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Understanding farmers' attitudes and aspirations for tree-cover restoration in the Kilombero Valley, Tanzania

Eleanor Durrant [a,*], Pete Howson [b], Susannah M. Sallu [c], Deo D. Shirima [d,e], Margherita Lala [h], Sergio G. Milheiras [a], Francis Lyimo [f], Petro P. Nyiti [d], Lilian Mwanga [d], Esther Kioko [g], Marion Pfeifer [a]

[a] School of Natural and Environmental Sciences, Faculty of Science, Agriculture & Engineering, Newcastle University, Newcastle-upon-Tyne, UK
[b] Department of Geography and Environmental Sciences, Northumbria University, Newcastle-upon-Tyne, UK
[c] School of Earth and Environment, Faculty of Environment, University of Leeds, Leeds, UK
[d] Reforest Africa, Mang'ula, Kilombero District, Morogoro, Tanzania
[e] Department of Ecosystems and Conservation, Sokoine University of Agriculture, Morogoro, Tanzania
[f] Department of Sociology and Anthropology, University of Dar es Salaam, Tanzania
[g] Invertebrate Zoology Section, Department of Zoology, National Museums of Kenya, Nairobi, Kenya
[h] Sociology Department, University of Turin, Turin, Italy

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ABSTRACT

Restoring tree cover to meet international commitments requires context-sensitive approaches, such as agroforestry in rural landscapes, that address local concerns and motivations. This study investigates farmers' attitudes and aspirations for tree-cover restoration in the Kilombero Valley, Tanzania, using a novel combination of participatory future farm scenarios and sentiment analysis. Unlike traditional applications of sentiment analysis on large online datasets, we demonstrate its utility in understanding attitudes in rural contexts, complementing participatory engagement efforts. We explore variables influencing smallholders' aspirations for their future farms, with a focus on agroforestry systems, and examine the impact of gender and wellbeing on perceptions and attitudes towards agroforestry and existing natural forests in the landscape. Our findings indicate positive attitudes towards agroforestry, particularly when it provides direct, tangible benefits. However, forests were viewed negatively due to concerns about resource access and human-wildlife interactions. Men associated tree planting with income opportunities, while women favoured scattered trees for subsistence needs. These results underscore the need for inclusive, gender-sensitive restoration practices that align with local preferences. By tailoring restoration strategies to specific local aspirations, concerns and motivations, we can enhance the effectiveness, equity, and acceptance of tree-cover restoration initiatives.

1. Introduction

Scaling up tree-cover restoration worldwide has become the focus of international commitments such as the Bonn Challenge, which aims to bring 350 million hectares of degraded and deforested landscapes into ecosystem restoration by 2030 (IUCN, 2021). The United Nations has declared 2021–2030 the Decade for Ecosystem Restoration highlighting the global urgency of this endeavour. A critical component to scaling-up tree restoration efforts to meet these ambitious commitments is tackling deforestation caused by land use change for agriculture (Pendrill et al., 2022), which constitutes 45 % of habitable land worldwide (Ritchie and Roser, 2024). In the tropics alone, croplands comprise about half of the area with the greatest potential for low-cost tree restoration cover, and 210 million people live in or near these areas (Shyamsundar et al., 2022). Here, agroforestry, the deliberate integration of trees into farming systems, offers a viable solution for tree-cover restoration that can reconnect remaining forest stands in the landscape in a way that can be managed by households and communities (Shyamsundar et al., 2022). This indigenous land practice (Nair et al., 1993) has gained prominence in scientific research, conservation and development domains as a means to improve biodiversity, livelihoods and food security across the continent (Ngango et al., 2024; Reed et al., 2017a).

* Corresponding author.
E-mail address: durranteleanor@gmail.com (E. Durrant).

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Scaling tree planting on farmland often looks to transform global landscapes and food systems (Tedesco et al., 2023). However, for large-scale tree-cover restoration efforts to be effective, restoration goals must align with the interests and aspirations of the people responsible for managing these ecosystems (Fleischman et al., 2020), such as landowners who retain their land rights but are expected to plant and nurture the trees. Participatory scenarios have been used to identify collaborative solutions for restoration planning, showcasing stakeholders' aspirations for tree restoration in their landscapes (Durrant et al., 2023). They can be used as a basis for stakeholder engagement and participatory decision-making and processes by bringing stakeholders into decision-making when developing restoration plans or evaluating interventions feasibility (Durrant et al., 2023; Metzger et al., 2017; Reed et al., 2013). By advancing the understanding of various on-the-ground realities, they help develop a more nuanced and context-specific representation of possible landscape futures, informed by local knowledge and prioritising the perspectives of the most vulnerable (Löfqvist et al., 2023).

Research highlights the need to place equity at the centre of tree-planting efforts (Elias et al., 2022; Fleischman et al., 2020; Löfqvist et al., 2023). This involves placing social considerations at the heart of restoration planning to lead to improved social, ecological, and environmental outcomes (Löfqvist et al., 2023). Identifying stakeholders' perceptions and attitudes is crucial, as these factors influence their preferences and willingness to participate in restoration interventions such as agroforestry (Meijer et al., 2015a; Sirivongs and Tsuchiya, 2012). In the context of tree-cover restoration in rural tropical landscapes, smallholder farmers and their attitudes towards trees on farms are particularly relevant. In East Africa, smallholders alone account for 75 % of agricultural production (Salami et al., 2010). Their interest in agroforestry may vary with distance to forests and dependency on them (Miller et al., 2017; Muhamad et al., 2014).

Positive attitudes and aspirations towards agroforestry have been shown to reinforce intentions to integrate and adopt trees into farming systems (Amare and Darr, 2024; Buyinza et al., 2020; Deißler et al., 2024; Sánchez Bogado et al., 2024), and have been associated with positive benefits to livelihoods (Shennan-Farpón et al., 2022). However, there are also negative aspects that stakeholders may associate with trees and forests (Razafindratsima et al., 2021) that may be driven by top-down exclusionary interventions (Howson, 2018). Both negative and positive experiences can coexist within and between stakeholder groups, influencing their attitudes, perceptions, and aspirations (Shackleton et al., 2016). Exploring the benefits and trade-offs between these experiences in tree-cover restoration scenarios across actors allows for better anticipation of risks and opportunities from interventions among different contexts, before a single tree is planted (Durrant et al., 2023; Löfqvist et al., 2023). While research has explored how to optimise agroforestry management scenarios to minimise trade-offs in economic outcomes, climate change mitigation and adaptation (Rahman et al., 2016; Tschora and Cherubini, 2020), there is a lack of evidence on how smallholders themselves perceive and desire to manage agroforestry trade-offs (Andreotti et al., 2020; Dumont et al., 2017; German et al., 2006).

Understanding attitudes and perceptions may prevent further marginalisation of vulnerable groups and acknowledge intersectional differences by informing more nuanced and effective restoration strategies (Löfqvist et al., 2023; Tebboth et al., 2020). Recognising how characteristics such as gender influence perceptions and attitudes can ensure inequalities are not exacerbated and enable efforts focussed on improving gender equity and women's participation in agroforestry decision-making across Africa (Kiptot and Franzel, 2011; Razafindratsima et al., 2021). Most research has explored how ecosystems influence human wellbeing, focusing on the role of agroforestry and restoration more generally in shaping wellbeing outcomes (Castle et al., 2022; Shennan-Farpón et al., 2022). However, evidence on the influence of wellbeing on attitudes towards restoration or agroforestry as a land management intervention in agriculture is limited (Verma and Sinha, 2018; Ward et al., 2016). We assert the importance of examining the interplay between gender and human well-being in attitudes towards tree-cover restoration. Such an exploration is crucial for understanding perspectives on farm and landscape futures, particularly in the context of restoring trees and forests. This approach can provide valuable insights for enhancing stakeholder engagement processes, addressing prevalent attitudes, and mitigating the risk of exacerbating existing inequalities in forest-adjacent communities (Löfqvist et al., 2023).

Despite the potential of participatory scenarios to help stakeholders envision agroforestry and tree-cover restoration futures, their application in conjunction with the analysis of stakeholder attitudes remain underexplored (Andreotti et al., 2020; Durrant et al., 2023; Novák et al., 2021). Sentiment analysis is emerging as a valuable tool to characterise people's attitudes towards a particular object or entity, such as agroforestry and forests, as reflected in written text (Liu, 2020). In this study, we employ sentiment analysis to understand attitudes in contexts where large online datasets are not applicable and demonstrate its utility in complementing participatory engagement efforts. While discrete choice experiments (DCEs) are a widely established method in economics to investigate preferences related to tree-growing (Haile et al., 2019; Nkurikiye et al., 2024; Stetter and Sauer, 2024), we chose sentiment analysis for this study due to its ability to capture nuanced, context-specific insights from the qualitative data that came from our participatory scenario workshops. Unlike DCEs, which simulate decision-making and preferences under defined hypothetical scenarios (Nkurikiye et al., 2024), sentiment analysis allows us to directly assess expressed attitudes and emotions (Jost et al., 2019) related to trees. This approach provides a complementary perspective to DCEs, particularly when used alongside participatory approaches that allow novel insights to emerge for understanding behavioural constraints and motivations shaped by local socio-economic and environmental factors.

Using the Kilombero Valley, Morogoro, Tanzania as a case study, we integrate ideal farm scenarios with sentiment analysis to investigate farmers' perceptions, attitudes and aspirations towards tree-cover restoration. Tanzania has pledged to restore 5,200,000 ha, 5.87 % of its land area to restoration in the Bonn Challenge. The Kilombero Valley is a human-dominated agricultural landscape experiencing rapid changes in tree cover, land use and management (Msofe et al., 2019). The region has experienced extensive deforestation for conversion to agriculture (Msofe et al., 2019), prompting government and conservation organisations to implement tree-cover restoration alongside forest conservation efforts (Matejcek and Verne, 2021). Specifically, we explore (1) the variables that may influence smallholders' aspirations for their future farms, focussing on agroforestry tree configurations, (2) the perceptions associated with farmer attitudes towards agroforestry and remaining natural forests adjacent to farms, (3) the effects of gender and wellbeing on farmer attitudes. Our aim is to demonstrate how conservation organisations can use participatory tools to explore future scenarios whilst also gaining a quantitative understanding of smallholder attitudes. Scaling restoration of trees and tree cover at landscape scale within the Kilombero Valley will require the support of smallholder farmers which will be influenced by their perceptions, desires and attitudes towards trees and forests. Our conceptual framework exploring perceptions, desires and attitudes towards tree-cover restoration, can help build engagement processes to design tree-cover restoration strategies with smallholders that align with their desired outcomes and reduce negative perceptions and attitudes.

