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Shifting ecosystem services within a climate crisis: Resilience experiences in a conservation area in the Eastern Cape, South Africa

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Abstract

The human dimensions of conservation areas are essential to sustaining food systems through the provision of ecosystem services like water regulation, soil fertility, and biodiversity. However, research on equitable access to these services in protected areas remains limited. We examined how protected areas in the Eastern Cape sustain both rural communities and game reserve developers, with perceived benefits extending sometimes up to 35 km. Framed within the legacy of unequal resource access, the study used qualitative approach, including participatory engagements, to examine divergent experiences among stakeholders. We found that while the aesthetic and ecological value of conservation areas is widely acknowledged, access to ecosystem services, especially water, firewood, and economic benefits, varies by proximity, socio-economic status, and land tenure. Marginalised communities with limited economic alternatives rely heavily on wild resources and regulatory services. Our findings underscore the need for policy reforms that prioritise equity and local participation. We recommend: (i) establishing local decision-making forums, (ii) supporting conservation linked livelihoods, and (iii) integrating community-based monitoring into governance. Conservation strategies must reflect lived realities and promote co-management models that build socio-ecological resilience and climate adaptation, aligning conservation with development goals and empowering vulnerable communities.

Keywords: Community-Based Conservation; Climate Vulnerability; Biodiversity Conservation; Ecosystem Services; Environmental Change; Rural Livelihoods; Socio-Ecological Resilience

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1. Introduction

It is increasingly recognised that conservation areas play a vital role in ensuring equitable access to ecosystems. This is essential for sustaining a healthy planet and supporting human livelihoods by providing crucial services such as climate regulation, water purification, soil conservation and biodiversity preservation (Zhang et al., 2019). However, according to Aukema et al. (2017) and Wang et al. (2024), these areas face growing challenges amidst the uncertainty of land-use changes, climate variability and competing resources demands. Global environmental threats, particularly climate change, exacerbate food and water insecurity through rising droughts, floods and the spread of diseases vectors (Wang et al., 2024). As biodiversity declines and ecological processes deteriorate, the availability of essential ecosystem services also diminishes (Ogwu et al., 2025). These disruptions weaken ecosystem resilience, which is the ability of an ecosystem to recover from disturbance while maintaining its core functions and structure.

Evidence suggests that the discussion of conservation areas and ecosystem services cannot be separated from broader issues such as poverty, rural livelihood sustainability and climate change. Studies highlight how climate variability intensifies competition over water resources, leading to heightened conflicts due to increased rainfall variability and water stress (Niesenbaum, 2019; Leal Filho et al., 2022; Nkhata, 2022; Kumar et al., 2024). Environmental disturbances further undermine socio-ecological resilience by exposing local communities to hazards and uncertainties (Adebayo, 2025). In Africa, food insecurity is historically linked to climate-driven impacts such as droughts and floods. In line with this observation, Mahlalela et al. (2020) reported a prolonged and severe drought in South Africa's Eastern Cape province in 2015, highlighting its significant socio-economic impacts, particularly on water supplies in both rural and urban areas. With climate change, these vulnerabilities are expected to worsen, leading to more frequent food shortages. Additionally, meeting the needs of a projected global population of 9–10 billion by 2050 will further strain food systems, increasing reliance on external aid (Nelson et al., 2009; Smith and Gregory, 2013).

Despite progress in food security over the past decades, various studies in sub-Saharan Africa have focused primarily on resilience, vulnerability and the adaptability of socio-ecological systems in response to rural challenges that often lead to unsustainable livelihoods (Sono et al., 2021; Schneider et al., 2024). Understanding resource use near conservation areas and dependence on ecosystem services is essential for fostering resilience and sustainability. Studying communities living in and around conservation areas provides valuable insights into the interconnectedness of social and ecological systems and their implications for global ecosystems management.

Historically, conservation efforts have often excluded local communities (Lele et al., 2010). The world's first national park, Yellowstone, was established in the US in the late 1800s under a strict preservationist model that prohibited human settlement (Colchester, 2004; Miller et al., 2011). In Africa, the establishment of protected areas was closely tied to colonial policies that displaced indigenous communities (Lele et al., 2010). In South Africa, the Kruger National Park was proclaimed in 1898 and officially designated as the country's first national park in 1926 (Van Vuuren, 2017). This model of conservation frequently marginalised rural communities, displacing them from ancestral lands, including game reserves in the Eastern Cape's Makana Local Municipality.

The expansion of private game reserves has led to significant land use change, affecting traditional farming practices, food security and local livelihoods. While conservation initiatives have created employment

opportunities for residents and boosted tourism, they have also brought challenges, including land access, community displacement, limitations of farming activities and changes in local food procurement methods (Sirima and Backman, 2013; Wondirad and Ewnetu, 2019). Many communities adjacent to protected areas in developing countries face significant pressures, often being forced to rely on external markets for food access (He and Jiao, 2023). Biodiversity conservation and poverty reduction remain critical global challenges, as poverty is often linked to biodiversity loss. Resource-dependent communities' resort to the illegal extraction of biodiversity when access to resources is restricted (Wondirad and Ewnetu, 2019; He and Jiao, 2023). This highlights the challenge of sustainable resource management to balance the needs of local communities and conservation areas to maintain both ecosystem resilience and livelihoods.

Consistent with this observation, Meybeck et al. (2024) examined resilience, vulnerability and socio-ecological transformations to address unsustainable livelihood practices driven by these pressures. However, a critical gap remains in understanding how local communities near conservation areas utilise natural resources and depend on ecosystem services, and how this dependence varies with proximity to the conservation area. Addressing this gap could inform strategies for fostering sustainable livelihoods and resilient socio-ecological systems. In the Eastern Cape, where poverty levels remain high, biodiversity conservation faces considerable challenges. Local communities often prioritise immediate survival needs over long-term environmental sustainability, whereas conservation authorities preserving ecosystems for broader ecological and economic benefits (Thondhlana and Cundill, 2017).

