

RESEARCH ARTICLE

An analysis of the perceived societal benefits of and threats from trees for the delivery of livelihoods and community development

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WoodRIGHTS Project

Societal Impact Statement

Understanding the perceptions of benefits and threats from trees is important for the livelihoods of communities. The study used focus group discussions, key informant interviews, and a questionnaire survey of 226 households in the province of KwaZulu-Natal, South Africa. The findings showed that household socio-economic factors such as gender and land tenure influenced perceptions of tree growing, and households that were involved in a tree restoration project viewed trees as contributing toward their livelihoods by reducing hunger. Hence there is a need to design strategies that promote socio-economic inclusivity of all households and genders and promote programs that increase awareness of ecosystem services within communities.

Summary

- Understanding the socio-economic factors that shape the way households value and utilize natural resources is critical in developing nature-based solutions. The study was aimed at understanding how the socio-economic circumstances of households determined their perceptions of the role of trees in livelihood delivery.
- A case study of Buffelsdraai and Osindisweni communities was used; these sites are adjacent to a municipal landfill where a tree restoration project intended to mitigate the effects of climate change is being implemented, and some of the households are involved in this project. The study used focus group discussions, key informant interviews, and a questionnaire survey of 226 households. It explored gender perspectives on the perceived benefits and threats of tree restoration. It analyzed the influence of households' economic characteristics and spatial configuration (the subdivisions of the landscape) to assess the impact of land tenure.
- The findings showed that gender influenced the perceptions that economic benefits can be derived from participating in the project. Households involved in the tree restoration project viewed trees as contributing to their livelihoods by reducing hunger. Households in peri-urban settlements, permanently resident in the area, showed greater reliance on natural resources than those in informal settlements and rural areas. Such differences can be attributed to differences in land tenure.

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- Hence, there is a need to design strategies and operations that promote socio-economic inclusivity of all households and genders and reduce inequality. These findings are important for informing scaling to yield better climate change considerations and policies.

KEYWORDS

benefits, communities, gender, livelihoods, perceptions, restoration, socio-economic, threats

1 | INTRODUCTION

Natural ecosystems play an important role in supporting the livelihoods and resilience of people (Douwes, 2020). Trees provide ecosystem services such as erosion control, water filtration, and filtration of urban pollutants; they furnish habitats for animals, act as carbon sinks, and increase biodiversity (Food and Agriculture Organization [FAO], 2016; Heusinkvelt, 2016). Furthermore, trees provide shade, wind protection, spaces for meetings (Shackleton et al., 2015; Sim et al., 2019), and green spaces, which can improve physical and mental health, thereby contributing to human wellbeing and enhanced human dignity (Food and Agriculture Organization [FAO], 2016). In addition, trees are a source of food in the form of fruit and nuts and support honey-producing bees. Trees therefore contribute to Sustainable Development Goals (SDG) 1: No Poverty; SDG 2: Zero Hunger; SDG 3: Good Health and Wellbeing; and SDG 5: Gender Equality. Achieving one or two SDGs tends to lead to benefits to other SDGs because the SDGs are interlinked. Hunting and Hankivsky (2020) reported that gender inequality interacts with other forms of inequality, so initiatives such as tree growing need to integrate gender perspectives so as to promote equality between women and men.

The study's main objective was to determine the perceived roles of trees in society and identify benefits, services and threats or risks regarding these roles. In addition to the gender perspective, the study analyzed the effect of households' economic and spatial configuration. Spatial configuration describes the living patterns in a landscape or the subdivisions of the landscape. Examining the spatial configuration brings out the issue of tenure and land rights. Those with secure tenure in an area (with title deeds) may perceive the environment differently from those with less certain tenure (such as those in informal dwellings). The study aimed to analyze the perceptions of benefits and threats from trees for delivery of SDG outcomes in terms of livelihoods and wellbeing and for the development and enhancement of dignity and social cohesion within communities adjacent to a municipal landfill where ecosystem restoration in the form of tree growing is taking place. The aim of including a gender perspective was to identify power imbalances, thereby avoiding the worsening of inequalities within the communities. Gaining a better understanding of the socio-economic and ecological context of the study area in a gender-inclusive and responsive way will assist in making a difference and having a greater impact in addressing environmental and social crises when dealing with social needs.

Munien et al. (2015) and Cinner and Pollnac (2004) reported that investigating community perceptions and attitudes toward natural resources facilitates an improved understanding of the ways they are used, prioritized, and evaluated. There is limited recognition of the complex systems within which decision-making and implementation of knowledge occur, and some assume that the generalizable outcomes of research are applicable across diverse contexts (van Kerkhoff, 2014). There is often a disconnect between scientific knowledge and implementation in addressing sustainability challenges concerning biodiversity conservation, environmental management, and climate change adaptation (Cook et al., 2013; van Kerkhoff, 2014). According to van Kerkhoff (2014), the boundary between science and society is artificial and is characterized by strong power disparities and assumptions about the superiority of scientific knowledge. Such boundaries may be overcome with openness from both sides, making it possible to view knowledge from different perspectives (Cundill et al., 2015; Hegger et al., 2012).

Knowing people's perceptions and attitudes toward natural resources facilitates improvement in understanding their use and how preferences are formed, and in developing and strengthening strategies for dealing with environmental change. This study adds to the pool of knowledge and constructive debates aimed at finding suitable solutions to environmental changes from the micro (case study level) to the global scale.