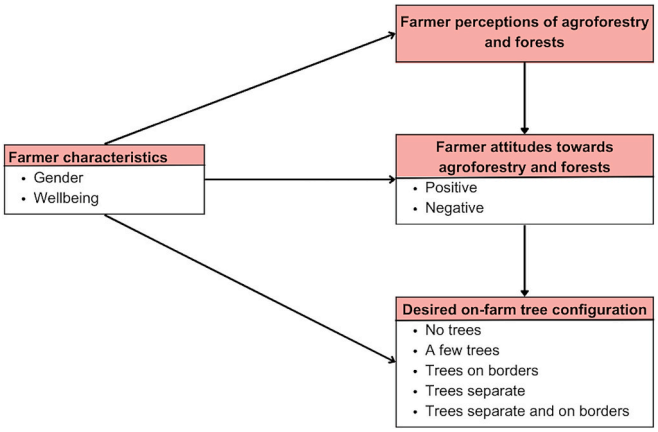

Fig. 1. Conceptual framework linking farmer perceptions, attitudes and desires for trees on farms and in the wider landscape.

2. Conceptual framework

The conceptual framework for this study (Fig. 1) draws upon the literature exploring attitudes towards nature and agroforestry, including that which has used attitudes as a variable to understand drivers of agroforestry adoption (Amare and Darr, 2024; Ihemezie et al., 2021; Kideghesho et al., 2007; Meijer et al., 2015a, 2015b; Sirivongs and Tsuchiya, 2012). Fig. 1 shows a visual representation of our hypothesised relationships between farmer perceptions, attitudes and scenarios of tree-cover restoration. We assert that farmer perceptions of tree-cover restoration will influence their attitudes towards it, which will then also influence their ideal tree-cover restoration scenarios. Within this framework, farmer characteristics such as gender and wellbeing have been hypothesised as influential on perceptions, attitudes and desires. Perceptions and attitudes are important intrinsic factors that affect decision-making by smallholders on planting of trees on farms and in the wider landscape (Amare and Darr, 2020; Meijer et al., 2015a). In this context, perceptions are the views farmers hold about tree cover restoration based on their experiences and needs whilst their attitudes are the negative or positive responses towards tree-cover restoration (Kideghesho et al., 2007; Lucungu et al., 2022; Meijer et al., 2015a).

In this study, we use accepted definitions for forests and agroforestry. Agroforestry is defined as the interaction of agriculture (crops, pasture) and trees, including the agricultural use of trees. This comprises trees on farms and in agricultural landscapes, farming in forests and along forest margins and tree-crop production (World Agroforestry, 2024). As a land use type this differs from forests, defined by the FAO as 'a land area of more than 0.5 ha, with a tree canopy cover of more than 10%, which is not primarily under agricultural or other specific non-forest land use. In the case of young forests or regions where tree growth is climatically suppressed, the trees should be capable of reaching a height of 5 m in situ, and of meeting the canopy cover requirement.' (FAO, 2024a).

Meijer et al. (2015a) argue that farmers' attitudes about agroforestry are shaped by their knowledge, perceptions, characteristics and external factors such as gender, wellbeing, geographical setting, political conditions, and the characteristics of the restoration innovation (Meijer et al., 2015a). Here, we draw on these framings to explore farmers' desired agroforestry systems in relation to their perceptions and attitudes. These intrinsic factors have been far less explored than extrinsic ones, particularly socio-economic variables within the agroforestry literature in Sub-Saharan Africa (Meijer et al., 2015a).

To apply this framework, we used participatory workshops, artistic drawings, and a sentiment analysis of the transcript data in a field where the majority of work analysing attitudes has been done using household surveys as the main data collection tool (Amare and Darr, 2024; Kideghesho et al., 2007; Lucungu et al., 2022; Meijer et al., 2015b). This approach offered an in-depth approach with a smaller number of participants in which they could guide the discussions and design their ideal scenario whilst allowing analysis of attitudes and perceptions.

3. Methods

3.1. Study area

The northern part of the Kilombero Valley, Morogoro region, Tanzania, comprises heavily protected forest and savanna ecosystems, settlements, an industrial sugarcane plantation and smallholder farms (farmer managing less than 10 ha (FAO, 2024b). Smallholders in the area use a diversity of farming practices including agroecological methods such as mulching, intercropping and post-harvest use of residues (Milheiras et al., 2022) to grow subsistence crops (e.g. maize, pumpkin, okra, cassava) and cash crops (e.g. rice, sugarcane) (Durrant and Pfeifer, 2024). Trees are often interspersed within the smallholder farmed land, at varying densities. Forested areas are generally under some form of conservation protection and cannot be entered or used without permission, such as the Udzungwa Mountains National Park, Julius Nyerere National Park or Magombera Nature Reserve. They border the farmed landscapes on almost all sides (Fig. 2). It has a sub-humid tropical climate across two rainy seasons: a long rainy season in March–May and a short rainy season in October–December.

The study area is also part of the Southern Agricultural Growth Corridor of Tanzania (SAGCOT), a partnership between the government and the private sector for promoting market-driven transformation and modernisation. Many international and local non-governmental organisations (NGOs) are active in the landscape, some of which promote agroforestry and provide trees to smallholders to restore tree cover on smallholder farms and improve livelihoods. Much of the restoration work in the area is planned, led and implemented by NGOs partnering with other NGOs and government bodies to strengthen protected areas, restore and expand forest cover (Matejcek and Verne, 2021). Ongoing and planned interventions include the Kilombero Elephant Corridor

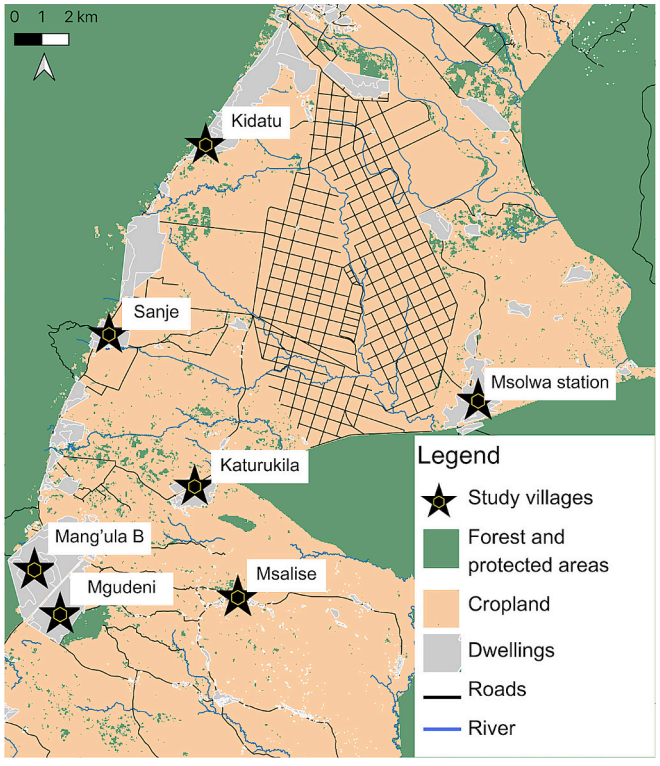

Fig. 2. Map of the northern Kilombero Valley, Morogoro region, Tanzania including the location of the villages in this study (Source: Author).

(Southern Tanzania Elephant Program, 2024) and riparian forest restoration along rivers (Pfeifer et al., 2022). A key theme is the prevalence of top-down interventions and a lack of participation in decision-making from smallholder farmers and other key local stakeholders such as village leaders (Lala et al., 2023; Matejcek and Verne, 2021).

3.2. Data collection

To explore smallholder aspirations for tree-cover restoration, we conducted nine participatory scenario workshops with smallholder farmers that were conducted to explore smallholders' aspirations for the future between July and August 2022. Their aim was to involve smallholders in the research process, focussing on co-generation of knowledge and understanding of the local farming context, needs and perspectives. The workshops involved 80 smallholder farmers from seven villages: Kidatu, Sanje, Msolwa Station, M'angula B, Mgudeni, Msalise and Katurukila (Fig. 2) and comprised 38 women and 42 men. We held nine workshops to ensure representation across villages, gender, wellbeing and age groups, aiming for 8–10 participants per workshop to help facilitate a gender balance, discussion and co-learning between participants. The workshops were differentiated by age and wellbeing (mixed = 3, high = 3 and low = 3) and we aimed for a 50:50 gender split where possible. Gender was categorised based on the gender of the participant as recorded in the household survey. There were two workshops for youth (18–35) ($n = 20$) and seven workshops for adults (35+) ($n = 60$) (Appendix Table A1).

Workshop participants were randomly selected among 440 people who had previously participated in a household survey to quantitatively measure human wellbeing. Survey participants had been randomly chosen from the village register (Milheiras et al., 2022). Wellbeing was measured with a composite indicator score calculated using household survey questions (Milheiras et al., 2022). We adopt the definition developed by the Wellbeing in Developing Countries research group, human wellbeing is 'a state of being with others, which arises where human needs are met, where one can act meaningfully to pursue one's goals and where one can enjoy a satisfactory quality of life.' (Gough and McGregor, 2007). Human wellbeing was measured across five dimensions put forward in the Millennium Ecosystems Assessment (Millennium ecosystem assessment [MEA], 2003), namely 'basic material for a good life', 'health', 'social relations', 'security', and 'freedom of choice and action', following the approach of (Loveridge et al., 2020). Two respondent wellbeing groups were determined by hierarchical cluster analysis of the five dimensions constituting the composite indicator. After a posteriori confirmation that the two resulting clusters had significantly different (p-value<0.001) mean wellbeing scores, respondents were classified as having 'high' or 'low' wellbeing. It was possible to have separate adult workshops (n = 6) based on participant wellbeing cluster in three village groups. In one village group and the youth group it was only possible to have one mixed wellbeing workshop due to a smaller pool of potential participants (Table A1).