Examining communities adjacent to conservation areas offers insights into complex interactions between social and ecological dynamics, offering essential guidance for global conservation strategies. Understanding the value of ecosystems is essential for designing conservation models that both protect biodiversity and promote sustainable use of natural resources. The availability and continuity of essential ecosystem goods and services – such as clean water, biodiversity and carbon sequestration depend on both the physical attributes of ecosystems (e.g. forest, wetlands) and their overall health (Fischlin et al., 2007). Monitoring the flow and quality of these services serves as a key indicator of ecosystem stability and resilience.

Within this context, this study focused on a game reserve area encompassing a diverse range of socio-economic and cultural stakeholders. The selected communities, including Alicedale and Seven Fountains as well as the Lalibela Game Reserve, were examined to assess their resource use patterns and the potential consequences of ecological change (Ngwenya, 2016). According to Danley and Widmark (2016), ecosystem services are components of nature that directly or indirectly contribute to human well-being. Without these resources, ecosystems would be unable to provide essential services. For example, wood can serve multiple purposes, such as fuel or construction, while a single ecosystem service such as electricity can be generated from various sources, including water or coal. However, despite their ecological and economic significance, these reserves face increasing pressure from land use change, climate variability and competing demands for resources. Many adjacent communities are already experiencing high population densities and unemployment, intensifying pressure on natural resources (Abukari and Mwalyosi, 2020). Understanding how local communities interact with and depend on these ecosystems is essential for balancing conservation efforts with promoting the sustainable use of their services.

The study aimed to investigate ecosystem services in communities surrounding protected areas and assess their resource use patterns. To achieve this, the study was guided by the following questions:

- What role do conservation areas play in providing natural resources to adjacent communities?

- What ecosystem services do local communities derive from resources in the vicinity of Alicedale, Seven Fountains and Lalibela Game Reserve in the Eastern Cape, South Africa?
- What key factors influence the dependence of communities and game reserve officials on natural resources and ecosystem services provided by conservation areas?

2. Theoretical framework

This study adopted an integrated theoretical framework combining socio-ecological systems theory, political ecology, ecosystem services theory and environmental justice to critically assess the dynamics of conservation areas and their impacts on adjacent rural communities in the Eastern Cape. Together, these theories offer a robust lens to explore the complex interactions between ecological conservation, socio-economic development and power asymmetries in land and resource governance.

Drawing from the socio-ecological systems (SES) perspective, as advanced by Biggs et al. (2021) and Ostrom (2009), the study emphasised the interdependent and co-evolving relationship between human societies and ecological systems. This framework enables an analysis of how rural communities and game reserve developers interact with and adapt to changes in ecosystem services. Key concepts such as feedback loops are central, illuminating how conservation policies influence local livelihoods and, conversely, how local responses shape conservation outcomes. In this study, feedback loops were observed in the reciprocal dynamics between conservation-induced restrictions and adaptative livelihood responses among affected households. Procedural justice was exemplified through the lack of meaningful community inclusion in land-use decisions. The concept of rewilding emerged in game reserve managers' efforts to restore previously framed land to its natural state. The SES approach also sheds light on community resilience and adaptation, particularly in response to restrictions on natural resources access. In this approach, institutional interplay is examined to reveal how government policies intersect with traditional governance structures, influencing resource use decisions and ultimately the success or failure of conservation models in aligning with local socio-ecological realities.

Complementing this, political ecology, as discussed by Roberts (2020) and Child and Barnes (2010), interrogates the roles of power, history and economic structure in shaping environmental governance and resource access. In the context of the Eastern Cape conservation landscape, private game reserves are often deeply rooted in histories of colonial and post-apartheid era land dispossession and economic inequalities. Archival sources, such as the 1913 Natives Land Act, land restitution case files, and historical settlement maps, provide documentary evidence of how Black communities were forcibly removed or excluded from fertile lands now designated for conservation or private game reserves (Walker, 2014). These historical dynamics are not merely contextual; they are central to understanding the contemporary governance structures and power asymmetries that influence whose interest's conservation serves. This study employed political ecology to trace these legacies, exploring how enduring institutional arrangement such as land tenure policies, and private property regimes, continue to marginalise rural residents. Such historical and spatial data underscore the continued material effects of exclusionary conservation models and help substantiate community claims of dispossession. The framework also highlights ongoing processes of marginalisation and resistance, where communities contest exclusionary conservation practices that limit access to land, water and grazing resources. It draws on archival records on archival records of land transfers during the colonial and apartheid periods (Van Vuuren, 2017). Landownership maps accessed through the Makana Municipality confirm the

concentration of land in the hands of private game reserves, reinforcing the political-economic asymmetries in the region. Such analysis is essential for understanding the roots of conflict and the persistence of inequality in post-colonial conservation contexts.

The lens of ecosystem services theory, as structured by the Millennium Ecosystem Assessment (Reid et al., 2005), further enriches the analysis by identifying four main categories of ecosystem services, namely provisioning, regulating, cultural and supporting services. This study applied the framework to explore how rural households rely on provisioning services such as firewood, water and medicinal plants, and how conservation policies may restrict access to these critical resources. Regulating services including carbon sequestration, flood control and biodiversity maintenance – are evaluated to understand their contribution to broader environmental goals. Cultural services provide insights into the spiritual, recreational and heritage values tied to landscapes now designated for conservation, while supporting services highlight the foundational role of biodiversity in maintaining ecological stability. This theoretical lens facilitates a comparison between the goals of biodiversity protection and tourism revenue generation, and the subsistence needs and cultural ties of local communities.