2 | CONCEPTUAL FRAMEWORK

Figure 1 presents a summary of the theoretical framework for the paper, which is based on the sustainable livelihoods approach. The paper explored the views and needs of the local communities from a gender perspective. The perspectives of study participants differ from those of professionals and scientists because the realities of those living in poverty tend to be local, diverse, often complex, and dynamic (Chambers, 1995). The dimensions of deprivation, such as vulnerability and inequality, have implications for policy and priorities of people affected by poverty, which need to be considered.

An understanding of how households live in areas where the natural environment is poised for change is best achieved through the sustainable livelihoods approach. The Brundtland Commission on Environment and Development described this approach as one that links socio-economic and ecological considerations and allows policies to address development, sustainable resource management, and

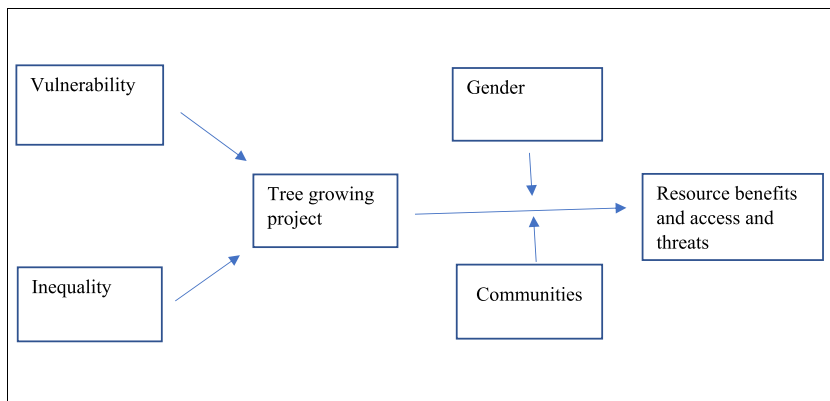


FIGURE 1 Components and flows in a livelihood. The figure shows how socio-economic factors such as vulnerability to poverty and inequalities within different gender and spatial configurations affect perceptions of the benefits or threats of growing trees. Adapted from Chambers (1995).

poverty eradication (Krantz, 2001). Chambers and Conway (1992) stated that livelihoods comprise capabilities, assets (both material and social resources), and the activities required for living. Livelihood is sustainable when it can cope with and recover from stresses and shocks currently and in the future, while not overutilizing the natural resource base (Chambers & Conway, 1992).

Dianga (2011) stated that the term livelihoods refers to the activities, entitlements, and assets whereby people make a living. This recognizes that households need access to assets to provide for their basic needs and help buffer themselves against various forms of vulnerability. The argument is that poverty reduction, economic reform, or sustainable development become effective at the individual, household, and community levels (Moser, 1996). The sustainable livelihoods approach assumes that sustainable poverty reduction will be achieved only if external support (support from outside the household) works with people in such a way as to be consistent with their current livelihood strategies, social environment, and ability to adapt (Moser, 1996). This implies exploring households' access to social and economic opportunities that contribute to their well-being.

Women are more vulnerable to shocks in the forms of household food insecurity and climate change effects as they have fewer assets and heavier burdens from additional household obligations (Buechler & Hanson, 2015; UN DESA, 2020). Some challenges may arise from gender inequality and socio-economic factors, and generally, gender discourses cannot be exempted from livelihood studies (Buechler & Hanson, 2015). Gender roles and dependence on resources for livelihoods are prominent in shaping perceptions and preferences for conservation and restoration initiatives (Sultana & Loftus, 2012). The spaces within which men and women operate influence perceptions and motives for exploiting or conserving resources (Gaard, 2011) because of disparities in property rights, which may cause inequality and vulnerabilities among marginalized groups. Figure 1 shows that perceptions of whether, in tree restoration projects, trees are considered beneficial, or a threat are a result of socio-economic factors such as vulnerability to poverty and inequalities within different gender and spatial configurations.

Restoration of natural forests is one way to mitigate climate change impacts. This is because forests act as carbon sinks through the uptake and storage of carbon, reducing the amount of carbon in the atmosphere (Mugwedi et al., 2018). Restoration projects may

affect men and women differently. Assessing the extent to which environmental projects adhere to the United Nations' strategy of promoting equality between genders in access to and control over resources in eco-sociological systems is important in the United Nations Environment Programme (2018). Gender equality is a prerequisite for improving the living conditions of those most affected by environmental changes and hence policy changes (United Nations Industrial Development Organization [UNIDO], 2015). Gender mainstreaming in socio-ecological projects assists in balancing the different needs of men and women more effectively by generating concrete and sustainable projects.

The practice of ecological restoration has long been contested in the field of environmental ethics. A viewpoint opposing this practice is that restoration is seen as a product of human design expressing domination over nature and that ecological restoration would not restore all the values lost through ecological destruction, even if the restoration restores the ecosystem to its state prior to the destruction. However, arguments for restoration are that they are healing, bringing back lost values, and encouraging local communities and individuals to engage in active, positive relationships with the nonhuman world (Palmer et al., 2014).