Each workshop was a full day and took place in Swahili, hosted by a Tanzanian facilitator, two research assistants and two artists. Participants described their current farming system and then they created a scenario of their ideal farming system, looking 5–10 years into the future. Groups were split by gender for each activity and then came together in a plenary session to exchange their ideas. They were free to describe as they wished, but they usually included details such as the size, configuration, and the main characteristics such as crops, trees, rivers, and wells. They also described their surrounding landscape, this was defined by the participants themselves and usually referred to the nearby surroundings of the farm. The artists depicted the ideal farm for each participant so that they could visualise, explain and compare their scenario with the broader group. They then explored the barriers and opportunities they face in achieving their ideal farming scenario. At the end of the workshop, participants were guided through booklets to disseminate previous research in the landscape on topics such as birds and trees. They were asked to give feedback on the information they were given and the wider workshop to reflect on the participatory research process (Durrant et al., 2023; Oteros-Rozas et al., 2015). Each workshop was audio recorded and then transcribed into English for analysis.

3.3. Data analysis

Agroforestry has been advocated as a tool for restoration of trees in rural farmed landscapes. This restoration of trees can encompass many different formats, including planting trees in woodlands or as linear structures along farm boundaries. In our landscape, remaining natural forests following decadal land use changes are largely under protected area status and these forests, whether degraded or not, come with strict governance rules, such as restrictions on use and accessibility. The distinctions between agroforestry and forests in our analysis reflects realities on the ground. In the workshop, participants' visions of their landscape distinguish between trees on farms and forests, i.e. tree-covered areas that are not on the farm and not under management by a participant. The forests referred to tended to be areas generally under some form of conservation protection and cannot be entered or used without permission, such as Magombera forest.

Based on the transcript text and the artist's depiction of the ideal farm, we categorised the ideal tree agroforestry configurations by participants (Fig. 3). The categories used in this analysis are those described by more than five participants; no trees on the farm, a few scattered trees within fields or on the border, trees lining the borders of crop fields, trees in a separate plot to any crops such as woodlots or a plantation, and trees on a separate plot and on the borders of crop fields (Fig. 3). We have classified these categories using similar language used by participants in the workshops.

To analyse the explicit or implicit expression of attitudes towards agroforestry and forests based on the transcripts, we used four points of classification for our sentiment analysis: the attitude holder, the target object, the claim, and the attitude (Jost et al., 2019; Kim and Hovy, 2004). The attitude holder is the individual workshop participant that can be linked to attributes for analysis such as gender and wellbeing and the target object is "trees" or associated words. We applied sentiment analysis to passages of text that included the target objects of "tree" or "forest" to quantify individual attitudes to tree-cover restoration on and surrounding farms. The key words were chosen based on synonyms of trees and forests alongside contextual knowledge of the study area. For instance, the 45 key words or phrases for forests included phrases such as 'forest reserve', 'Magombera forest', 'Selous game reserve' and 'TANAPA forest'. There were 124 keywords for trees which included both English and Swahili words for trees such as 'coconut tree', 'lemon tree', 'mfuru', 'mkundekunde'. Often swahili words for trees were left untranslated in the transcripts, particularly if the transcriber was unsure of the English translation. See Appendix Table A2 for the full list of keywords used for analysis.

The claim is the different topics or context surrounding the target object, while the attitude is the orientation of this claim, i.e. positive (1), negative (−1), or neutral (0) (Table 1). A score was given for each mention of the word tree or associated keywords. Scores for each participant were then added to give a total score for when describing their current farm, when describing their ideal farm and across the entire workshop. This method allowed the integration of quantitative sentiment scoring with qualitative analysis of the perceptions driving expressed sentiment using the claim classification. Qualitative coding was conducted using QSR Vivo 14. The coding identified dominant themes associated with the passages of text discussing trees and associated key words or phrases that were classified in the sentiment analysis such as the example in Table 1.

Natural language processing (NLP) or computational linguistics have been employed in the environmental sector to analyse sentiment of large online datasets such as scientific abstracts (Lennox et al., 2020) or social

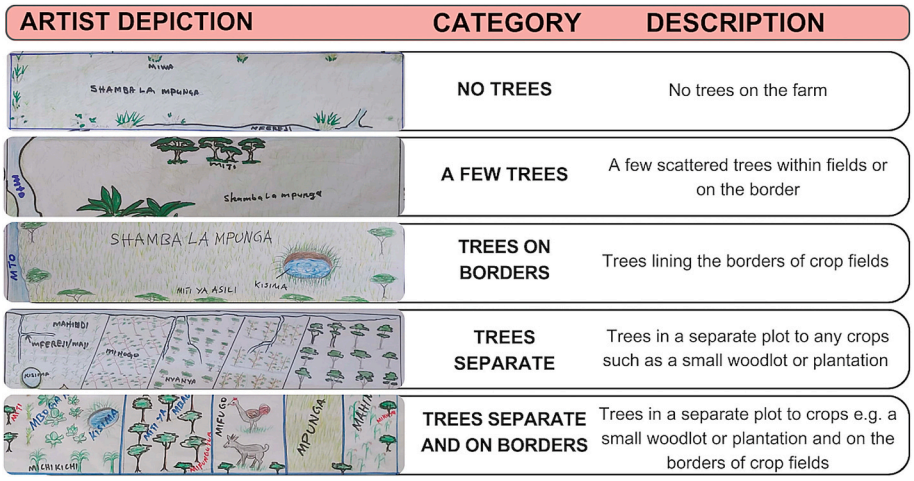

Fig. 3. Ideal agroforestry configuration categories that were described by more than five participants.

Table 1
Description of each classification used for the manual sentiment analysis with example claims from the workshop transcripts from when farmers describe their current and ideal farming scenario.

Classification	Description	Example from the current farm	Example from current farm	Example from the ideal farm scenario
Attitude holder	Individual participant	Workshop 1, woman 3	Workshop 1, woman 3	Workshop 1, woman 3
Target object	Trees	Tree	Tree	Tree
Claim	Different topic or context surrounding the target object	'*Benefits are like if the tree is not at the middle of the farm, if it is peripheral, I can benefit from tree fruits, when I work there I can take fruits for eating,*'	'*When the tree is in the middle of the farm, when you plant crops, may not grow, and even if they grow they don't produce, if you expected to harvest 1 back, you just end up to get 2 buckets, that is the effect of tree.*'	'*I don't want more trees, if possible I should decrease the number of trees or I should cut them all down.*'
Attitude	Sentiment or orientation of the claim, i.e. positive (1), negative (−1) or neutral (0)	1	−1	−1

media data (Acerbi et al., 2023). However, sentiment is difficult to assess automatically because of the semantic complexity of language (Murphy, 2014). Training sets in NLP need to be sufficiently large to achieve accurate results (Mozetič et al., 2016) and despite interobserver disagreement in human classification being as high as 20 %, this is similar to results achieved through NLP processes (Ogneva, 2010). It was not possible to do the sentiment analysis in Swahili because the data was directly transcribed from recordings into English. To achieve the highest accuracy given a relatively small corpus and the nature of the translated data, we used human classification. Two analysts (ED and PN) did the human classification, and the scores were subsequently compared. PN is Tanzanian, fluent in Swahili and English, was present at the workshops, translated and transcribed the data. The Intraclass correlation coefficient (ICC) (A,1) was calculated to evaluate the agreement between the two independent raters for the total score per participant. The obtained ICC value was 0.99 (CI [0.98, 0.99]), indicating excellent agreement between raters.

All analyses were done using R version 4.2.1 (R Core Team, 2022) and visualisations were created using *ggplot2* (Wickham, 2016). To understand the variables that may influence smallholders' ideal farm scenarios we first evaluated if the current farm sentiment score was statistically different from the ideal farm sentiment score (see Table 1 for fictitious example) using Wilcoxon signed rank test to compare mean sentiment scores. We then used linear mixed effects models to assess if there was an influence of current farm sentiment score and gender on ideal farm sentiment score to account for the nested structure of observations within workshops ($n = 80$) and used a likelihood ratio test to compare the model to a null model. We used a regression model to explore the influence of wellbeing on ideal farm sentiment score. To assess whether the agroforestry configurations in the ideal farm were influenced by gender, wellbeing and sentiment when discussing the current farm we used Fisher tests. If the Fisher test was significant, we followed this with a multinomial regression to examine the association further. We removed all configuration categories with less than 5 data points ($n = 73$) for this.

To understand the effects of gender and wellbeing on farmer attitudes, we first examined the effects of gender on the participants' total sentiment score through linear mixed-effects models using the *lme4* package (Bates et al., 2015), allowing us to account for the nested structure of observations within workshops as a random effect (n = 80). We conducted Hausman tests using the *Plm* (Croissant and Millo, 2008) to check for correlations between the fixed effects and random effects in all mixed-effects models. None of the tests indicated significant correlations ($p > 0.05$), justifying the use of random-effects models for all analyses (Appendix Tables A3 and A4). Results were further examined using the *MuMIn* (Bartoń, 2024) package. We then used a likelihood ratio test to compare the model to a null model. To analyse differences in sentiment between those with high and low wellbeing ($n = 52$), we performed a non-parametric Mann-Whitney *U* test. To assess the interaction between gender and wellbeing in affecting total sentiment score (n = 52), we used linear regression, acknowledging that a random effect did not apply because workshops were already split by wellbeing category.

4. Results

4.1. Ideal farm agroforestry configurations

Participants had more positive attitudes towards trees when discussing their ideal farm scenario than when discussing their current farm

(Fig. 5, Wilcoxon signed-rank test V = 348.5, $p < 0.005$). However, ideal farm sentiment score was not explained by current farm sentiment score, gender, or wellbeing (Tables 2, A3). Through configuration of the farm, participants discussed how to maximise benefits such as food production and income diversification and minimise the trade-offs with crops. Most farmers desired trees in their ideal farming system but they have very few in their current farm and reported removing trees more commonly than planting where they owned the land. 16 farmers (20 % of all participants) desired no trees in their ideal scenario.

The majority of participants also preferred a larger farm than they currently have, where they could grow crops with just a few trees or have the space to grow trees separately on borders or in small plantations (note: this was usually for timber trees, see 'trees separate' in Fig. 3); only two participants wanted to intercrop trees and crops. A few scattered trees or trees on the borders were usually desired for boundary marking or to provide subsistence fruit, firewood and timber, and were associated more with women (Fig. 4). It was often mentioned that these trees needed to have small canopies to mitigate perceived negative effects on crops. In the ideal farm scenario, only a couple of participants wanted to be close to the forest. Most participants wanted to be surrounded by neighbouring farms for safety from wild animals and pests. Some even specified that they should not be near forested areas, driven by the perceived increase in incidents and severity of crop losses due to wild animals. Only one participant specified they wanted to be neighbouring the forest.