Finally, environmental justice theory – as conceptualised by Schlosberg (2007), Walker (2012) and Pandey et al. (2024) – offers a normative framework for assessing equity in conservation. This perspective is employed to evaluate distributive justice and to question whether the costs of conservation, such as restricted land access, are unfairly borne by rural communities while private game reserves benefit from tourism and conservation branding. Procedural justice is considered through the extent to which local voices are meaningfully included in conservation planning and governance as opposed to top-down impositions (Roe et al., 2009). The study also considers recognition justice, assessing the extent to which indigenous knowledge systems, cultural identities and land rights are acknowledged and respected within conservation initiatives.

These dimensions are critical for assessing whether conservation models in the Eastern Cape perpetuate historical injustice or contribute to more equitable and inclusive forms of development. By integrating these theoretical perspectives, the study offered a multidimensional analysis of conservation areas as socio-ecological spaces where ecological processes, governance systems and power dynamics intersect with historical and institutional legacies. This integrated framework reveals how resource valuation and access are contested along lines of justice and equity, substantiated by documentary, cartographic and legal records that trace patterns of exclusion. It moves beyond reductive 'people versus conservation' narratives and instead highlights how historical, institutional and economic forces shape the contemporary landscape of conservation, conflicts and potential collaboration.

3. Materials and methods

3.1. Description of the study area

The study was conducted in the South Africa's Eastern Cape province, specifically within the Makana Local Municipality. The study examined two stakeholder groups: (i) adjacent rural communities in Seven Fountains and Alicedale and (ii) Lalibela Game Reserve management. The selected reserve, situated along the N2 highway, covers an area of approximately 62 km2 (Maciejewski and Kerley, 2014). This reserve is well known for its rich biodiversity including the 'Big Five' and other wildlife species, (Eastern Cape Game Reserves , 2025). There

was a total of 56 participants, comprising representatives from 52 households in the two rural communities and four key informants (two managers from Lalibela Game Reserve and two community leaders: one from Alicedale and one from Seven Fountains).

Seven Fountains is an informal settlement located approximately 5 km from Lalibela Game Reserve and 3 km from the N2 highway, whereas Alicedale is a semi-rural town about 35 km from the reserve and 30 km from the N2. While Alicedale features modern housing, Seven Fountains mainly comprises informal dwellings and lacks formal educational infrastructure. The demographic composition of the study area includes Black, White and Coloured South Africans. The region faces significant socio-economic challenges, with the unemployment rate estimated at 42.4% in the first quarter of 2024 (ECSECC, 2024). Most residents rely on informal economic activities, and only a small percentage are employed within the game reserve sector. The Eastern Cape is known for its climate, which is conducive to robust farming operations. The region typically experiences summer temperatures averaging 26°C and winter temperatures 13°C, with average seasonal rainfall of 1000 mm in summer and 400 mm in winter. These measurable climatic factors play a significant role in the province's agricultural productivity, particularly livestock, vegetables, crops and citrus production (Gidi et al., 2024). This region falls within the Albany Thicket biome, known for its rich biodiversity, featuring spiny shrubs, succulents and occasional forest patches. The terrain is hilly, with elevations between 300 and 700 m above sea level (Lubke et al., 1986).

The Alicedale and Seven Fountains communities both contend with widespread poverty, inadequate road infrastructure, climate change effects and restricted land access. Some community members find seasonal employment in game reserve lodges and occasionally receive infrastructural support. However, benefit-sharing initiatives linked to game reserve development have been slow to take effect. Due to high population density and chronic poverty, local natural resources face increasing pressure. Most households practise subsistence farming, while limited employment opportunities drive many young people to seek seasonal jobs in nearby game reserves (Wondirad and Ewnetu, 2019). Given their dependence on local natural resources, these communities represent a crucial aspect of the study.

The study assessed differences in ecosystem services between game reserve managers in conservation areas and communities, whose responses were further analysed to compare communities located near the reserves with those living further from protected zones. The study highlighted key variations in the availability, accessibility and significance of ecosystem services for these two stakeholder groups. For the identification of ecosystem services and their categorisation, the Millennium Ecosystem Assessment synthesis was used (Reid et al., 2005).

3.2. Data collection and analysis

Fieldwork was conducted during July and August 2024 in the Makana Local Municipality, Eastern Cape province. Participants were divided into two target groups: (i) rural communities from Seven Fountains and Alicedale, and (ii) game reserve managers within the study area.

All the participants were selected based on their involvement with ecosystem services from the reserve (Mouton, 2001). However, individuals not directly involved in conservation areas were not excluded as participants. The data collection methods included interviews with key informants and focus group discussions (FGDs). To ensure broad representation, a stratified random sampling approach was used to

identify participants from the target population (Mack et al., 2005). Snowball sampling was subsequently used to complement this approach, until data saturation was achieved. The methods applied follow Mack et al. (2005)'s guidelines for qualitative research and aligned with Effossou et al. (2022)'s emphasis on adaptative recruitment through snowball techniques. As the study progressed, participant numbers increased, eventually totalling 56. Recruitment of the participants was conducted using both snowball and stratified random sampling. Stratified random sampling was used to ensure diverse representation across key demographics within the two communities. Snowball sampling was used to supplement this by reaching additional participants, particularly among key stakeholders and community leaders in Alicedale and Seven Fountains. Community liaison officers' familiar with the local context facilitated participant recruitment through a referral approach, particularly in Alicedale and Seven Fountains. Interviews were conducted either partially or entirely in a local language (primarily isiXhosa), depending on participants' preferences.

