
Mixed farming	–	Commercial farms which practice a combination of activities including wildlife ranching and conventional agriculture (cultivation of crops and/or livestock).
Nonconsumptive use	Non-extractive use	Recreational activities which involve wildlife without killing it—for example, birdwatching, photographic tourism, hiking.
Private wildlife ranches	Game ranches; game farms; private game reserves	Private land on which wildlife ranching is practiced.
Trophy hunting	Safari hunting; a form of recreational hunting	Selective hunting of wild ungulate species, mostly by international tourists, in the presence of a professional hunter. Hunted animals are selected for their large horns, tusks, or body size and trophies are usually kept by hunters, while meat is usually not (Taylor et al., 2020).
Wildlife breeding	Game breeding	Selection of individual wild animals based on desired genetic traits, to manipulate the characteristics of their offspring. Animals are bred (either intensively or extensively) for trophy hunting or live game sales (Taylor et al., 2020).
Wildlife ranching	Game ranching; game farming	The practice of commercializing wildlife-based land uses in a defined area (usually on private land but could also be on community land), which can involve any combination of land uses mentioned here (trophy hunting, ecotourism, meat hunting, wildlife breeding, or mixed farming) (Taylor et al., 2020).