The qualitative analysis indicated that male participants tended to want more trees in their farming systems than women. More men desired small plantation plots whereas more women preferred a few trees scattered on their farms (Fig. 4). Women often wanted to expand their food crops and minimise the perceived negative effects of trees on yields, relying on a smaller number of trees for shade and household use. Men were more inclined to desire plantations for timber or sometimes fruits, perceiving the income from timber and hanging beehives for honey production as additional livelihood opportunities. Fisher's exact test indicated an association between gender and ideal farm configuration ($p = 0.002$), but not between wellbeing and ideal farm configuration ($p = 0.85$). Our multinomial regression also showed that gender influences the likelihood of choosing different ideal farm configurations. All other variables constant, the relative log odds of desiring trees separately to crops in a plantation plot compared to desiring no trees on the farm increased if the participant was male (Table 3).

Table 2
Model results examining the influence of gender, current farm sentiment score and wellbeing on ideal farm sentiment score.

	Dependent variable		
	Ideal farm sentiment score		
	Linear mixed-effects		Ordinary least squares regression
	(1)	(2)	(3)
Male	1.77		
	(0.93)		
Current farm sentiment score		0.09	
		(0.14)	
Low wellbeing			−1.61
			(1.10)
Constant	1.50*	2.48***	3.88***
	(0.67)	(0.54)	(0.79)
Observations	80	80	51
R^2			0.042
Adjusted R^2			0.022
Log Likelihood	−227.936	−230.291	
Akaike Inf. Crit.	463.87	468.58	
Bayesian Inf. Crit.	473.40	478.11	
Residual Std. Error			3.94 (df = 49)
F Statistic			2.13 (df = 1; 49)

Note: *p**p***$p < 0.001$.

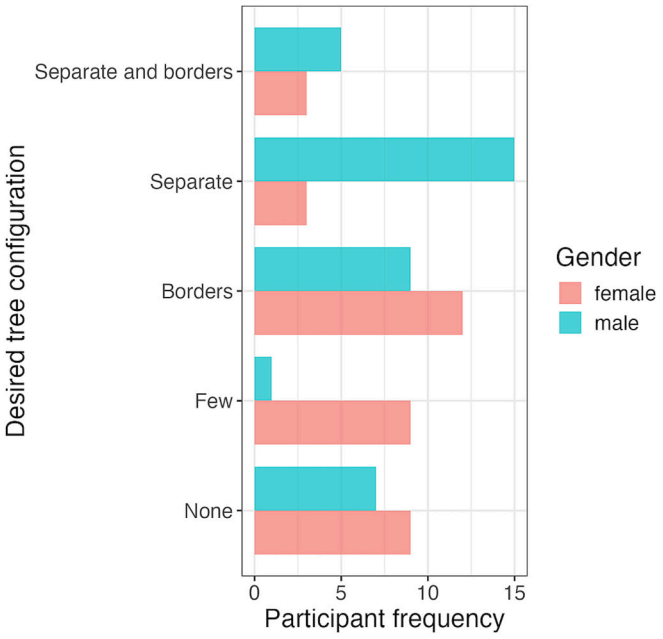

Fig. 4. The frequency of desired tree configurations by gender.

Table 3
Results of the multinomial regression of gender and ideal farm configuration.

	Dependent variable			
	Borders	Few	Separate	Separate and borders
Male	0.96	0.14	6.43*	2.14
	(0.67)	(1.17)	(0.81)	(0.89)
Constant	1.33	1.00	0.33	0.33
	(0.44)	(0.47)	(0.67)	(0.67)
n	73	73	73	73
Akaike Inf. Crit.	225.17	225.17	225.17	225.17

Note: *$p < 0.05$.

4.2. Perceptions associated with farmer attitudes

Farmers were more positive about agroforestry but more negative about forests when discussing their current and ideal farming systems

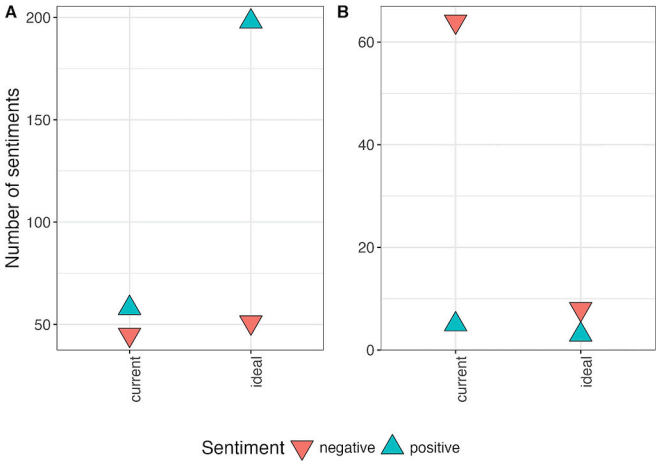

Fig. 5. The number of positive and negative sentiments towards (A) agroforestry, now and in the ideal future scenario and (B) forest adjacent to farms, now and in the ideal future scenario.

(Fig. 5). Most of the perceptions associated with a positive attitude towards agroforestry came from the provision of multiple benefits such as fruit, shade, wind control, firewood, medicine, farm boundary control and timber. Often, products such as fruit, palm oil and timber were first described for household use or consumption, with excess being sold to diversify incomes. Another strong theme was that trees attract rainfall to the farm and surrounding area and a few participants with farms besides a river mentioned planting to reduce soil erosion.

Negative attitudes towards agroforestry were most strongly associated with the perception that crops, particularly rice and sugarcane are negatively impacted by trees due to light and root competition. This perception was the leading driver for farmers who owned their land to remove trees from their farm and stop planting trees, and there was a strong narrative that farm plots are for food only and trees should be grown separately. There was also a strong perception that some trees, such as fruit trees, attract wild animals such as elephants to the farm, leading to increased crop losses, farm damage and causing conflict with neighbours. For those that lived further from their farm, theft of trees, fruit and firewood was also described as an issue.

Attitudes towards surrounding forests focussed on how they influenced the farm and farmer. There were strong negative attitudes towards forest in the landscape, particularly when describing the current farming system (Fig. 5). This was driven by the perception that farmers no longer have access to direct benefits such as firewood as most forests are under some form of protection regime which is exclusionary to enter without a permit. Meanwhile, they mainly face challenges such as fuel wood shortages and crop losses caused by wild animals from the surrounding forest areas, particularly elephants and monkeys. Crop losses from wild animals have a large spatial component, with farmers describing that those closer to forest being more affected than farms located further away from forests. They also perceived wildlife-crop interactions to have worsened in the past few years due to increased protection of both protected areas and animals themselves. Additionally, farmers perceived that land is being taken from agriculture and integrated into reserves which is decreasing land availability for farming (Fig. 6). The few positive sentiments regarding forest were associated with them being a source of rainfall and rivers.

4.3. Influence of gender and wellbeing on farmer attitudes

Our mixed effect model shows that gender affects attitudes towards trees, as men tended to have a higher total sentiment score than women (Tables 4, A4, Fig. 7A). The model explained approximately 15.8 % of the total variance, 7 % was explained by gender whilst random effects (encoded as workshop type) accounted for 9.5 %. There were no statistical differences of total sentiment score between those with higher or lower wellbeing (Mann-Whitney U W = 398.5, $p = 0.266$) (Fig. 7B) or of the interaction of gender and wellbeing (Table 4).

Table 4
Model results of gender and wellbeing on total sentiment score.

	Dependent variable	
	Total sentiment score	
	Linear mixed-effects	Ordinary least squares regression
	(1)	(2)
Male	3.15*	4.14
	(1.23)	(2.22)
Low wellbeing		−2.75
		(2.26)
Male:Low wellbeing		0.87
		(3.11)
Constant	0.09	2.25
	(1.04)	(1.60)
Observations	80	51
R^2		0.19
Adjusted R^2		0.13
Log Likelihood	−252.18	
Akaike Inf. Crit.	512.35	
Bayesian Inf. Crit.	521.88	
Residual Std. Error		5.54 (df = 47)
F Statistic		3.59* (df = 3; 47)

Note: *p**p***$p < 0.001$.

5. Discussion

Placing equity at the core of forest landscape restoration for biodiversity, climate and human livelihoods is a complex challenge. Our findings highlight significant differences between current tree-cover restoration efforts and the aspirations of smallholder farmers in the Kilombero Valley. While farmers generally showed positive attitudes towards agroforestry, they expressed negative sentiments towards forests, primarily due to concerns about crop losses from wildlife and restrictions on forest use. Additionally, gender differences were evident, with men showing more positive attitudes towards agroforestry than women. Despite gender explaining only a small proportion of the variance in our model, these insights underscore the necessity of adopting an inclusive, participatory approach to restoration that addresses the diverse needs and preferences of different community members. This approach can help align restoration goals with local interests, potentially leading to more sustainable and accepted tree-cover restoration outcomes at landscape scales.

5.1. Ideal tree-cover restoration scenarios and attitudes towards forests

Participants' scenarios do not align with the ongoing and planned restoration interventions planned by NGOs and government bodies in the study area, which are looking to expand and strengthen protected forest areas. Instead, participants expressed a desire to be surrounded by neighbouring farms for safety from wild animals and pests, some specifying they did not want to be near the forest. Expanding forest cover in

Fig. 6. A diagram of perceptions associated with positive (blue circles) and negative (red circles) attitudes of agroforestry and forests from the qualitative analysis.