The data collection tools included semi-structured questionnaires designed to address key issues repeatedly in varied ways to ensure the consistency of responses. Key informant interviews and FGDs were held to gather group insights (Anderson, 2010; Frost, 2011). These methods assessed participants' perspectives on conservation areas and ecosystem services.

Separate FGDs were conducted in Alicedale and Seven Fountains to gather in-depth insights from local communities benefiting from conservation areas. Discussions were carefully structured and facilitated in a welcoming, non-threatening environment to encourage open dialogue and meaningful data collection. Each FGD consisted of six to ten participants aged 18 and older, grouped into homogeneous sub-groups based on gender and age to promote open discussion, as recommended by De Vos et al. (2011). This approach ensured that all participants could actively engage. The FGDs lasted between 45 and 60 minutes and were audio-recorded. An ethics clearance for this study was obtained from the University of Fort Hare Inter-Faculty Human Research Ethics Committee (IFRED). In addition, written consent was obtained from all participants after explaining the study's objectives, potential risks, and their rights to withdraw at any stage without consequence. Confidentiality and anonymity were strictly maintained throughout the interviews.

Key informant interviews were conducted with community leaders and game reserve managers, each lasting between 30 and 45 minutes. The game reserve managers provided detailed insights into the reserves, highlighting the location and uses of key natural resources relative to their activities and the purposes for which each of the resources were used. As noted, community liaison officers facilitated participant recruitment through a referral approach to ensure contextual representation.

Both FGDs and interviews followed an open-ended format, allowing participants to explore topics such as the development of conservation areas, ecosystem services and their impacts. Some interviews and FGDs were conducted in isiXhosa and were translated into English. To preserve meaning or tones while ensuring clarity, translations were lightly edited for grammar, but care was taken not to distort participants intent. Transcription was undertaken verbatim, with only minor adjustments for readability (e.g., repeated words).

A key objective of the study was to compare the ecosystem services experienced by stakeholders located near to and further from the conservation area. This was addressed through two approaches: (i) data collection along a distance gradient extending up to 35 km, though these references are illustrative rather than quantitatively measured from Lalibela Game Reserve, and (ii) comparison of findings across stakeholder groups based on proximity to the reserve. The data collected was qualitative, with each sub-group sharing its discussions with the larger group to validate or challenge emerging findings.

The interview and FGD results were manually coded for analysis (Saldaña, 2009). The researchers organised the data by creating a separate folder for each collection site, labelled with the date and location. The analysis involved an iterative process of reading, coding and categorising the data to identify key themes and patterns related to ecosystem services, resource use, and the dynamics of the relationship between the community and the reserve. A combination of inductive and deductive coding was used. Inductive coding allowed themes to emerge directly from the data, while deductive coding was guided by the research questions and theoretical framework. Manual coding was employed to ensure deep engagement with the data and to capture the nuances of participants' perspectives.

A summary codebook was developed to systematise the themes, and a thematic matrix was created to cross-reference themes across stakeholder groups and locations. This matrix allowed for comparison of recurring patterns and the identification of divergences in perspectives between groups. The coding process involved multiple rounds of review and refinement to ensure consistency and reliability (Bailey, 2008). Confidentiality was maintained by removing any personal or identifiable information related to participants.

The findings from the interviews and FGDs are presented as descriptive narratives, with directs quotation included illustrate key points. Quotes are marked with general identities (e.g., "female FGD, Seven Fountains") to maintain anonymity. These narratives are based on participants' feedback during fieldwork.

4. Results

The findings section explores stakeholders' perception of the ecosystem surrounding the game reserve, examining the socio-economic challenges and the impacts of climate variability on ecosystem services, as well as the opportunities and constraints these changes present from the participants' perspectives. This section is based on thematic analysis of data gathered through in-depth interviews, focus group discussions, and key informant interviews conducted between July and August 2024. The findings have been organised thematically to reflect both the convergence and divergence of perspectives among community members and game managers. The findings offer critical insights into the realities faced by communities living near conservation areas, particularly their ongoing struggle for equitable access to reserve resources.

4.1. Community and game managers' perceptions and socio-economic challenges

The results revealed a complex and often fraught relationship between conservation managers and adjacent communities, particularly in Seven Fountains and Alicedale. While game reserves are widely acknowledged for their role in biodiversity protection, community participants especially women and elders expressed frustration over the socio-economic costs of living near these areas. These costs are compounded by limited employment opportunities, loss of access to traditional land and pervasive feelings of marginalisation. Unemployment remains a pressing concern, and many participants expressed frustration about the lack of meaningful inclusion of the local population in conservation-related industries. A recurring theme in FGDs was disillusionment with unfulfilled promises from conservation managers. A female community member from Alicedale captured this sentiment:

> '*Honestly, I am not really satisfied. There is nothing I can do about it. We are ignored or even marginalised. The game reserve is more about business than helping local people*' (Female FGD, Alicedale, August 2024).

Participants widely perceived the anticipated benefits of conservation, such as employment and community development, as unreliable and unevenly distributed. Another major concern was restricted land access, which has direct implications for food security and cultural practices. A significant portion of land is controlled by game reserves, limiting its use by residents. According to key informants and FGDs, the proclaimed reserve controls approximately two-thirds of the land. Much of which remains underutilised but could support small-scale farming and livestock, given that the shift from subsistence agriculture to market-based food systems has significantly increased household vulnerability, particularly among low-income families.