Gender is determined by biological, sociological, and psychological factors (Hameed & Shukri, 2014). The study by Hameed and Shukri (2014) considered the psychological approach, which recognizes that the categories of masculinity and femininity are culturally specific. Individuals exhibit behaviors consistent with their gender by understanding the concepts of gender roles that they have been taught or that are based on social experiences (Bern, 1993; Meyer, 2010). Gender differences are apparent in individuals' knowledge of the environment, and the use of, and responsibilities for, managing natural resources (Buechler & Hanson, 2015; Ernason, 2012; Meinzen-Dick et al., 2014). This may lead to differences in accountability, stewardship, and action in socio-ecological systems. Gender mainstreaming may assist in building the resilience of communities to climate change and open up more effective solutions to some environmental challenges (Eastin, 2018). However, there has been insufficient sex-aggregated data on men's and women's needs, resource use, and responsibilities in the field of environment and conservation (UNEP, 2018). Considering the complex societal and environmental challenges such as poverty and climate change (UNEP, 2020) facing

communities today, there is an increasing need to present sex-disaggregated data analysis and diagnostics of the different gender roles in socio-ecological systems. Including the gendered aspect helps projects to avoid the perfunctory selection of beneficiaries, which often leads to projects providing further access to resources to those community members who are already advantaged.

The Buffelsdraai Landfill Site Community Reforestation Project is a tree restoration project being undertaken to mitigate the effects of climate change. This study integrates gender-specific components in analyzing the perceived roles of trees in society and identifies the benefits, services, and threats or risks of growing trees in a society. The rising cost of living has increased the number of informal settlements in South Africa. Despite the government's construction of low-cost housing, the demand for housing is far greater than the supply. Wilkins and Hofmeyer (1994) reported that informal settlements have the highest proportions of the lower-income marginalized and welfare-dependent households in KwaZulu-Natal province. This implies that policies and initiatives must be re-directed toward the needs of the people living in poverty.

3 | METHODOLOGY

3.1 | Study site

The Buffelsdraai Landfill Site Community Reforestation Project is located approximately 25 km north of Durban, in the KwaZulu-Natal province of South Africa. Durban, which is in the eThekweni municipality, is one of the five major cities in the country in terms of contribution to the overall GDP. However, the municipality is characterized by contrasts in demography and economy (The eThekweni Municipality and The Wildlands Conservation Trust, 2011). Residents from Buffelsdraai and Osindisweni communities participate in the tree growing project and are employed to re-plant and maintain the site.

The annual rainfall at the project site is approximately 800 mm per year and falls mostly in the summer months. Average daily temperatures range from 22°C in winter to 27°C in summer. The Wildlands Conservation Trust (WCT) is implementing the reforestation project, which is located in the buffer zone of the Buffelsdraai landfill site, on behalf of eThekweni Municipality. Sugarcane farming was halted in a large section of the 800 ha landfill site buffer zone in order to rehabilitate the degraded ecosystems to their original forested state. The aim is to increase the site's biodiversity and lead to a net reduction in atmospheric greenhouse gases (GHG) through the sequestration of carbon in biomass and soils (The eThekweni Municipality and The Wildlands Conservation Trust, 2011).

3.2 | Sampling and selection of households

Sample selection was done in three stages, with the first stage being purposive. The selection of Buffelsdraai and Osindisweni sites was purposive and aimed to account for differences in socio-economic

opportunities. Osindisweni is largely communal, while Buffelsdraai is a peri-urban area and privately owned. These two sites can be further classified into three groups based on settlement patterns: peri-urban (with households who bought houses, owned title deeds, or were allocated governmental low-cost houses and were permanent residents in the area), informal, and rural. EmaGcakini and Two Room communities in Buffelsdraai have mostly informal dwellings, while Ogonjini and Mfolozi in Osindisweni are mostly rural. The communities of Khuzwayo, Mangena, Jikeni bus 1, and Jikeni bus 2 in Buffelsdraai and Osindisweni in the Osindisweni region are peri-urban settlement areas. These land-use patterns and political governance differences lead to varying demography and economic activities, influencing households' perceptions of the reforestation project.

Buffelsdraai and Osindisweni had a combined population of 1,349 households at the time of the study (The eThekweni Municipality and The Wildlands Conservation Trust, 2011). The Raosoft sample size calculator (Raosoft, 2004) with a 90% confidence level determined a sample size of 226 households. At the next sampling stage, the sub-sample size was proportionate to the number of households in each community. The sub-sample sizes for Buffelsdraai and Osindisweni were 160 and 66 households respectively. The final stage of sampling involved randomly selecting households during the survey.

3.3 | Data collection

Data were collected between May and June 2021, using a structured household questionnaire, focus group discussions (FGDs), and key informant interviews. During the administration of the questionnaire, the person interviewed was the most senior available and knowledgeable about household practices. The FGDs and open-ended key informant interviews generated data that complemented the structured questionnaire by explaining the quantitative data and related issues. Four FGDs were conducted, one with men only and the other with women only, selected from each of the two communities. Focus group discussions featured a mixture of project beneficiaries and other members of the communities. Female participants included married, single, and widowed women. Snowballing was used to identify stakeholders for key informant interviews. Key informants included the councilor (the political head of peri-urban and informal communities); the traditional village head (heading the rural communities); the Buffelsdraai Landfill Site Community Reforestation Project manager; and the community liaison officer and project manager of the Wildlands Conservation Trust, an NGO responsible for implementing the reforestation project located in the buffer zone of the Buffelsdraai landfill site on behalf of eThekweni Municipality. The enumerators interviewed one person per household during the questionnaire survey. The gender of the household head was recorded. Six isiZulu-speaking enumerators administered the pre-tested questionnaire.

All ethical considerations were observed during and after the data collection period. Ethical considerations for the study required that participation would be voluntary, and stipulated anonymity, informed consent, confidentiality, disclosure that there was no potential for

harm, and that results would be used only for research purposes by staff and students at the learning institution. Ethical clearance was obtained from the University of KwaZulu-Natal ethics committee.