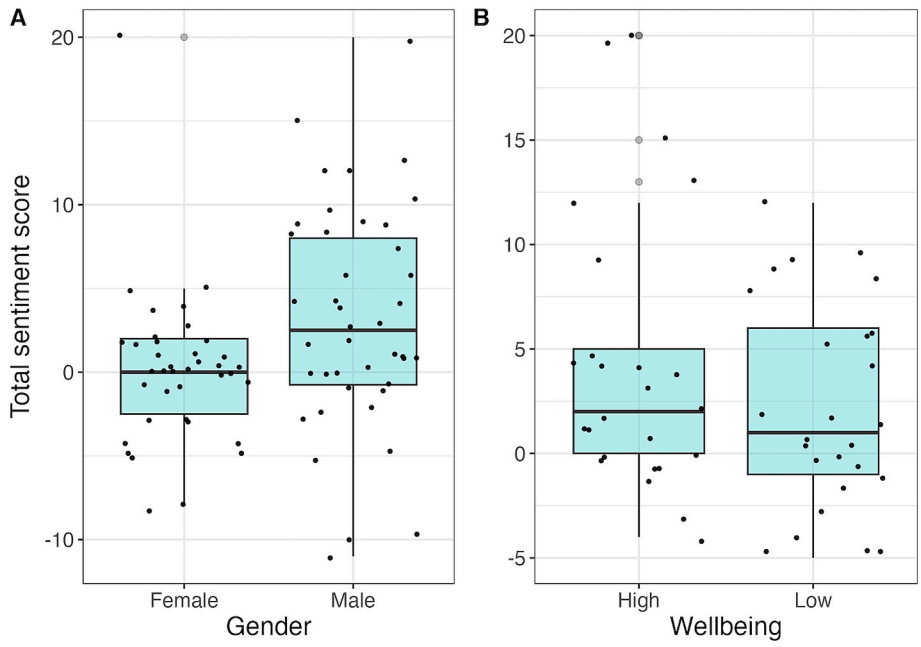

Fig. 7. Total sentiment score towards trees and forest by (A) men and women (n = 80), (B) high and low wellbeing (*n* = 52).

linear formations, such as wildlife corridors and riparian forests, will increase the number of farms adjacent to forests. The anticipated impacts of such current and planned restoration projects on communities are unclear; however, research has indicated that an increase in forest cover will raise the overall probability of crop raiding risk and alter its spatial distribution, likely increasing human wildlife interactions (Pfeifer et al., 2022). Elsewhere, Vedeld et al. (2012) documented tensions in villages surrounding the nearby Mikumi National Park due to wildlife crop raiding, estimating living close to the park incurs a cost of that 2–20 % of household income mainly through wildlife raiding crops and livestock. Wildlife crop losses have been shown to have adverse effects on attitudes to wildlife (Baker et al., 2014; Malley and Gorenflo, 2023). Malley and Gorenflo (2023) documented that attitudes towards elephants in the Kilombero Valley have shifted from positive to negative in the past decade due to factors such as the amount of crop lost to elephants, perceived benefits from elephants, and perceived trends of increased human-elephant conflict in both space and time. Misalignment between community impacts and institutional restoration programs reflects the current approach to restoration planning, driven by organisations with priorities different from those of local farmers, who control decision-making (Pfeifer et al., 2022; Southern Tanzania Elephant Program, 2024). Maintaining their access to natural resources through legal, economic and political mechanisms (Ribot and Peluso, 2003). Matejcek and Verne (2021) argue that top-down interventions often attempt to gain community approval through capacity enhancement activities, seeking to influence local aspirations to align with their own plans and objectives. However, these efforts fall short of engaging in inclusive governance models that prioritise the needs and aspirations of local stakeholders (Löfqvist et al., 2023). Despite evidence that participation in conservation projects is associated with more positive attitudes towards conservation actions in the Serengeti buffer zone, Tanzania (Kideghesho et al., 2007).

Low benefits from conservation have been shown to trigger negative attitudes towards forest conservation in Sub-Saharan Africa (Ihemezie et al., 2021). (Kideghesho et al., 2007) also found that prohibition from access to resources was an important factor in shaping attitudes towards conservation. This is perhaps reflected in our results, where farmers expressed negative attitudes towards lack of access to forest resources from the forest alongside experiencing increasing disadvantages, particularly from crop losses due to wildlife. Attitudes have previously been linked to the conservation actions people will accept (Loyau and Schmeller, 2017) and willingness to participate (Sirivongs and Tsuchiya, 2012).

In the context of forest conservation in Tanzania, our findings should cause pause for thought on how to reconcile ambitious forest conservation interventions with the diversity of community aspirations and attitudes, in particular in rural landscapes with high dependencies between people's livelihoods and natural resources. Expanding and strengthening protected areas within the study region while simultaneously restricting local use will likely exacerbate distributional inequalities in the costs and benefits associated with forests and incurred to local communities (Ihemezie et al., 2021; Löfqvist et al., 2023; Vedeld et al., 2012). This has been documented elsewhere in Tanzania, where restricting forest use removed charcoal production as a coping strategy for income in extreme droughts (Robledo et al., 2012). Neglecting these aspects can jeopardise long-term restoration success for forests in the wider landscape and exacerbate injustice for those already marginalised from decision-making (Löfqvist et al., 2023). Moreover, Kijazi and Kant (2011) showed that local communities had more positive attitudes towards participatory management regimes that would increase their power to manage forest resources over exclusionary bureaucratically centralised regimes in the Mount Kilimanjaro region of Tanzania.

5.2. Ideal tree-cover restoration scenarios and attitudes towards agroforestry

Farmers often preferred tree configurations that diversified their production system while maximising their desired benefits and minimising the interaction between trees and crops. Scenarios characterised by increasing on-farm tree cover for the purpose of diversification aligns with findings in a previous study (Andreotti et al., 2020). Diversification is a widely recognized strategy for reducing risks within agriculture such as crop failure (Ellis, 2000) and tree products can act as a safety net in times of shock or food insecurity (Kilonzo, 2022; Quandt et al., 2019). Participants also tended to desire more trees than they currently have, perhaps emphasising the gap that often exists aspirations and capabilities, given their households' circumstances and available resources (Emerton and Snyder, 2018). This is reiterated by farmers to own larger farms and have irrigation systems but being constrained by factors such as financial capital (Lala et al., 2023). Most participants wanted to own a

farm and women in particular expressed the importance of owning a farm for improving their livelihoods (Lala et al., 2023). The desire for land ownership and to grow trees on their own land, may also be reflective of farmers' desire to control access to tree resources (Ribot and Peluso, 2003).

Our results show that positive attitudes are associated with agroforestry's beneficial and instrumental contributions to their livelihoods such as through firewood and shade (Pascual et al., 2017; Shennan-Farpón et al., 2022). Promoting agroforestry alongside protection and sustainable management of existing forests may therefore offer a more equitable pathway for reconciling tree planting targets with local community livelihood needs, as long as people are empowered to select the trees they need and maintain their local food production systems (Fleischman et al., 2020). Yet, this will rely on stronger evidence from the field with regards to tree:crop combinations that can deliver on these objectives as the perceived negative impact of trees on crop yields, particularly due to canopy shading, was the biggest driver of negative attitudes. The scientific evidence for the presence of trees on food production in the tropics is limited, a review by Reed et al. (2017b) found 54 % of studies reported a positive effect on food yields. This is evidently an area in which further research is needed with farmers to overcome barriers of perceived negative tree-crop interactions when scaling agroforestry.

5.3. The influence of gender on ideal scenarios and attitudes

Both men and women expressed a desire for agroforestry systems in their ideal farms, consistent with other research in Morogoro and Dodoma, Tanzania, where gender did not influence agroforestry adoption (Jha et al., 2021). However, our findings reveal a gendered divide in the desired intensity and configurations of trees. Women preferred fewer scattered trees, prioritising the expansion of food crops and relying on a smaller number of trees for shade and household use. In contrast, men were more inclined to favour the presence of more trees, viewing agroforestry as an additional livelihood opportunity. These findings are consistent with other studies conducted in Africa, as highlighted by Kiptot (2015), who emphasises that women predominantly bear the responsibility for meeting household needs related to food and fuel. Conversely, men tend to control the more commercially valuable agroforestry products such as timber (Kiptot and Franzel, 2011). Furthermore, a study across five African countries, including Tanzania, also notes that land allocation to tree cash crops is lower among female-headed households (Miller et al., 2017). Our results indicate that agroforestry interventions need to address the specific needs and constraints of both men and women, promoting equitable access to resources and opportunities for participation (Kiptot and Franzel, 2011).

Although men spoke more than women (Wilcoxon test $W = 444$, $p < 0.005$), there was no correlation between word count and total sentiment score (spearman's rho $= 0.19$, $p > 0.05$), indicating that this was not the driver of differences. It is also important to note that gender accounted for only 7 % of the variation in our model, underscoring the substantial heterogeneity of attitudes influenced by a multitude of intersecting factors (Meijer et al., 2015a).

5.4. Intersecting wellbeing and attitudes to trees and forests

Conservation and restoration research has focussed on operationalising the measuring and monitoring of human wellbeing to capture effectiveness of interventions (Loveridge et al., 2020, 2022; Milheiras et al., 2022). It set the pathway for using defined and measurable indicators of wellbeing to track intervention outcomes, policy progress and highlight social issues requiring attention (Loveridge et al., 2020). Using an aggregated metric has simplified the complexity of wellbeing across the five main dimensions of material, health, social, security and freedom. However, our study highlights the constraints and limitations associated with the use of a composite wellbeing metric when trying to understand intersections between people, their attitudes and perceptions and forests or trees on their land. Aggregating variables, like done when creating a single index to capture wellbeing, can obscure patterns and differences across the five dimensions of wellbeing and individual indicators. This then hinders the design of effective management interventions.

Specific to our study, using the wellbeing index as an aggregate index for workshop participants may be misleading. The same wellbeing score can apply to two individuals (see Appendix Fig. A1), but may translate to different scores along each of the five dimensions of wellbeing thus masking mechanisms underlying attitudes and perceptions to trees on farms and in the landscape. Consequently, making specific recommendations to address prevalent attitudes without exacerbating existing inequalities in wellbeing is challenging due to the unclear localisation of these inequalities. Recognising that restoration interventions affect people differently and may enhance specific aspects of wellbeing while worsening others (Woodhouse et al., 2015), the composite indicator lacks the information to provide such insights. Therefore, we recommend that future studies in this field examine individual dimensions of wellbeing rather than relying solely on an aggregate metric to obtain more nuanced and insightful results.

6. Conclusion

Our findings reveal several insights with policy and practice implications for those aiming to scale-up planting for tree-cover restoration efforts to meet ambitious commitments and tackle deforestation caused by conversion to agriculture.

Firstly, farmers' ideal future landscapes do not align with current tree-cover restoration efforts driven by external actors within the landscape. To foster sustained and meaningful landscape restoration with smallholders, which could address urgent land degradation concerns and climate risks (Shyamsundar et al., 2022), we reiterate previous calls for restoration interventions to be implemented through inclusive governance processes that incorporate social and equity considerations to achieve improved social, ecological, and environmental outcomes (Löfqvist et al., 2023). There has been considerable research guidance published on processes that foster inclusive governance models such as legitimate representation of stakeholders, structured engagement processes and methods, balancing power dynamics and provision of information and decision-making power to all participants (de Vente et al., 2016; Reed et al., 2017b; Wood et al., 2016). Africa specific, structured and transparent approaches to co-design and co-production of policies and management plans that aligns objectives of all social groups has been shown to support more resilient and equitable landscapes (Favretto et al., 2021). Additionally, we suggest using sentiment analysis to measure responses to and help improve restoration interventions, using this data as a baseline assessment (Drijfhout et al., 2016). It could be useful in this instance to measure whether shifts towards inclusive governance structures and interventions aimed at reducing risks to human life and crop losses from wildlife succeed in improving attitudes towards forests. Furthermore, quantitative insights are crucial for reporting and monitoring changes over time, providing valuable feedback for adapting and improving restoration strategies. We also recognise that sentiment analysis has limitations, particularly in it's ability to model explicitly trade-offs that farmers may consider when making tree-growing decisions, complementary methods such as discrete choice experiments could help address this.