Participants also highlighted the erosion of cultural ties due to restricted land use. For example, a ward councillor from Seven Fountains noted that:

> *'The imposed restrictions have broken our connection with the land. Cultural practices and traditional grazing [are] all gone. The needs and presence of local communities appear to be overlooked'* (Key informant interview (KII), Ward councillor, Seven Fountains, July 2024).

As a result, resentment towards conservation managers is growing, driven by the perceived imbalance between environmental goals and community welfare.

Similar frustrations emerged in Alicedale where participants discussed the historical legacies of land dispossession and its continuing effects on housing and land tenure. Rural community members emphasised their customary rights, which they believe are being disregarded. They traced the roots of current land ownership patterns to colonial and apartheid era land acquisitions. A ward councillor from Alicedale highlighted:

> *'Game reserve developers got access to communal land during colonial and the apartheid time. That's when conservation areas first started. Now we are being push[ed] off land we have always used. This leads to informal zinc houses, where we struggle to find stable housing'* (KII, Ward councillor, Alicedale, August 2024).

Participants frequently referred to structural inequalities and racialised land ownership patterns in Makana Local Municipality, where much of the arable land remains in the hand of white private farmers. This continued exclusion has further strained relations between residents and conservation managers, fuelling the perception that conservation efforts prioritise wildlife over human well-being. Despite these challenges, there were calls for improved collaboration and equitable benefit-sharing. A male elder participant from Seven Fountains emphasised the importance of dialogue:

> *'We need better collaboration between the community and the conservation area. While conservation efforts are crucial for protecting biodiversity, the well-being of people should also be a priority'* (Male elder, Seven Fountains, August 2024).

Both community members and reserve managers acknowledged the importance of ecosystem services. Various community members, especially the older generation, value these areas for providing firewood, construction materials and a historical landmark. However, restrictions on access to natural resources such as firewood and water have made it difficult to sustain traditional livelihoods. Additionally, wild animals, including cheetah and elephants from the reserve pose risks to local communities. Participants expressed frustration over the lack of mitigation efforts by conservation managers.

Overall, this theme reveals overlapping yet contested understandings of conservation, where communities view themselves as historical custodians of the land, while reserve managers focus primarily on ecological protection and tourism development. While there is recognition of the ecological importance of game reserves, community members remain deeply concerned about socio-economic exclusion. The findings underscore the urgent need for inclusive and participatory conservation models that balance environmental sustainability with the welfare of adjacent communities.

4.2. Ecosystem services and climate variability

The relationships between ecosystem services, the rural community, game reserve management and climate variability were also investigated. Data drawn from interviews and FGDs indicate that both Alicedale and Seven Fountains communities rely heavily on natural resources for daily survival. Participants described how the game reserve provides a range of ecosystem services from water to firewood, poles, wild edible plants, and cultural and aesthetic value. However, these benefits are unevenly distributed and increasingly strained under the pressure of climate variability.

Water provisioning is one of the most critical services identified by both community members and reserve officials. The study revealed multiple sources of water including boreholes, springs, piped water and municipal tanks. In Seven Fountains and Alicedale, many households depend on boreholes and municipal tanks for their daily water needs. However, participants reported inadequate access to sufficient clean water; for example, a ward councillor in Alicedale mentioned:

> *'Water scarcity is a concern for the community. Sometimes, we only receive water every two days, and delivery can be unpredictable'* (KII, Ward councillor, Alicedale, August 2024).

Another male participant in Seven Fountains echoed similar concerns, stating:

> *'We struggle with unpredictable rainfall and lack sufficient water. Conservation areas have access to more water resources but don't share these with the community'* (Male, Seven Fountains, July 2024).

Multiple participants in Alicedale and Seven Fountains expressed concern that conservation managers prioritise lodge operations and wildlife watering holes over local household needs. According to rural communities, there used to be a water pipe supplying the community in Alicedale but it is now used primarily for the reserves, which no longer share much water with the rural community. The Seven Fountains community believes that the distance and fencing from the conservation area negatively affect their ability to use springs directly as a household water source.

These challenges were corroborated by conservation managers, who acknowledged the impacts of climate variability on their operations. Game reserve management noted that changing rainfall patterns have forced them to adapt by using boreholes and reducing wildlife stocking rates to mitigate ecological stress. A reserve ecologist mentioned, for example:

> *'With rivers drying up, we are losing waterbirds…the native wildlife is clearly in decline''* (KII, Game Reserve *ecologist*, August 2024).

Energy provisioning through firewood collection remains a vital ecosystem service for rural households. In Seven Fountains, firewood is essential for cooking and heating, especially in homes without reliable electricity access. However, the results revealed that due to fencing and conservation protocols, community members face restricted access to these resources. Based on the perspectives of key informants and FGDs, a firewood collection point is always designated by game reserve management to avoid human–wildlife conflict. In response, reserve management has made efforts to offer controlled access. The reserve ecological staff member reported:

> '*When we remove invasive species or clear brush, we allow the community to collect left-over wood*' (KII, Game Reserve, July 2024).