3.4 | Limitations of the methodology

The limitation of the study was the potential for bias in answers. However, since the respondents were adults living in the same household and were knowledgeable about practices in that household, the outcome of the study was not negatively influenced. In addition, FGDs assisted in backing up and explaining some of the responses made during the surveys to facilitate an understanding of the basis for perceptions.

3.5 | Statistical analyses

Data were coded and analyzed using descriptive statistics for the socio-economic characteristics of the households in the study area using the Statistical Package for Social Sciences (SPSS) (IBM Corp., 2017). The gender effect was tested using the Chi-square test to compare pairs of gender and community categories for perceived benefits and threats of trees.

Variable	Categorical	Frequency	Percentage (n = 226)
Location	Peri-urban	128	57
	Informal	54	24
	Rural	24	19
Gender	Female	157	69.5
	Male	69	30.5
Marital status	Single	77	34
	Married	30	13
	Widowed	44	20
	Cohabiting	74	33
Educational level	None	15	7
	Primary	91	40
	Secondary	108	48
	Tertiary	12	5
Land ownership	Allocated	77	34
	Inherited	22	10
	Bought	96	42
	Renting	27	12
	Borrowed	4	2
Head of household occupation	Unemployed	64	28
	Temporarily- employed	34	15
	Permanently- employed	34	15
	Pension	67	30
	Self-employed	1	0
	Small-business	26	12

4 | RESULTS

4.1 | Socio-economic status of households

Tables 1 and 2 show the socioeconomic status and educational levels of households. These results are important because perceptions of biodiversity conservation initiatives cannot be separated from human livelihoods. Table 1 shows the socio-economic status of the households in the study areas. Most respondents were females (69.5%), and they had either primary (40%) or secondary (48%) school educational level; most were either unemployed (28%) and receiving government child social grants or pensioners (30%). The sources of income indicate the high level of poverty in the areas.

4.2 | Gender and community differences in educational levels of household heads

Table 2 shows a significant difference in educational levels between men and women ($p < .05$) and in household heads of the communities ($p < .05$) in the study area, which may affect perceptions of the value and utilization of natural resources. A high number of household heads in the rural Osindisweni area with a tertiary qualification could be attributed to there being a provincial hospital in the area.

TABLE 1 Descriptive statistics for socio-economic status of households in Buffelsdraai and Osindisweni areas in the province of KwaZulu-Natal, South Africa.

TABLE 2 Chi-square gender and community differences in educational levels of household heads in Buffelsdraai and Osindisweni in the province of KwaZulu-Natal, South Africa (as a %).

Variable		None	Primary	Secondary	Tertiary	χ^2
Gender	Female	6	50	41	3	**
	Male	8	29	54	9	
Community	Peri-urban	10	37	48	4	**
	Informal	2	63	33	2	
	Rural	2	39	48	11	

Abbreviation: ns, not significant.

*** $p < .01$; ** $p < .05$; * $p > .05$.

TABLE 3 Chi-square differences in energy sources used by different gender and communities in Buffelsdraai and Osindisweni in the province of KwaZulu-Natal, South Africa (as a %).

Variable		Gender		χ^2	Peri-urban	Community		χ^2
		Female	Male			Informal	Rural	
Firewood	No	13	17	ns	16	93	67	*
	Yes	87	83					
Ga	No	94	84	***	19	94	59	ns
	Yes	6	16					
Paraffin	No	66	65	ns	2	91	70	ns
	Yes	34	35					

Abbreviation: ns, not significant.

*** $p < .01$; ** $p < .05$; * $p > .05$.

TABLE 4 Descriptive statistics for water sources of men and women in Buffelsdraai and Osindisweni in the province of KwaZulu-Natal, South Africa (as a %).

Variable	Not a source	Collected by males	Collected by females	Collected by both males and females
Borehole	91.1	1.3	5.8	1.8
River	80.1	1.3	13.7	4.9
Well	95.6	1.8	2.2	0.4
Tap	7.1	11.9	59.3	21.7
Tank	29.2	13.7	36.7	20.4

4.3 | Energy sources

Tables 3 and 4 show results for household resource use and energy and water sources as these may affect perceptions. These results showed that in addition to using electricity within their homes, households use other sources of energy (Table 3). There was no statistical difference between men and women in the use of firewood and paraffin, although there were statistically significant differences in the use of gas ($p < .01$). The use of wood for cooking and heating was not necessary in these communities; rather it was a 'cost-saving strategy' as boiling water, for example for bathing, uses large amounts of electricity. Thus, households would rather use wood fires to heat water as wood was mostly obtained and collected for free. According to focus group participants, it was generally considered the duty of women to fetch firewood derived from cutting down dead and desiccated trees

from the natural environment, which they collected weekly. There was a statistically significant difference in the use of firewood among the different communities ($p > .05$), while the use of gas and paraffin was not statistically different among them.

4.4 | Water source

Despite 93% of the households having tap water, households used water from rivers, wells, and boreholes (Table 4). During FGDs, households indicated that using water from these sources was a "habit born out of tradition" more than a necessity. Water from the storage tanks was mostly used as a coping mechanism when taps ran dry. The results also revealed that it was mostly the duty of women to collect water for household use.