Secondly, positive attitudes towards agroforestry may indicate that farmers are interested and willing to integrate and adopt trees into their farming systems (Amare and Darr, 2024; Buyinza et al., 2020). This lends strong support for agroforestry scaling opportunities in rural landscapes as a climate change mitigation and adaptation strategy. These results can be used by organisations to anticipate risks, trade-offs and opportunities that may emerge through agroforestry interventions. Gender emerged as a significant factor influencing ideal scenarios and

attitudes towards agroforestry and forests. This finding emphasises the importance of adopting a gender-sensitive approach that addresses the unique needs and aspirations of both women and men when engaging smallholders in agroforestry interventions. It is crucial to implement inclusive, participatory decision-making processes that enhance gender equity and actively involve women. Our results also indicate the necessity of considering a wide array of intersectional factors in future research to fully understand attitudes towards agroforestry and forest restoration.

Third, we demonstrate that participatory scenarios can be a useful tool to give space for local communities' voices that have been historically marginalised from conservation governance (Lala et al., 2023). Participants cited the benefits of the workshops such as the two-way transfer of knowledge and having their own experiences heard, and they valued the dissemination of research results at the end (see Appendix for a longer summary and quotes). The diversity in scenarios and attitudes highlights the unique experiences of each participant, providing a nuanced and context-specific representation of possible landscape futures informed by local knowledge that prioritises the perspectives of smallholders (Löfqvist et al., 2023). Overall, they reiterate the importance of incorporating diverse local attitudes towards and aspirations for tree-cover restoration efforts and highlight the need for inclusive and participatory decision-making processes that genuinely include the voices and needs of smallholder farmers.

Ethics

Ethical review and approval was granted by the University of Leeds Ethics Committee (ref: AREA 19-017) and Research Permission was granted by COSTECH (ref: 2019-118-NA-2016-101) in accordance with the local legislation and institutional requirements.

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used Chat GPT and Google Gemini to improve readability and language of the manuscript. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

CRediT authorship contribution statement

Eleanor Durrant: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Pete Howson:** Conceptualization, Writing – review & editing, Supervision. **Susannah M. Sallu:** Funding acquisition, Conceptualization, Methodology, Investigation, Writing – review & editing. **Deo D. Shirima:** Funding acquisition, Writing – review & editing. **Margherita Lala:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Sergio G. Milheiras:** Methodology, Investigation, Writing – review & editing. **Francis Lyimo:** Investigation, Methodology, Writing – review & editing. **Petro P. Nyiti:** Investigation, Writing – review & editing. **Lilian Mwanga:** Investigation, Writing – review & editing. **Esther Kioko:** Funding acquisition, Writing – review & editing. **Marion Pfeifer:** Funding acquisition, Conceptualization, Methodology, Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.forpol.2025.103452.

Data availability

All data and code used in this publication and analysis is available in Figshare https://doi.org/10.6084/m9.figshare.26946505.v1, https://doi.org/10.6084/m9.figshare.26946493.v1, https://doi.org/10.6084/m9.figshare.26136196.v1, https://doi.org/10.6084/m9.figshare.26135752.v1, https://doi.org/10.6084/m9.figshare.26135746.v1, https://doi.org/10.6084/m9.figshare.26135692.v1.

References

Acerbi, A., Burns, J., Cabuk, U., Kryczka, J., Trapp, B., Valletta, J.J., Mesoudi, A., 2023. Sentiment analysis of the twitter response to Netflix's our planet documentary. Conserv. Biol. 37, e14060. https://doi.org/10.1111/cobi.14060.

Amare, D., Darr, D., 2020. Agroforestry adoption as a systems concept: a review. Forest Policy Econ. 120, 102299. https://doi.org/10.1016/j.forpol.2020.102299.

Amare, D., Darr, D., 2024. Holistic analysis of factors influencing the adoption of agroforestry to foster forest sector based climate solutions. Forest Policy Econ. 164, 103233. https://doi.org/10.1016/j.forpol.2024.103233.

Andreotti, F., Speelman, E.N., Van den Meersche, K., Allinne, C., 2020. Combining participatory games and backcasting to support collective scenario evaluation: an action research approach for sustainable agroforestry landscape management. Sustain. Sci. 15, 1383–1399. https://doi.org/10.1007/s11625-020-00829-3.

Baker, L.R., Olubode, O.S., Tanimola, A.A., Garshelis, D.L., 2014. Role of local culture, religion, and human attitudes in the conservation of sacred populations of a threatened 'pest' species. Biodivers. Conserv. 23, 1895–1909. https://doi.org/10.1007/s10531-014-0694-6.

Bartoń, K., 2024. MuMIn: Multi-Model Inference. http://r-forge.r-project.org/projects/mumin/.

Bates, D., Mächler, M., Bolker, B., Walker, S., 2015. Fitting linear mixed-effects models using lme4. J. Stat. Softw. 67, 1–48. https://doi.org/10.18637/jss.v067.i01.

Buyinza, J., Nuberg, I.K., Muthuri, C.W., Denton, M.D., 2020. Psychological factors influencing farmers' intention to adopt agroforestry: a structural equation modeling approach. J. Sustain. For. 39, 854–865. https://doi.org/10.1080/10549811.2020.1738948.

Castle, S.E., Miller, D.C., Merten, N., Ordonez, P.J., Baylis, K., 2022. Evidence for the impacts of agroforestry on ecosystem services and human well-being in high-income countries: a systematic map. Environ. Evid. 11, 10. https://doi.org/10.1186/s13750-022-00260-4.

Croissant, Y., Millo, G., 2008. Panel data econometrics in R: the plm package. J. Stat. Softw. 27. https://doi.org/10.18637/jss.v027.i02.

de Vente, J., Reed, M.S., Stringer, L.C., Valente, S., Newig, J., 2016. How does the context and design of participatory decision making processes affect their outcomes? Evidence from sustainable land management in global drylands. Ecol. Soc. 21.

Deißler, L., Mausch, K., Grote, U., Karanja, A., McMullin, S., 2024. Aspirations, ambitions and the adoption of diverse fruit trees – a case study of the livelihood effects in Kenya. Trees For. People 16, 100544. https://doi.org/10.1016/j.tfp.2024.100544.

Drijfhout, M., Kendal, D., Vohl, D., Green, P.T., 2016. Sentiment analysis: ready for conservation. Front. Ecol. Environ. 14, 525–526. https://doi.org/10.1002/fee.1435.

Dumont, E.S., Bonhomme, S., Pagella, T.F., Sinclair, F.L., 2017. Structured stakeholder engagement leads to development of more diverse and inclusive agroforestry options. Exp. Agric. 55, 252–274. https://doi.org/10.1017/S0014479716000788.

Durrant, E., Pfeifer, M., 2024. Homegarden and Participant Characteristics. https://doi.org/10.6084/m9.figshare.25226207.v1.

Durrant, E., Howson, P., Puttick, B., Potts, S., Shennan-Farpón, Y., Sari, N., Allen, N., Yeongeun, J., Grainger, M., Teh, Y.A., Pfeifer, M., 2023. Existing evidence on the use of participatory scenarios in ecological restoration: a systematic map. Environ. Evid. 12, 27. https://doi.org/10.1186/s13750-023-00314-1.

Elias, M., Kandel, M., Mansourian, S., Meinzen-Dick, R., Crossland, M., Joshi, D., Kariuki, J., Lee, L.C., McElwee, P., Sen, A., 2022. Ten people-centered rules for socially sustainable ecosystem restoration. Restor. Ecol. 30, e13574.

Ellis, F., 2000. Rural Livelihoods and Diversity in Developing Countries. Oxford university press.

Emerton, L., Snyder, K.A., 2018. Rethinking sustainable land management planning: understanding the social and economic drivers of farmer decision-making in Africa. Land Use Policy 79, 684–694. https://doi.org/10.1016/j.landusepol.2018.08.041.

FAO, 2024a. FRA 2000 on Definitions of Forest and Forest Change [WWW Document]. URL. https://www.fao.org/4/ad665e/ad665e03.htm (accessed 1.21.25).

FAO, 2024b. Smallholders and Family Farmers | FAO [WWW Document]. URL. https://www.fao.org/family-farming/detail/en/c/273864/ (accessed 7.29.24).

Favretto, N., Shackleton, S., Sallu, S.M., Hoffman, T., 2021. Editorial for special issue: "collaboration and multi-stakeholder engagement in landscape governance and management in Africa: lessons from practice". Land 10, 285. https://doi.org/10.3390/land10030285.

Fleischman, F., Basant, S., Chhatre, A., Coleman, E.A., Fischer, H.W., Gupta, D., Güneralp, B., Kashwan, P., Khatri, D., Muscarella, R., Powers, J.S., Ramprasad, V., Rana, P., Solorzano, C.R., Veldman, J.W., 2020. Pitfalls of tree planting show why we need people-centered natural climate solutions. BioScience 70, 947–950. https://doi.org/10.1093/biosci/biaa094.

German, L., Charamila, S., Tolera, T., 2006. Managing trade-offs in agroforestry: from conflict to collaboration in natural resource management. In: AHI Work. Pap. Highl. Initiat. No 10.

Gough, I., McGregor, J.A., 2007. Wellbeing in Developing Countries: From Theory to Research. Cambridge University Press.

Haile, K.K., Tirivayi, N., Tesfaye, W., 2019. Farmers' willingness to accept payments for ecosystem services on agricultural land: the case of climate-smart agroforestry in Ethiopia. Ecosyst. Serv. 39, 100964. https://doi.org/10.1016/j.ecoser.2019.100964.

Howson, P., 2018. Slippery violence in the REDD+ forests of Central Kalimantan, Indonesia. Conserv. Soc. 16, 136. https://doi.org/10.4103/cs.cs_16_150.

Ihemezie, E.J., Nawrath, M., Strauß, L., Stringer, L.C., Dallimer, M., 2021. The influence of human values on attitudes and behaviours towards forest conservation. J. Environ. Manag. 292, 112857. https://doi.org/10.1016/j.jenvman.2021.112857.