Table 1. Ecosystem services surrounding the Lalibela Game Reserve

Service type	Community perspectives (Seven Fountains and Alicedale)	Game reserve management perspectives	Notable issues	Impact of climate variability
Water provisioning	Use boreholes, rivers, and municipal tanks for domestic purposes 90% of Seven Fountains community uses rivers and the reserve's borehole water for farming	Conservation area is viewed as a critical water source Water is used by wildlife and lodge operations	Water scarcity in both villages Rainfall variability impacting backyard farming and wildlife	Decreased rainfall decreases water availability, placing wildlife and agriculture under stress
Energy provisioning	Participants collect firewood (mainly left-over wood) from designated areas in the reserve 90% of the Seven Fountains community relies on firewood for cooking and heating Access to the game reserve is more distant for the Alicedale community	Firewood is used for heating and recreational activities like barbeques	Firewood collection is organised with game reserve management for safety and sustainability	Decreased availability of wood and higher risk of overharvesting during dry seasons

Service type	Community perspectives (Seven Fountains and Alicedale)	Game reserve management perspectives	Notable issues	Impact of climate variability
Building materials	Some households (especially in Seven Fountains) collect poles and sand for construction	Poles and sand are collected for lodge construction Reeds or dry vegetation are used for thatched roofing at the lodge	Alicedale households collect less than those in Seven Fountains	Decreased availability of building materials due to vegetation stress and erosion
Aesthetic value	Communities value visual beauty and see the reserve as important to their identity	Officials regard the aesthetic value as critical for conservation and tourism	Shared appreciation across stakeholders	Vegetation changes and fire risk reduce scenic beauty
Nutrition (wild foods)	Wide variety of wild edible plants (fruits, herbs, vegetables) are collected for household use and income especially in high rainfall areas within the reserve	This issue was not directly addressed	Wild food and income	Reduced plant diversity and disrupted harvest cycles
Cultural and heritage	Strong emotional and spiritual attachment due to ancestral graves and historical presence	Officials acknowledge and respect the cultural heritage of local communities	Restricted access; fences limit traditional practices	Climate impacts threaten sacred sites and heritage biodiversity
Recreation and tourism	Communities perceive reserves as important for livelihoods	Seen as vital for tourism, recreational use and wildlife conservation	Community involvement in tourism could be expanded	Climate stress reduces wildlife visibility and visitor comfort

Source: Field data, 2024.

Firewood is collected using vehicles, by headload or with wheelbarrows. Firewood collection was not significantly affected by household size and gender. However, the results clearly show that there is a relationship between distance and the frequency of firewood collection. This finding aligns with spatial dependency patterns noted in the SES literature, which show that increased travel time reduces the frequency of natural resource collection, particularly among women and the elderly Firewood collection is decreasing

due to the impact of climate variability. Table 1 outlines the various types of ecosystem services identified by participants living in and around the reserve.

Participants noted that apart from their material needs (herbs and reeds), the reserve holds deep cultural significance. The rural communities described their emotional ties to ancestral lands, traditional practices and sacred sites now located within fenced conservation areas. The community members need access for traditional purposes, like visiting ancestral graves and harvesting herbs and reeds for medicinal use. Participants strongly emphasised that conservation policies have not sufficiently recognised these non-material cultural ecosystem services, which they argue are central to community identity. Despite this frustration, the reserve's scenic beauty was consistently mentioned by all the participants as an essential aesthetic and cultural resource. A middled-aged female participant in Alicedale said:

'*I am proud of the reserve, even if I have mixed feelings'* (Female, Alicedale, July 2024).

The aesthetic value of the reserve was consistently ranked highest among the ecosystem services. However, community members expressed concerns that the expansion of game reserves has intensified pressure on their indigenous systems. For example, the ward councillor from Seven Fountains reported:

> *'Cultural practices such as boys' initiation schools are no longer held [due to] to fear of wild animal attacks.'*

However, according to the game reserve managers, conservation zones are dedicated to 'rewilding' the landscape, and they convert old farms into protected areas. These restoration efforts include eradicating invasive plant species, maintaining ecosystems, and managing wildlife and tourism growth.

The results revealed climate change as a compounding factor in the degradation of ecosystem services, intensifying the vulnerability of both communities and reserve managers. Participants reported increasing unpredictability in rainfall, longer dry seasons and reduced crop yields. Participants identified poor early-season planning and declining maize and vegetables yields as key indicators of climate-related stress. An elderly pensioner in Alicedale explained that climate change makes things more difficult for community members and referred to the growing burden on household food production. More affluent households in Alicedale and Seven Fountains are better able to cope with these changes, particularly through access to alternative water sources.

Game reserve managers also expressed concern about environmental changes that could disrupt the reserve's ecosystems. These changes could negatively impact essential services provided by birds, insects and other fauna. Additionally, they raised fears that upstream poaching and related illegal activities could further degrade ecosystem services. Game reserve managers and ecologists advocated for continued conservation efforts, emphasising the importance of protecting wildlife from extinction and preserving the area's aesthetic and ecological value. This shared concern highlights the potential for collaborative climate adaptation strategies that balance conservation goals with community needs. The study confirmed that climate change has already had a noticeable impact in the region, with increased droughts affecting both people and wildlife.

4.3. Opportunities for improved relations and sustainability to enhance inclusion and address socio-economic vulnerabilities

According to the rural communities in Seven Fountains and Alicedale, the extent to which they benefit from ecosystem services provided by biodiversity conservation initiatives remains a subject of ongoing contention. While conservation areas play a critical role in protecting ecosystems and maintaining biodiversity, numerous community members, including youth and older adults, often perceive these efforts as exclusionary, prioritising ecological goals at the expense of their livelihood and cultural ties to the land. A male participant from Alicedale, for example, noted:

> *'They are using large area of land, and we are left with small space. It's not fair to have it done this way'* (Male, Alicedale, August 2024).

A participant in Seven Fountains expressed concern:

> '*Living near the reserve brings more challenges than benefits. There is no reliable water supply for nearby community, and we often must deal with wild animals that come too close. It's risky, especially with kids around*' (Seven Fountains, August 2024).