4.5 | Household perceptions of the benefits of trees

Tables 5 and 6 show household perceptions classified by gender and spatial configuration of the benefits obtained from growing trees. Table 5 presents results for what men and women perceived as the benefits of trees in the area. Timber ($p > .05$), improvement in health ($p > .05$), and seedling sales ($p > .05$) as benefits were perceived significantly differently between men and women. Interviews with the Wildlands Trust community liaison officer, the project manager, and FGDs revealed that more women than men participated in seedling growing and sales to the tree restoration project. The reason was that men preferred job opportunities that provided “immediate remuneration in the form of cash.” During FGDs, participants expressed unhappiness with the project concerning seedling sales. They expressed displeasure at the “little” remuneration paid per seedling sold. The remuneration was in the form of food vouchers and was delayed, usually being made only after several months.

TABLE 5 Gendered perceptions of benefits of trees in the Buffelsdraai and Osindisweni areas of the province of KwaZulu-Natal, South Africa (as a %).

Variable		Female	Male	χ^2
Firewood	No	13	19	ns
	Yes	87	81	
Timber	No	20	30	*
	Yes	80	70	
Medicinal plants	No	14	17	ns
	Yes	86	83	
Food security	No	15	16	ns
	Yes	85	84	
Shade and space	No	12	12	ns
	Yes	88	88	
Erosion control	No	29	26	ns
	Yes	71	74	
Flood attenuation	No	34	29	ns
	Yes	66	71	
Carbon sink	No	44	39	ns
	Yes	56	61	
Animal habitat	No	10	13	ns
	Yes	90	87	
Increasing biodiversity	No	20	33	ns
	Yes	80	77	
Improving health	No	16	7	*
	Yes	84	93	
Seedling sales	No	62	74	*
	Yes	38	26	

Abbreviation: ns = not significant.

* $p < .05$.

Table 6 shows significant differences (at $p < .01$) in the different communities' perceptions of the benefits of trees for firewood, timber, shade, space, and erosion control. There were also significant differences (at $p < .05$) in the perceptions by the different communities of the contributions made by trees toward food security, animal habitat, increasing biodiversity, and improvement of health. In addition, perceptions of benefits from seedling sales were significantly different (at $p > .05$) among households in the different communities. However, medicinal plants and flood attenuation were not perceived significantly differently.

4.6 | Household perceptions of the constraints/ threats in growing trees

The results in Table 7 show no significant differences in household perceptions between men and women of the constraints or threats inherent in growing trees with regard to inadequate seedlings, inadequate water supply, loss of land, ineffective consideration of their potential, and inadequate access to sales benefits. However, there

TABLE 6 Perceptions of benefits of trees in Buffelsdraai and Osindisweni in the province of KwaZulu-Natal, South Africa (as a %).

Variable		Peri-urban	Informal	Rural	χ^2
Firewood	No	18	19	2	***
	Yes	82	81	98	
Timber	No	33	39	5	***
	Yes	77	61	95	
Medicinal plants	No	18	13	9	ns
	Yes	82	87	91	
Food security	No	12	7	34	**
	Yes	88	93	66	
Shade and space	No	14	17	0	***
	Yes	86	83	100	
Erosion control	No	31	35	11	***
	Yes	69	65	89	
Flood attenuation	No	32	37	30	ns
	Yes	68	63	70	
Animal habitat	No	21	20	0	**
	Yes	89	80	100	
Increase biodiversity	No	25	24	5	**
	Yes	75	76	95	
Improve health	No	14	22	0	**
	Yes	86	78	100	
Seedling sale	No	69	76	50	*
	Yes	31	24	50	

Abbreviation: ns, not significant.

*** $p < .01$; ** $p < .05$; * $p < .05$.

TABLE 7 Gendered perceptions of constraints/threats inherent in growing trees in Buffelsdraai and Osindisweni in the province of KwaZulu-Natal, South Africa (as a %).

Variable		Female	Male	χ^2
Constraint of inadequate seedlings	No	8	14	ns
	Yes	92	86	
Constraint of inadequate water supply	No	4	10	ns
	Yes	96	90	
Threat of sustainability in the long run	No	7	17	*
	Yes	93	83	
Constraint of loss of land	No	18	20	ns
	Yes	82	80	
Insufficient consideration of potential	No	7	7	ns
	Yes	93	93	
Unequal access to sales benefits	No	6	7	ns
	Yes	94	93	

Abbreviation: ns = not significant.

* $p < .05$.

TABLE 8 Constraints/threats related to growing trees in Buffelsdraai and Osindisweni areas in the province of KwaZulu-Natal, South Africa (as a %).

Variable		Peri-urban	Informal	Rural	χ^2
Constraint of inadequate seedlings	No	12	7	5	ns
	Yes	88	93	95	
Constraint of inadequate water	No	6	7	2	ns
	Yes	94	93	98	
Threat of sustainability	No	12	11	2	ns
	Yes	88	89	98	
Constraint of lack of land	No	16	31	14	*
	Yes	84	69	86	
Insufficient consideration of potential	No	8	7	5	ns
	Yes	92	93	95	
Inadequate access to sales benefits	No	6	7	5	ns
	Yes	94	93	95	

Abbreviation: ns = not significant.

* $p < .05$.

was a significant difference in the perception of the threat of the sustainability of tree growing in the long run ($p > .05$) between men and women.