IUCN, 2021. The Bonn challenge | Bonchallenge [WWW Document]. Bonn Chall. URL. https://www.bonnchallenge.org/ (accessed 2.11.21).

Jha, S., Kaechele, H., Sieber, S., 2021. Factors influencing the adoption of agroforestry by smallholder farmer households in Tanzania: case studies from Morogoro and Dodoma. Land Use Policy 103, 105308. https://doi.org/10.1016/j.landusepol.2021.105308.

Jost, F., Dale, A., Schwebel, S., 2019. How positive is "change" in climate change? A sentiment analysis. Environ. Sci. Pol. 96, 27–36. https://doi.org/10.1016/j.envsci.2019.02.007.

Kideghesho, J.R., Røskaft, E., Kaltenborn, B.P., 2007. Factors influencing conservation attitudes of local people in Western Serengeti, Tanzania. Biodivers. Conserv. 16, 2213–2230. https://doi.org/10.1007/s10531-006-9132-8.

Kijazi, M.H., Kant, S., 2011. Social acceptability of alternative forest regimes in Mount Kilimanjaro, Tanzania, using stakeholder attitudes as metrics of uncertainty. Forest Policy Econ. 13, 242–257. https://doi.org/10.1016/j.forpol.2010.12.001.

Kilonzo, M., 2022. Quantification of non-timber forest products utilized by local communities in Nyanjange forest reserve, Morogoro, Tanzania. Environ. Sustain. Indic. 16, 100215. https://doi.org/10.1016/j.indic.2022.100215.

Kim, S.-M., Hovy, E., 2004. Determining the sentiment of opinions. In: Presented at the COLING 2004: Proceedings of the 20th International Conference on Computational Linguistics, pp. 1367–1373.

Kiptot, E., 2015. Gender roles, responsibilities, and spaces: implications for agroforestry research and development in Africa. Int. For. Rev. 17, 11–21.

Kiptot, E., Franzel, S.C., 2011. Gender and agroforestry in Africa: are women participating?. In: ICRAF Occas. Pap. No 13 Nairobi World Agrofor. Cent.

Lala, M., Sallu, S.M., Lyimo, F., Moore, E., Shirima, D.D., Nnyiti, P., Mwanga, L., Pfeifer, M., 2023. Revealing diversity among narratives of agricultural transformation: insights from smallholder farmers in the northern Kilombero Valley, Tanzania. Front. Sustain. Food Syst. 7. https://doi.org/10.3389/fsufs.2023.1148928.

Lennox, R.J., Veríssimo, D., Twardek, W.M., Davis, C.R., Jarić, I., 2020. Sentiment analysis as a measure of conservation culture in scientific literature. Conserv. Biol. 34, 462–471. https://doi.org/10.1111/cobi.13404.

Liu, B., 2020. Sentiment Analysis: Mining Opinions, Sentiments, and Emotions. Cambridge University Press.

Löfqvist, S., Kleinschroth, F., Bey, A., de Bremond, A., DeFries, R., Dong, J., Fleischman, F., Lele, S., Martin, D.A., Messerli, P., Meyfroidt, P., Pfeifer, M., Rakotonarivo, S.O., Ramankutty, N., Ramprasad, V., Rana, P., Rhemtulla, J.M., Ryan, C.M., Vieira, I.C.G., Wells, G.J., Garrett, R.D., 2023. How social considerations improve the equity and effectiveness of ecosystem restoration. BioScience 73, 134–148. https://doi.org/10.1093/biosci/biac099.

Loveridge, R., Sallu, S.M., Pesha, I.J., Marshall, A.R., 2020. Measuring human wellbeing: a protocol for selecting local indicators. Environ. Sci. Pol. 114, 461–469.

Loveridge, R., Marshall, A.R., Pfeifer, M., Rushton, S., Nnyiti, P.P., Fredy, L., Sallu, S.M., 2022. Pathways to win-wins or trade-offs? How certified community forests impact forest restoration and human wellbeing. Philos. Trans. R. Soc. B Biol. Sci. 378, 20210080. https://doi.org/10.1098/rstb.2021.0080.

Loyau, A., Schmeller, D.S., 2017. Positive sentiment and knowledge increase tolerance towards conservation actions. Biodivers. Conserv. 26, 461–478. https://doi.org/10.1007/s10531-016-1253-0.

Lucungu, P.B., Dhital, N., Asselin, H., Kibambe, J.-P., Ngabinzeke, J.S., Khasa, D.P., 2022. Local perception and attitude toward community forest concessions in the Democratic Republic of Congo. Forest Policy Econ. 139, 102734. https://doi.org/10.1016/j.forpol.2022.102734.

Malley, G.S., Gorenflo, L.J., 2023. Shifts in the conflict-coexistence continuum: exploring social-ecological determinants of human-elephant interactions. PLoS One 18, e0274155. https://doi.org/10.1371/journal.pone.0274155.

Matejcek, A., Verne, J., 2021. Restoration-as-development? Contesting aspirational politics regarding the restoration of wildlife corridors in the Kilombero Valley, Tanzania. Eur. J. Dev. Res. 33, 1022–1043. https://doi.org/10.1057/s41287-021-00403-2.

Meijer, S.S., Catacutan, D., Ajayi, O.C., Sileshi, G.W., Nieuwenhuis, M., 2015a. The role of knowledge, attitudes and perceptions in the uptake of agricultural and agroforestry innovations among smallholder farmers in sub-Saharan Africa. Int. J. Agric. Sustain. 13, 40–54. https://doi.org/10.1080/14735903.2014.912493.

Meijer, S.S., Catacutan, D., Sileshi, G.W., Nieuwenhuis, M., 2015b. Tree planting by smallholder farmers in Malawi: using the theory of planned behaviour to examine the relationship between attitudes and behaviour. J. Environ. Psychol. 43, 1–12. https://doi.org/10.1016/j.jenvp.2015.05.008.

Metzger, J.P., Latawiec, A.E., Acosta, André Luis, Jardim, André Vitor Fleuri, Saraiva, Antonio Mauro, Strassburg, B., Joly, C., Kamiyama, C., Krug, C., Hagen, D., D'Albertas, Francisco, Duarte, Gabriela Teixeira, Sparovek, G., Grytnes, John-Arvid, Esler, K., Tambosi, L., Garcia, Letícia Couto, Arias, M., Ruggiero, P.G., Brancalion, P. H., Crouzeilles, R., Rodrigues, Ricardo Ribeiro, 2017. Best practice for the use of scenarios for restoration planning. Curr. Opin. Environ. Sustain. 29, 14–25. https://doi.org/10.1016/j.cosust.2017.10.004.

Milheiras, S.G., Sallu, S.M., Loveridge, R., Nnyiti, P., Mwanga, L., Baraka, E., Lala, M., Moore, E., Shirima, D.D., Kioko, E.N., Marshall, A.R., Pfeifer, M., 2022. Agroecological practices increase farmers' well-being in an agricultural growth corridor in Tanzania. Agron. Sustain. Dev. 42, 56. https://doi.org/10.1007/s13593-022-00789-1.

Millennium ecosystem assessment (MEA), 2005. Ecosystems and human well-being, Vol. 5. Island press, Washington, DC, p. 563.

Miller, D.C., Muñoz-Mora, J.C., Christiaensen, L., 2017. Prevalence, economic contribution, and determinants of trees on farms across sub-Saharan Africa. Forest Policy Econ. 84, 47–61. https://doi.org/10.1016/j.forpol.2016.12.005.

Mozetič, I., Grčar, M., Smailović, J., 2016. Multilingual twitter sentiment classification: the role of human annotators. PLoS One 11, e0155036. https://doi.org/10.1371/journal.pone.0155036.

Msofe, N.K., Sheng, L., Lyimo, J., 2019. Land use change trends and their driving forces in the Kilombero Valley floodplain, Southeastern Tanzania. Sustainability 11, 505. https://doi.org/10.3390/su11020505.

Muhamad, D., Okubo, S., Harashina, K., Parikesit, Gunawan, B., Takeuchi, K., 2014. Living close to forests enhances people's perception of ecosystem services in a forest–agricultural landscape of West Java, Indonesia. Ecosyst. Serv. 8, 197–206. https://doi.org/10.1016/j.ecoser.2014.04.003.

Murphy, J., 2014. Ten things survey researchers should know about Twitter. In: Soc. Media Soc. Res. Blogs Burn. Boundaries Lond. UK NatCen Soc. Res.

Nair, P.R., Kumar, B.M., Nair, V.D., 1993. Introduction. In: An Introduction to Agroforestry: Four Decades of Scientific Developments. Springer.

Ngango, J., Musabanganji, E., Maniriho, A., Nkikabahizi, F., Mukamuhire, A., Ng'ombe, J.N., 2024. Does agroforestry contribute to household food security? A micro-perspective from southern Rwanda. Forest Policy Econ. 165, 103252. https://doi.org/10.1016/j.forpol.2024.103252.

Nkurikiye, J.B., Uwizeyimana, V., Van Ruymbeke, K., Vanermen, I., Verbist, B., Bizoza, A.R., Vranken, L., 2024. Farmers' preferences for adopting agroforestry in the Eastern Province of Rwanda: a choice experiment. Trees For. People 16, 100592. https://doi.org/10.1016/j.tfp.2024.100592.

Sentiment analysis in agriculture. In: Novák, J., Benda, P., Šilerová, E., Vaněk, J., Kánská, E. (Eds.), 2021. AGRIS -Line Pap. Econ. Inform. https://doi.org/10.22004/ag.econ.320252.

Ogneva, M., 2010. How Companies can use Sentiment Analysis to Improve their Business [WWW Document]. Mashable. URL. https://mashable.com/archive/sentiment-analysis (accessed 6.18.24).

Oteros-Rozas, E., Martín-López, B., Daw, T.M., Bohensky, E.L., Butler, J.R.A., Hill, R., Martin-Ortega, J., Quinlan, A., Ravera, F., Ruiz-Mallén, I., Thyresson, M., Mistry, J., Palomo, I., Peterson, G.D., Plieninger, T., Waylen, K.A., Beach, D.M., Bohnet, I.C., Hamann, M., Hanspach, J., Hubacek, K., Lavorel, S., Vilardy, S.P., 2015. Participatory scenario planning in place-based social-ecological research: insights and experiences from 23 case studies. Ecol. Soc. 20.

Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., Watson, R.T., Başak Dessane, E., Islar, M., Kelemen, E., Maris, V., Quaas, M., Subramanian, S.M., Wittmer, H., Adlan, A., Ahn, S., Al-Hafedh, Y.S., Amankwah, E., Asah, S.T., Berry, P., Bilgin, A., Breslow, S.J., Bullock, C., Cáceres, D., Daly-Hassen, H., Figueroa, E., Golden, C.D., Gómez-Baggethun, E., González-Jiménez, D., Houdet, J., Keune, H., Kumar, R., Ma, K., May, P.H., Mead, A., O'Farrell, P., Pandit, R., Pengue, W., Pichis-Madruga, R., Popa, F., Preston, S., Pacheco-Balanza, D., Saarikoski, H., Strassburg, B. B., van den Belt, M., Verma, M., Wickson, F., Yagi, N., 2017. Valuing nature's contributions to people: the IPBES approach. Curr. Opin. Environ. Sustain. 26–27, 7–16. https://doi.org/10.1016/j.cosust.2016.12.006.

Pendrill, F., Gardner, T.A., Meyfroidt, P., Persson, U.M., Adams, J., Azevedo, T., Bastos Lima, M.G., Baumann, M., Curtis, P.G., De Sy, V., Garrett, R., Godar, J., Goldman, E. D., Hansen, M.C., Heilmayr, R., Herold, M., Kuemmerle, T., Lathuillière, M.J.,

Ribeiro, V., Tyukavina, A., Weisse, M.J., West, C., 2022. Disentangling the numbers behind agriculture-driven tropical deforestation. Science 377, eabm9267. https://doi.org/10.1126/science.abm9267.

Pfeifer, M., Sallu, S.M., Marshall, A.R., Rushton, S., Moore, E., Shirima, D.D., Smit, J., Kioko, E., Barnes, L., Waite, C., Raes, L., Braunholtz, L., Olivier, P.I., Ishengoma, E., Bowers, S., Guerreiro-Milheiras, S., 2022. A systems approach framework for evaluating tree restoration interventions for social and ecological outcomes in rural tropical landscapes. Philos. Trans. R. Soc. B Biol. Sci. 378, 20210111. https://doi.org/10.1098/rstb.2021.0111.

Quandt, A., Neufeldt, H., McCabe, J.T., 2019. Building livelihood resilience: what role does agroforestry play? Clim. Dev. 11, 485–500. https://doi.org/10.1080/17565529.2018.1447903.

R Core Team, 2022. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. URL: https://www.R-project.org/.

Rahman, S.A., Sunderland, T., Kshatriya, M., Roshetko, J.M., Pagella, T., Healey, J.R., 2016. Towards productive landscapes: trade-offs in tree-cover and income across a matrix of smallholder agricultural land-use systems. Land Use Policy 58, 152–164. https://doi.org/10.1016/j.landusepol.2016.07.003.

Razafindratsima, O.H., Kamoto, J.F.M., Sills, E.O., Mutta, D.N., Song, C., Kabwe, G., Castle, S.E., Kristjanson, P.M., Ryan, C.M., Brockhaus, M., Sunderland, T., 2021. Reviewing the evidence on the roles of forests and tree-based systems in poverty dynamics. Forest Policy Econ. 131, 102576. https://doi.org/10.1016/j.forpol.2021.102576.

Reed, M.S., Kenter, J., Bonn, A., Broad, K., Burt, T., Fazey, I., Fraser, E., Hubacek, K., Nainggolan, D., Quinn, C., 2013. Participatory scenario development for environmental management: a methodological framework illustrated with experience from the UK uplands. J. Environ. Manag. 128, 345–362.

Reed, J., van Vianen, J., Foli, S., Clendenning, J., Yang, K., MacDonald, M., Petrokofsky, G., Padoch, C., Sunderland, T., 2017a. Trees for life: the ecosystem service contribution of trees to food production and livelihoods in the tropics. Forest Policy Econ. 84, 62–71. https://doi.org/10.1016/j.forpol.2017.01.012.

Reed, M., Vella, S., Challies, E., de Vente, J., Frewer, L., Hohenwallner-Ries, D., Huber, T., Neumann, R.K., Oughton, E.A., del Ceno, J.S., van Delden, H., 2017b. A theory of participation: what makes stakeholder and public engagement in environmental management work? Restor. Ecol. 26, S7–S17. https://doi.org/10.1111/rec.12541.

Ribot, J.C., Peluso, N.L., 2003. A theory of access. Rural. Sociol. 68, 153–181. https://doi.org/10.1111/j.1549-0831.2003.tb00133.x.

Ritchie, H., Roser, M., 2024. Half of the World's Habitable Land is Used for Agriculture. Published Online at OurWorldinData.org. Retrieved from: https://ourworldindata.org/global-land-for-agriculture.

Robledo, C., Clot, N., Hammill, A., Riché, B., 2012. The role of forest ecosystems in community-based coping strategies to climate hazards: three examples from rural areas in Africa. Forest Policy Econ. 24, 20–28. https://doi.org/10.1016/j.forpol.2011.04.006.

Salami, A., Kamara, A.B., Brixiova, Z., 2010. Smallholder agriculture in East Africa: Trends, constraints and opportunities. African Development Bank, Tunis, Tunisia, p. 52.

Sánchez Bogado, A.C., Estrada-Carmona, N., Beillouin, D., Chéron-Bessou, C., Rapidel, B., Jones, S.K., 2024. Farming for the future: understanding factors enabling the adoption of diversified farming systems. Glob. Food Secur. 43, 100820. https://doi.org/10.1016/j.gfs.2024.100820.

Shackleton, C.M., Ruwanza, S., Sinasson Sanni, G.K., Bennett, S., De Lacy, P., Modipa, R., Mtati, N., Sachikonye, M., Thondhlana, G., 2016. Unpacking Pandora's box: understanding and categorising ecosystem disservices for environmental management and human wellbeing. Ecosystems 19, 587–600. https://doi.org/10.1007/s10021-015-9952-z.

Shennan-Farpón, Y., Mills, M., Souza, A., Homewood, K., 2022. The role of agroforestry in restoring Brazil's Atlantic forest: opportunities and challenges for smallholder farmers. People Nat. 4, 462–480. https://doi.org/10.1002/pan3.10297.

Shyamsundar, P., Cohen, F., Boucher, T.M., Kroeger, T., Erbaugh, J.T., Waterfield, G., Clarke, C., Cook-Patton, S.C., Garcia, E., Juma, K., Kaur, S., Leisher, C., Miller, D.C., Oester, K., Saigal, S., Siikamaki, J., Sills, E.O., Thaung, T., Trihadmojo, B., Veiga, F., Vincent, J.R., Yi, Y., Zhang, X.X., 2022. Scaling smallholder tree cover restoration across the tropics. Glob. Environ. Chang. 76, 102591. https://doi.org/10.1016/j.gloenvcha.2022.102591.

Sirivongs, K., Tsuchiya, T., 2012. Relationship between local residents' perceptions, attitudes and participation towards national protected areas: a case study of Phou Khao Khouay national protected area, central Lao PDR. Forest Policy Econ. 21, 92–100. https://doi.org/10.1016/j.forpol.2012.04.003.

Southern Tanzania Elephant Program, 2024. Kilombero Elephant Corridor. URL. https://stzelephants.or.tz/programs/wildlife-corridors/kilombero-elephant-corridor/ (accessed 8.6.24).

Stetter, C., Sauer, J., 2024. Tackling climate change: agroforestry adoption in the face of regional weather extremes. Ecol. Econ. 224, 108266. https://doi.org/10.1016/j.ecolecon.2024.108266.

Tebboth, M.G.L., Few, R., Assen, M., Degefu, M.A., 2020. Valuing local perspectives on invasive species management: moving beyond the ecosystem service-disservice dichotomy. Ecosyst. Serv. 42, 101068. https://doi.org/10.1016/j.ecoser.2020.101068.

Tedesco, A.M., López-Cubillos, S., Chazdon, R., Rhodes, J.R., Archibald, C.L., Pérez-Hämmerle, K.-V., Brancalion, P.H.S., Wilson, K.A., Oliveira, M., Correa, D.F., Ota, L., Morrison, T.H., Possingham, H.P., Mills, M., Santos, F.C., Dean, A.J., 2023. Beyond ecology: ecosystem restoration as a process for social-ecological transformation. Trends Ecol. Evol. 38, 643–653. https://doi.org/10.1016/j.tree.2023.02.007.

Tschora, H., Cherubini, F., 2020. Co-benefits and trade-offs of agroforestry for climate change mitigation and other sustainability goals in West Africa. Glob. Ecol. Conserv. 22, e00919. https://doi.org/10.1016/j.gecco.2020.e00919.

Vedeld, P., Jumane, A., Wapalila, G., Songorwa, A., 2012. Protected areas, poverty and conflicts: a livelihood case study of Mikumi National Park, Tanzania. Forest Policy Econ. 21, 20–31. https://doi.org/10.1016/j.forpol.2012.01.008.

Verma, P., Sinha, N., 2018. Integrating perceived economic wellbeing to technology acceptance model: the case of mobile based agricultural extension service. Technol. Forecast. Soc. Change 126, 207–216. https://doi.org/10.1016/j.techfore.2017.08.013.

Ward, J., Varua, M.E., Maheshwari, B., Oza, S., Purohit, R., Hakimuddin, Dave, S., 2016. Exploring the relationship between subjective wellbeing and groundwater attitudes and practices of farmers in rural India. J. Hydrol. 540, 1–16. https://doi.org/10.1016/j.jhydrol.2016.05.037.

Wickham, H., 2016. ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag, New York. ISBN 978-3-319-24277-4. https://ggplot2.tidyverse.org.

Wood, B.T., Dougill, A.J., Quinn, C.H., Stringer, L.C., 2016. Exploring power and procedural justice within climate compatible development project design: whose priorities are being considered? J. Environ. Dev. 25, 363–395. https://doi.org/10.1177/1070496516664179.

Woodhouse, E., Homewood, K.M., Beauchamp, E., Clements, T., McCabe, J.T., Wilkie, D., Milner-Gulland, E.J., 2015. Guiding principles for evaluating the impacts of conservation interventions on human well-being. Philos. Trans. R. Soc. B Biol. Sci. 370, 20150103. https://doi.org/10.1098/rstb.2015.0103.

World Agroforestry, 2024. What is agroforestry?. In: World Agrofor. Transform. Lives Landsc. Trees URL. https://www.worldagroforestry.org/about/agroforestry-2 (accessed 1.21.25).