The preceding narratives underscore the urgent need for transformative governance opportunities that not only safeguard biodiversity but also promote meaningful community inclusion and address the socio-economic vulnerabilities faced by people residing near reserves. Participants consistently expressed a desire for more equitable collaboration and resources access, emphasising that the success of protected areas is inherently linked to community well-being. The following sentiments were shared by a ward councillor from Alicedale:

> '*Many people feel hopeless. Business owners prioritise profit over community well-being, leading to a lack of adequate benefits for workers.*'

Community voices repeatedly called for co-management arrangements and transparent benefit-sharing agreements to address ongoing exclusion and to build mutual trust with conservation managers.

A truly sustainable conservation strategy must integrate social equity and ensure that the provisioning, regulating and cultural ecosystem services generated by these areas benefit all stakeholders. As one Female participant from Seven Fountains put it:

> '*We need better collaboration between the community and the conservation area. While conservation efforts are crucial, the well-being of people should also be a priority'* (Female, Seven Fountains, August 2024).

Furthermore, conservation managers could enhance community engagement through educational initiatives that foster greater understanding of the long-term benefits of conservation. Programmes that integrate local knowledge and traditional environmental management practices could strengthen collaboration, creating a conservation model that supports both ecological sustainability and human well-being.

In recognition of these concerns, game reserve officials have signalled willingness to adopt more inclusive and adaptive governance approaches. This reflects a growing awareness of the need to incorporate traditional ecological knowledge and land-use practices into conservation governance. Such knowledge includes seasonal harvesting practices, grazing rotations, and herbal medicine traditions that are deeply embedded in the local communities' interactions with the land. Such an approach not only enhances local participation but also contributes to the long-term maintenance of ecosystem services, including soil fertility, water regulation and biodiversity habitat.

Moreover, the intensifying impacts of climate change have compelled conservation officials to reconsider their roles in fostering community resilience. This recognition of the interdependence between ecological integrity and socio-economic stability signals a shift toward more holistic, ecosystem-based governance. The findings support the notion that future conservation success depends not only on ecological factors, but also on how well biodiversity goals are integrated with ecosystem services delivery and community development. By aligning these objectives, emerging governance models have the potential to create resilient socio-ecological systems that are both inclusive and sustainable.

5. Discussion

The findings of the study highlight the complex and often contested relationship between the conservation area and local communities in Seven Fountains, Alicedale and Lalibela Game Reserve. While conservation areas are crucial sources of ecosystem services, including biodiversity conservation, climate regulation and water provision, their benefits are not always equitably distributed among stakeholders. This section explores the key themes emerging from the data, including the proximity of the stakeholders to natural resources and the broader socio-economic and environmental implications of these reserves.

Proximity to conservation areas significantly influences access to ecosystem services. Water is a natural resource up to a least 35 km from the conservation boundary. Stakeholders living in and around the reserve have better access to clean spring water, firewood for cooking and heating, and other natural resources such as herbs, wild vegetables and poles for construction. However, close proximity can also lead to conflicts over resources access, especially in communities experiencing food and livelihood insecurity, as it significantly influences patterns of resource use and dependence on ecosystem services. The proximity to conservation areas significantly influences resource use patterns and dependence on ecosystem services. Communities closer to the reserve have greater access to resources but also experience more conflict with reserve management.

This dynamic is effectively explained through the socio-ecological systems (SES) framework, which emphasises feedback loops between ecological availability and social responses to resources and governance. can be understood through the lens of socio-ecological systems (SES) theory, which emphasises the interconnectedness of human and natural systems. This proximity creates a zone of interaction where the rules and norms of the conservation area intersect with the livelihood practices of the community, often leading to friction. In line with SES theory, such intersections reveal the need for adaptative co-management, which includes feedback-driven learning and flexible institutional responses.

Previous studies support the findings of this study, including those by Liu et al. (2016) and Buschke and Capitani (2023), which similarly highlighted how spatial proximity, influenced by land use changes, affects

biodiversity conservation and the availability of ecosystem services. As distance from conservation area increases, communities tend to rely more on piped water, boreholes and purchased firewood due to limited availability and longer collection distances. Additionally, Makungo and Mashinye (2022) noted a rainfall gradient across South Africa, with increased rainfall in the west and declining rainfall in parts of the far north-east. This spatial variation has contributed to shifting rainfall patterns in the Eastern Cape province over recent decades, which in turn affect resource use patterns around the conservation areas.

Shah et al. (2019) show that in Kenya, Maasai communities closer to reserves benefit from more diverse and abundant natural resources that support daily living. In contrast, villagers living further away (like those in Alicedale), depend primarily on piped water supplied by the municipality. Game reserve management and other wealthier stakeholders have drilled boreholes to improve their access to water. The findings of Makungo and Mashinye (2022), who examined the impacts of climate change on water resources in a rural community in South Africa's Limpopo province, further illustrate the broader implications of changing environmental conditions on local livelihoods.

Cultural and socio-economic differences between rural community members and game reserve management result in varying use and valuation of ecosystem services. Communities in Seven Fountains and Alicedale depend on natural resources for their basic needs, including access to water, firewood, wild food and medicinal plants (Makana Municipality, 2020; Fedele et al., 2021). The qualitative data demonstrated that many community members are disproportionately affected by restricted access to these resources. The inequitable access to ecosystem services experienced in the Makana Local Municipality is not an isolated case. Similar phenomena have been observed in other developing countries, particularly in areas surrounding protected reserves. For example, communities in Kenya, Nepal and Brazil have often faced restricted access to grazing lands, water resources and non-timber products, and have struggled with exclusion from natural resources due to conservation policies (Hariohay et al., 2018; Henry, 2020; Bhatta et al., 2022). In contrast, wealthier stakeholders such as game reserve management tend to use these resources for recreational purposes, such as barbeques, and place greater value on aesthetic and tourism-related benefits.