The results in Table 8 show that there were significant differences ($p < .05$) in how households perceived the threat of lack of land for growing trees in different communities. However, there were no significant differences in household perceptions of the constraints of inadequate water supply and insufficient consideration of the potential of growing trees, inadequate seedlings, and inadequate access to sales benefits as constraints in growing trees and the sustainability of tree growing in the long run. FGDs revealed that most community members agreed that inadequate tree seedlings, land, and water, and inadequate access to sales benefits, were constraints to the tree growing project. They also raised concerns over the sustainability and effectiveness of the project.

4.7 | Perceptions of environmental conservation and growing of trees

Tables 9 and 10 show household perceptions depending on gender and spatial configuration regarding the role of growing trees in environmental conservation. Table 9 shows significant differences in the perceptions of achieving good health and climate control through environmental conservation and growing trees ($p < .05$) between genders. There were no significant differences in the perceptions of environmental conservation and growing trees as they affected poverty reduction, zero hunger, clean water and sanitation, clean energy, and reducing inequality. An interview with the local councilor revealed that the municipality was working to generate renewable energy as biogas from landfill waste. The aim of this is to reduce greenhouse gas emissions and reduce costs for household electricity supply.

Table 10 shows significant differences in the perceptions of poverty reduction and achieving zero hunger ($p < .05$) and achieving good health and climate control ($p > .05$), through environmental conservation and growing trees by households in different locations. However, there were no significant differences in the perceptions of environmental conservation and growing trees as they may reduce inequality and achieve clean water and sanitation and clean energy, by households in different locations.

TABLE 9 Gendered perceptions of achievements through environmental conservation and growing of trees in Buffelsdraai and Osindisweni in the province of KwaZulu-Natal, South Africa.

Variable		Female	Male	χ^2
Reduce poverty	No	78	81	ns
	Yes	22	19	
Achieve zero hunger	No	79	75	ns
	Yes	21	25	
Achieve good health	No	15	12	*
	Yes	85	88	
Achieve reduced inequality	No	68	71	ns
	Yes	32	29	
Achieve clean water and sanitation	No	46	49	ns
	Yes	54	51	
Achieve clean energy	No	45	46	ns
	Yes	55	54	
Achieve climate control	No	35	26	*
	Yes	65	74	

Abbreviation: ns = not significant.

* $p < .05$.

Variable		Peri-urban	Community Informal	Rural	χ^2
Reduce poverty	No	72	96	80	**
	Yes	28	4	20	
Achieve zero hunger	No	68	93	82	**
	Yes	32	7	18	
Achieve good health	No	14	22	5	*
	Yes	86	78	95	
Reduce inequality	No	68	70	68	ns
	Yes	32	30	32	
Achieve clean water and sanitation	No	48	52	36	ns
	Yes	52	48	64	
Achieve clean energy	No	47	46	41	ns
	Yes	53	54	59	
Climate change control	No	38	24	25	*
	Yes	62	76	75	

Abbreviation: ns = not significant.

** $p < .05$. * $p < .05$.

Tables 9 and 10 revealed that households perceive that climate change control can be achieved through tree growing. This may be attributable to the availability of many sources of information about climate change.

5 | DISCUSSION

The results from this study revealed great dependence on natural resource use, particularly in the peri-urban communities of Buffelsdraai. This corresponds to the findings of Mancebo (2011), which showed that Buffelsdraai is the community where natural resources were more widely used compared to Osindisweni, which is predominantly rural. DEA (2018) reported that climate change would likely increase poverty and inequality, particularly among those who rely on the natural resource base for their livelihoods.

Most respondents in the study areas were females. Most of these respondents were unemployed and were financially dependent on the government's grants for child support or old age pensions. There was a significant difference in the educational levels of men and women and among household heads across the different communities in the study areas. These socio-economic factors may have shaped perceptions of the value and utilization of natural resources.

Although most households had access to electricity within their homesteads, they used firewood for cooking and heating to reduce costs, showing greater reliance on firewood than on electricity as an energy source. This was particularly true for households in peri-urban areas. According to Sutherland et al. (2016), urbanization has resulted in the loss of trees and forests and a consequent loss of the benefits they offer. This exacerbates inequalities within cities and peri-urban areas. Despite having access to tap water, most households use water

TABLE 10 Perceptions of households of the potential achievements obtained through environmental conservation and growing of trees in the Buffelsdraai and Osindisweni areas of the province of KwaZulu-Natal, South Africa.

from rivers, wells, and boreholes, a habit born out of tradition. The use of river water attests to the low economic status of the households (Mancebo, 2011). Generally, it was women who fetched firewood and water, as it was considered their duty. The gender differences in using such natural resources may lead to differences in accountability and stewardship and call for the need to incorporate gender mainstreaming in building the resilience of communities to climate change (Eastin, 2018; Ernason, 2012). Due to gender differences in roles and responsibilities, the consequences of climate change may affect women and men in different ways (UNEP, 2016), with women being particularly vulnerable to the negative impacts of climate change given their traditional caregiving roles of collecting firewood and water (Nhamo, 2014). These findings showed that how people relate to the natural resource base affects their perceptions and behavior.

The results showed significant differences in the perceptions of the benefits from trees for firewood, food security, seedling sales, erosion control, timber, animal habitat, increasing biodiversity, improvement in health, and shade and space across communities. However, men and women differed significantly in their perceptions of timber's benefits, health improvement, and seedling sales. More men than women perceived trees as important for timber and health improvement. On the other hand, more women than men considered seedling sales an important benefit of growing trees. This finding is consistent with FGDs, which revealed that more women than men were involved in the growing and selling of tree seedlings to contribute to their livelihoods. Chambers (1995) reported findings similar to those obtained in the current study and reported that the realities of households living in poverty tend to be local, diverse, often complex, and dynamic. Identifying such differences in community perceptions and attitudes toward natural resources facilitates an improved understanding of resource use and prioritization (Cinner & Pollnac, 2004; Lukey, 2020; Munien et al., 2015). The differences in community perceptions could be because rural communities' livelihoods depend mostly on natural resources, with most people being small-scale farmers who earn their livelihoods from working the land. Hence for these individuals there is a stronger linkage with the management of the environment.

The findings showed a significant difference between men and women in their perceptions of the threat of the sustainability of tree growing in the long run. There was a significant difference in the perception across communities of the effect of lack of land for growing trees. This could be attributed to land use patterns. During FGDs, some individuals mentioned that although they had previously participated in the tree restoration project through the sale of tree seedlings, they were no longer participants because the required indigenous seedlings were no longer available in their proximity. They had to travel long distances to look for the seedlings. Others reported that they were deterred from participating in the project because they perceived it non-viable due to limited sales benefits and poor remuneration for seedlings. Remuneration per seedling was R5¹ and was paid in

the form of food vouchers that were often delayed for several months. These findings highlight the importance of providing incentives if perceptions and behavioral change are needed for people to gain interest in reforestation programs.

There were significant differences across gender in the perceptions of the possibility of achieving good health and climate change through environmental conservation and the growing of trees. Communities differed significantly; perceptions of achieving good health, climate change, reducing poverty, and zero hunger through environmental conservation and growing trees differed. The benefits of trees in providing ecosystem services such as erosion control, water filtration and regulation, providing habitats for animals, and increasing urban biodiversity have been widely reported (FAO, 2016; Heusinkvelt, 2016; Sim et al., 2019), yet the findings from the study attest to the inadequacy of households' knowledge base relating to tree benefits or to ignorance (as seen in the significant differences due to different education levels). These survey results correspond with those from the FGDs, where differing views of tree benefits were expressed. There may be a need to raise awareness among communities. The results show that although households have a great need to utilize trees for firewood, timber, and food, little value is placed on trees contributing to their livelihoods. This may be attributable to either lack of knowledge or greater poverty levels in the areas. Chambers (1995) reported that the views and needs of the local communities themselves might differ from those of scientists and professionals because the realities of the people living in poverty tend to be context-based, diverse, often complex, and dynamic. This is coupled with dimensions such as vulnerability and inequality (UNEP, 2018; UNEP, 2020).

Restoration cannot be upscaled if ecosystems are undervalued, and the ecosystem services they provide are not perceived and appreciated (Buisson et al., 2020). These findings attest to the need to improve the knowledge base and promote programs on awareness of ecosystem services within communities. Improving the knowledge base may include integrating indigenous knowledge with that derived from scientific research, aligning with local practices, and empowering communities to be part of initiatives in order to sustain interventions and ensure that outcomes relate to context. With the introduction of the new Constitution in South Africa, the 1995 *White Paper on Education and Training* stated that environmental education and training were essential for all sectors of society. However, despite efforts to include environmental education in the school curriculum by integrating it into different learning areas, there is no clarity as to how environmental education should be implemented in the formal education system (Loubser, 2013).

There are important sustainability debates related to the potential benefits and pitfalls of large-scale tree planting, which are important. Although there is evidence from the literature that tree planting can mitigate climate change and that it is a nature-based solution to reducing atmospheric carbon dioxide and maintaining livelihoods (DEA, 2018), there are concerns over the sustainability of investment in tree growing in the long run; for example, the costs of management, felling trees, fire management, and the concerns of plantations on

¹Equivalent to US\$0.33 at the exchange rate US\$: ZAR15

vulnerable grassy biomes (Bond et al., 2019). Evidence has also shown that trees reduce streamflow, and plantations shade other vegetation. Restoration processes also need to be considered in the context of rural development pressures (Bond et al., 2019). In the current study, FGDs revealed general unhappiness about the hiring process used by the restoration management. Hence, there is a need for sustainable employment opportunities and an equitable hiring process in order to minimize conflicts and adequately sustain human livelihoods (Moyo et al., 2021; Nkambule, 2017). In the current study, the local councilor revealed that the municipality plans to generate biogas, a renewable energy source, from landfill waste. Pataki et al. (2021) reported that urban trees are more useful for climate and pollution adaptation strategies than as strategies for the mitigation of greenhouse gas emissions, air pollution, and varying environmental conditions. Perhaps the municipality's plans to generate electricity from waste may constitute a better, quicker, and more certain way of reducing emissions.

Households in different locations perceived the role of trees differently, with those in peri-urban settlements showing greater reliance on natural resources than those in informal and rural areas. The difference could be attributed to residents of peri-urban areas having a lower socioeconomic status and having a sense of belonging in the area due to their land tenure status. The findings showed that households involved in the Buffelsdraai landfill tree restoration project, either as treepreneurs (growing and selling tree seedlings) or employed, viewed trees as contributing to their livelihoods in reducing hunger since they derived economic benefits. However, according to FGDs, the contribution made by tree seedling sales was marginal and had to be supplemented with governmental social grants. Douwes et al. (2017) reported similar findings. This indicates that despite households' unhappiness with the processes of remuneration for tree-seedling sales, they considered the project to be a contributor to increased food security and livelihoods. These results show that promoting socio-economic inclusivity of all households and genders will assist in changing perceptions of tree restoration programs. Hence, understanding how socio-economic factors influence the value that people place on the environment assists in developing effective conservation strategies to mitigate climate change. Similar findings were obtained by Cinner and Pollnac (2004).