Across developing countries, the trends of inequitable access to ecosystem services have generated concern about land acquisition and the implications of rural communities' access to natural resources. While adjacent communities emphasise the cultural and subsistence importance of ecosystem services, reserve authorities focus primarily on recreational and commercial interests. According to households in Seven Fountains and Alicedale, they are especially dependent on natural resources. Wild herbs and foods hold particular importance for older residents and low-income families, serving both nutritional and medicinal purposes. This uneven distribution and valuation of ecosystem services is best understood through the lens of environmental justice, particularly distributive justice, which calls attention to the unequal costs and benefits of conservation policies. Hence, the results concur with the findings of Nguyen et al. (2020) and Grobler (2018) that in uncertain environments, households often adopt coping strategies that maximise the use of available natural resources to supplement their diets and income. Larger households tend to rely more heavily on these resources to stretch limited financial means and support extended family members, especially during times of crisis such as illness or job loss.

From the perspective of ecosystem services theory, provisioning services such as water, fuelwood and wild foods are essential to human well-being. However, when conservation policies restrict access to these resources, conservation areas can become sites of conflict, reinforcing environmental inequalities. Participants'

voices underscore the importance of procedural justice specifically, the right of communities to participate in decisions that directly impact their livelihoods and land use.

Climate change has further complicated the relationship between conservation areas and local communities. Changes in rainfall patterns, prolonged droughts and extreme weather events have intensified existing challenges, particularly in relation to water access and agricultural viability. While conservation efforts aim to protect ecosystems and mitigate the impacts of climate change, local communities often lack the resources, infrastructure and support needed to adapt effectively.

The study found significant absence of integrated climate adaptation strategies that bridge community resilience that align with biodiversity goals, such as sustainable water management initiatives and community-driven conservation projects. In SES terms, climate change acts as an external disturbance that disrupts the balance of the socio-ecological system, necessitating adaptative responses that include social learning and collective action.

For many low-income households, natural resources serve as a cost-saving substitute for essential goods. Studies on replacement values have shown that without access to these 'free' resources, many families would struggle to meet their basic living expenses. These coping strategies are especially vital for maintaining livelihood security and may be adopted on either a short- or long-term basis, depending on a household's financial situation (Dalu et al., 2021). This perspective aligns with environmental justice and political ecology frameworks, both of which emphasise how structural inequalities and power asymmetries influence access to and control over natural resources (Schlosberg, 2007; Walker, 2012; Pandey et al., 2024). Morever, political ecology perspectives offer additional insight by revealing how historical and structural power relations continue to influence unequal access to land and resources in post-apartheid South africa.

Addressing these challenges requires a more inclusive and participatory approach to conservation management. Drawing on political ecology, this means shifting power dynamics through co-governance mechanisms that give voices to marginalised stakeholders. Strengthening community engagement through transparent communication, benefit-sharing agreements and co-management frameworks can help build trust and foster a sense of shared responsibility. Additionally, conservation areas should explore ways to incorporate local economic activities, such as small-scale farming and ecotourism, into their operational models. Investments in infrastructure, education and climate resilience programmes would further help bridge the gap between conservation objectives and community well-being.

6. Recommendations

The outcomes of the study have led to the following recommendations:

- *Strengthen policy frameworks:* Ensure inclusive community participation and promote procedural justice and collaborative governance as emphasised by SES theory.
- *Establish equitable benefit-sharing mechanisms:* Ensure fair distribution of economic benefits from conservation, including transparent revenue-sharing, community development funds and access rights to non-timber forest products (e.g., firewood, herbs and poles).

- *Promote ecosystem-based livelihoods:* Provide support for sustainable, biodiversity-friendly, income-generating activities such as ecotourism, traditional medicine and small-scale agriculture through training and capacity building.
- *Improve access to essential ecosystem services:* Expand infrastructure and create regulated zones to enable equitable access to essential resources such as water, firewood and medicinal plants, particularly for vulnerable households.
- *Respect cultural and ancestral rights:* Recognise indigenous land claims, protect sacred sites and permit continued access for traditional practices to uphold cultural heritage within conservation landscapes.

7. Conclusions

This study highlights the complex interactions between different stakeholder groups and the ecosystem services provided by conservation areas in the Eastern Cape. Game reserves serve as vital sources of diverse natural resources for communities located up to 35 km away. The rural communities of Seven Fountains and Alicedale, alongside the management of Lalibela Game Reserve, demonstrated varied but significant reliance on these reserves, whether for subsistence, cultural or recreational purposes.

Both community members and game reserve management derive substantial provisioning from ecosystem services such as water, firewood and wild foods, while also valuing cultural services such as aesthetic beauty and tourism. These values and uses differ across stakeholder groups but reflect a shared dependence on the ecological integrity of reserves. The conservation areas in Makana Local Municipality thus play a crucial role in supporting livelihoods and well-being across the region.

Sustaining this flow of ecosystem services requires responsible and inclusive management. Overexploitation threatens to degrade the natural resource base, reducing the quality and availability of services and adversely affecting socio-economic conditions. Given the growing population in Makana Local Municipality, the demand for natural resources is likely to increase, heightening the need for regulated and sustainable use.

Effective governance is central to ensuring long-term benefits from these conservation areas. Currently, governance systems are undeveloped and do not adequately support the sustainable delivery of ecosystem services. Transforming private game reserves into nationally protected areas could create employment opportunities and strengthen oversight. Governance mechanisms that support socio-economic development, while promoting sustainable water use and fuelwood harvesting, are essential for maintaining ecosystem health and improving community resilience in the Eastern Cape.

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