The current study has shown that differing perceptions of tree-growing projects are influenced by household socio-economic factors (gender, reliance on the natural resource base, and benefits obtained from the project) and land tenure. Although this is a case study, its findings have implications in informing decision-making and policy at a broader scale. Studies aimed at understanding perceptions of tree-related benefits and threats will advance knowledge to inform reforestation programs, particularly where similar projects are planned.

6 | CONCLUSIONS AND POLICY IMPLICATIONS

This study looked at the gender perspective and analyzed the influence of households' economic characteristics and spatial configuration

to assessing the impact of tenure and land rights. Households that are permanently resident in an area (with title deeds) perceived the environment differently from those in transit (such as those in informal dwellings). The study also demonstrated the socio-economic benefits and threats of growing trees perceived by local communities living adjacent to a landfill where a tree restoration project intended to mitigate climate change effects is being practiced.

Although not to a greater extent than location differences, gender plays an important role in determining perceptions of the benefits of achieving good health and climate change, and of seedling sales, between men and women. Gender also reinforced the economic benefits of participating in the project. More women than men considered seedling sales an important benefit of growing trees. They were more involved in the project, growing and selling tree seedlings to contribute to their livelihoods. The nature of the participation determined the effect of the tree-restoration project on food security. Households involved in the tree restoration project viewed trees as contributing to their livelihoods by reducing hunger since they derived benefits.

The land tenure system in which households reside significantly influences their perceptions of achieving good health, climate change, reducing poverty, and zero hunger through environmental conservation and growing trees. There were also significant differences in the perceptions of the different communities of the benefits obtained from trees in terms of firewood, food security, seedling sales, erosion control, timber, animal habitat, increasing biodiversity, and shade and space. Communities in informal dwellings did not perceive the achievement of good health, climate change, poverty, hunger reduction, or inequality reduction as benefits obtained from trees. Households in peri-urban settlements showed greater reliance on natural resources than those in informal and rural areas. Such differences can be attributed to differences in land tenure, with households in peri-urban areas, residing there permanently, perceiving trees as beneficial more than those in informal dwellings.

The findings presented here provide a useful case study for addressing various policies related to livelihood systems and climate change at different scales. While the study focused on these dynamics at the local level, involving local communities and their perceptions and related human wellbeing in the context of livelihoods, it highlights the need to address the climate change challenge using integrated and holistic approaches that cut across environmental (through ecosystem management), economic (through improved livelihood opportunities), and community-oriented (through improved knowledgebase) systems. Solutions, however, depend on regional and global partnerships and are also influenced by drivers of change such as policy, production, and ecological conditions. At the policy level, institutions and property rights may indirectly affect ecosystems, while production-level conditions (such as carbon emissions and reforestation) and ecological factors (such as climate change) directly affect ecosystems.

The work has provided useful information and insights for environmental managers, researchers, and policymakers, pointing to the need for future programs to improve the knowledge base and promote programs of awareness about ecosystem services within communities.

The findings showed that household socio-economic factors and land tenure influenced perceptions of tree growing and this information is important to inform the process of prioritization for implementing tree restoration within the study area. As indicated in the introduction, benefits from achieving one or two SDGs are linked to realizing other SDGs. This linkage across SDGs has policy implications in that it contributes to improved livelihoods but requires, among other things, the prudent management of ecosystems. Policies for sustainable livelihoods in tree restoration projects can therefore be shaped by designing strategies and operations that promote socio-economic inclusivity of all households and genders and reduce inequality. Wood et al. (2018) pointed to the environmental and socio-economic benefits of trees and their contribution to the fulfilment of SDGs, particularly the goals of poverty alleviation, health and wellbeing, food security, the preservation of life on land, climate change mitigation, and the provision of ecosystem services. The accrual of these benefits demonstrates the importance of trees in achieving more sustainable, equitable, and resilient livelihood outcomes and hence meeting the requirements for sustainable livelihoods.

The authors of this study recommend a partnership between government, non-governmental organizations, and local communities for tree restoration projects if they are to contribute significantly toward sustainable livelihoods. Policy recommendations for socio-economic inclusivity include the need for equitable hiring processes and the creation of sustainable employment opportunities to reduce conflicts and effectively sustain human livelihoods. The planning stages of restoration initiatives should be linked to sustainable livelihoods; this translates to how tree planting generates sustainable outcomes while reducing gender inequality and disparities among marginalized groups with different property rights. However, the role of employment creation should not be left exclusively to non-governmental organizations. Governments also need to play their role in ensuring sustainable livelihoods for their citizens by employing monetary policies that support employment creation and more equitable income distribution in order to ensure progress toward the achievement of the SDGs relating to poverty and hunger. Government interventions are crucial if economic reforms and sustainable development are to be achieved at different levels in society. Changes in households' perceptions through programs of awareness of restoration projects will enhance climate mitigation measures and ecological resilience while sustaining livelihoods, thereby maximizing the value of investment of resources utilized in such initiatives.

AUTHOR CONTRIBUTIONS

TS was involved in the conceptualization of the research, methodology, data collection, investigation, data analysis, and the original draft preparation of the manuscript. MM and MT were involved in supervision, validation, methodology, and the review and editing of the manuscript.

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CONFLICT OF INTEREST

There was no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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